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What Works? A First Look at Evaluating Manitoba's Regional Health Programs and Policies at the Population Level

March 2008

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We thank the University of Manitoba, Faculty of Medicine, and Health Research Ethics Board for their review of this project. MCHP complies with all legislative acts and regulations governing the protection and use of sensitive information. We implement strict policies and procedures to protect the privacy and security of anonymized data used to produce this report and we keep the provincial Health Information Privacy Committee informed of all work undertaken for Manitoba Health.

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The following is a list of *The Need to Know* Team "What Works" Interviewees.
Please note: We may not have all the names of those who contributed to the descriptive work and for this we apologize.

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Faye White
Polypharmacy
Lori Jones
Breastfeeding,
Immunization&
Teen Pregnancy
Elizabeth Rose
Pam Walker
Pat Martin
Judy Gabler
Injury & Suicide
Deb Carnegie
Betty Kozak
Dorinda Stamford
Katherine Bayes
C–Sections &
Hysterectomies
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Judith Macdowall
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Amputations
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Kim Smith
Cervical Cancer
Screening
Pam Walker

Brandon RHA
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Nancy McPherson
Teen Pregnancy
Jane Skinner
Breastfeeding
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Marilyn Day
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Sandy Phillips
Kim Petaski
Suicide
Jeanette Warren
Injury
Judy McKinnon
C–Sections &
Hysterectomies
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Cathy Hynes
C–Sections & Hysterectomies
Lynette Kowalchuk
Diabetes
Gwen Millar
Cervical Cancer Screening
Bev Hill

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Suicide
Marion Cooper
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Nick Honcharik
Diabetes
Colleen Rand
C–Sections & Hysterectomies
Dr. Carol Schneide

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EXECUTIVE SUMMARY

Although many descriptive healthcare studies are available for Manitoba's Regional Health Authorities (RHAs) and Manitoba Health, a question of critical importance for planners and decision–makers is "what works"—what are the effects of various programs or policies on the population as a whole. This report is looked at long–term trends in the rates of some health outcomes of key interest to RHAs and the province—for example diabetes, teen pregnancy, mammography uptake, and so on—and the possible influences on these outcomes. The question becomes: has the entire population's health status or health care service use pattern changed over time, and does this change appear to be related in any way to specific policies or programs?

In Manitoba, we are fortunate to have a collaborative researcher/planner group known as *The Need To Know* Team who identified the need for population–based information on "what works" as a critical aspect of regional and provincial planning. This is the fourth joint epidemiological research project of *The Need To Know* Team, directed by Dr. Patricia Martens of the Manitoba Centre for Health Policy (MCHP). *The Need To Know* Team is a nationally acclaimed collaborative group of researchers from MCHP, planners from Manitoba Health, and planners from each of the eleven RHAs of Manitoba. They have been meeting together three times a year since 2001 to enable (1) creation of new knowledge of relevance to regions and to researchers, (2) capacity building—for the academics on how to do research of relevance to RHAs and for team members on how to understand and interpret research, and (3) dissemination and application of the research at the planning and decision–making level.

The overall **purpose** of this report is to examine selected outcome indicators and to ask the following questions about these indicators:

Question #1: Is a region's rate statistically higher or lower than the Manitoba average?

Question #2: What are the trends in this indicator over time?

Question #3: Is the time trend of each region similar to or different from the provincial trend?

Question #4: What are the BEST predictors of each outcome, in the most recent time period? (using regression modeling—a way to "untangle" the effects of many factors on the outcome)

Question #5: When comparing all of the above information with descriptive information on policies or programs throughout Manitoba, is there an association between rates and/or changes in rates and the initiatives that are in various regions?

This report is loosely divided into four sections of health and health services use:

- Part A consists of Chapters 2 and 3. They address concerns for overall health status (as measured by Premature Mortality Rate) and a particular chronic condition (diabetes and one of the adverse outcomes—lower limb amputation).

- Part B consists of public health issues. Chapter 4 looks at teen pregnancy, Chapter 5 investigates injury, and Chapter 6 analyzes suicide and suicide attempt rates.
- Part C consists of prevention and screening initiatives: Chapter 7 on breastfeeding, Chapter 8 on two–year–old immunizations, Chapter 9 on complete physicals (the "periodic health exam"); Chapter 10 on mammography and Chapter 11 on cervical cancer screening ("Pap tests").
- Part D looks at health services procedures and practices, including Chapter 12 on polypharmacy of the older adult, Chapter 13 on caesarean section rates, Chapter 14 on hysterectomy rates, and Chapter 15 on access to specialists (both overall and those for which the patient must travel outside their RHA of residence).

Each chapter has extensive information on Manitoba's rates and trends. But it also includes literature reviews on research throughout the world that looks at what could influence that particular outcome—for example, the teen pregnancy chapter looks at the literature on prevention of teen pregnancy.

In addition to the extensive information which is provided in the body of this report, further details on quantitative outcomes are given on the website (for example, RHA and district level trend data, not just aggregate area trend data). As well, information derived from the in–person interviews is also available, which is much more detailed than the timeline tables given in the report.

Table E1 shows basic information from selected chapters, including the provincial rates over two time periods, the long–term time trend (usually over the last 15 years), disparities in the outcome amongst different areas of the province, promising regions that show either good rates or improving trends worthy of note, and other modifiable effects on the outcomes.

Table E1: Overview of the What Works deliverable and Relevant Key Findings

Note: **promising** refers to places where improvement is evident, even if rates were not "good" at the outset.
CC = Continuity of Care ("good" CC refers to at least 50% of a person's care received from the same physician)

Indicator	**Provincial Rate (fiscal year time periods)**	**Provincial Time Trend**	**Disparities in rates over time**		**What Works—*promising* regional effects: areas that have promising rates or trends**	**What Works**—comments about other effects that are ***modifiable effects***
			Non–Winnipeg	*Winnipeg*		
Chapter 3: Diabetes Prevalence (20–79 year olds, three–year period prevalence)	88/89–95/96: 4.1% 96/97–03/04: 5.9%	Substantial increases across all RHAs	Greater disparity (mainly due to North increase)	Small increase in disparity	*Central, North Eastman, South Eastman, Parkland, Assiniboine *Lower–than–expected in Winnipeg's Point Douglas & Downtown after controlling for individual risks	* possible link between breastfeeding and reduced diabetes prevalence
Chapter 3: Amputation due to diabetes (20–79 year old diabetics)	86/87–94/95: 13.6 per thousand diabetics 95/96–03/04: 14.5 per thousand diabetics	Increases up to mid– to late–1990s, decreases in most recent period	Greater disparity	Greater disparity	*Brandon, Assiniboine—most longstanding regional diabetes program *Interlake—nurse–practitioner program	* good CC
Chapter 4: Teen pregnancy (15–19 year old females)	88/89–95/96: 63.0 per thousand 96/97–03/04: 58.8 per thousand	Up, then down 84/85: 55.6 96/97: 67.5 03/04: 51.7 Per thousand	Similar disparity (North very high throughout)	Increased disparity	*Assiniboine, southern districts of Central RHA, particular districts of Nor–Man (Flin Flon/SL/CP)—linking reproductive health to STI prevention, available clinics (Note: Burntwood RHA's district of Island Lake: rate is high, but improving rapidly)	*birth control pill use not related to teen pregnancy risk *mental illness increases risk *generational effect (the younger the teen's mom at first birth, more likely teen will have teen pregnancy)
Chapter 5: Injury	88/89–95/96: Males 12.4; Females 9.8 per thousand. 96/97–03/04: Males 9.7; Females 8.8 per thousand	Decreased substantially for males and females (male rates dropping faster, so sex difference decreases over time)	Decreased gradient (North decreasing more rapidly)	Similar for females, slightly reduced for males; much smaller disparity than non–Winnipeg	*Brandon—multi–faceted approach to injury prevention *Nor–Man—–rapid improvement, longest running programs and long–standing falls–reduction strategies *Most of Winnipeg *South Eastman	*need to consider different strategies for different age groups e.g., young males and elderly females

Indicator	Provincial Rate	Provincial Time Trend	Disparities in rates over time		What Works—*promising* regional effects: areas that have promising rates or trends	What Works—comments about other effects that are ***modifiable effects***
			Non–Winnipeg	*Winnipeg*		
Chapter 6: Suicide (age 10+, two year period prevalence)	88/89–95/96: 1.9 per thousand 96/97–03/04: 1.7 per thousand	Relatively stable trend over time, around 1.8 per thousand	Increased disparity (mainly driven by North rates)	Stable	*Most of Winnipeg, Central, South Eastman, Interlake, Assiniboine, Parkland, Brandon—long–standing preventive programs, psychiatric crisis units, Trauma Teams, hot lines *Certain districts in Burntwood—show more rapid improvement (but there is no information in this report for "on–reserve" initiatives)	*need to integrate this into the mental health strategy
Chapter 7: Breastfeeding Initiation (newborns)	88/89–95/96: 75.4% 96/97–03/04: 81.0%	Steady increase provincially	Increased disparity (mainly due to a leveling off of North rates)	Decreased disparity (mainly due to rapid increases in "least healthy" areas of Winnipeg	*South Eastman—most active in terms of promotion, policy and support initiatives over the longest time period *"Patchy" effects in some RHAs—Assiniboine, Brandon, Central, Interlake, North Eastman—had programs, policies or supports available in certain areas. *Winnipeg: high rates, many CAs improving faster, rapid increases in poorest areas—Winnipeg has history of many support programs, plus targeted support to low income women through national/provincial programs such as CPNP, Healthy Baby, BabyFirst. *Hospitals: Bethesda (Steinbach), Boundary Trails (Morden/Winkler)—both have worked on BFHI policies	* C–Section decreases likelihood of breastfeeding
Chapter 8: Two–year–old immunization	90/91–95/96: 73.9% 96/97–01/02: 71.5%	Drop seen in 92/93 birth cohort, leveled off since then (the problem is the DTP shot; MMR and Polio meet herd immunity threshold)	Decreasing gradient (North has better rates over time)	Decreasing gradient, but all area rates lower	*Churchill, Brandon, Parkland—system of reminders (letters, calls), public health nurses heavily involved	*good CC *if child breastfed, more likely to be immunized

Indicator	Provincial Rate	Provincial Time Trend	Disparities in rates over time		What Works—*promising* regional effects: areas that have promising rates or trends	What Works—comments about other effects that are ***modifiable effects***
			Non–Winnipeg	*Winnipeg*		
Chapter 9: Complete physicals	88/89–95/96: 42.7% 96/97–03/04: 39.8%	Increased up to early 1990s, gradually decreased throughout 1990s, possibly slight rise after that	Increased disparity (due to decline in North)	No disparity, all higher than non–Winnipeg	*Controversial issue, with differing opinions as to usefulness Winnipeg, Brandon, Interlake—may be seen as an opportunity to do preventive education and screening by primary care physicians	*good CC
Chapter 10: Mammography (women age 50–69, 1+ in 2 years)	88/89–95/96: 29.3% 96/97–03/04: 57.9%	Rose dramatically throughout the province	Since the early 1990s, much reduced disparity, with most areas near provincial average in recent time period	Since the early to mid–1990s, similar disparity but wider spread than non–Winnipeg	*Assiniboine, Brandon and Parkland (highest likelihood, consistent throughout RHA), plus Central, North Eastman, South Eastman and Interlake; plus all non–Winnipeg areas showing dramatic increases – rural mobile screening units, notification, fixed screening site in Brandon since 1995	*good CC
Chapter 11: Pap Tests	86/87–94/95: 70.8% 95/96–03/04: 71.6%	Mostly plateauing, with only slight increases in latest time period	Increased disparity (North rates declining—may be a data issue)	Slightly increased disparity (declining rates in least healthy area)	*Nor–Man, Parkland, South Eastman. Interlake, and Churchill include nurses/midwives *Winnipeg rates higher in most CAs—primary health clinic and "no appointment" clinics.	*good CC
Chapter 12: Polypharmacy (6+ different drugs in 121 days, aged 60+ community dwellers)	96/97–99/00: 3.4% 00/01–03/04: 6.3%	Substantial increases over 8 year period	Increased disparity, with North showing greatest increase	Increased disparity, but much smaller gradient than in non–Winnipeg	*Winnipeg had lower rates. All non–Winnipeg rate similar to or higher than the provincial average Winnipeg's Geriatric Program Assessment Team do medication reviews	*CC had no statistical effect, but may show a small trend to lowering risk
Chapter 13: C–Sections	88/89–95/96: 14.7% 96/97–03/04: 18.0%	Provincial rates below 15% until mid–1990s, gradual increase since then	Decreased disparity except for Brandon rates	Small disparity, not much change over time	*Complex story of C–Section risk, RHAs and hospitals of birth—need to look at Robson Index to focus on strategy necessary	Emergency C–Section: *labour augmentation or induction increased risk
Chapter 14: Hysterectomy	88/89–95/96: 5.2 per thousand 96/97–03/04: 4.9 per thousand	Rates decreased substantially since 1984	Disparity decreased (mainly due to rapid reduction in the North)	Similar rates, no disparity over time	*Winnipeg CAs were all either similar to or lower than the provincial average—Winnipeg was the most proactive re protocols, guidelines and discussions of alternatives (HALT program)	

One of the recurrent themes in several of the chapters was the influence of "continuity of care" in overall uptake of preventive and screening initiatives. This is important given the current trends to encourage primary care team approaches. Even though our indicator relates to continuity of physician care, it can be viewed as a surrogate for people receiving care from a health care provider team on a consistent basis. Chapter 1 of this report goes into detail about how to calculate "Population Attributable Risk" (PAR). PAR is a term used in epidemiology to determine a theoretical benefit of certain interventions. This is a mathematical calculation that depends both on the magnitude of the risk associated with a certain "exposure" and the proportion of the population that is exposed to that particular "exposure". The "answer" from a PAR calculation gives you a hypothetical estimate of the proportion of the outcome (such as having an amputation in people with diabetes) that could be "attributed" to being exposed to some risk (like lack of continuity of care).

Selected estimates of the effects of a population receiving poor continuity of care are shown in Table E2. For example, if 50% of the population had poor continuity of care, theoretically we can calculate that around 13% of amputations in people with diabetes, 7% of non–immunized two year olds, 10% of people not having a complete physical, 16% of women not having a mammography, and 10% of women not having a Pap test may be "attributable" to their lack of continuity of care.

Table E2: Population Attributable Risk (PAR) calculations related to lack of continuity of care, for five outcome indicators

	PAR (Population Attributable Risk) of receiving poor continuity of care				
Percent of population having **poor continuity of care****	Those diabetics with a lower limb amputation due to diabetes	Those two–year–olds with incomplete immunizations	Those people not having a complete physical	Those women not having mammography screening	Those women not having cervical cancer screening (no PAP test)
10%	3.0%	1.5%	2.2%	3.5%	2.2%
50%	13.4%	7.1%	10.3%	15.5%	10.2%
90%	21.8%	12.0%	17.1%	24.8%	17.0%

** poor continuity of care means that the person received less than 50% of their visits from the same physician in a given year. The variation in poor continuity of care for districts within the province is from around 10% to 60% (Fransoo et al. 2005).

Each chapter has indicator–specific recommendations. Overall recommendations arising out of this report include:

- Look at each outcome indicator to determine which areas appear to have "promising" rates/trends and which programs or policies may be associated with these promising outcomes
- Continue to monitor these outcome indicators since many initiatives geared to address the concerns have only recently begun. Hence, change may very likely be detected in subsequent years if these programs and policies are working at the population level
- Recognize the importance of continuity of care as a predictor of uptake for many of the prevention or screening–related outcomes
- Continue to use this administrative data methodology for locating "promising practice" areas to observe for various health and health care use outcome indicators (including quality of care initiatives or population–based intervention strategies)

The Need To Know Team, comprised of planners or community health assessment coordinators from the RHAs and from Manitoba Health, has been instrumental in making this report a reality—from conception of the topic, to critique of the analyses, to interpretation of the data, and finally to dissemination. This Team and the MCHP researchers will continue to facilitate the report's application in regional and provincial decision–making processes. The report is being highlighted by Team members in various ways such as at the annual MCHP Rural and Northern Health Care Day Workshop, MCHP briefings to the Ministry of Health, RHA planning meetings and Board meetings, and academic conferences throughout Canada. *The Need To Know* Team realizes the importance of evidence–informed decision–making and continues to work towards ensuring that this report will be widely distributed and used in discussions about programs, policies, and public health and health services planning throughout the province and beyond.

The entire document, as well as each graph in Excel spreadsheet form, is available at MCHP's website (www.umanitoba.ca/centres/mchp/) under "Reports" or "Data Extras". Hard copies may be requested through the website under Reports or by contacting MCHP directly (204–789–3819).

Abbreviations and Phrases Frequently Used in this Report

Aggregate Areas = Seven groups created for purposes of showing differences throughout the province when analyzing time trends and when giving comparisons in the RHA and Winnipeg bar graphs.

1. North = Churchill, Burntwood and Nor–Man RHAs
2. Mid = North Eastman, Interlake and Parkland RHAs
3. South = South Eastman, Central and Assiniboine RHAs
4. Brandon = the whole Brandon RHA
5. Winnipeg Most Healthy = Assiniboine South, Fort Garry South, Fort Garry North, Inkster West, River East North, River East East, River East West, River Heights West, St. Boniface East, St. James–Assiniboia West, and St. Vital South (Those NCs of Winnipeg that have PMRs that are statistically lower than the provincial average in the 1991–2000 time period.)
6. Winnipeg Average Health = Downtown West, River East South, River Heights East, Seven Oaks North, Seven Oaks East, Seven Oaks West, St. Vital North, and Transcona (Those NCs of Winnipeg that have PMRs statistically similar to the provincial average in the 1991–2000 time period.)
7. Winnipeg Least Healthy = Downtown East, Inkster East, Point Douglas North, Point Douglas South, St. Boniface West, and St. James–Assiniboia East (Those NCs of Winnipeg that have PMRs statistically higher than the provincial average in the 1991–2000 time period.)

CA = Community Area

NC = Neighbourhood Cluster

MIMS = Manitoba Immunization Monitoring System

PMR = Premature Mortality Rate

RHA = Regional Health Authority

Chapter 1: Introduction and Methods

1.1 The Background of the Research Team

Although many descriptive studies of health and health care are available for Manitoba's Regional Health Authorities (RHAs), a question of critical importance for planners and decision–makers is "what works"—what are the effects of various programs or policies on the population as a whole. Often when programs are evaluated, their effects may be overstated due to volunteer bias, that is, the most motivated people may take part in such programs and may show the greatest benefits. But what is most important to Manitoba is the effect of various programs or policies over the entire population and whether the entire population's health status or health care service use patterns have changed as a result.

In Manitoba, we are fortunate to have a collaborative researcher/planner group known as *The Need To Know* Team, described below, who identified the need for population–based information on "what works" as a critical aspect of regional planning for RHAs. This is the fourth joint epidemiological research project of *The Need To Know* Team, directed by Dr. Patricia Martens of the Manitoba Centre for Health Policy.

The Manitoba Centre for Health Policy (MCHP) is a unit of the Department of Community Health Sciences in the University of Manitoba's Faculty of Medicine. According to its mission, MCHP is a research centre of excellence that conducts world class population–based research on health services, population and public health, and the social determinants of health. MCHP develops and maintains the comprehensive population–based data repository on behalf of the Province of Manitoba for use by the local, national and international research community. MCHP promotes a collaborative environment to create, disseminate and apply its research. The work of MCHP supports the development of policy, programs and services that maintain and improve the health of Manitobans.

The Need To Know Team is a nationally acclaimed collaborative group of researchers from MCHP, planners from Manitoba Health, and high–level planners from each of the eleven RHAs of Manitoba. Since 2001, they meet together three times a year for two–day workshops to enable (1) creation of new knowledge of relevance to regions and to researchers, (2) capacity building—for the academics on how to do research of relevance to RHAs and for team members on how to understand and interpret research and (3) dissemination and application of the research at the planning and decision–making level. The Team won the national 2005 CIHR Knowledge Translation (KT) Award for Regional Impact. For more information about *The Need To Know* Team's research reports, please review publications by the original evaluator of the project, Dr. Sarah Bowen, as well as the subsequent evaluator Jennifer Magoon. In addition, there are several publications (Martens et al. 2007; Martens et al. 2006; Bowen and Martens 2006; Martens 2006; Martens and Roos 2005; Bowen et al. 2005) as well as project reports and evaluation reports available online (http://www.rha.cpe.umanitoba.ca/ and go to Research Reports).

Through funding and support from Manitoba Health, the MCHP grant and the Canadian Institutes of Health Research or "CIHR" (2001–2006 Community Alliances for Health Research project, CIHR KT Award 2006/07, and CIHR/PHAC Applied Public Health Chair to Dr. Patricia Martens, 2008–2013), *The Need To Know* Team has completed the following three projects to date:

- The Manitoba RHA Indicators Atlas: Population–Based Comparisons of Health and Health Care Use (Martens, Fransoo, *The Need To Know* Team et al. 2003)
- Patterns of Regional Mental Illness Disorder Diagnoses and Service Use in Manitoba: A population–based study (Martens, Fransoo, McKeen, *The Need To Know* Team et al. 2004)
- Sex Differences in Health Status, Health Care Use, and Quality of Care: A Population–based analysis for Manitoba's RHAs (Fransoo, Martens, *The Need To Know* Team et al. 2005)

This project on "What Works" is the **fourth** epidemiological report for the Team, and they are also presently working on a **fifth** (an RHA Indicators Atlas 2008).

For this project, the Team was also assisted by a Working Group of health and planning experts, who contributed countless hours assisting the Team. In addition to the working group, there were many people interviewed by Linda Romphf as part of the descriptive information collected on regional policies and programs. Please take the time to look at the Acknowledgements section at the front of this report. We owe thanks to all of these people.

1.2 Purpose of This Report and Outline of the Chapters

The overall **purpose** of this report is to examine various selected outcome indicators, and to ask the following questions about these indicators:

Question #1: Is a region's rate statistically higher than the Manitoba average?

Question #2: What are the trends in this indicator over time?

Question #3: Is the time trend of each region similar to or different from the Manitoba time trend (since the earliest time period for which data are available, up to 2003/04)?

Question #4: What are the BEST predictors of each outcome, in the most recent time period, using regression modelling?

Question #5: When comparing all of the above information with descriptive information on policies or programs throughout Manitoba, is there an association between high rates or rapid improvement, and the initiatives that are present regionally?

This report is loosely divided into four sections of health and health services use:

- Part A consists of Chapters 2 and 3. They address concerns for overall health status (as measured by Premature Mortality Rate) and a particular chronic condition (diabetes and one of the adverse outcomes—lower limb amputation).

- Part B consists of public health issues. Chapter 4 looks at teen pregnancy, Chapter 5 investigates injury, and Chapter 6 analyzes suicide and suicide attempt rates.
- Part C consists of prevention and screening initiatives: Chapter 7 on breastfeeding, Chapter 8 on two–year–old immunizations, Chapter 9 on complete physicals (the "periodic health exam"); Chapter 10 on mammography and Chapter 11 on cervical cancer screening ("Pap tests").
- Part D looks at health services procedures and practices, including Chapter 12 on polypharmacy of the older adult, Chapter 13 on caesarean section rates, Chapter 14 on hysterectomy rates, and Chapter 15 on access to specialists (both overall and those for which the patient must travel outside their RHA of residence).

The Appendices also contain useful information:

- Appendix 1 is the Glossary where various terms used in the report are defined and, at times, additional information is given beyond that in the relevant chapter.
- Appendix 2 goes into detail as to how each of the districts or sub–regions within the RHAs has been defined.
- Appendix 3 gives crude rate tables while most of the indicators in the body of the text give "adjusted" rates to reflect a fair comparison between regions that have very different age structures of their populations (see Chapter 1, Section 1.5 for a further description of crude versus adjusted rate).
- Appendix 4 contains all of the logistic regression tables. They show Odds Ratios for each of the indicators. Within the text of the report, descriptions are given of individuals and regions that are of higher likelihood or lower likelihood for the various outcomes (such as teen pregnancy or receiving a Pap test). The details of the analysis are provided in Appendix 4.
- Finally, Appendix 5 gives further information about the extensive descriptive information collected on the various policies and programs by region.

1.3 What's in This Report: The Types of Graphs, Tables and Analyses

The focus of this report is to give insight to policy makers, decision–makers and planners on patterns of various health and health services outcome indicators, trends by region and over time, predictors of these outcome indicators, and descriptive information to determine "what works" in promoting good outcomes or positive trends in various regions or districts of the province.

Chapters 3 through 15 have a consistent set of graphs and tables which provide a number of perspectives for each indicator. Most indicators are for both males and females; however, some indicators are separated by sex (such as the injury chapter), where it is critical to understanding the patterns. In each chapter, you will find the following:

- First, there are **bar graphs** showing population–based rates of the indicator. They show **two time periods** (usually from the late 1980s to the mid 1990s, and then from the mid 1990s to 2003/04). These bar graphs are shown by RHA, then by districts for the non–Winnipeg RHAs, then by the Winnipeg CAs, and finally by the Winnipeg NCs.

- These graphs are followed by two **time trend graphs**—one for non–Winnipeg "aggregate areas" and one for Winnipeg "aggregate areas" (see below for a further description of these aggregate areas). These graphs usually have one year or two year rates to better detect changes over time and give a comparison of each area to the Manitoba time trend. Although only aggregate areas are shown, information available on MCHP's website show time trends for each RHA and sub–regions of RHAs (www.umanitoba.ca/centres/mchp and then go to Reports, or to Data Extras).
- Then there are two **maps shown in colour**. The **first map shows the "quintiles" of the rates** that were originally shown in the first bar graphs for the latest time period. To derive the quintiles, the difference between the highest rate and the lowest rate was partitioned into five equal groupings, so that any district whose rate fell within one of the five groups was coloured accordingly—dark green was the best rate (either high or low depending on the indicator), light green the next, yellow the next, pink the second worse category, and red the worst category. The **second map shows the trends of the rates over time** as compared to the Manitoba time trend. For this map, green meant improving faster than the Manitoba time trend, yellow meant trending similarly to the Manitoba time trend, pink meant not improving as fast or getting worse compared to the Manitoba time trend, and blue meant that the time trend of that district was erratic (i.e., sometimes similar, or improving, or getting worse, but there was no consistent effect over time). The time trends have been characterized using concepts of quality control which are described further in this chapter.
- Following the two maps are **tables which summarize much of the descriptive information** derived from interviews with key people in each of the RHAs. Due to the vast amount of information collected (which is available in its entirety—see Appendix 5), these tables summarize the key points through symbols. The symbols illustrate which RHAs had particular programs, policies or initiatives operating during spans of time.
- The **discussion section** gives an overview of key findings from the graphs and maps and from the regression modeling and how all of these relate (or do not relate) to the descriptive findings. For those readers who would appreciate seeing the **actual regression model** output, these are provided in Appendix 4.
- In the **discussion section**, there are also the results of the logistic regression models for the latest time period (usually 2003/04). These reveal the best predictors of who would have high or low rates or which region would have high or low rates after controlling for differences in individuals between regions (such as individuals being sicker or older). Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease). Male/female differences are explored for each of the relevant indicators in this modeling. These are given descriptively in the second part of the discussion.
- The **literature review section** summarizes publications throughout the world and compares these to our study. First, there is a comparison with the actual rates or trends. Then, there is an overview of policy or program initiatives pertinent to the particular outcome indicators

(for example, teen pregnancy reduction programs or policies), and this is compared to what we found in our study.

- The **recommendations section** summarizes the key results of the chapter suggesting further planning, policies or research initiatives that arose from the findings. Caution should be noted, our methodology of comparing the quantitative and descriptive findings along with the literature review findings does not imply that we can infer direct causation between policies/programs and outcome measures. The study design has mid–level "internal validity". This means that although there appear to be associations between certain programs/policies and health outcomes in the region, we cannot say that one definitely caused the other.

The outcome indicators were chosen by the RHA Team Members reflecting both their planning and decision–making needs and the availability of population–based data to measure these outcomes. During meetings of *The Need To Know* Team at the planning stage, each RHA and Manitoba Health chose at least one outcome indicator of interest, knowing that this indicator would be included only if it was feasible to analyze using administrative databases available in the Repository housed at MCHP. Each was chosen to be of use throughout the province, not just for the RHA that put forth the indicator.

1.4 How to Read This Report: Geographical Boundaries

1.4.1 Regional Health Authorities (RHAs) and sub–divisions within RHAs:

There are currently 11 RHAs in Manitoba. One is the Winnipeg RHA which encompasses the provincial capital city of Winnipeg, and the other 10 are non–Winnipeg RHAs. In 1997, the government of Manitoba established eleven non–Winnipeg RHAs. Two of these amalgamated in 2002 to become Assiniboine RHA.

This report gives indicator outcome information for all 11 RHAs: Assiniboine, Brandon, Burntwood, Central, Churchill, Interlake, Nor–Man, North Eastman, Parkland, South Eastman and Winnipeg. Winnipeg planners have worked on several ways in which to sub–divide Winnipeg RHA, and for purposes of this report, we are using Community Areas and Neighbourhood Clusters. Each of the non–Winnipeg members of *The Need To Know* Team has worked with MCHP and Manitoba Health to define sub–regional "districts" for purposes of regional planning. These have changed slightly over time with some RHAs (such as Brandon and Central) requesting finer subdivisions for more specific planning.

Figure 1.1 illustrates the RHA geographical boundaries, and Figures 1.2 and 1.3 show the district divisions of each non–Winnipeg RHA. Figure 1.4 shows the sub–regional divisions of Winnipeg—the 12 Community Areas (CAs) which are further subdivided into 25 Neighbourhood Clusters (NCs). Municipalities (and postal codes where necessary) comprising each of the districts are listed in Appendix 2. Most RHAs have between 3 and 11 districts with the exception of the RHA of Churchill. Due to its very small population (just over 1,000 residents), any further subdivision would result in unstable rates. For a further explanation of the process by which districts were determined, refer to *The Manitoba RHA Indicators Atlas Report* (Martens, Fransoo, *The Need To Know* Team et al., 2003), Chapter 1.

1.4.2 Aggregate Areas used in time trend graphs:

For purposes of showing differences throughout the province when analyzing time trends and when giving comparisons in the RHA and Winnipeg bar graphs, the RHAs have been grouped into "North", "Mid", "South", Brandon RHA, Winnipeg RHA, and three sub–regions of Winnipeg called, "Winnipeg Most Healthy", "Winnipeg Average Health" and "Winnipeg Least Healthy". These aggregate areas are defined as follows:

North: An aggregate of Churchill, Burntwood and Nor–Man RHAs
Mid: An aggregate of North Eastman, Interlake and Parkland RHAs
South: An aggregate of South Eastman, Central and Assiniboine RHAs

For the sub–regions of **Winnipeg**, the clustering is based upon premature mortality rates.

Winnipeg Most Healthy: Those NCs of Winnipeg that have PMRs (premature mortality rates—see Chapter 2 for further explanation) that are statistically lower than the provincial average in the 1991–2000 time period—Assiniboine South, Fort Garry South, Fort Garry North, Inkster West, River East North, River East East, River East West, River Heights West, St. Boniface East, St. James–Assiniboia West, and St. Vital South.

Winnipeg Average Health: Those NCs of Winnipeg that have PMRs statistically similar to the provincial average in the 1991–2000 time period—Downtown West, River East South, River Heights East, Seven Oaks North, Seven Oaks East, Seven Oaks West, St. Vital North, and Transcona.

Winnipeg Least Healthy: Those NCs of Winnipeg that have PMRs statistically higher than the provincial average in the 1991–2000 time period—Downtown East, Inkster East, Point Douglas North, Point Douglas South, St. Boniface West, and St. James–Assiniboia East.

The way in which the RHAs and districts are ordered in this report has special significance. Each **RHA and district graph is ordered consistently** throughout the entire report. This order is based upon the overall population health status of the area as measured **by the premature mortality rate** of the area over a ten year period (1991 through 2000). Premature mortality rate (PMR) is an age– and sex–adjusted rate of "premature" death, that is, death before the age of 75 years. It is also used as a surrogate measure for the overall health status of a group of people. Refer to Chapter 2 for a detailed explanation of PMR. This ordering by PMR essentially gives a framework beyond just the information in a graph. The poorer the health status of a population, the more one would expect that population to use health care services. **Therefore, when reading the graphs, ask the question whether the outcome indicator rates make sense from a perspective of underlying health status—**is there some sort of a trend from the top (South Eastman, the region with the best overall health status) to the bottom (Burntwood, the region with the worst overall health status)?

Figure 1.1: Regional Health Authorities (RHAs) of Manitoba

Figure 1.2: Districts of Northern RHAs

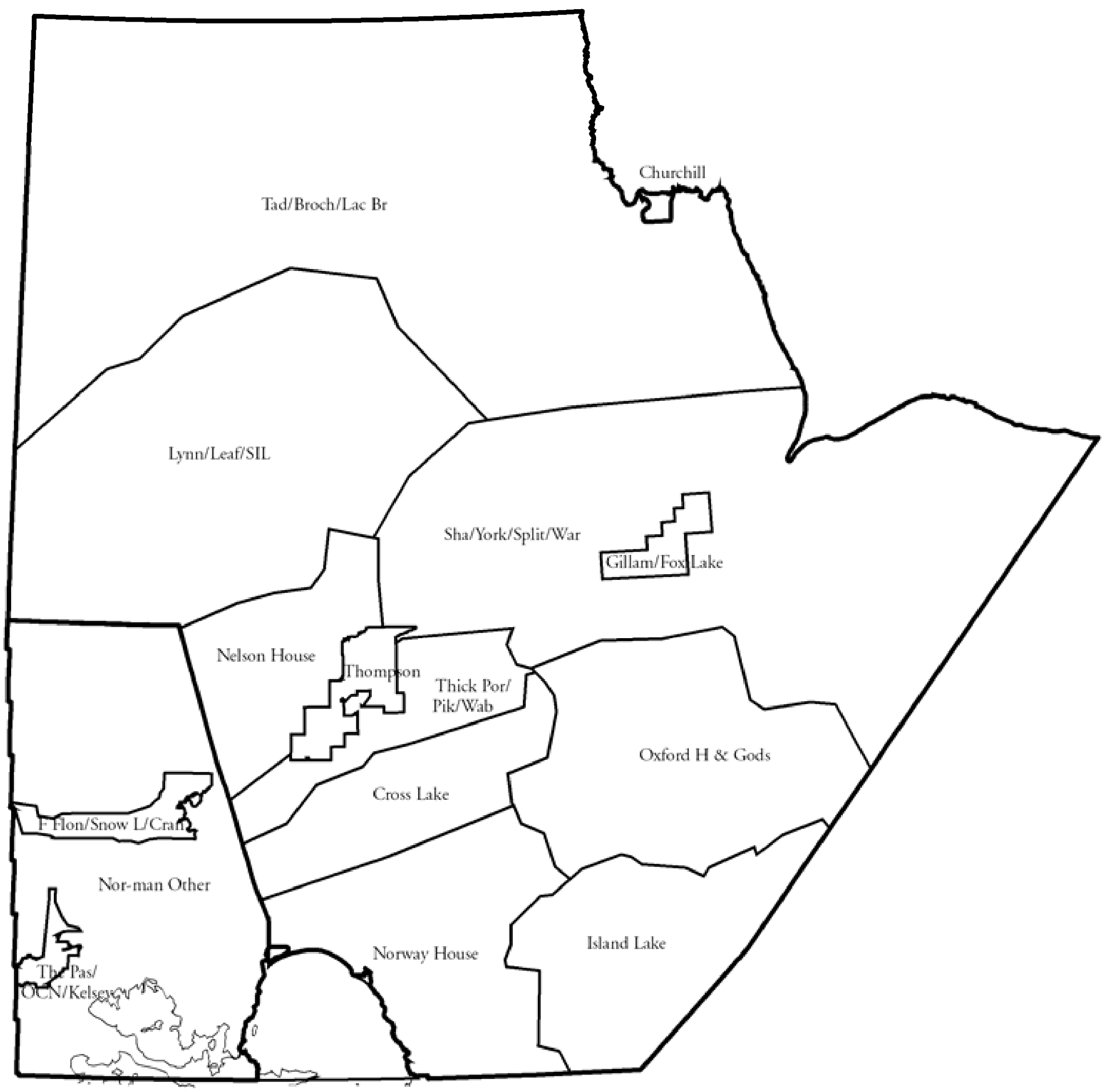
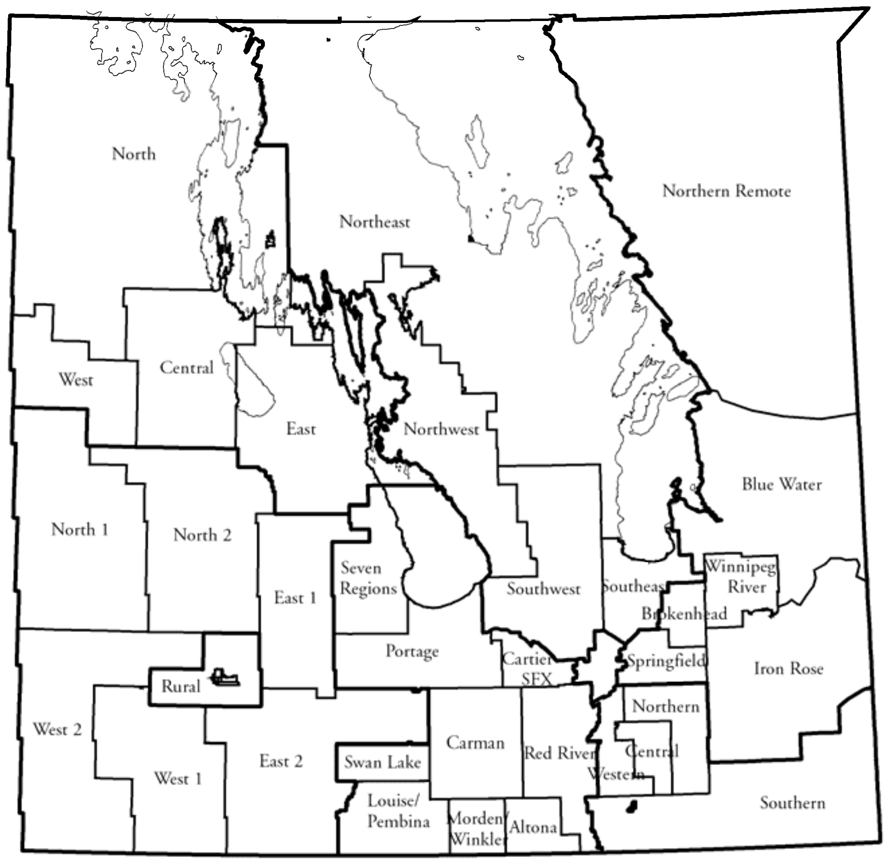


Figure 1.3: Districts of Southern RHAs & Brandon RHA



Brandon RHA

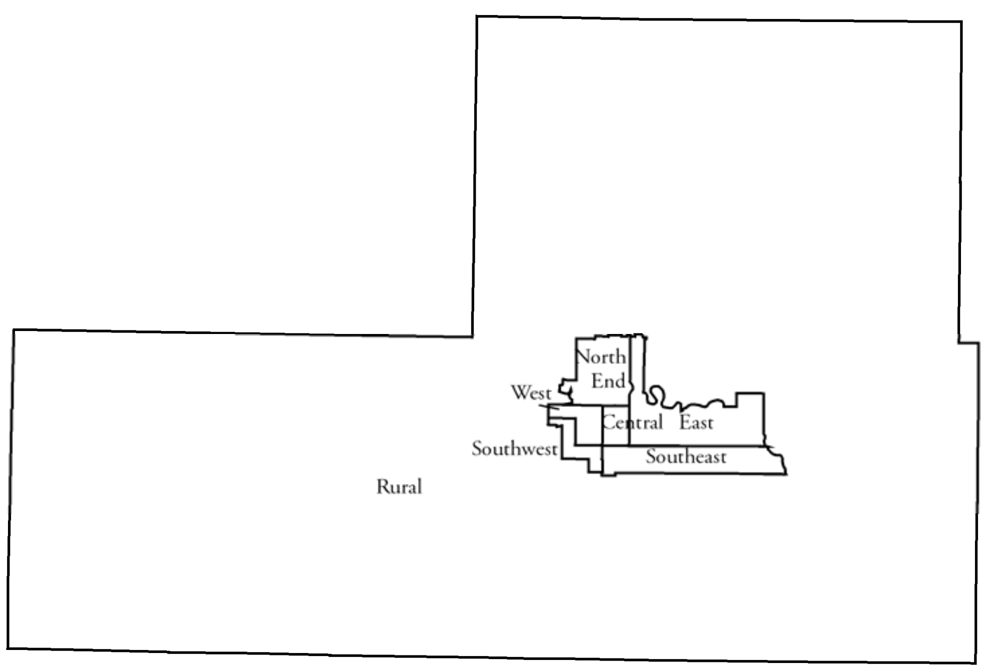


Figure 1.4: Winnipeg Community Areas and Neighbourhood Clusters

1.5 Methods Used in this Report

1.5.1 The Meaning of "Population–Based":

This report is a population–based report. What does this mean? First, it means that the rates or the prevalence are based upon every person living in Manitoba who has a provincial health card. For each of the indicators, a different population is used. For example, for immunization rates, we look only at two–year–olds, and for mammography, we look at women aged 50–69 years old. Each chapter includes definitions for that particular indicator, describing the population included in that analysis. So the rates are not based upon smaller "samples," but rather the entire population fitting these criteria—hence, "population–based".

Furthermore, the information in this report is based on **where you live, not where you go for treatment.** For example, a person living in a remote area may be hospitalized in Winnipeg for a certain illness, but the hospitalization is "attributed back" to the population living in that remote area. The rate of hospitalization of the people in a region like Burntwood includes all the hospitalizations of all the people who live in Burntwood, whether that hospitalization took place in a Burntwood hospital or a hospital in another RHA like Winnipeg or Nor–Man. Thus, the report offers insights into the health and health care use patterns of the population **within a geographical region**, no matter where the people of that region received the care.

1.5.2 The Data Sets Used in This Research:

MCHP houses sets of data collectively referred to as the **Population Health Research Data Repository** (often referred to as the Repository). These are derived from administrative data, that is, data which are obtained in order to administer the universal health care system within Manitoba. However, prior to MCHP using these data, identifying information such as name, street address and true health number is removed. Therefore, the Repository contains anonymized information, which is only "linkable" across files through a fictitious number assigned to the records. The Repository includes information of key interest to health planners, such as mortality and birth information, physician and hospital use, pharmaceutical use, and use of services such as home care and nursing homes (personal care homes). As well, enumeration area information from census data, like average household income for the geographical area, is "attributed" to all people living in that area. This gives insight into how socioeconomic factors affect health patterns or health care use.

For purposes of this report, the database files of the Population Health Research Data Repository were accessed:

- Hospital claims (records of hospital admissions)
- Medical claims (records of visits to physicians outside of those occurring to a hospital in–patient)
- Physician files to identify the type of service provided—a family physician/general practitioner or a specialist (such as a psychiatrist)
- Home care (records of the use of provincial home care services)
- Personal care homes (records of the use of nursing homes)

- The registry files (records of the time a person is registered as a resident of Manitoba as well as their age, sex, and area of residence)
- Vital statistics (records of births and deaths, causes of death)
- Pharmaceutical claims (pharmaceutical use from the Drug Program Information Network)
- The MIMS system (Manitoba Immunization Monitoring System) for records of immunizations of children and adults registered as residents of Manitoba
- The 1990, 1996, and 2001 census files (for socioeconomic information at the neighbourhood level)

Depending upon the source of data, rates and prevalence are generated for either fiscal years or calendar years. For example, "1996/97–2003/04" represents the fiscal years April 1, 1996 to March 31, 2004, and 2000–2001 represents calendar years January 1, 2000 to December 31, 2001. Most health care use data are reported in fiscal years, whereas most mortality data (like premature mortality rates) are reported by calendar years.

MCHP obtained ethical approval from the University of Manitoba's Faculty of Medicine Human Research Ethics Board, and from the Health Information Privacy Committee of the Manitoba government, to access the Population Health Research Data Repository for purposes of this report.

1.5.3 How Rates Were Generated:

In many former MCHP reports showing indicators, rates were age– and sex–adjusted through a statistical technique called direct standardization. This had its limitations, especially when determining rates for areas of smaller population counts. To compare and estimate rates of events in this report, the count of events for each indicator was "modeled" using a statistical technique called a generalized linear model (GLM), suitable for non–normally distributed data such as counts. Various distributions were used for different indicators, including Poisson distribution (very rare events), negative binomial distribution (relatively rare but highly variable) or binomial distribution (two outcomes—yes/no), depending upon which fit the data best. Covariates were included in the model to "adjust" for such effects as sex (male/female) or age. To determine differences by region or time, covariates described geography (using Manitoba as the reference) and time (using the first time period as the reference), as well as geography by time interactions. A list of all covariates for each outcome indicator is given in the Glossary under the "Modelling and Estimation of Rates" entry.

In order to obtain region and district rates for the various bar graphs and time trend graphs, relative risks were estimated for each region and time period. To estimate relative risks of rates rather than events, the log of the population count in each stratum was included in the model as an offset (see more detail in the Glossary). Estimated rates were calculated for each region/district by multiplying the Manitoba crude reference rate by the appropriate relative risk estimate.

1.5.4 Adjusted Rates, Crude Rates, and Statistical Testing of Rates:

Most of the indicators are given as **adjusted rates,** adjusted through the statistical modeling described earlier. This means that the rate has been adjusted to create a fair comparison among regions with different age distributions. All rates are adjusted to reflect what the rate would be if each area's population had the same age (and sex, in some indicators) distribution as the Manitoba overall population at the first time period of the analysis. Rates are **suppressed** (that is, not reported) where the counts upon which the rates are based represent five events or less (unless the rate is truly 0, in which case it can be reported). This is to avoid breeches of confidentiality and is similar to the way in which Statistics Canada reports data. Throughout the report, the letter "s" in brackets beside the RHA or district name on the left–hand side of the graph indicates a suppressed rate.

Appendix 2 contains tables listing the **crude rates or prevalence** (the actual count divided by the actual population), without any adjustment for age and sex distributions. These tables also include the 'observed' number of events for each indicator. This type of information is helpful in giving a realistic look at the effect of the population burden of illness on the region's health care system—actual numbers of the regional population who will require health care services for their illness or condition.

Statistical testing indicates how much confidence to put in the results. If a difference is "statistically significant," then this difference is large enough that we are confident it is not just due to chance. So we would expect to see the rate remain either higher or lower than the provincial average from year to year, unless some change is implemented. When you see a large difference that is NOT statistically significant, it is telling you that this rate is considered similar to the comparison (usually the provincial average) and that it could fluctuate greatly from year to year. This is usually due to the rate being based on small numbers (either a small number of events or a small underlying population), so it could change from year to year and may be higher, similar or lower than the comparison the next time it is measured. Because of its very small population, Churchill RHA often has highly fluctuating rates and as a result, rarely shows rates that are considered truly statistically different than the Manitoba overall rate.

Most of the graphs contain information about **statistical comparisons**. This simply gives an indication as to whether or not an area's rate is statistically higher or lower than the comparison group, or if the rate should be considered similar to the comparison group when no statistical difference is noted. In each graph, the notation provided in brackets beside the name of the RHA or district indicates statistical significance. Below each graph is an explanation of the statistical notations.

In most of the chapters, the first four graphs are bar graphs, showing rates of the outcome indicator for two time periods for each RHA, district, Winnipeg CA, or Winnipeg NC. The notation "**1**" beside the name of the area means that this area's rate at the earlier time (time "1") is **significantly different than the overall Manitoba average rate at time 1** (which is shown by the dotted vertical grey line, and by the grey bar beside the Manitoba overall rate at the bottom of the graph). A "**2**" simply means that this area's rate at the later time (time "2") is **significantly different than the overall Manitoba rate at time 2** (shown by the dotted vertical black line, and by the black bar beside the Manitoba overall rate at the bottom of the graph). A "**t**" means that there is a statistically significant **difference over time** within that RHA or district.

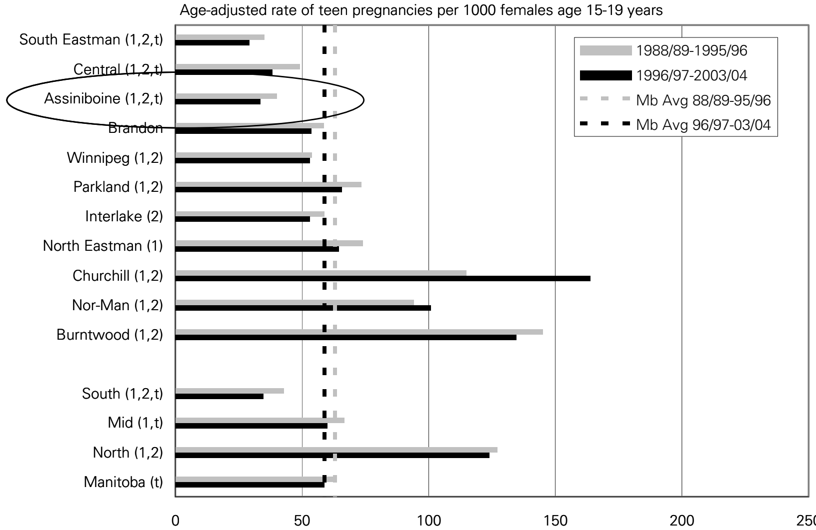
Statistical testing is done in such a way that when a difference is "statistically significant", it means that there is 95% certainty that the difference one sees is not due to chance alone. "Statistically significant" differences occur about 5% of the time merely through chance. This chance finding is called a Type I error—finding a statistical difference when in reality there was no difference.

In situations where statistical testing is done repeatedly on the same data set, one could potentially have a much larger Type I error than the traditionally allowed 5%. To avoid much larger Type I error, one uses a Bonferroni correction factor whereby the traditional p<.05 (5%) level of significance is stiffened for each individual test in the series of tests. This helps keep the overall level of Type I error at the allowable 5% level. So when we tested for differences between each RHA or each Winnipeg CA and the Manitoba overall average, the statistical criterion of p<.01 was applied for each single test, to give an approximate overall p<.05, or 5%, level of Type I error. Similarly, when testing for differences between each district or each Winnipeg NC and the Manitoba overall average, the criterion of p<.005 was applied to each single test. The standard statistical criterion of p<.05 was used for testing differences between time within each RHA. All data management, programming and analyses were performed using SAS® software.

Here is an example from Chapter 4, to illustrate how to read statistical notations. Assiniboine RHA has the notation (1, 2, t) beside its name. The "1" notation means that the teen pregnancy rate in Assiniboine RHA was "statistically different"—in this case, it's lower—than the provincial average (the dotted grey line) in 1988/89–1995/96. The "2" means that the same is true for the second time period—Assiniboine's black bar teen pregnancy rate is statistically lower than the provincial average (black dotted line) for 1996/97–2003/04. The "t" means that Assiniboine RHA's teen pregnancy rate is statistically different over those two time periods—in this case, the teen pregnancy rate in this RHA dropped over time.

Figure 4.1: Teen Pregnancy Rates by RHA

Age-adjusted rate of teen pregnancies per 1000 females age 15-19 years



'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates cahnge over time was statistically significant for that area
's' indicates data suppressed due to small numbers Source: Manitoba Centre for Health Policy, 2007

Looking at Churchill RHA's rates in this graph, they are both statistically different (i.e., in this case higher) than the provincial averages in both time periods (hence, the "1" and "2" notation), but despite the appearance of an increase, this is not considered a statistically significant increase (there is no "t"), so could appear to be different only due to random fluctuation that could easily occur in such a small population.

1.5.5 How Time Trends Were Determined to be Similar or Different From the Manitoba Time Trend—the Use of Control Charts:

When evaluating programs or policies at the population level, various approaches could be used. For example, a randomized trial may be set up, so that people or sites are randomly selected to either receive or not receive the "intervention" under evaluation. However, this randomized approach is sometimes not practical in the daily world of health care, where decisions are often made regionally without any randomization involved. "Quasi–experimental" designs take a similar approach, but use real world situations where one group/region receives a certain intervention, and another group/region that is similar to the intervention site is chosen as a comparison site. If measures can be taken at both sites before and after the intervention occurred, then differences pre– and post–intervention can be compared to see if the intervention produced a positive outcome more than would be seen just through historical changes over time. This type of study is called a time series study, and more specifically, a quasi–experimental time trend with comparison group study. It is often diagrammed like this, where the Os represent some sort of measure, the X represents the intervention, the top row represents the intervention site, the bottom row represents the comparison site, and the dashed line indicates that these sites were not randomly chosen but rather chosen because of their similarity (hence, a "quasi" experiment, not a randomized experiment—see Campbell and Stanley 1963).

O O X O O

O O   O O

For example, let's say that one region provided a teenage pregnancy reduction program. That would be the "X". Another region did not. So using the Repository information, we could go back in time, calculate teen pregnancy rates before and after X in that region, and compare these with another region that did not introduce this program. We would assume that if the intervention worked, we would see different time trends in the two regions at the population–level, with the teen pregnancy rates possibly going down faster in the intervention region than in the comparison region.

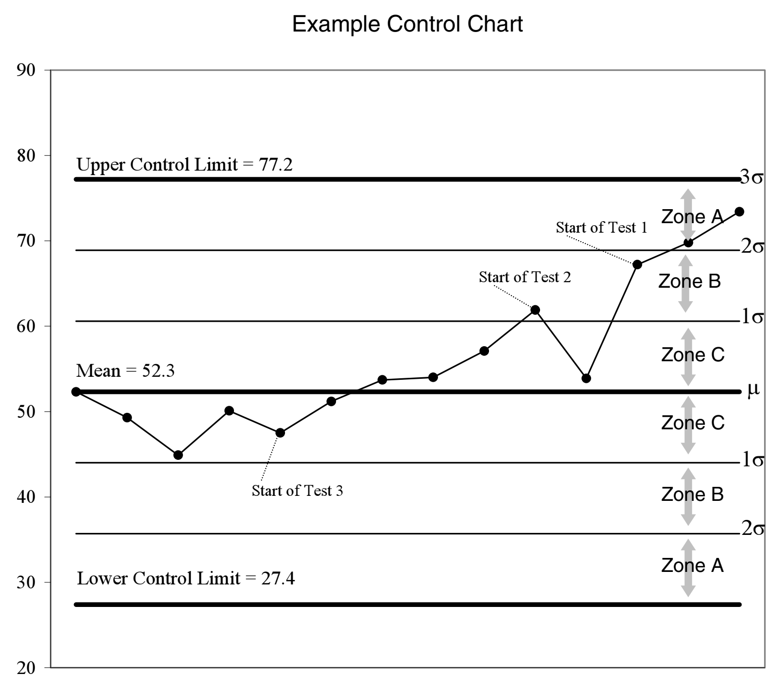
The problem with this sort of design is that policies and programs are often not that neat and tidy. There may be many Xs within various regions of the province, all occurring at different times, and some occurring over more than one region. As well, programs often attract the people who are most motivated to change. What's more important from a policy perspective is if we could detect an overall change of the whole region (for example, an overall drop in teen pregnancy for the whole region, not just for those who were known to be in the small program). The second problem can often be in the non–linear nature of the data. For example, in this report many of the outcome indicators showed variations over time, from increasing rates for a period of time, to decreasing rates at other periods of time. Hence, we needed to determine a different way of evaluating the real–world context of what one could call 'messy interventions'.

Assuming that natural change occurs over time, whether through cultural shift or big–picture changes beyond the control of provincial governments or regional planners, we chose the Manitoba time trend as the "historical time trend" to which all other regions and districts were compared. What we were interested in was whether or not certain areas of the province were "bucking the trend". Were there areas of the province that appeared to be improving faster than the provincial historical trend?

For each outcome indicator, we used data in the Repository for as far back in time as was valid. This was often back as far as the mid– to late 1980s. Once the rates by geographical areas were determined as described earlier, we then used the concept of Control Chart statistics. This technique is familiar to many health care settings, and is an industrial statistical method for determining whether some sort of process is "going out of control". In our situation, we assigned the Manitoba time trend as the gold standard to which we would compare all other geographical regions, to determine if these regions were "in control", i.e., parallel to the provincial time trend, or "out of control", i.e., showing rates that either increased or decreased faster than the Manitoba time trend.

Control Charts are a visual statistical tool in Quality Control Analysis used to distinguish between normal and abnormal variation in a quality characteristic or indicator and to detect changes in indicators over time. An example of a control chart is displayed below.

The chart contains a centre line (μ) that represents the mean or average value of the quality characteristic corresponding to the in–control state. In this report, the centre line is always the estimate of the difference between a given area's rate at the start of the study period and the provincial rate at that time. Hence, if the "process" were in control, this difference would be maintained throughout the entire time period (i.e., the area's rate over time would be parallel—possibly higher, lower or similar—to the provincial rate, throughout the entire time period tracked).



Two other horizontal lines, called the upper control limit and lower control limit, are also shown on the chart. These limits are always three standard deviations (3σ) from the estimate of the area's rate difference at the start of the study period. These control limits are chosen so that if the process is in control, nearly all of the sample points will fall within the control limits. The control chart is further partitioned into three zones A, B and C on each side of the centre line. Zone C lies between the centre line and one standard deviation from the centre, Zone B lies between one and two standard deviations of the centre and Zone A lies between two and three standard deviations from the centre.

Increasing or decreasing trends as well as out of control conditions can be easily visualized using control charts and quality control tests, often called the *Western Electric Rules* (Reference: Montgomery, Douglas C., *Introduction to Statistical Quality Control*, Third Edition, John Wiley and Sons, Inc., New York, NY, 1996). The tests chosen to test for trends in this report are:

1. Two out of three consecutive points outside the 2–sigma warning limits (Zone A or beyond)—called "Test 5".
2. Four out of five consecutive points outside the 1–sigma warning limits (Zone B or beyond)—called "Test 6".
3. A run of six consecutive points steadily increasing or decreasing—called "Test 3".

In cases of very rare events, such as suicide, a control chart may have a small number of points due to the fact that several years of data were combined for more stable rates in each time period. In these cases an alternate quality control test was employed:

4. One or more points outside the control limits (beyond Zone A)—called "Test 1".

For the purpose of this study, control charts were created for each area in Manitoba (i.e., RHAs, aggregate areas, districts, CA and NC) for each indicator (e.g., rates of teen pregnancy, breastfeeding initiation, etc.).

These control charts were analyzed independently by five of the study staff, including the investigators, programmers and research assistant. According to the statistical output based upon the Western Electric Rules, each person coded the trend for each area as either 'similar,' 'increasing,' 'decreasing' or 'erratic' (see Glossary information on Control Charts for further discussion of how this was determined). Coding results were compiled and reviewed as a group if less than 4 out of 5 agreed. Differences were discussed and a final code determined by consensus or majority. These final codes were then mapped to help visualize the trend in rates for each indicator in each area.

1.5.6 Logistic Regression Modeling of the Outcome Indicators in the Most Recent Period (2003/04 for most indicators):

Through the use of **logistic regression**, we were able to determine the **unique contribution of many factors on each outcome indicator** in the most recent period of data available to us. For example, in the case of immunization (Chapter 8, Section 8.2), we wanted to know the predictors of complete immunizations in the year 2003/04. Logistic regression is a technique to determine the likelihood of a "yes/no" outcome given certain individual or regional characteristics. These models generate Odds Ratios (OR). An OR of greater than 1 means that there is a higher likelihood, an OR of less than 1 means a lower likelihood, and an OR around 1 means that this characteristic has no effect on the outcome. The OR tables are provided in Appendix 4, and each chapter also gives a verbal description of the predictors. Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. Therefore, we cannot claim that one causes the other, but we can state that there is an association where the explanatory variable was associated with an increase or decrease (not that it caused the increase or decrease). For example, unique contributions to the likelihood of getting a complete set of immunizations at two years of age are as follows (see Chapter 8, Section 8.2):

- Individual characteristics that **increased** the likelihood of immunization (i.e., OR was greater than 1, and statistically significant)—higher mother's age at the birth of her first child, higher average household income of the neighbourhood of residence, higher gestational age or birthweight of the newborn, if the child was breastfed, and if the child received good "continuity of care" by a physician (i.e., at least 50% of visits are to the same physician within one year).
- Individual characteristics that **did not affect** the likelihood of immunization (i.e., OR was around 1, and not statistically significant)—whether the baby was male or female; whether or not the mother visited a chiropractor in the past year.
- Geographical characteristics that **increased** the likelihood of immunization, after controlling for all other factors—residing in Parkland RHA, and in Winnipeg's St. Vital community area.

This information yields **valuable insights into what characteristics at both the individual and regional levels appear to influence the likelihood of a good outcome** (in some indicators, this may mean decreasing the likelihood, and in some, increasing the likelihood). After controlling for variations in individual characteristics (for example, some regions may have much younger mothers, or more babies of low birth weight), those regions of the province that still increase the likelihood of a good outcome, i.e., two–year–old complete immunizations, could serve as examples for particularly effective childhood immunization programs or policies.

Why did we use "region" in the modeling? Knowing that we were unable to model certain policies or programs specifically (due to the possible bias in specifying the timing or characteristics of the programs, especially for those occurring before 2000), geography is really a surrogate for regional characteristics that were not measurable in our study—specifically, certain programs or policies that varied regionally. When a geographical area proves to be anomalous in a health outcome measure, it gives some degree of evidence that there is something about the geographical area beyond individual–level effects that is related to a positive (or negative) outcome of the particular health indicator. This can prove helpful in trying to map the descriptive information for policies/programs onto the quantitative analysis, knowing that measureable characteristics of the individuals that may affect health and may also be different amongst regions (such as the proportion of the population of certain ages, income levels or comorbidities).

1.6 A Cautionary Note on Causation

The study design in these analyses is quasi–experimental time trend analysis, using a comparison group (Manitoba time trend). This is considered to have medium internal validity. That is, although we may find an association between certain anomalous regional time trends and the uniqueness of the policy or program descriptions for that area, we can only state that there is an association between the two. We cannot ascribe direct causation of the policy or program to the observed health outcomes. There could be unmeasured effects that explain the results (such as programs that were not included in the interviews or regional characteristics of the people residing there that were unmeasured in the study). Despite this limitation, it is important to note that according to quasi–experimental theory (Campbell and Stanley 1963; Cook and Campbell 1979; Campbell et al. 2002), time trend analyses with comparison groups control for all of the biases in internal validity (history, maturation, testing, regression towards the mean, instrumentation, selection, and mortality). However, because we were unable to measure a specific 'X' at a specific time with certainty, internal validity for a direct causation effect of the policies/programs needs to be stated with caution.

1.7 A Population Perspective—Population Attributable Risk Calculations and Examples

In some chapters, as well as in Table 1.1 below, a Population Attributable Risk calculation has been added to the discussion sections. **Population Attributable Risk (PAR)** is a term used in epidemiology to determine a theoretical benefit of certain interventions. This is a mathematical calculation that depends both on the magnitude of the risk associated with a certain "exposure" and the proportion of the population that is "exposed" to that particular exposure. The "answer" from a PAR calculation gives you a hypothetical estimate of the proportion of the outcome (such as having an amputation in people with diabetes) that could be attributed to being exposed to something (like lack of continuity of care).

Because this brings a population health perspective from both public health and health services research, this is a critical lens through which to view various interventions. Continuity of care is an issue of policy and practice within our health care system, particularly pertinent as provinces explore primary care models. Although we are limited in this report to measuring the continuity of care provided by physicians (nurse practitioners have only recently begun shadow billing into the system, and various other health care providers are certainly important to a Team approach), we look at continuity of physician care as a "surrogate" for care being consistent over time. Table 1.1 gives a summary of the PAR for continuity of care (or the lack of it) on various outcomes of interest in this report. Five of the outcomes in this report (see Appendix 4) show a positive effect of continuity of care: reduced risk of amputation for people with diabetes, increased likelihood of having complete two–year–old immunizations, complete physicals, mammography, and cervical cancer screening[1].

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[1] PAR = P(RR–1)/[P(RR–1) + 1], where P is the prevalence of the exposure, and RR is the relative risk of getting a certain condition if you are exposed to the given exposure under discussion. To use the PAR formula, a relative risk (RR) is required (see Zhang and Yu, 1998). In this report, odds ratios (OR) were generated in the logistic regression models. OR and RR are close mathematically if the prevalence of the "disease" is low (10% or less). The following are the OR and the RR for lack of continuity of care for each of the indicators: lower limb amputation (OR 1.31; RR 1.31); incomplete immunizations (OR 1.56; RR 1.15); not having a complete physical (OR 1.38; RR 1.23); no mammogram (OR 1.97; RR 1.37); no Pap test (OR 1.82; RR 1.23).

We calculated the PAR (population attributable risk) of the "disease state" (i.e., the non–desired effect) for lack of continuity of care (shown in Table 1.1). The values in the table are the estimated proportion of each outcome that could be attributed to being "exposed" to low continuity of care. For example, in the population of all people with diabetes, if 50% of them had poor continuity of care, then 13.4% of the amputations in people with diabetes would be "attributable" to lack of continuity of care. If only 10% of the population of people with diabetes had poor continuity of care, 3.0% of the amputations would be attributable to lack of continuity of care.

Table 1.1: Population Attributable Risk (PAR) calculations related to lack of continuity of care, for five outcome indicators

		PAR (Population Attributable Risk) of receiving poor continuity of care				
Percent of population having good continuity of care	Percent of population having **poor continuity of care****	Those diabetics with a lower limb amputation due to diabetes	Those two-year olds with incomplete immunizations	Those people not having a complete physical	Those women not having mammography screening	Those women not having cervical cancer screening (no PAP test)
90%	10%	3.0%	1.5%	2.2%	3.5%	2.2%
80%	20%	5.8%	2.9%	4.4%	6.8%	4.4%
70%	30%	8.5%	4.4%	6.4%	9.9%	6.4%
60%	40%	11.0%	5.7%	8.4%	12.8%	8.4%
50%	50%	13.4%	7.1%	10.3%	15.5%	10.2%
40%	60%	15.7%	8.3%	12.1%	18.0%	12.0%
30%	70%	17.8%	9.6%	13.8%	20.4%	13.7%
20%	80%	19.9%	10.8%	15.5%	22.7%	15.4%
10%	90%	21.8%	12.0%	17.1%	24.8%	17.0%

** poor continuity of care means that the person received less than 50% of their visits from the same physician in a given year.

Note: the overall provincial average of good continuity of care is around 70% for both males and females, with variations by RHA districts from around 40% to 90% (see Fransoo et al. 2005, in the Sex Differences Report; Figures 4.6.1 and 4.6.2)

1.8 Summary

There is a wealth of information in this report on outcome indicators of use to planners and decision–makers of Manitoba who are interested in public health and health service programs and policies. *The Need To Know* Team hopes that this will prove useful to planners, decision–makers and policy–makers in each of the RHAs of Manitoba, as well as other planners throughout Canada. The information can be used in many ways. A region can obtain an overview of the population it is serving and how outcomes have changed over time as well as how rates differ within their own regions. Regions can "cross–compare" their information with other regions. What we are trying to do through this report is to delve down into the somewhat murky waters of "what works" at the population level. Given the wealth of descriptive and quantitative information in this report, regional planners will ask many questions about the context of their outcome indicators—how do the data add to the knowledge that planners have about their region and its services, and what appears to be "working"? Furthermore, this report gives us fertile ground on which to base evaluations of more recent initiatives provincially and regionally.

We hope that this information will be a useful tool in the effort to improve the health of the entire population of Manitoba. If you would like to access an electronic version of this report, which may help you in creating your own summary presentations, you will find this on the website of the Manitoba Centre for Health Policy, under Reports (complete reports). You will also find Excel spreadsheets for the graphs in this report (and graphs from other key reports of interest to RHA planners) by looking under the MCHP link called "Data Extras." **Some of the more detailed information, such as time trends at the regional and district levels, and extensive descriptive information on programs and policies at the RHA level, was not included in the paper copy of this report but is available on the website.**

The MCHP website address is **http://www.umanitoba.ca/centres/mchp/**

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Chapter 2: Premature Mortality Rate

This chapter is intended to be background material for the rest of this research report, rather than an "outcome" of particular programs or policies. Premature mortality rate, or PMR, is considered a fundamental indicator for the overall "healthiness" of a regional populationand has been used in many MCHP reports.

Although it may seem unusual to use a mortality measure as a way in which to measure health status, PMR has been noted in various research studies as a robust indicator which is highly correlated with other health indicators, including physical illnesses, self–reported health status, and measures of socioeconomic status. Thus PMR is used extensively as a framework, since it is considered a surrogate for the underlying health status of a group of people and thus their "need" for health care (Eyles et al. 1991; Eyles and Birch 1993; Heistaro et al. 2001; Miiunpalo et al. 1997; Black et al. 1999; Roos 1999; Roos et al. 1999; Martens et al. 2002; Martens et al. 2003).

A ten year age–adjusted premature mortality rate (PMR) is calculated from 1991 to 2000, combining both males and females, for the purpose of ordering the geographical areas in all figures. RHAs are ordered from lowest PMR to highest PMR, or from best overall health status to poorest overall health status, on each graph. In figures showing RHA Districts, the ordering of RHAs is preserved, and the districts within the RHAs are also ordered from lowest to highest PMR. The same is true for the Winnipeg Regional Health Authority's 12 Community Areas (CAs) and 25 Neighbourhood Clusters (NCs).

Thus graphs shown in this research report all have the same ordering of RHAs—
South Eastman, Central, Assiniboine, Brandon, Winnipeg, Parkland, Interlake, North Eastman, Churchill, Nor–Man and Burntwood. This reflects the ten year PMR, from the lowest (most healthy population) in South Eastman to the highest (least healthy population) in Burntwood. The districts of South Eastman are ordered as: Northern, Central, Western, and Southern (with Northern being the healthiest population overall and Southern the least healthy, within South Eastman RHA).

Therefore, when looking at any of the indicator graphs, a "layer" of extra information is available. The reader can ask the question: Is this particular indicator correlated with the PMR ordering which reflects the underlying health status, or "healthiness", of the population? It would not be surprising to find that healthcare service rates are higher in areas of higher PMR (i.e., lower overall health status) given the burden of illness of the region. But it would be disconcerting to see that a region of high PMR had the opposite—lower visit rates to a given healthcare service, indicating that underlying health "needs" may not be matched with the overall healthcare service use. **Although it is difficult to say what is the "right rate" when looking at health service use, one can probably assume that a regional rate should be higher if a region has overall poorer health.** So although a "right rate" cannot be stated, a comparatively "right rate", i.e., higher use for regions of lower health status, should be seen.

2.1 Definition, Graphs and Maps

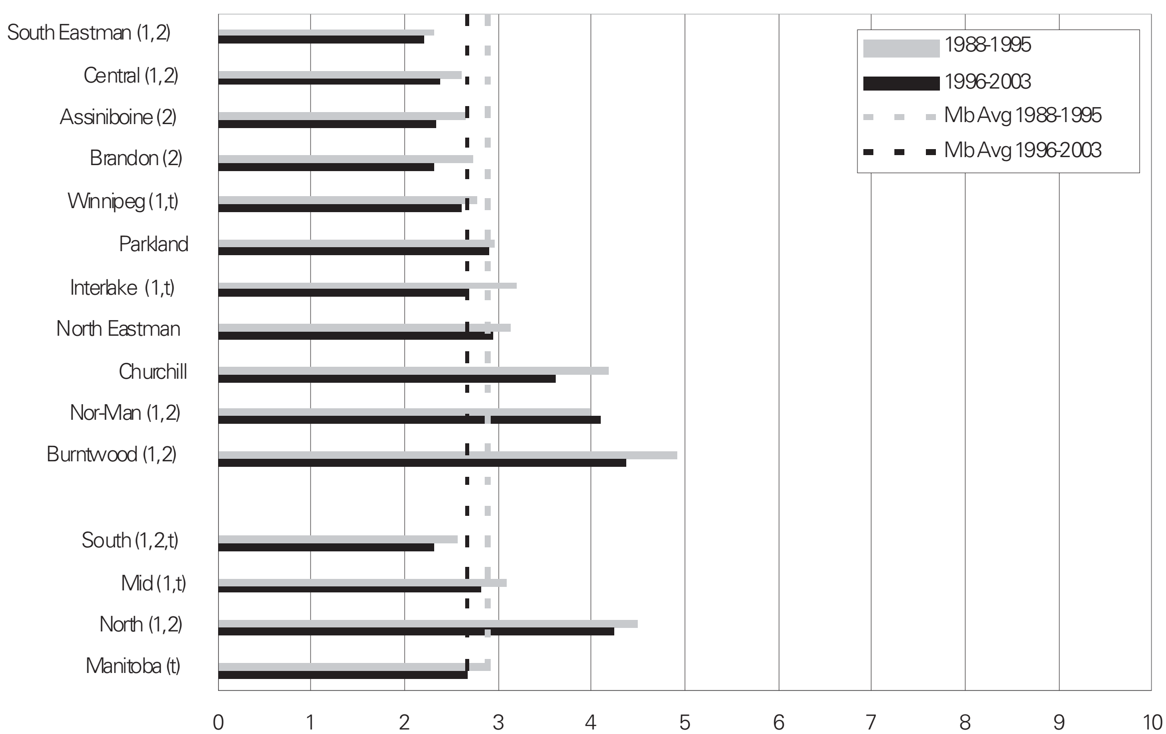
Premature mortality rate (PMR) is the age–adjusted rate of death among area residents 0–74 years old, per thousand 0–74 year olds in that area, calculated separately for females and males. A separate set of graphs has been provided for both females and males.

Four–year premature mortality rates are calculated over 20 calendar years, 1984–2003, to determine trends in PMR in Manitoba over time. Premature mortality rates are often used as an overall indicator of population health, and are correlated with other commonly used measures such as disease prevalence, self–rated health and socioeconomic factors. It is often considered to be the best single indicator of population health status capturing the need for health services.

Note that "**wards of the state**" **were excluded from all PMR analyses,** which is different from some previous MCHP reports. Refer to the Glossary in Appendix 1 for details about the rationale behind this and how this affects PMR results.

Figure 2.1: Premature Mortality Rate for Females by RHA

Age-adjusted average annual death rate per 1,000 females age 0-74

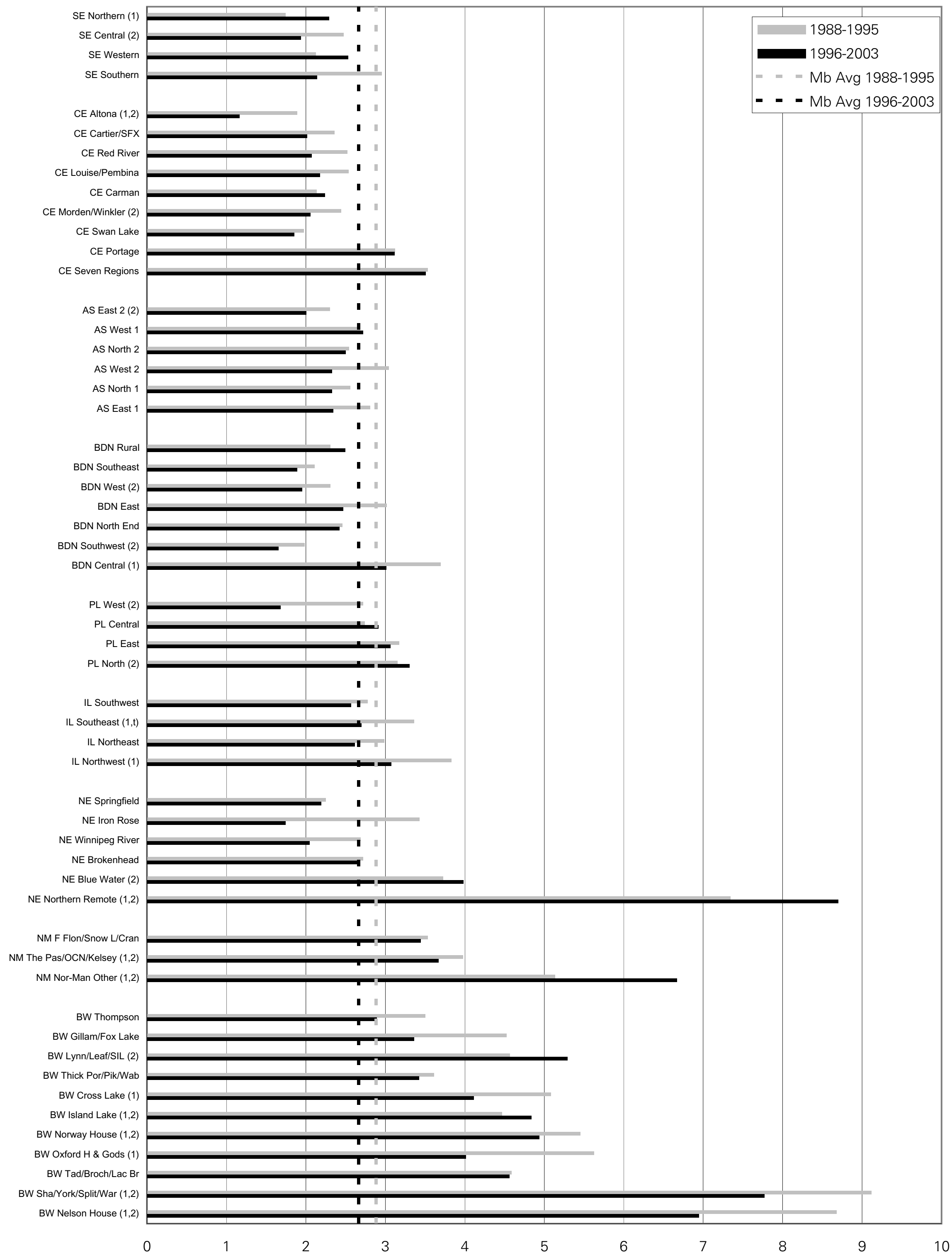


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 2.2: Premature Mortality Rate for Females by District

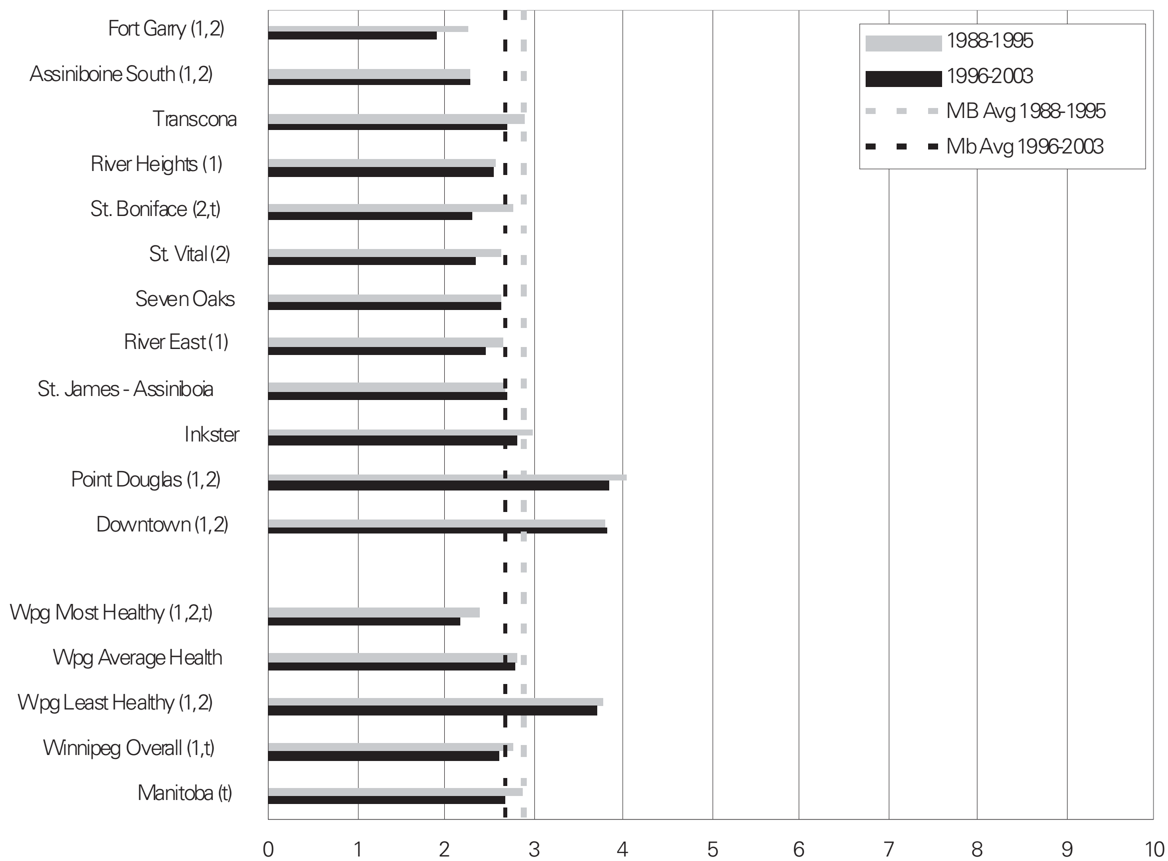
Age-adjusted average annual death rate per 1,000 females age 0-74



Source: Manitoba Centre for Health Policy, 2008

Figure 2.3: Premature Mortality Rate for Females by Winnipeg Community Areas

Age-adjusted average annual death rate per 1,000 females age 0-74

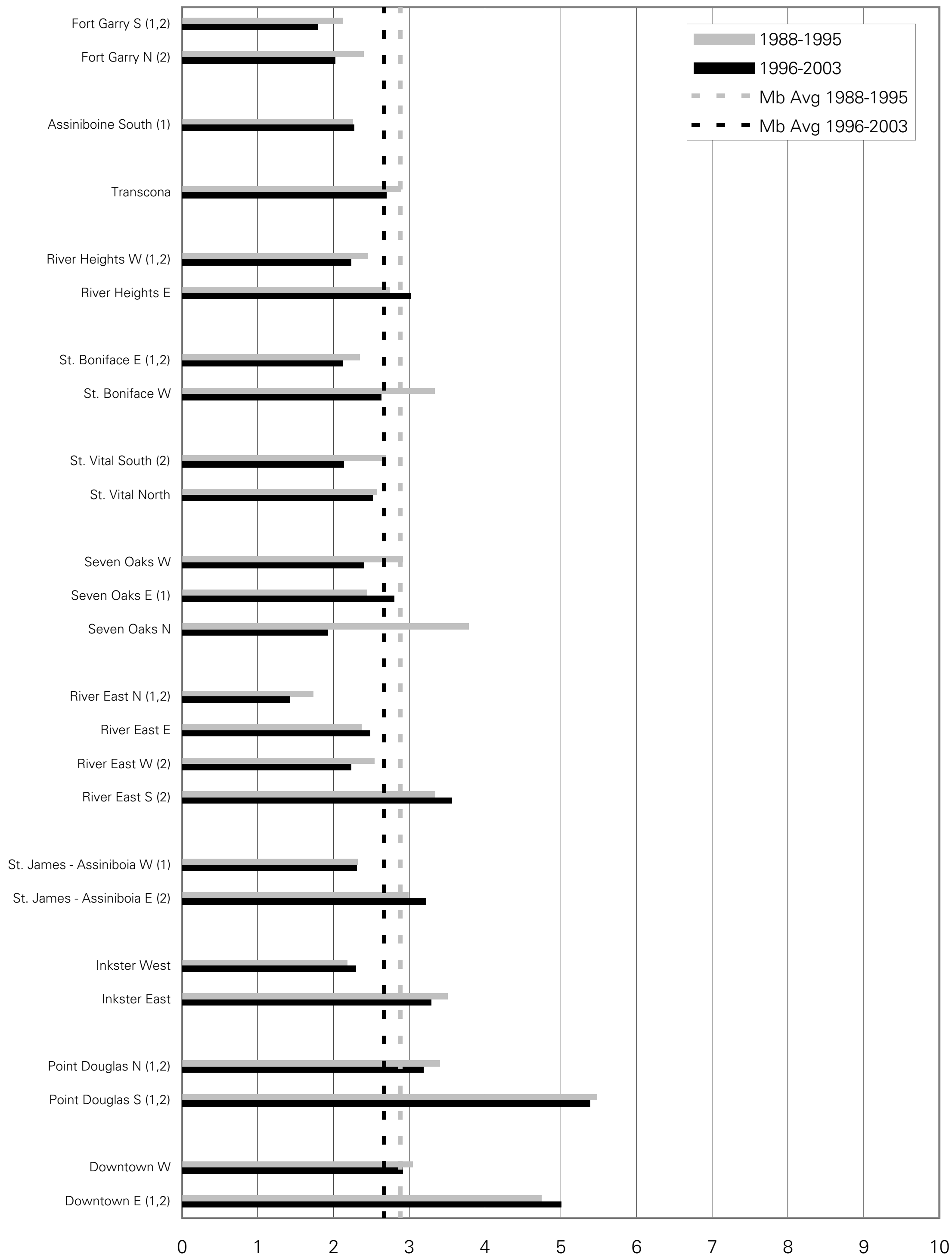


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 2.4: Premature Mortality Rate for Females by Winnipeg Neighbourhood Clusters

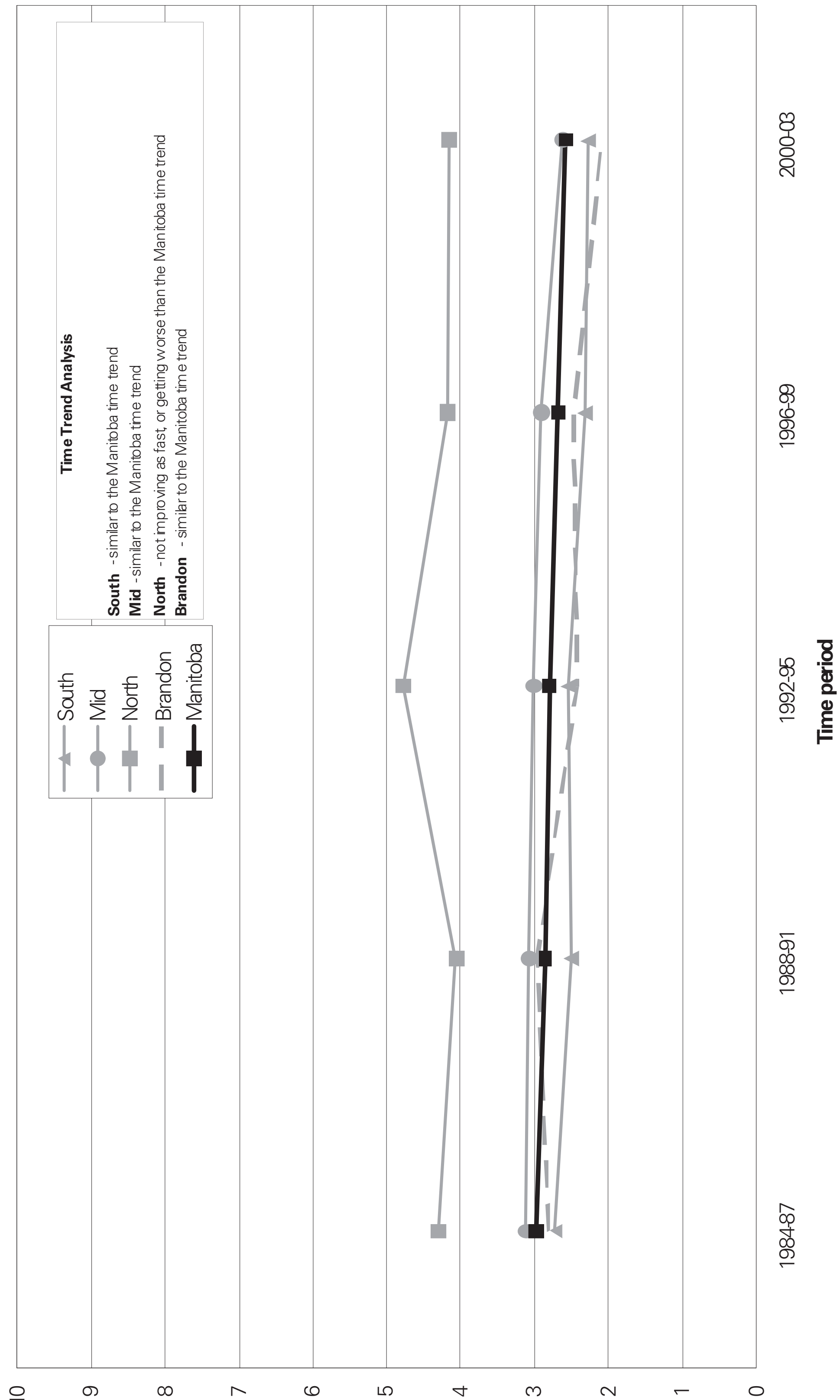
Age-adjusted average annual death rate per 1,000 females age 0-74



Source: Manitoba Centre for Health Policy, 2008

Figure 2.5: Trends in Non-Winnipeg Premature Mortality Rates for Females

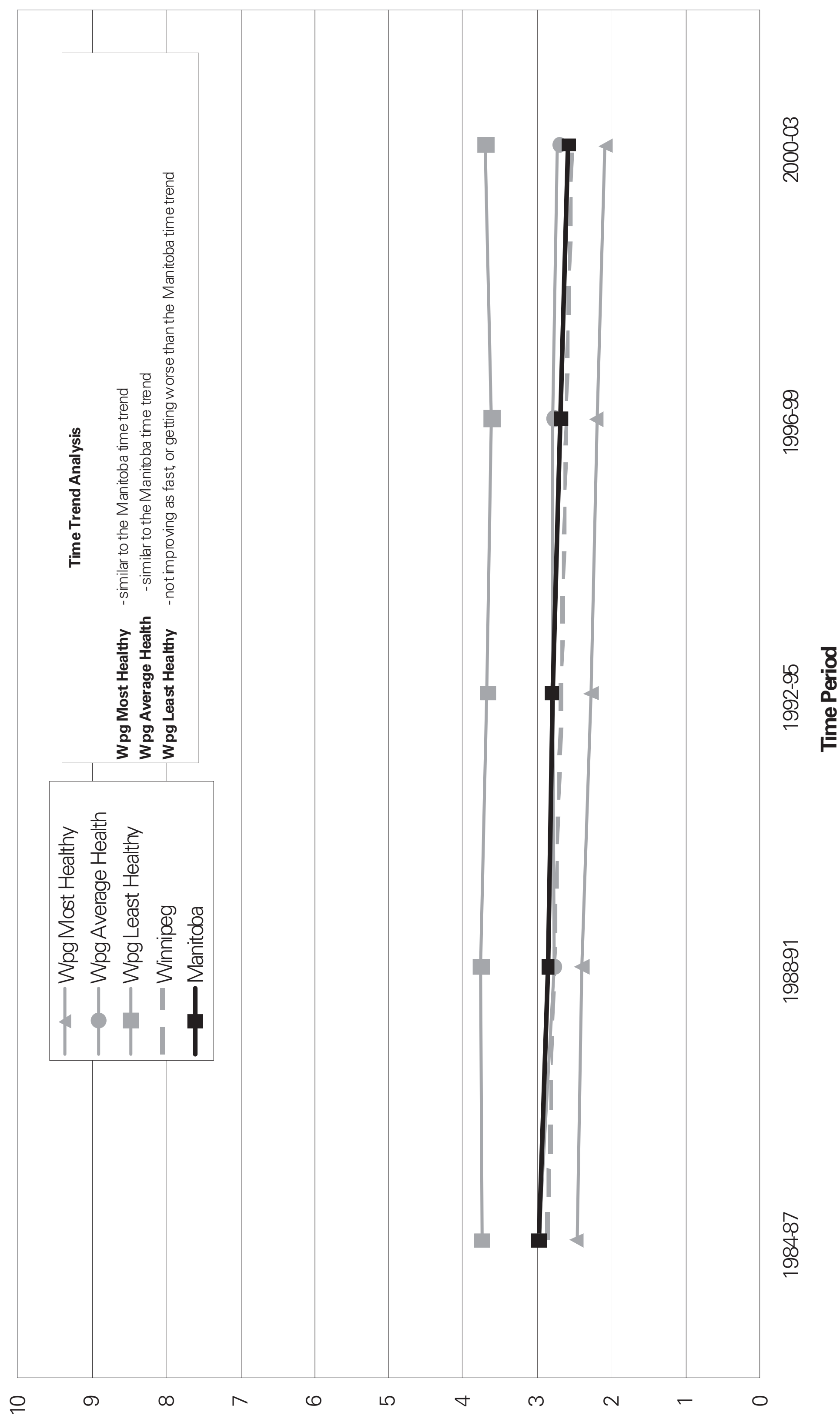
Age-adjusted average annual death rate per 1,000 females age 0-74



Source: Manitoba Centre for Health Policy, 2008

Figure 2.6: Trends in Winnipeg Premature Mortality Rates for Females

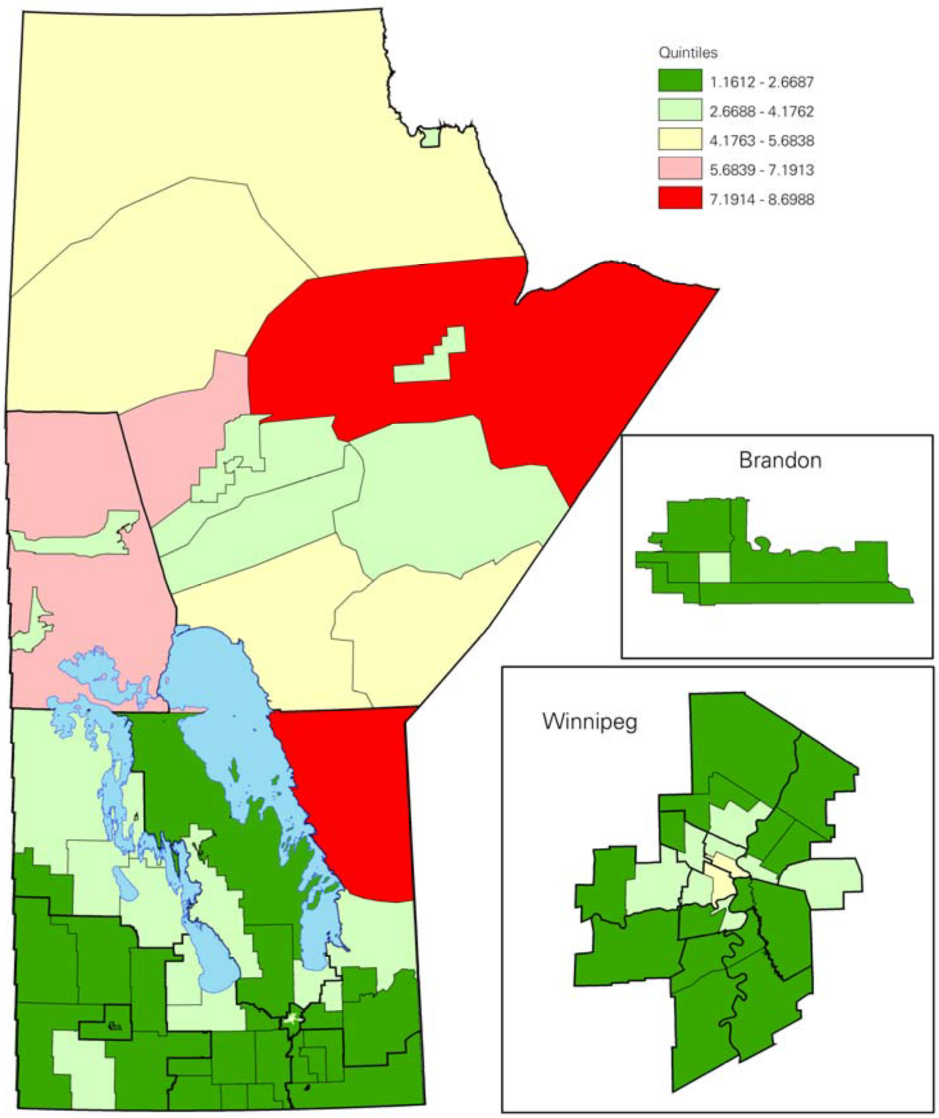
Age-adjusted average annual death rate per 1,000 females age 0-74



Source: Manitoba Centre for Health Policy, 2008

Figure 2.7: Female Premature Mortality Rate Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

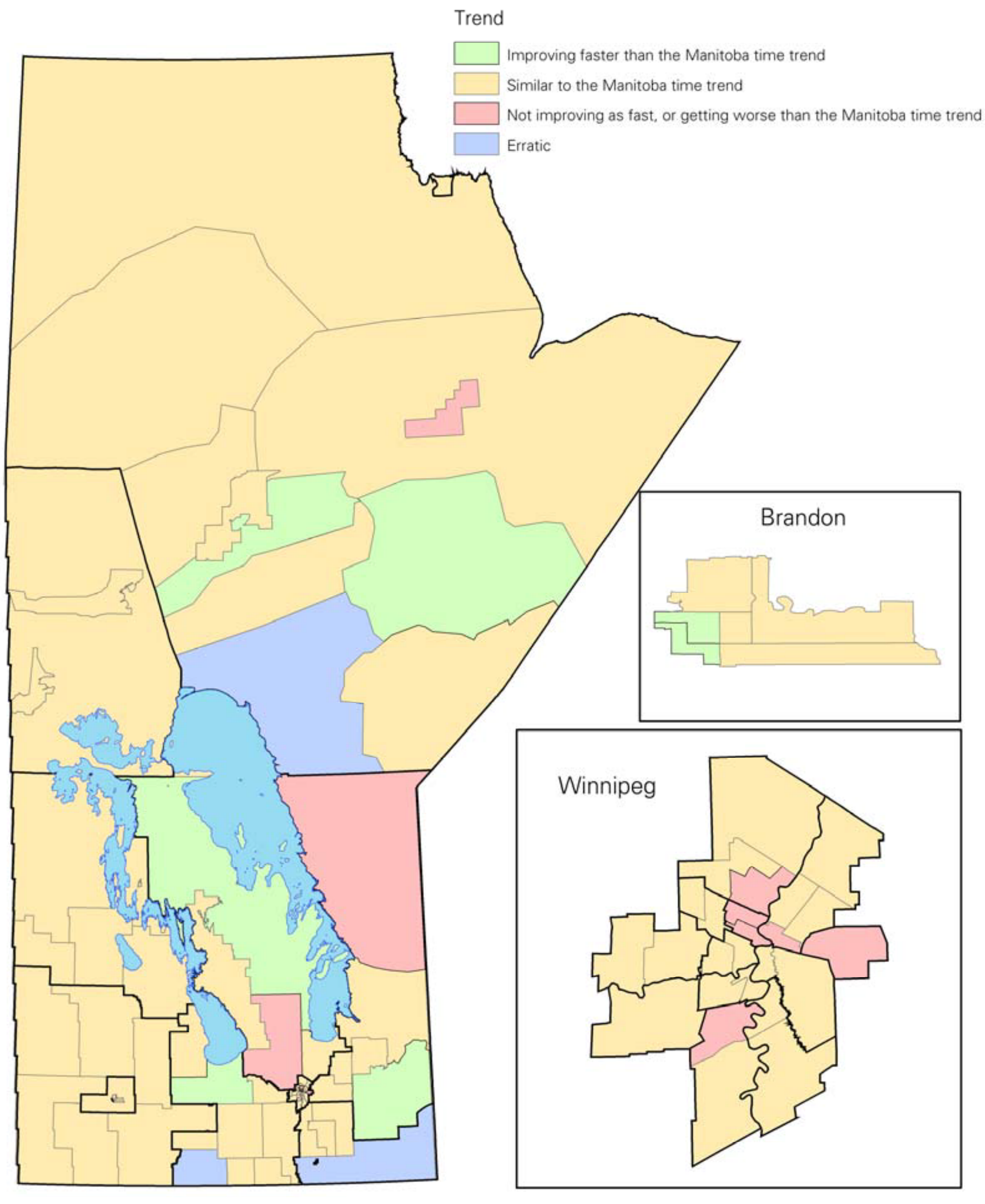
Age-adjusted annual death rate per 1,000 residents age 0-74, 1996-2003



Source: Manitoba Centre for Health Policy, 2008

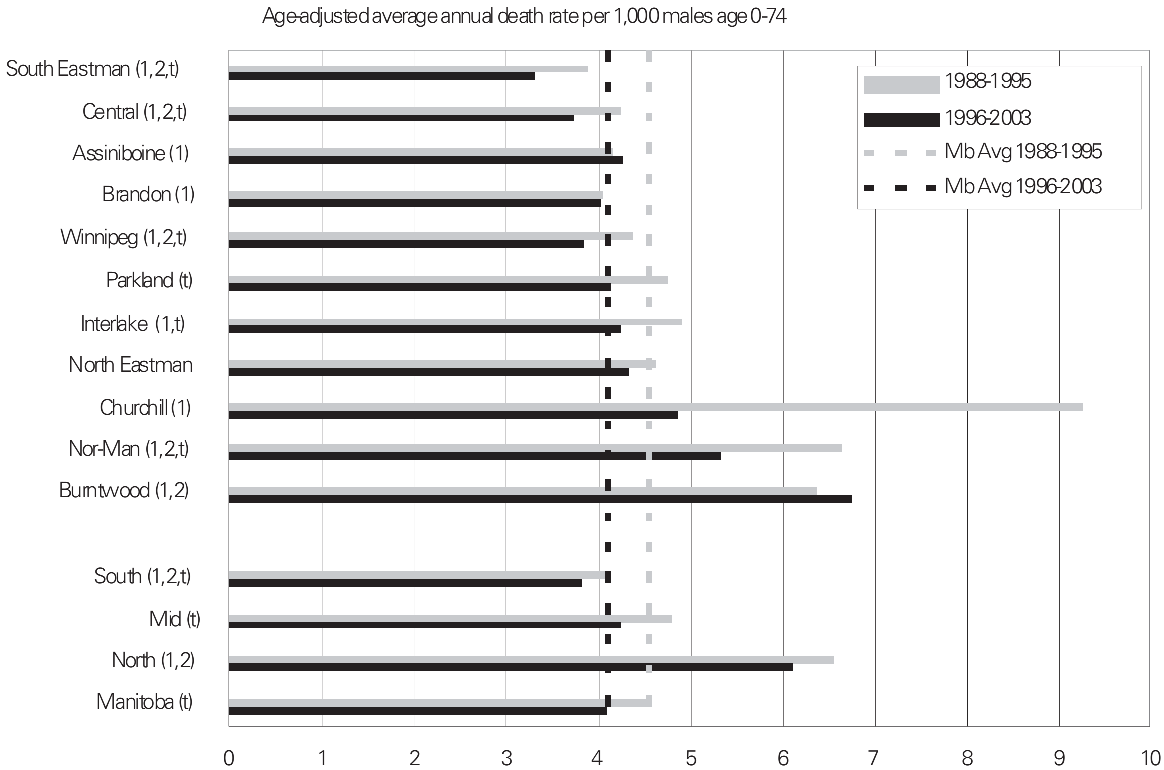
Figure 2.8: Trends in Female Premature Mortality Rates by RHA Districts and Winnipeg Neighbourhood Clusters

Age-adjusted annual death rate per 1,000 residents age 0-74, 1984-2003



Source: Manitoba Centre for Health Policy, 2008

Figure 2.9: Premature Mortality Rate for Males by RHA

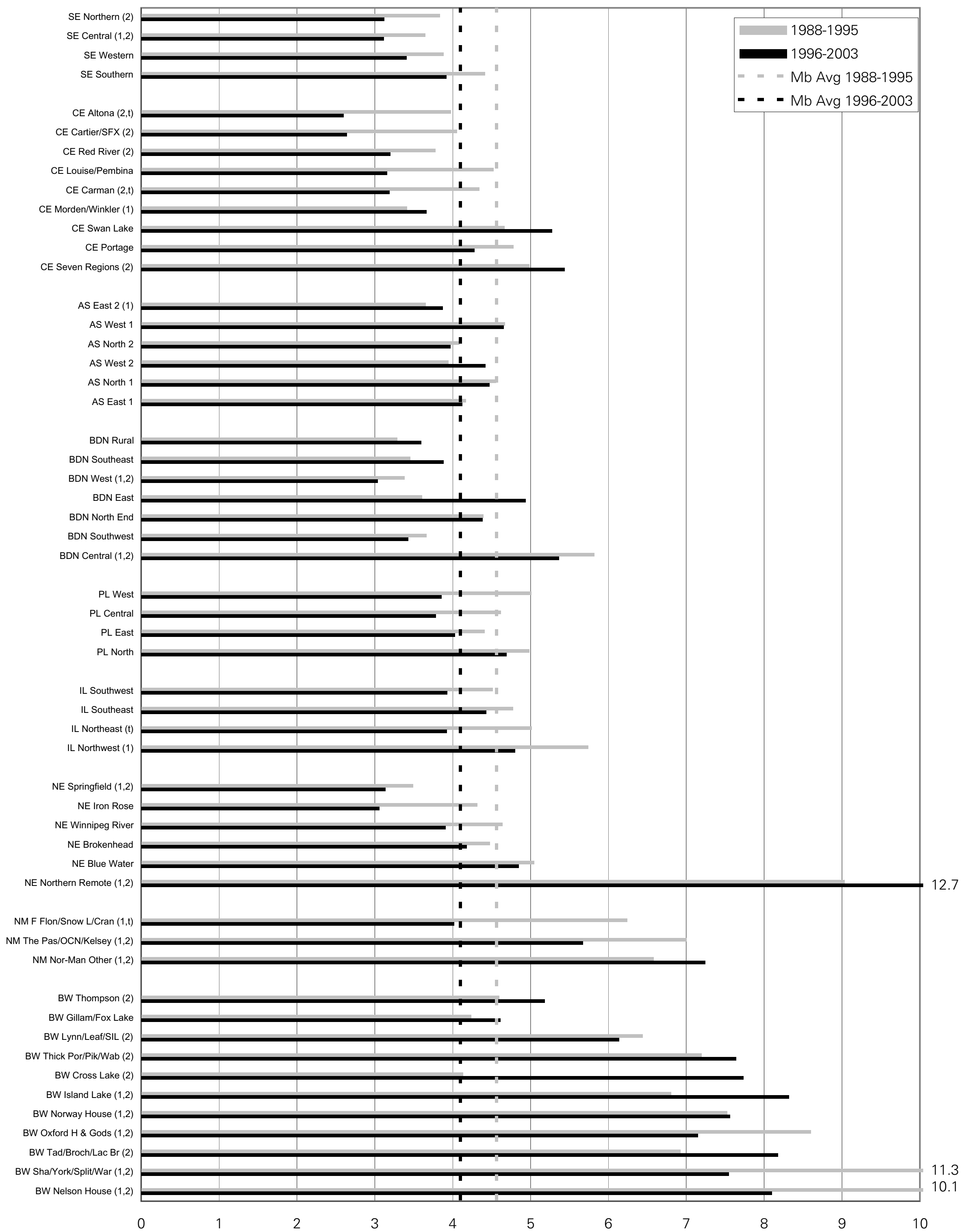


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 2.10: Premature Mortality Rate for Males by District

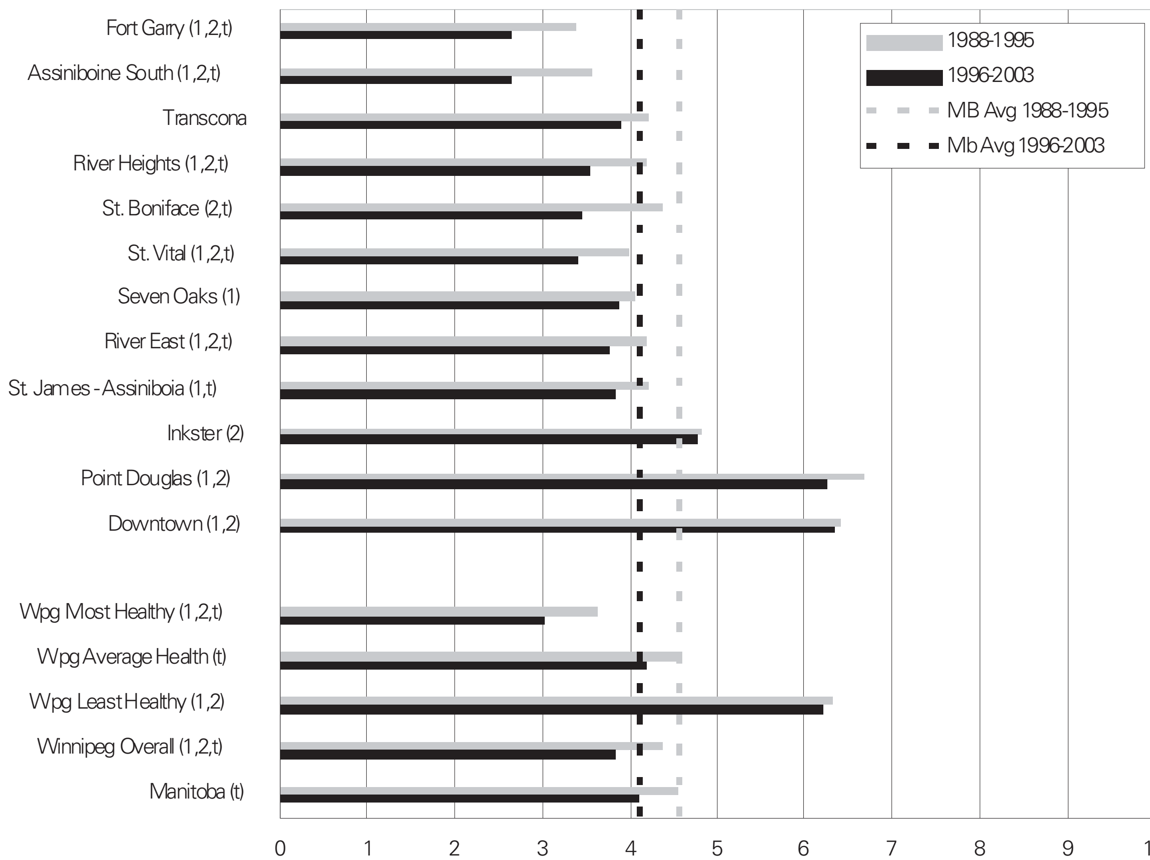
Age-adjusted average annual death rate per 1,000 males age 0-74



Source: Manitoba Centre for Health Policy, 2008

Figure 2.11: Premature Mortality Rate for Males by Winnipeg Community Areas

Age-adjusted average annual death rate per 1,000 males age 0-74



'1' indicates area's rate was statistically different from Manitoba average in first time period

'2' indicates area's rate was statistically different from Manitoba average in second time period

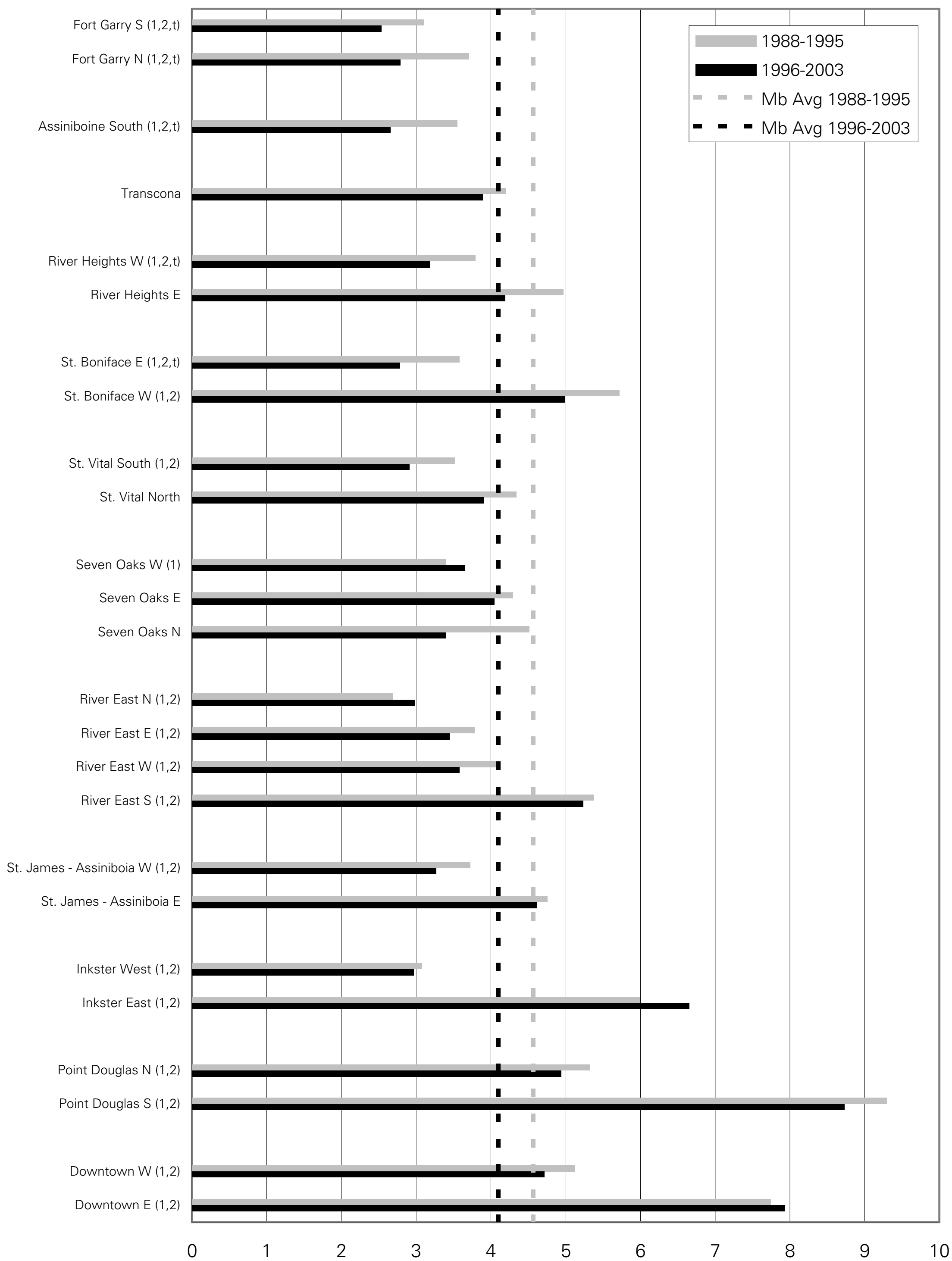
't' indicates change over time was statistically significant for that area

's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 2.12: Premature Mortality Rate for Males by Winnipeg Neighbourhood Clusters

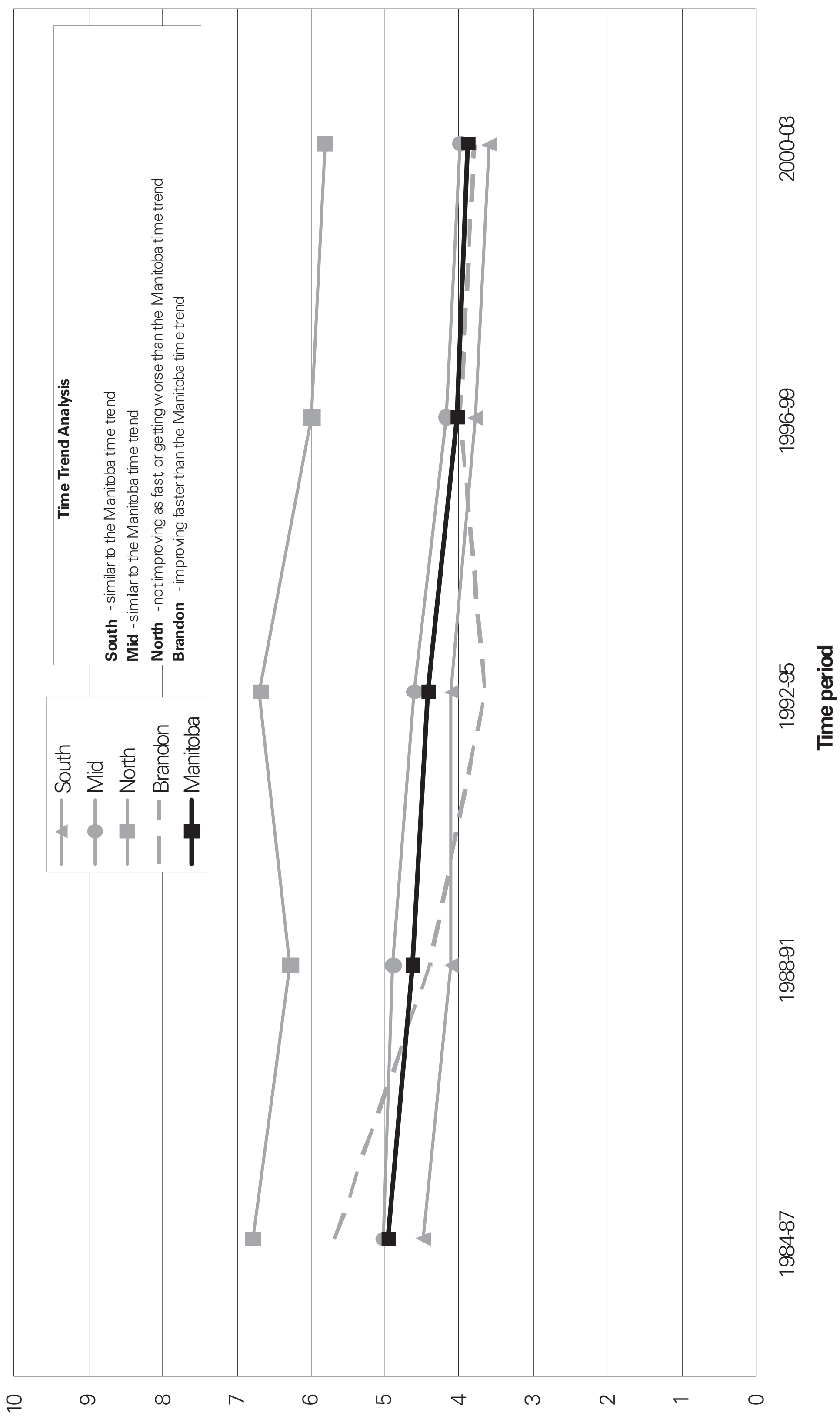
Age-adjusted average annual death rate per 1,000 males age 0-74



Source: Manitoba Centre for Health Policy, 2008

Figure 2.13: Trends in Non-Winnipeg Premature Mortality Rates for Males

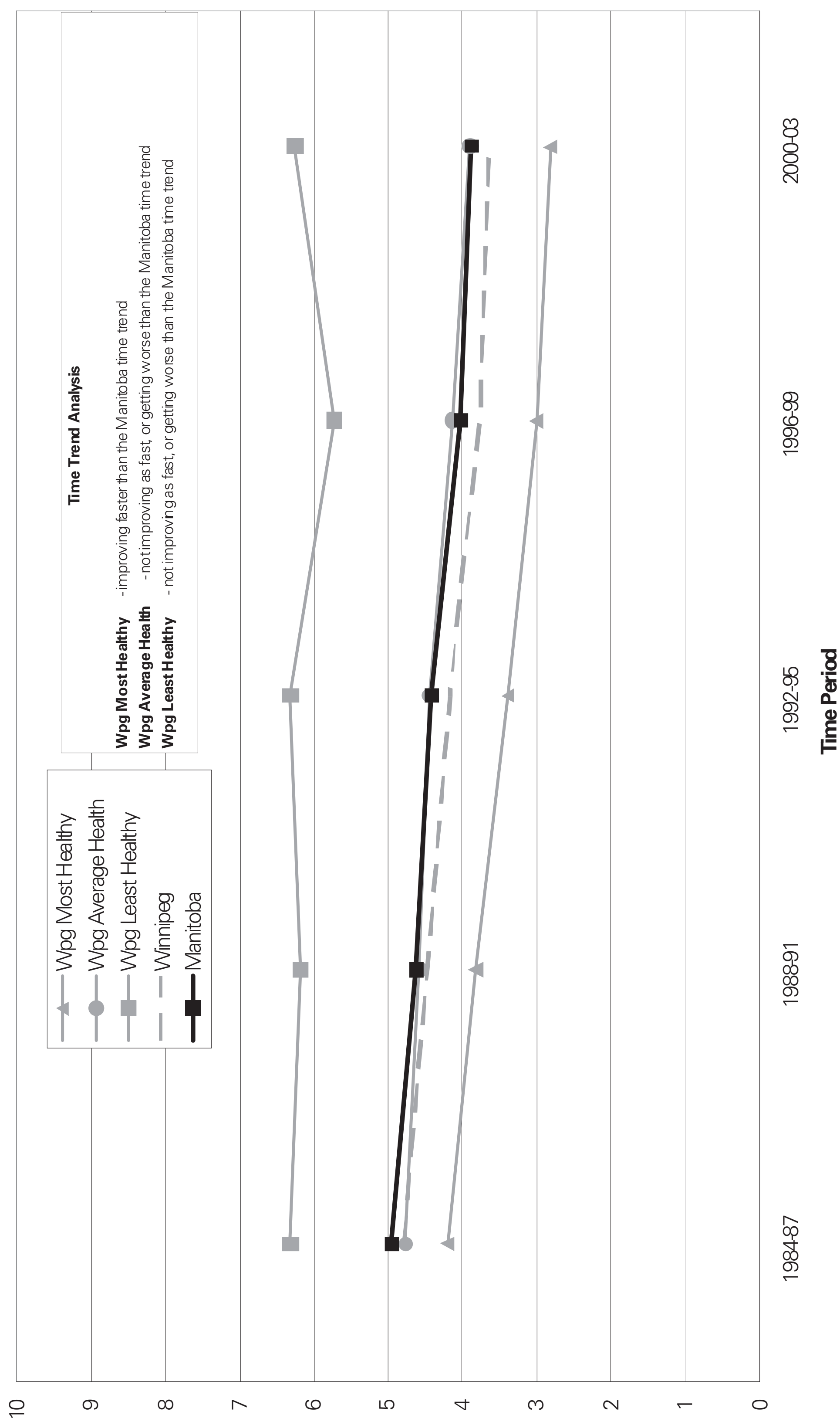
Age-adjusted average annual death rate per 1,000 males age 0-74



Source: Manitoba Centre for Health Policy, 2008

Figure 2.14: Trends in Winnipeg Premature Mortality Rates for Males

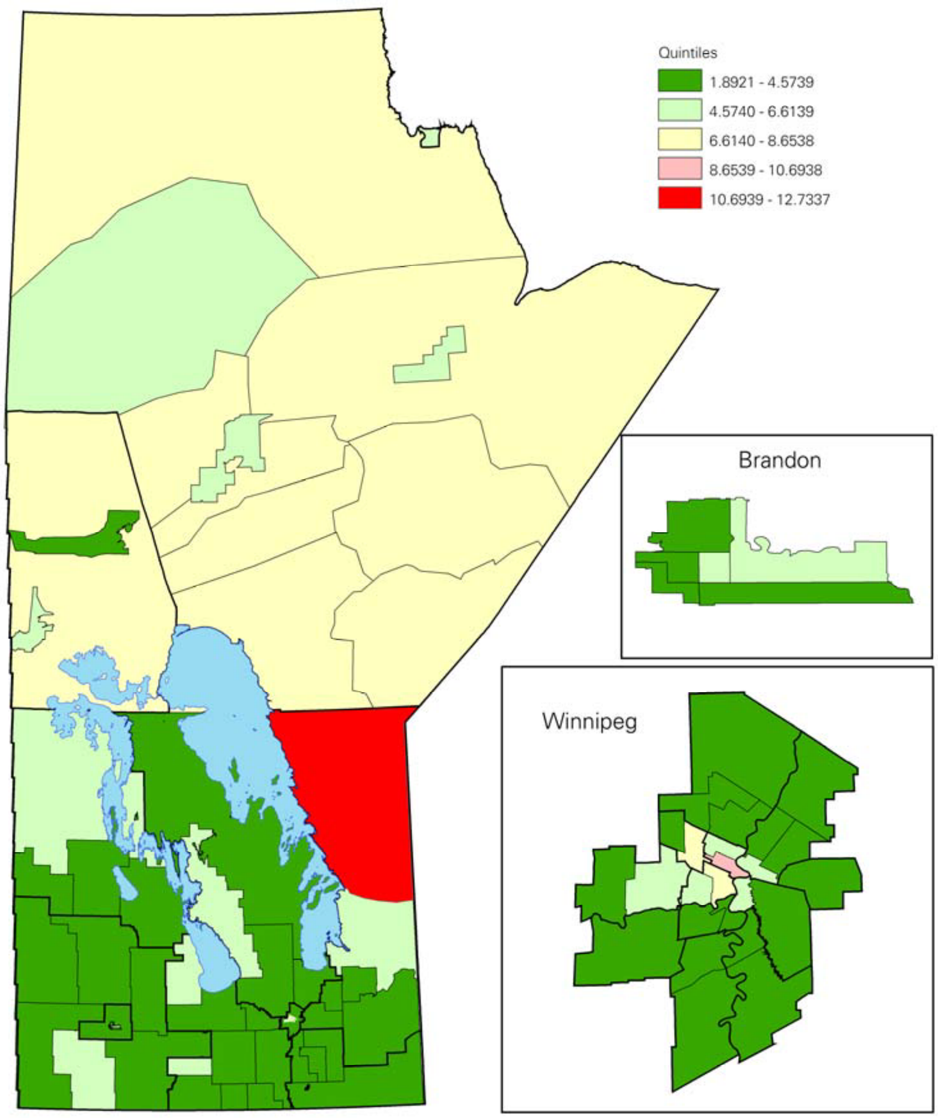
Age-adjusted average annual death rate per 1,000 males age 0-74



Source: Manitoba Centre for Health Policy, 2008

Figure 2.15: Male Premature Mortality Rate Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

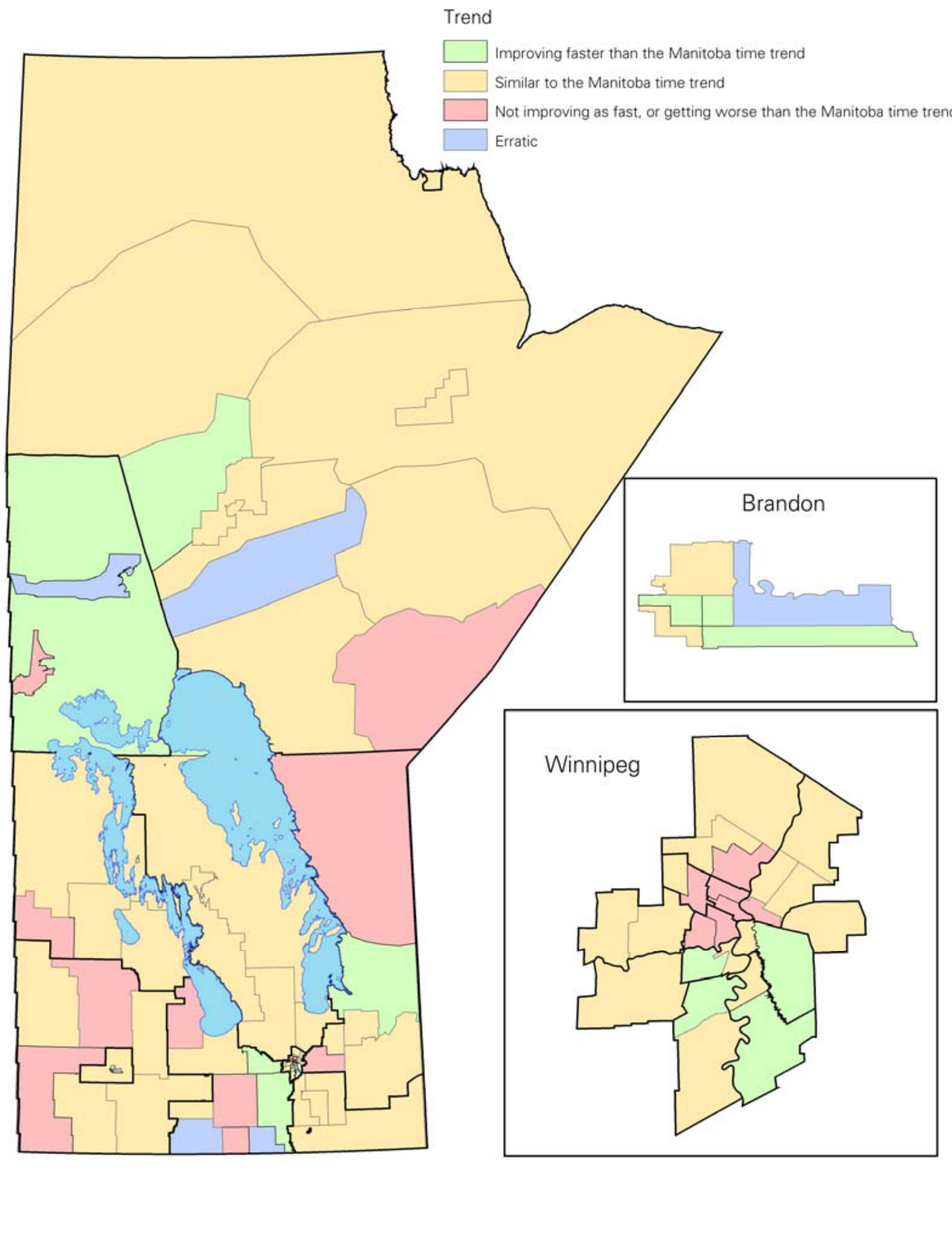
Age-adjusted annual death rate per 1,000 residents age 0-74, 1996-2003



Source: Manitoba Centre for Health Policy, 2008

Figure 2.16: Trends in Male Premature Mortality Rates by RHA Districts and Winnipeg Neighbourhood Clusters

Age-adjusted annual death rate per 1,000 residents age 0-74, 1984-2003



Source: Manitoba Centre for Health Policy, 2008

2.2 Discussion

What the figures and maps tell us about overall rates and trends in PMR:

- Provincially, both female and male PMR have decreased from the first time period of 1988–1995 to the second time period of 1996–2003. Female rates dropped from 2.88 to 2.67 per thousand; male rates dropped from 4.57 to 4.10 per thousand.
- For both females and males, RHAs with the highest PMR are in the North, in the RHAs of Churchill, Nor–Man and Burntwood. In the latest time period of 1996–2003, the North aggregate area had a PMR at least 50% higher that of the South for both females (4.23 vs. 2.33 per thousand) and males (6.12 vs. 3.82 per thousand).
- Comparing the two time periods of 1988–1995 to 1996–2003: For females, most regions saw a drop (although not statistically significant except for Winnipeg and Interlake) for female PMR. The drop was more substantial for males, with South Eastman, Central, Winnipeg, Parkland, Interlake and Nor–Man all showing statistically significant drops.
- The most disparate PMR rates in districts within RHAs occur in North Eastman, where the NE Northern Remote district is the highest PMR in the province for both females (8.7 per thousand in 1996–2003) and for males (12.7 per thousand). In contrast, NE Springfield and NE Iron Rose districts have some of the lowest PMRs in the province (see Figure 2.2 and 2.10).
- Within Winnipeg RHA, most CAs' premature mortality rates are similar to or below the provincial average, with the exception of Point Douglas and Downtown. Only the "most healthy" aggregate region of Winnipeg has experienced a drop in PMR for females from 1988–1995 to 1996–2003, whereas both the most healthy and the average health Winnipeg aggregate areas have seen a drop in PMR for males (see Figures 2.3 and 2.11).
- The time trend in PMR from 1984–87 to 2000–03 shows that South, Mid, and Brandon all show downward trends in PMR similar to or better than the overall provincial downward trend (Figures 2.5 and 2.13). Provincially, the PMR dropped from 2.99 to 2.57 per thousand for females and from 4.96 to 3.88 for males. However, the North is not improving as fast as the Manitoba time trend with females only experiencing a small drop from 4.31 to 4.16 per thousand (and in the 1992–95 period, there was actually an increase) and males showing a similar pattern from a PMR of 6.79 to 5.82 per thousand. Male PMR rates are higher than females overall, but the rate of improvement is faster with male PMRs dropping by 22% whereas females only dropped by 14% (see Figures 2.5 and 2.13).
- In Winnipeg, the "Least Healthy" area shows similar trends for both males and females to the North aggregate area, where this area's PMR has not improved as fast as the provincial average from 1984–87 to 2000–03 (in contrast with the other aggregate areas of Winnipeg).
- Even though the overall trend of most aggregate areas show improvement in PMR since 1984, the gradient in PMR has not improved because the North and the Winnipeg Least Healthy areas show much slower improvement. For females, there is a slightly larger gap between the aggregate areas with lowest and highest PMRs both inside and outside Winnipeg. For males, the gap appears to have decreased slightly outside Winnipeg, but increased within Winnipeg (see Figures 2.5, 2.6, 2.13, 2.14).

- Looking at the PMR maps (Figures 2.7, 2.8, 2.15, 2.16), particular districts of concern for both males and females is the North Eastman's Northern Remote district (with both high rates, i.e., "pink", and rates not improving or getting worse compared to the Manitoba time trend, i.e., "red"). For males, the Winnipeg NC of Point Douglas South is also a problem area, plus many of the NCs in the core area of Winnipeg show a cluster of rates not improving as fast as the Manitoba time trend. For females, a few areas of the province show positive trends of low rates (light or dark green) and improving faster than the Manitoba time trend (green): Burntwood RHA's districts of Oxford House/Gods Lake and Thicket Portage/Pikwitonei/Wabowden; Interlake RHA's Northeast district; Central RHA's Portage district; North Eastman RHA's Iron Rose district; Brandon RHA's districts Southwest and West. For males, a few areas of the province show positive trends as well: Central RHA's Red River and Cartier/SFX districts; North Eastman RHA's Blue Water district; Brandon RHA's districts of West, Central, and Southeast; and Winnipeg RHA's NCs of St. Vital South, St. Boniface East, Fort Garry North, and River Heights West.

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CHAPTER 3: DIABETES AND RELATED LOWER LIMB AMPUTATION RATES

This chapter includes both diabetes prevalence and rates of lower limb amputation among residents with diabetes. The discussion and recommendations will cover both indicators.

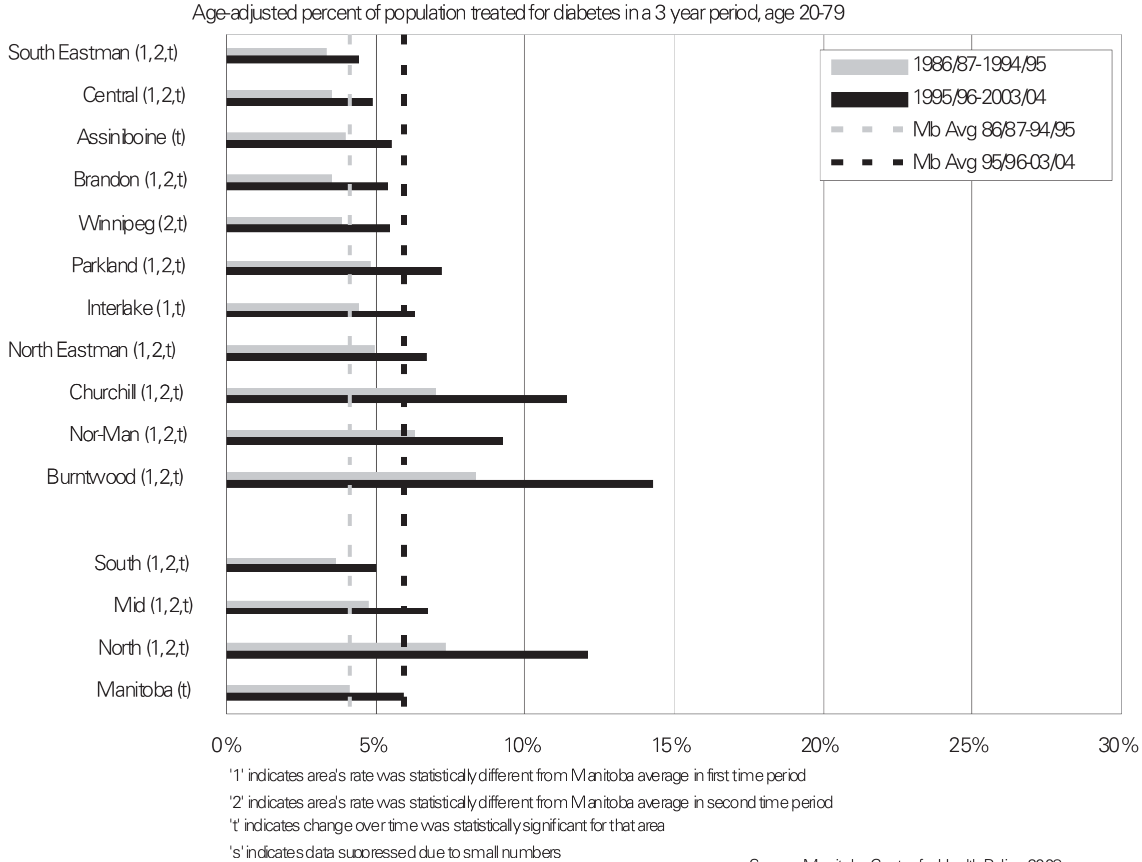
3.1a Definition, Graphs and Maps for Diabetes Prevalence

Diabetes is a chronic condition in which the pancreas no longer produces enough insulin (type 1 diabetes) or when cells stop responding to the insulin that is produced (type 2 diabetes), so that glucose in the blood cannot be absorbed into the cells of the body. Diabetes affects many organs and body functions, especially those involved in metabolism, and can cause serious health complications including renal failure, heart disease, stroke, amputation and blindness.

In this study, the treatment prevalence of diabetes (referred to within the text of this chapter as "diabetes prevalence") was measured as the percentage of residents aged 20–79 diagnosed with either type 1 or 2 diabetes (ICD–9–CM code 250) in at least two physician visits or one hospitalization during a three year period over 18 fiscal years, 1986/87–2003/04. Age is calculated as of December 31 of the denominator year for each three–year period. Region of residence is assigned based on the first record for each three–year period.

Figure 3.1: Diabetes Treatment Prevalence by RHA

Age-adjusted percent of population treated for diabetes in a 3 year period, age 20-79

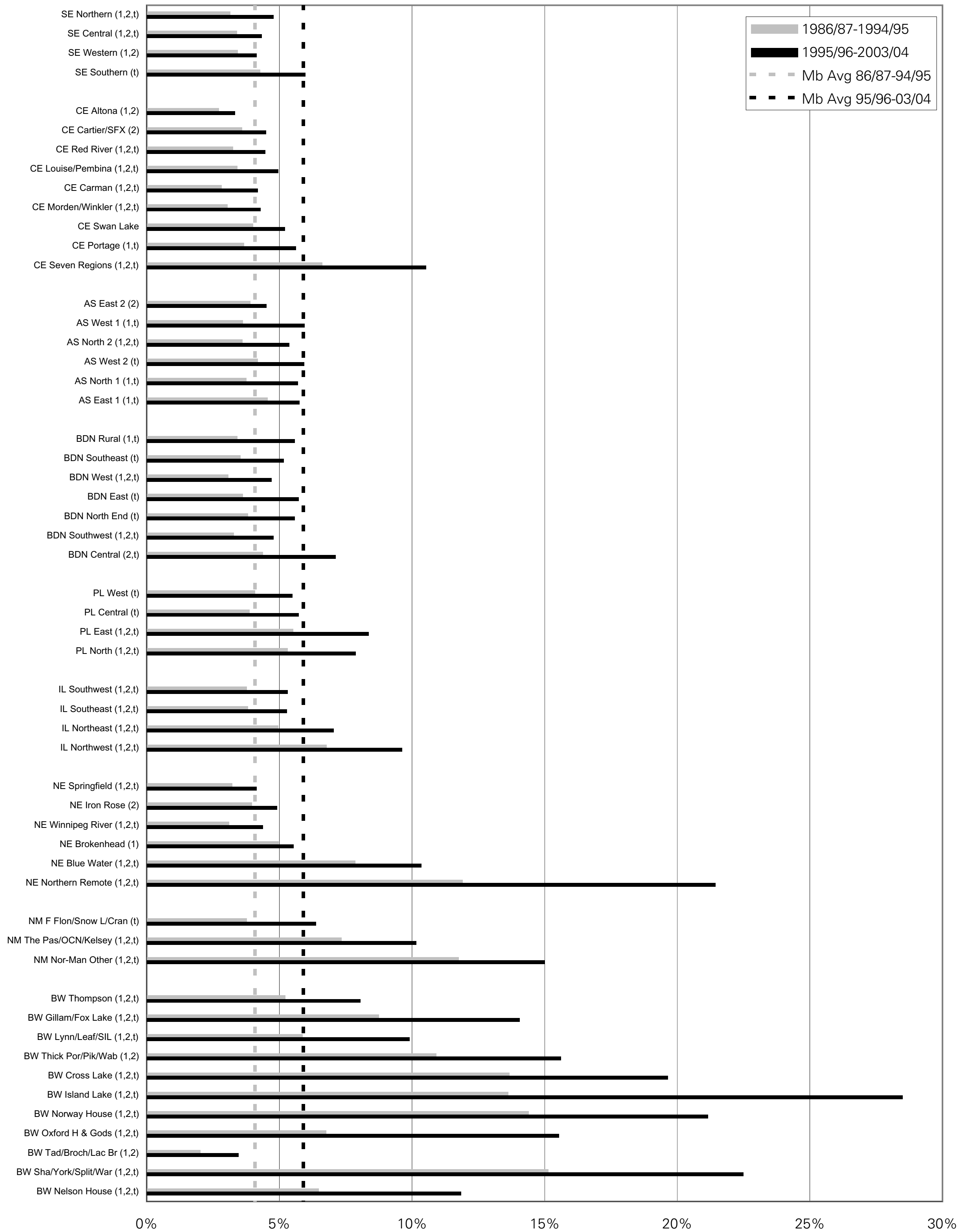


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 3.2: Diabetes Treatment Prevalence by District

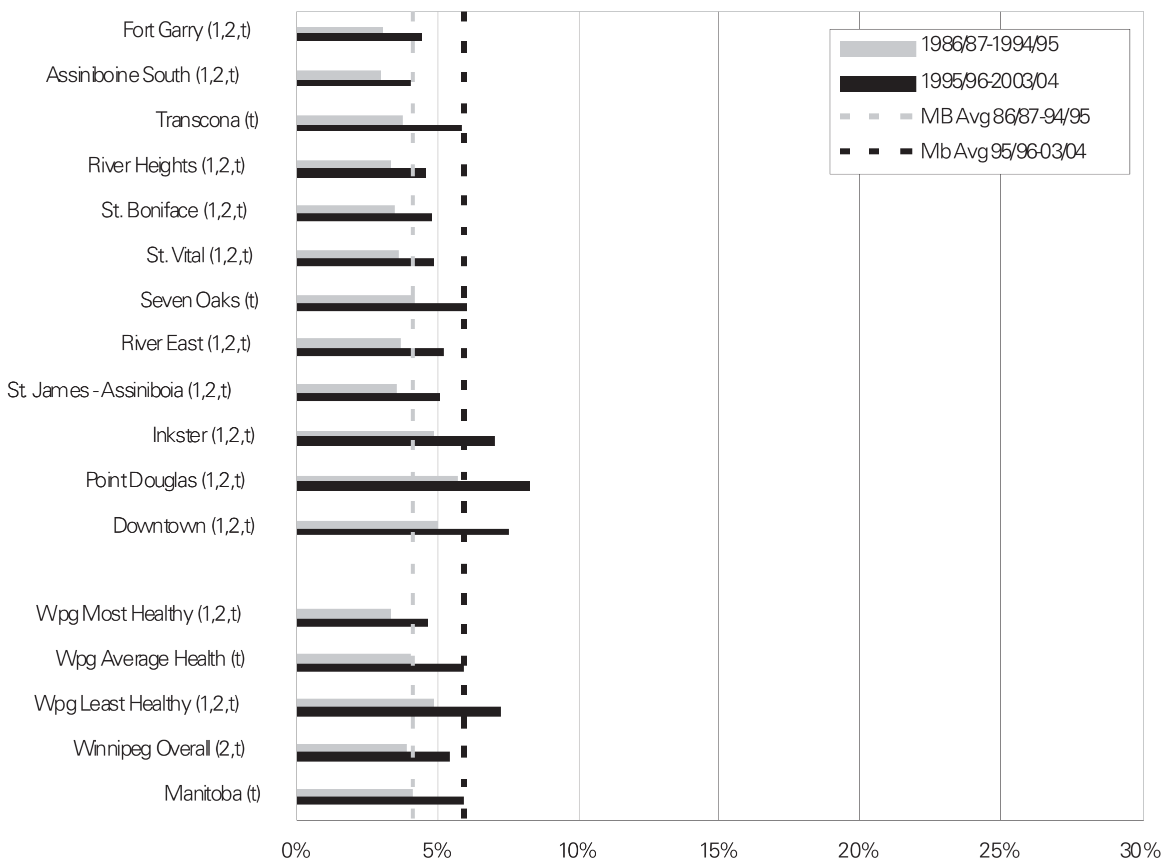
Age-adjusted percent of population treated for diabetes in a 3 year period, age 20-79



Source: Manitoba Centre for Health Policy, 2008

Figure 3.3: Diabetes Treatment Prevalence by Winnipeg Community Areas

Age-adjusted percent of population treated for diabetes in a 3 year period, age 20-79

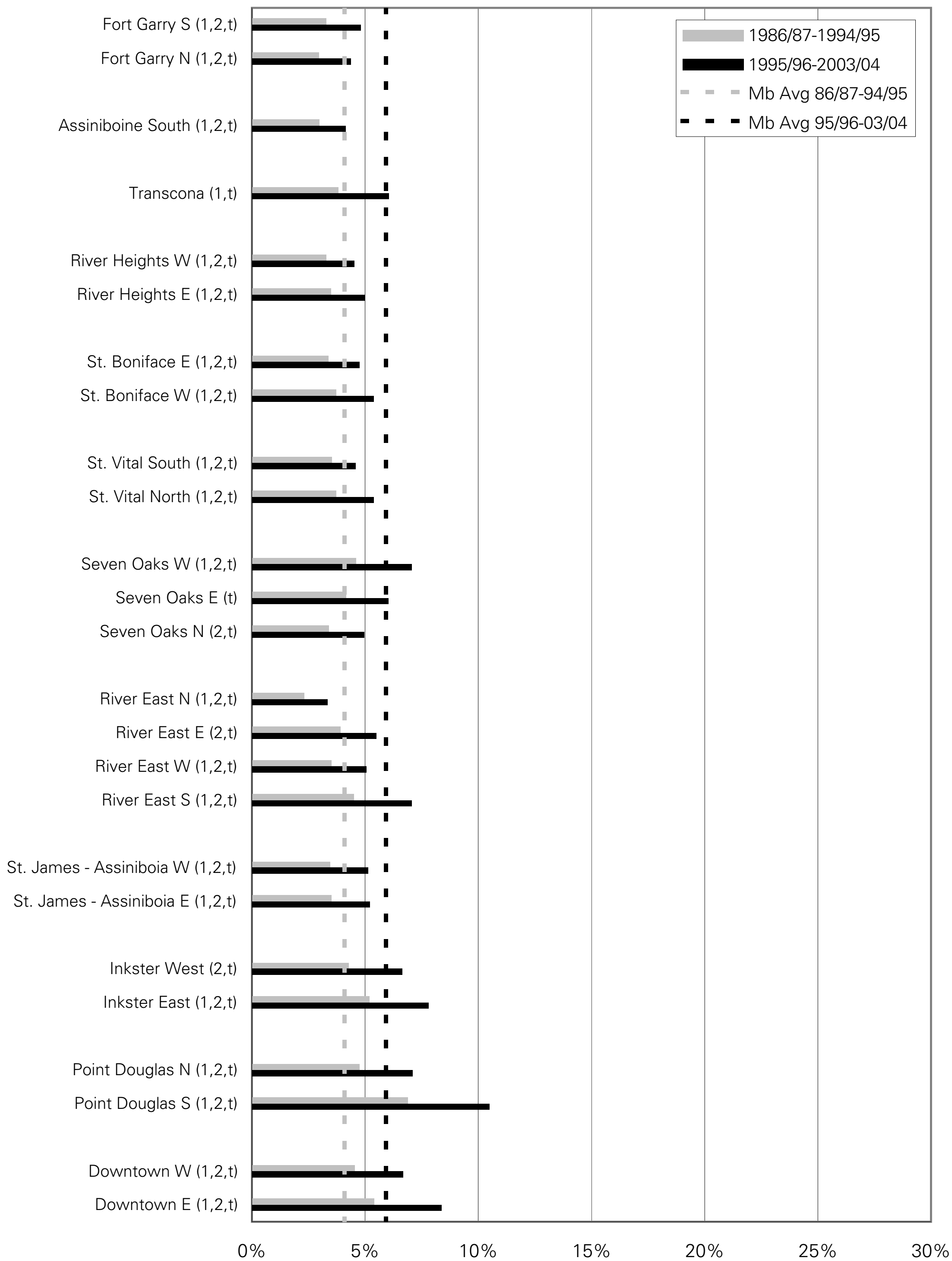


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 3.4: Diabetes Treatment Prevalence by Winnipeg Neighbourhood Clusters

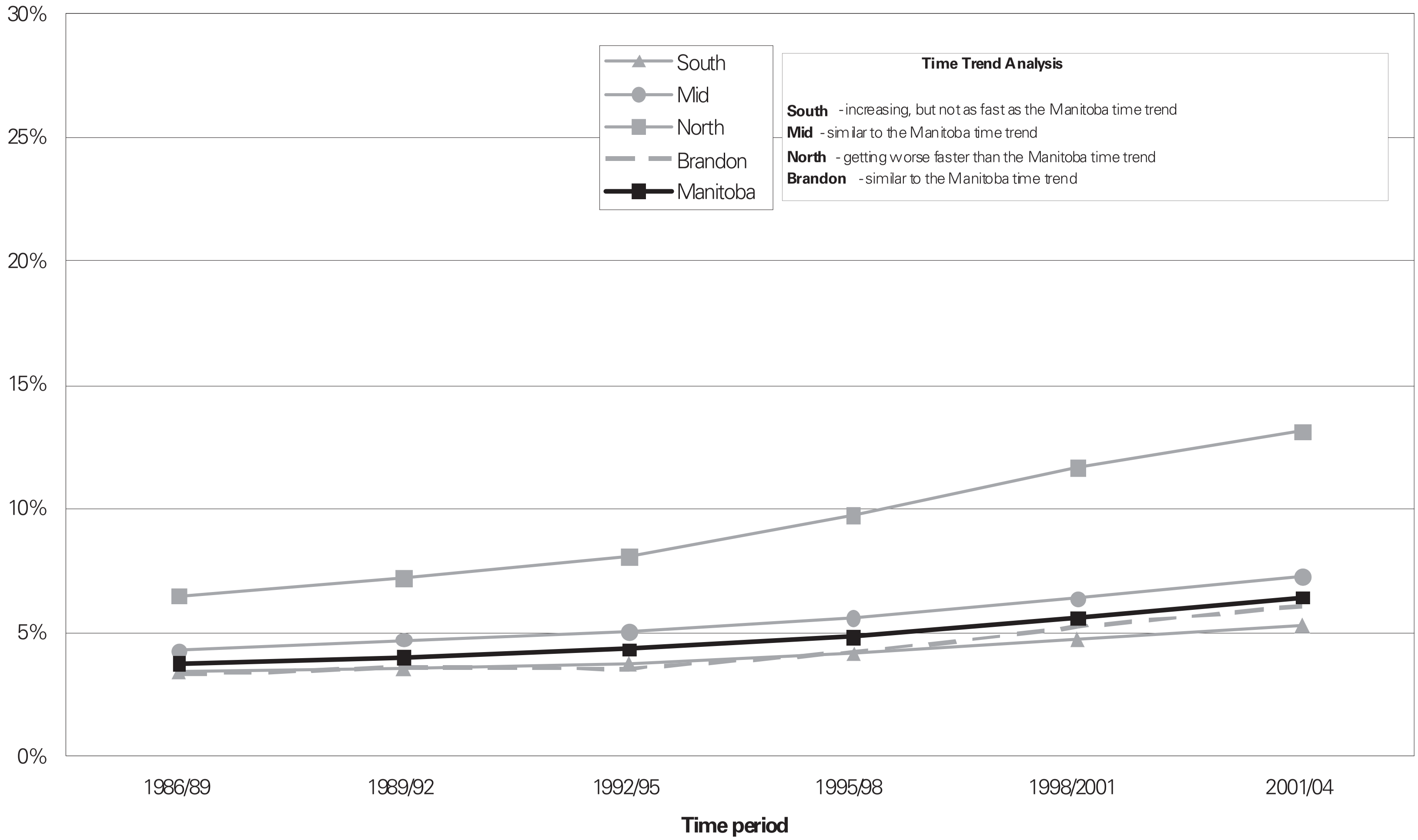
Age-adjusted percent of population treated for diabetes in a 3 year period, age 20-79



Source: Manitoba Centre for Health Policy, 2008

Figure 3.5: Trends in Non-Winnipeg Diabetes Treatment Prevalence

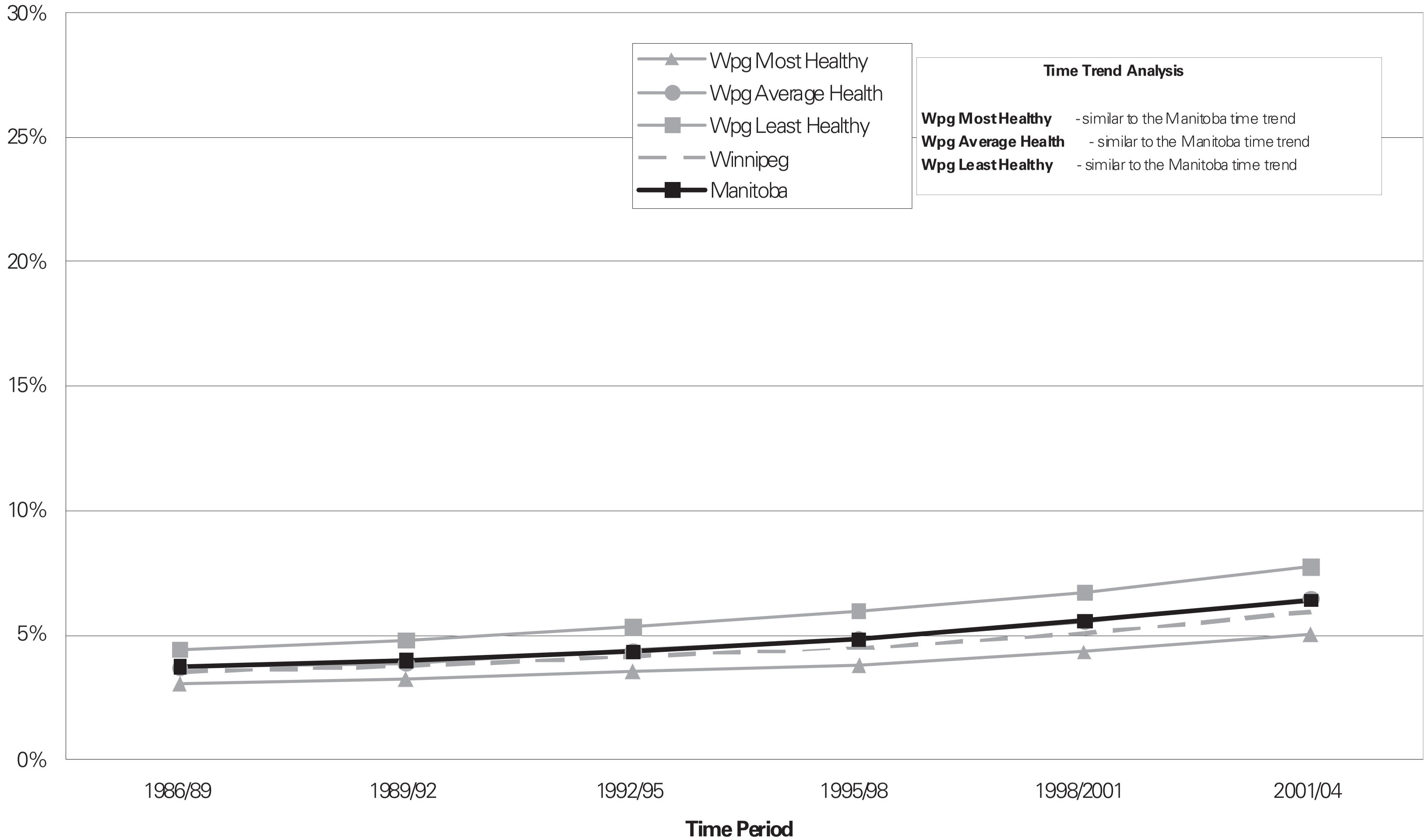
Age-adjusted percent of population treated for diabetes in a 3 year period, age 20-79



Source: Manitoba Centre for Health Policy, 2008

Figure 3.6: Trends in Winnipeg Diabetes Treatment Prevalence

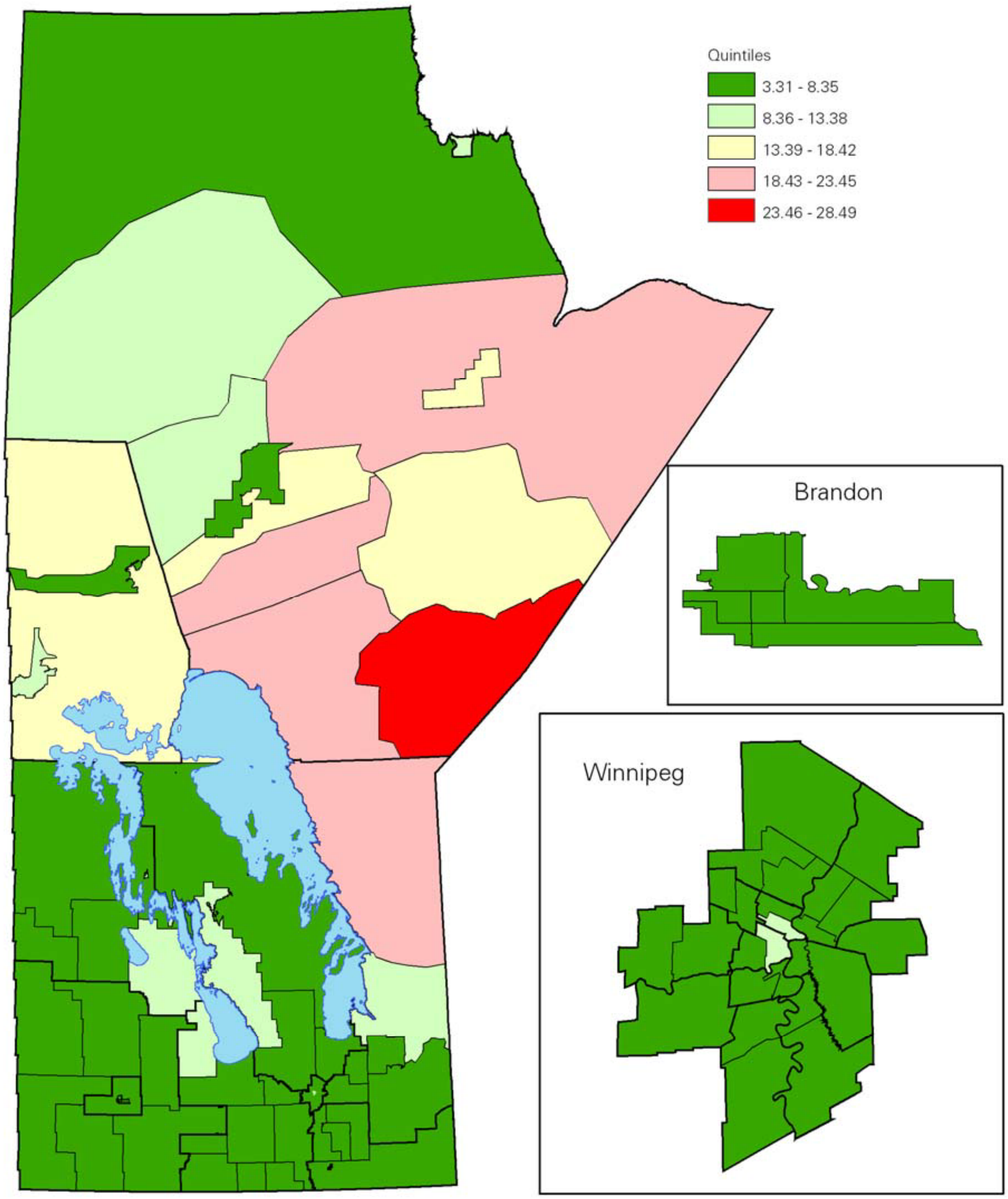
Age-adjusted percent of population treated for diabetes in a 3 year period, age 20-79



Source: Manitoba Centre for Health Policy, 2008

Figure 3.7: Diabetes Treatment Prevalence Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

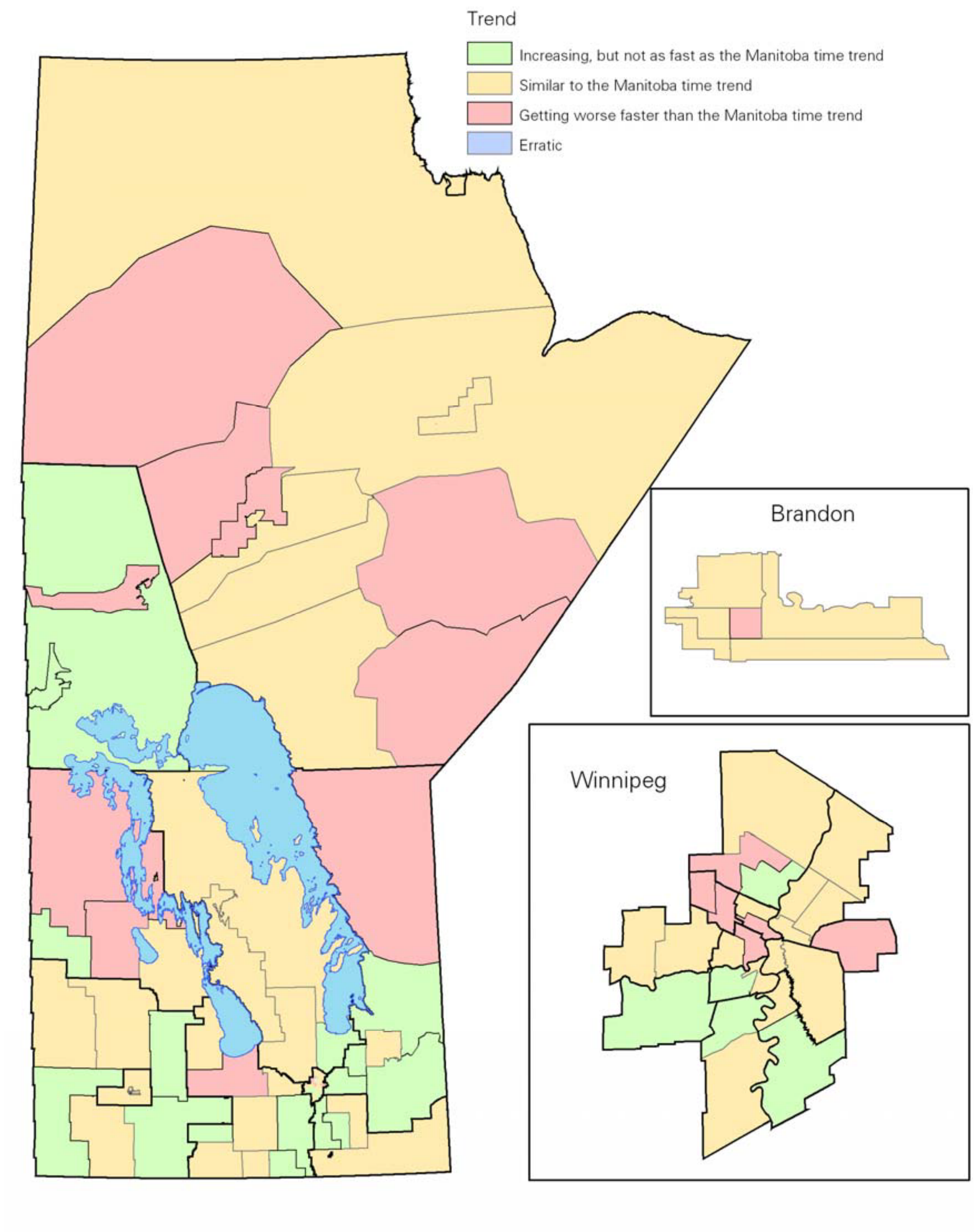
Age-adjusted percent of population treated for diabetes in a three-year period age 20-79, 1995/96-2003/04



Source: Manitoba Centre for Health Policy, 2008

Figure 3.8: Trends in Diabetes Treatment Prevalence by RHA Districts and Winnipeg Neighbourhood Clusters

Age-adjusted percent of population treated for diabetes in a three-year period age 20-79, 1986/87–2003/04



Source: Manitoba Centre for Health Policy, 2008

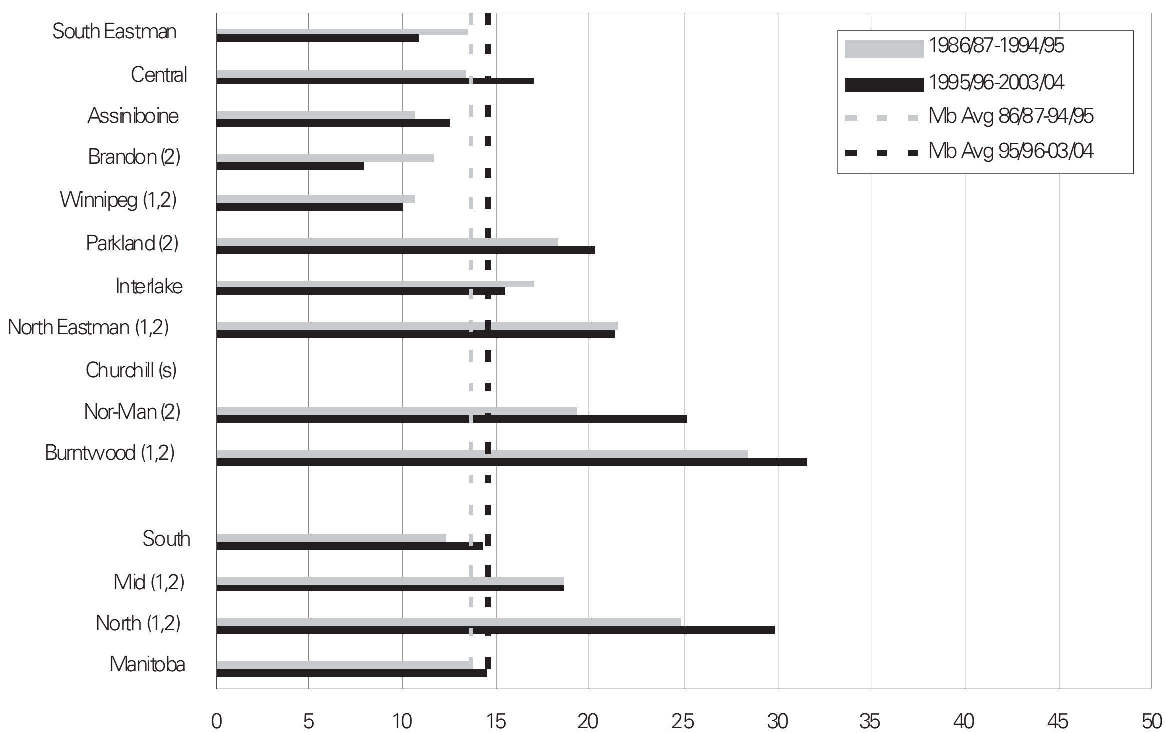
3.1b Definition, Graphs and Maps for Rates of Lower Limb Amputation with Diabetes Comorbidity

A lower limb amputation with diabetes comorbidity is defined as the removal of the lower limb (below or including the knee) by amputation on a person diagnosed with diabetes. This does not include all amputations, but only those for which there was an existing condition of diabetes coded with the amputation.

In this study, the rate of lower limb amputations with a comorbid diagnosis of diabetes was calculated over fiscal years 1984/85–2003/04 for Manitoba residents age 20 through 79. Amputation is defined by a single hospitalization with a surgery for a lower limb amputation, identified by ICD–9–CM procedure codes 84.1–84.17 in any procedure field. The hospital abstract for the amputation must be combined with a diagnosis of diabetes in any diagnosis field, defined by ICD–9 CM diagnosis code 250. Amputations due to accidental injury (defined by ICD–9–CM diagnosis codes 895, 896, 897) were excluded. Age is calculated as of the date of surgery in the numerator and December 31 of each year in the denominator. Region of residence is assigned based on the first record in the study period.

Figure 3.9: Diabetes Related Lower Limb Amputation Rates by RHA

Age-adjusted annual rate of amputations per 1,000 people with diabetes in a 3 year period, age 20-79

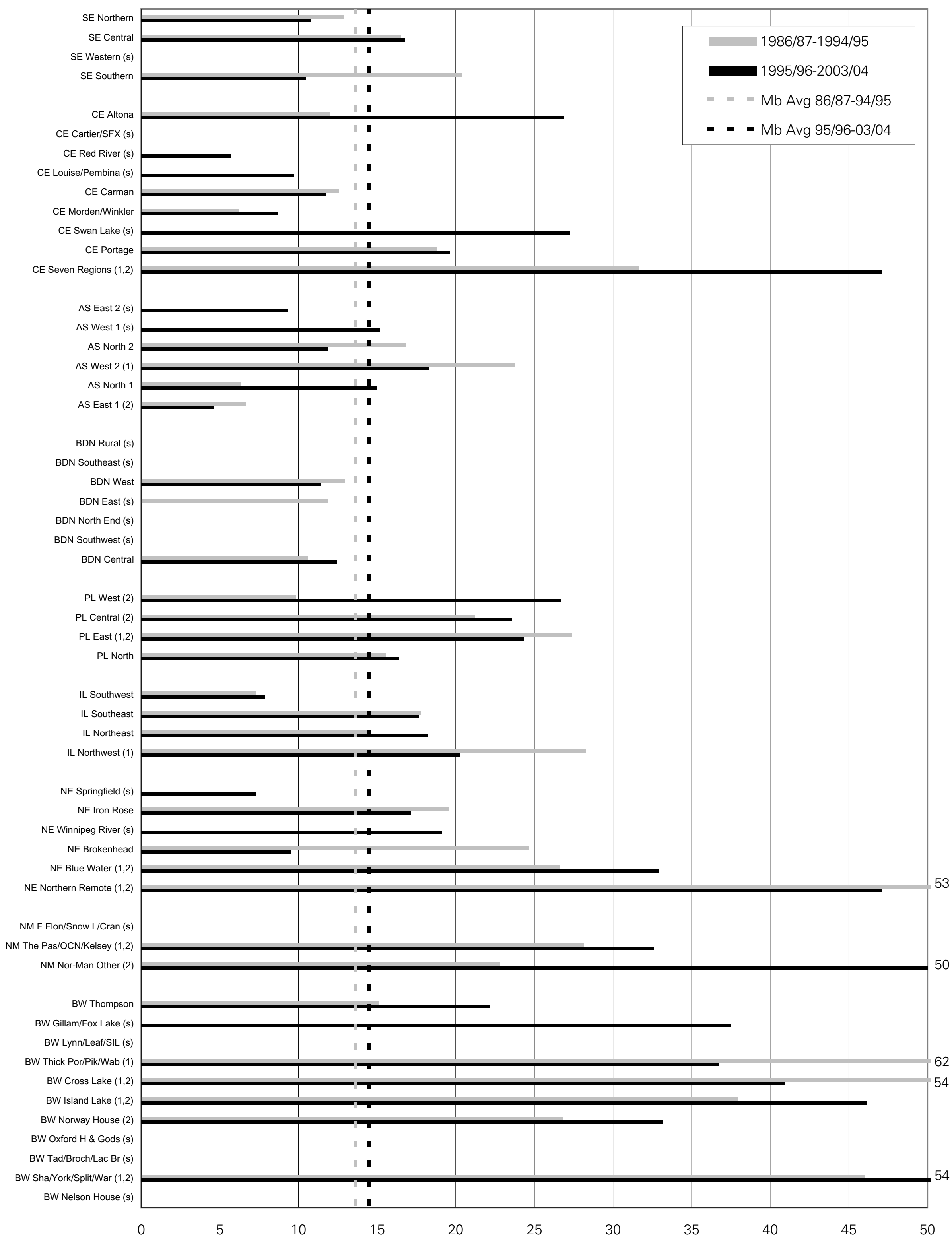


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 3.10: Diabetes Related Lower Limb Amputation Rates by District

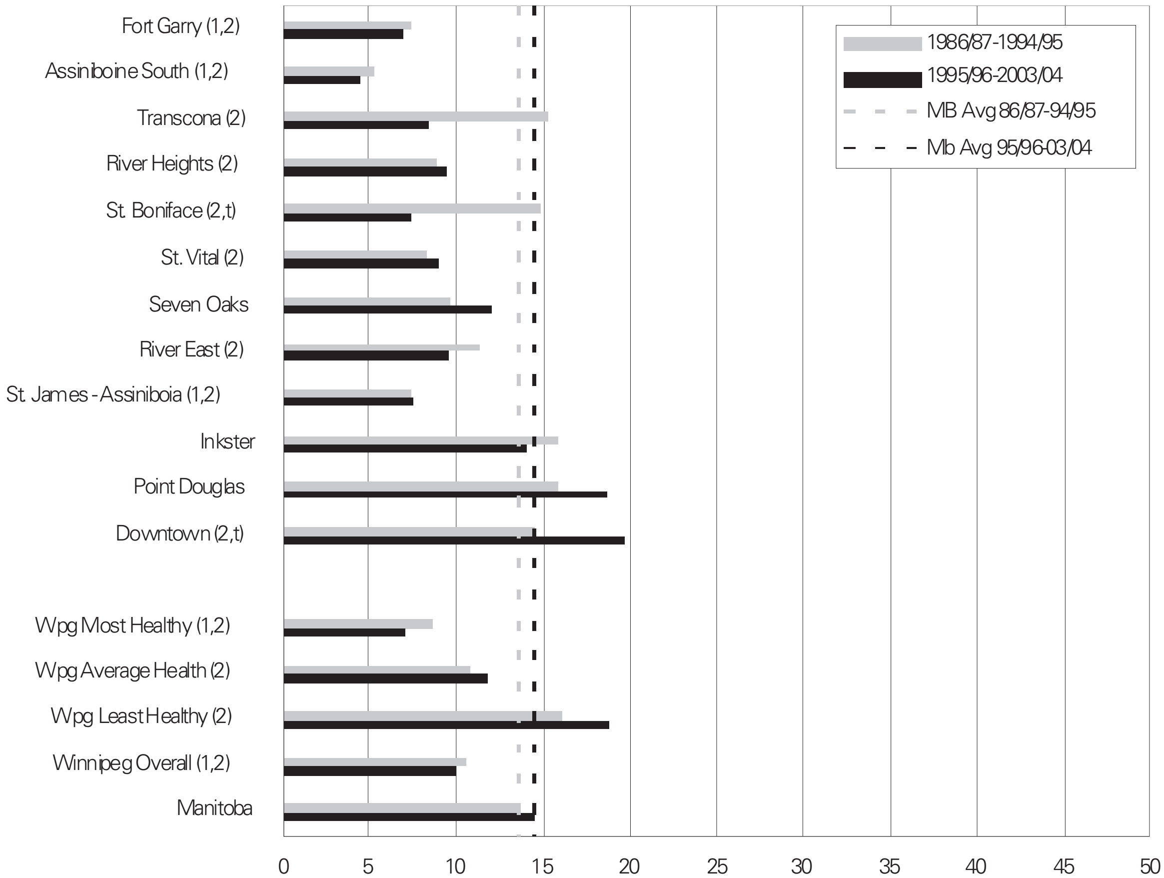
Age-adjusted annual rate of amputations per 1,000 people with diabetes in a 3 year period, age 20-79



Source: Manitoba Centre for Health Policy, 2008

Figure 3.11: Diabetes Related Lower Limb Amputation Rates by Winnipeg Community Areas

Age-adjusted annual rate of amputations per 1,000 people with diabetes in a 3 year period, age 20-79

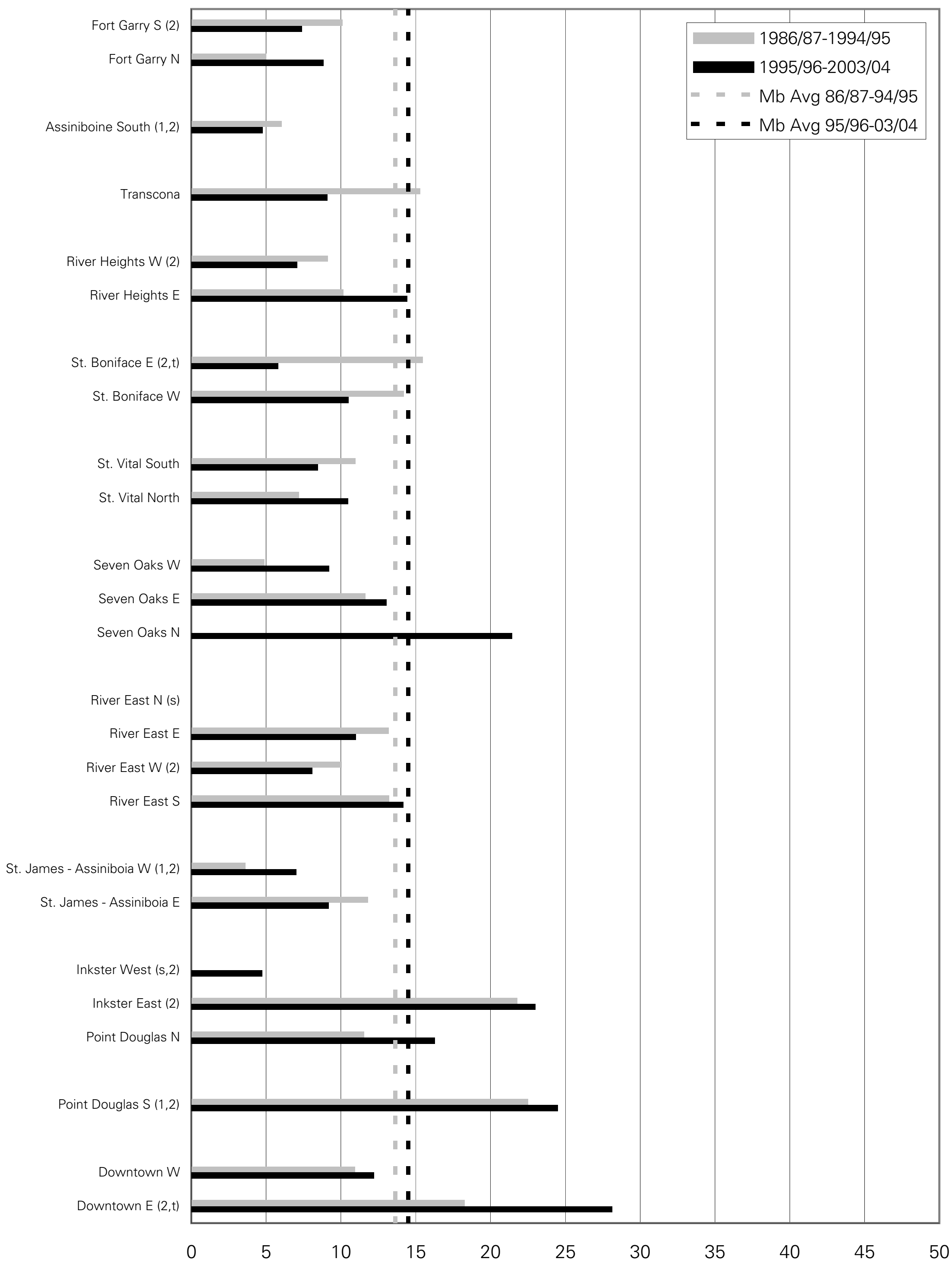


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 3.12: Diabetes Related Lower Limb Amputation Rates by Winnipeg Neighbourhood Clusters

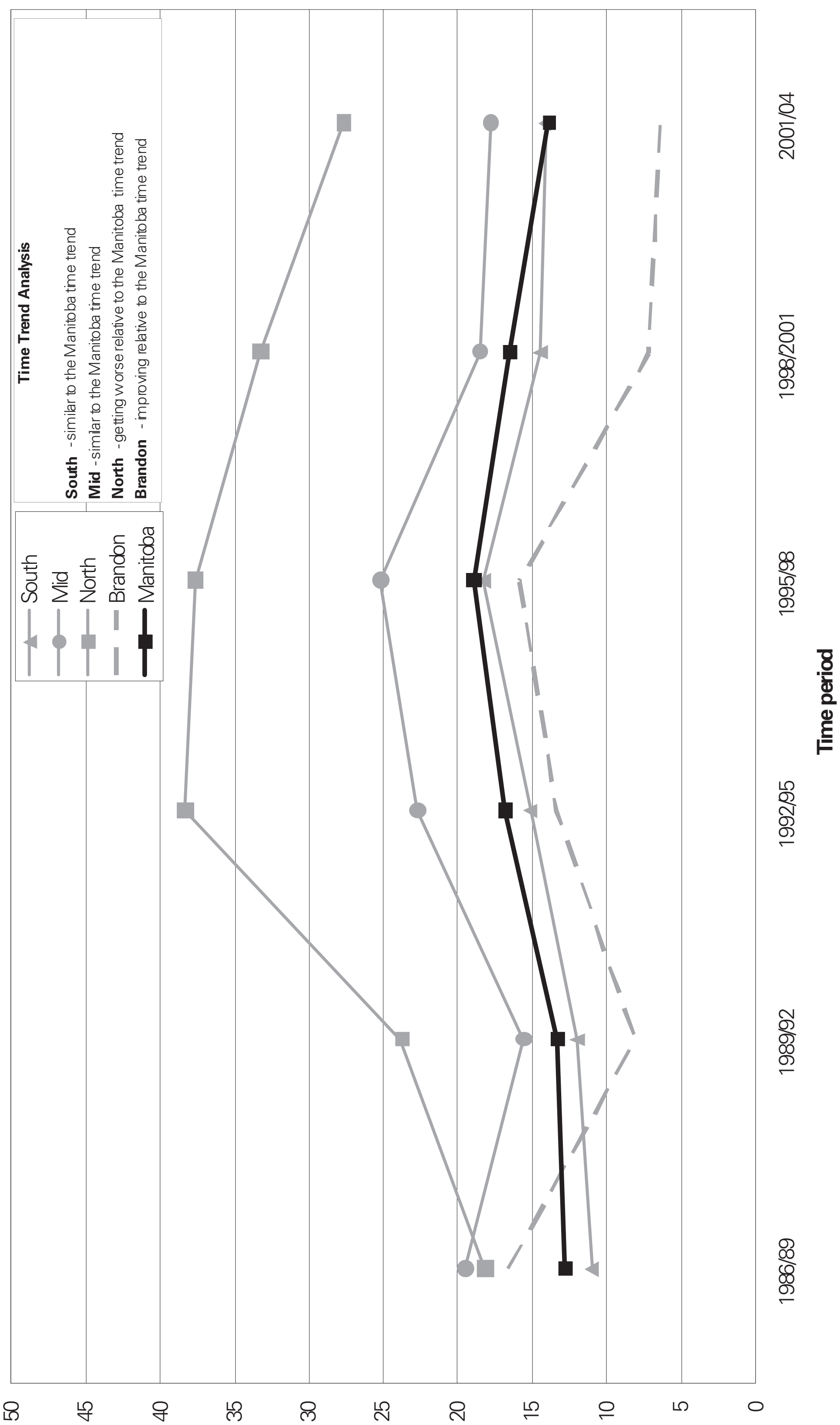
Age-adjusted annual rate of amputations per 1,000 people with diabetes in a 3 year period, age 20-79



Source: Manitoba Centre for Health Policy, 2008

Figure 3.13: Trends in Non-Winnipeg Diabetes Related Lower Limb Amputation Rates

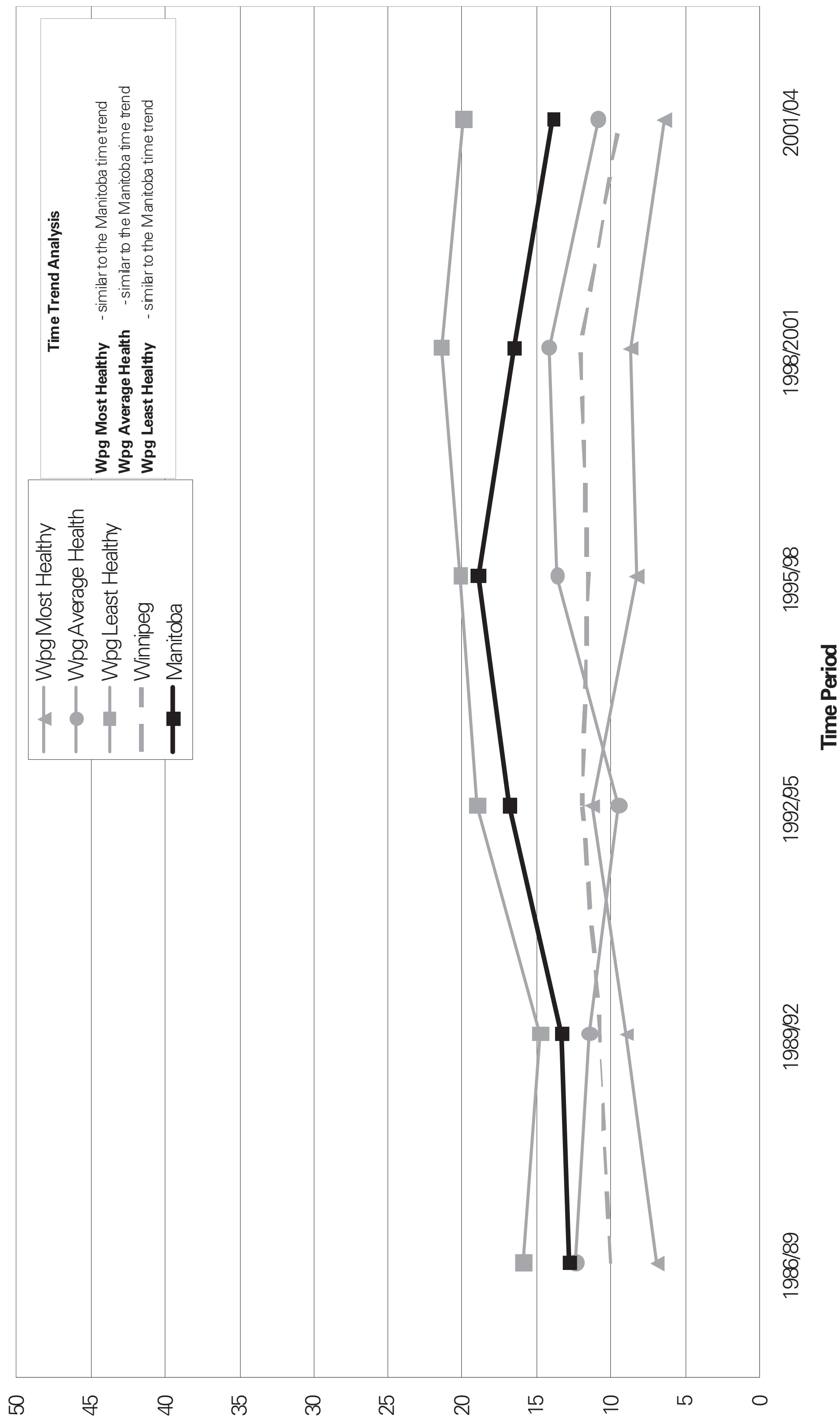
Age-adjusted annual rate of amputations per 1,000 people with diabetes in a 3 year period, age 20-79



Source: Manitoba Centre for Health Policy, 2008

Figure 3.14: Trends in Winnipeg Diabetes Related Lower Limb Amputation Rates

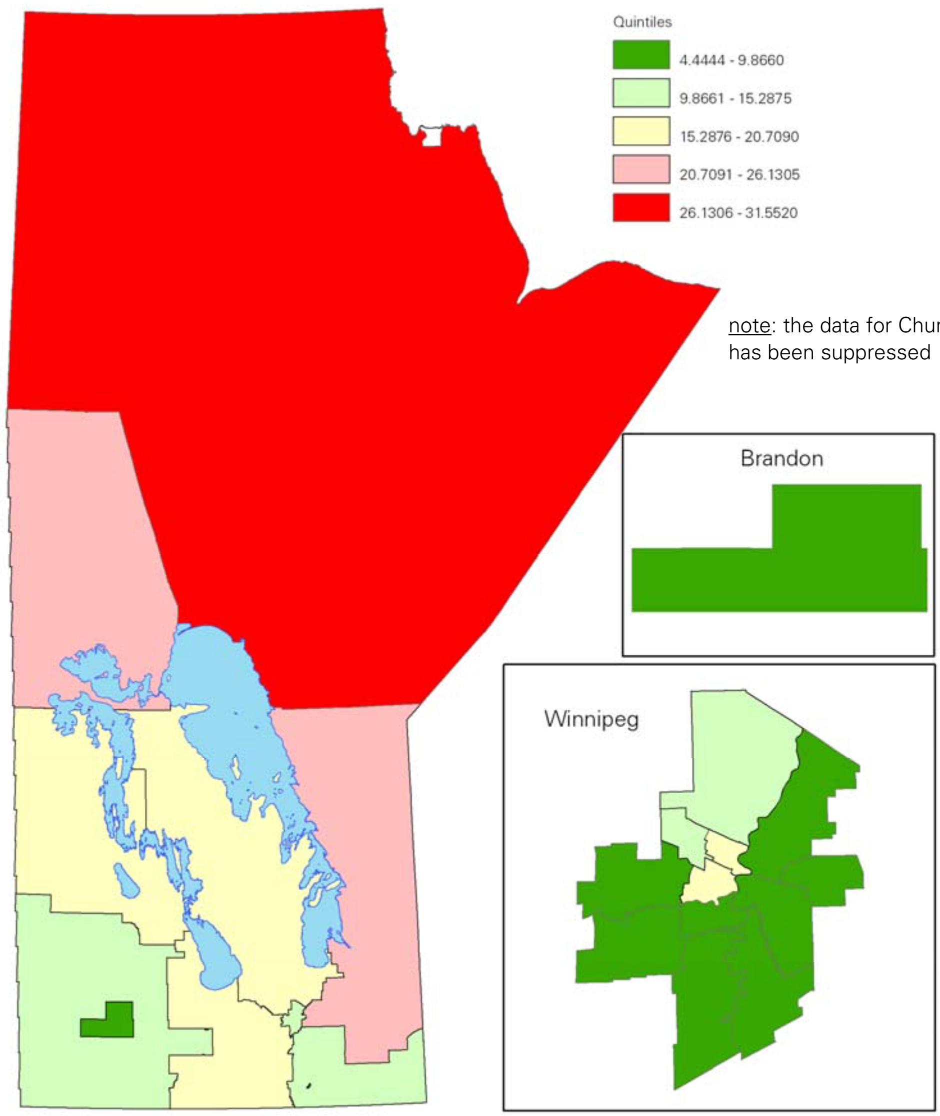
Age-adjusted annual rate of amputations per 1,000 people with diabetes in a 3 year period, age 20-79



Source: Manitoba Centre for Health Policy, 2008

Figure 3.15: Diabetes Related Lower Limb Amputation Rate Quintiles by RHAs and Winnipeg Community Areas

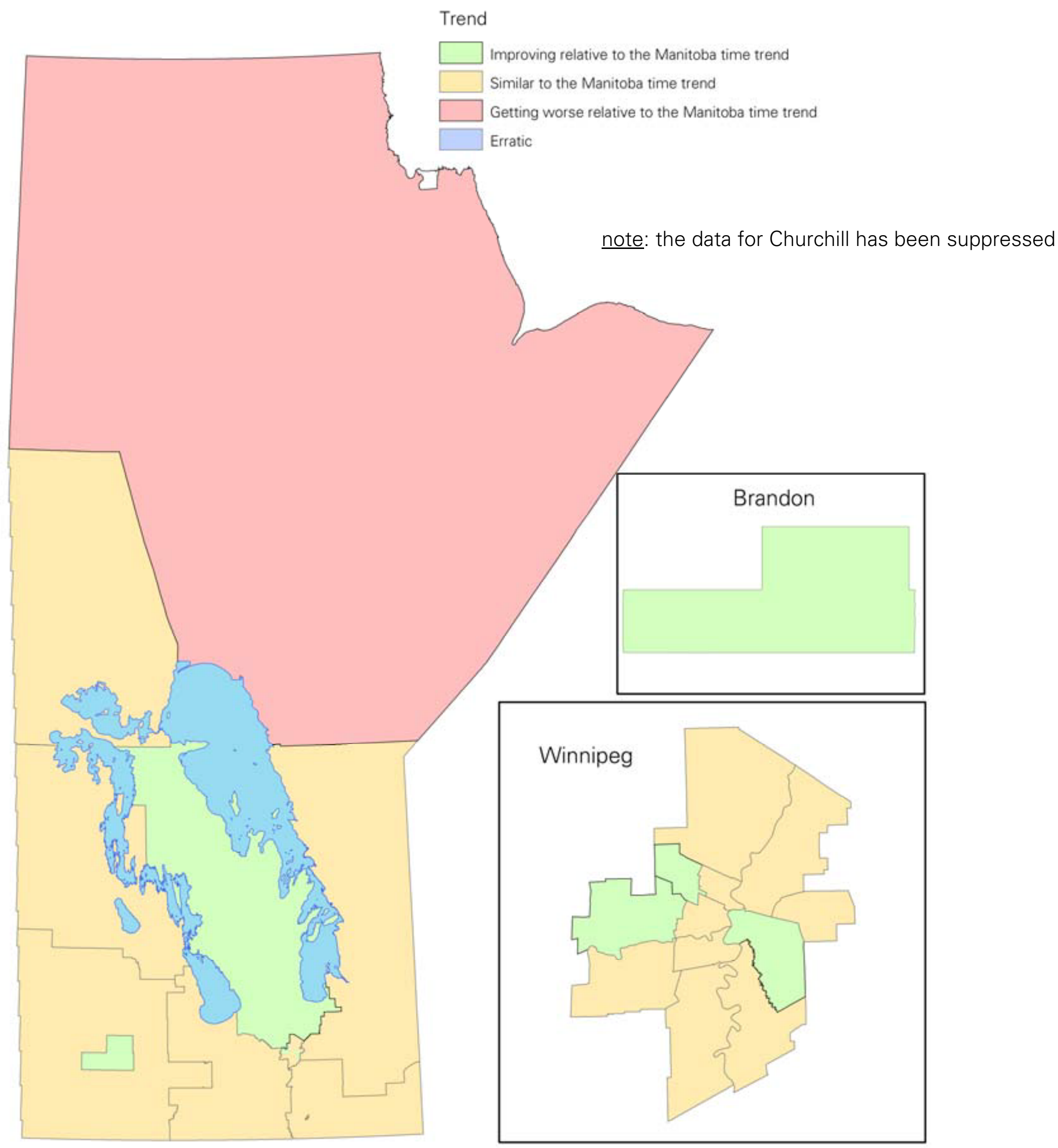
Age-adjusted annual rate of amputations per 1,000 diabetics in a three-year period, age 20-79, 1995/96 -2003/04



Source: Manitoba Centre for Health Policy, 2008

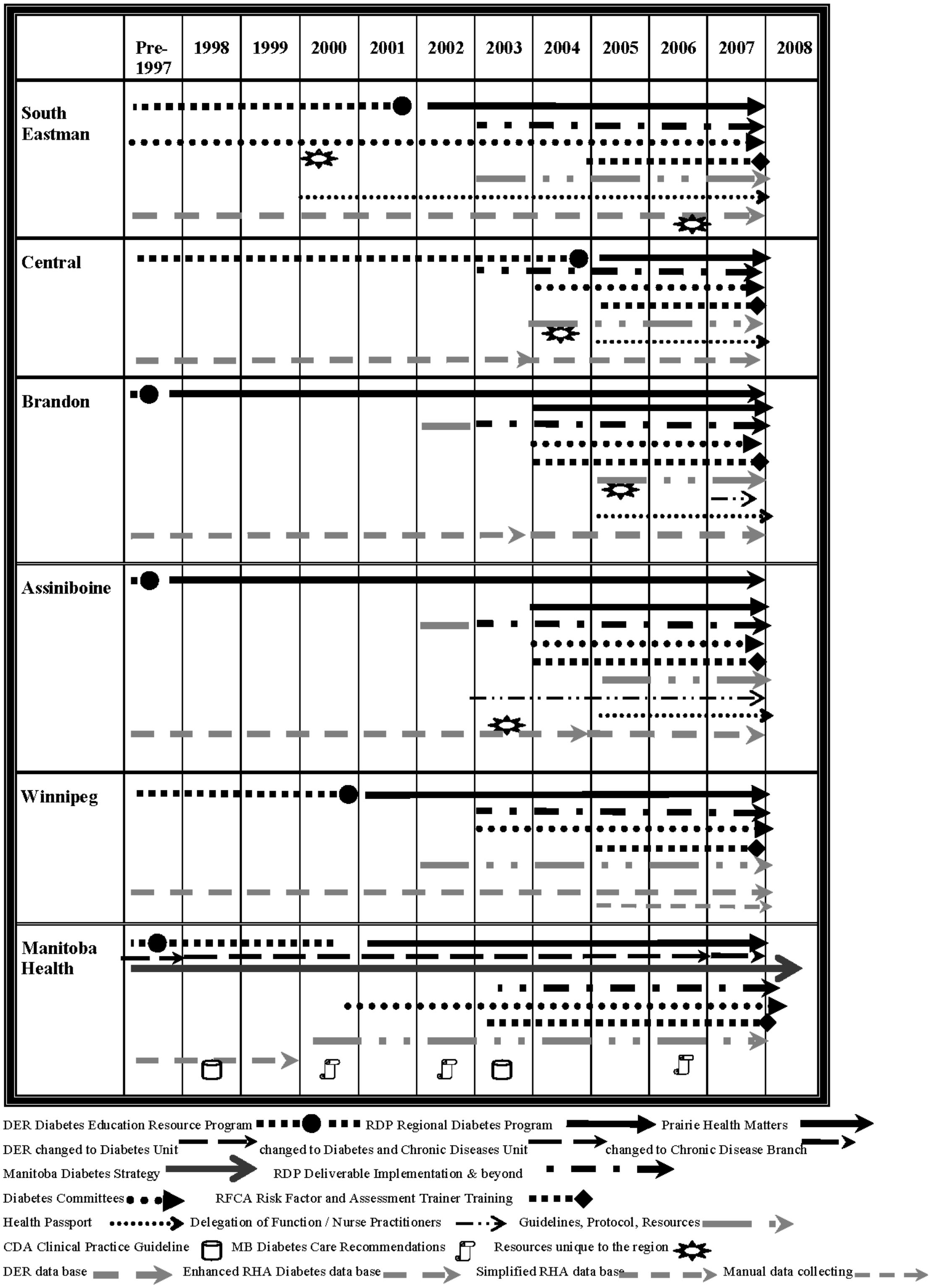
Figure 3.16: Trends in Diabetes Related Lower Limb Amputation Rates by RHAs and Winnipeg Community Areas

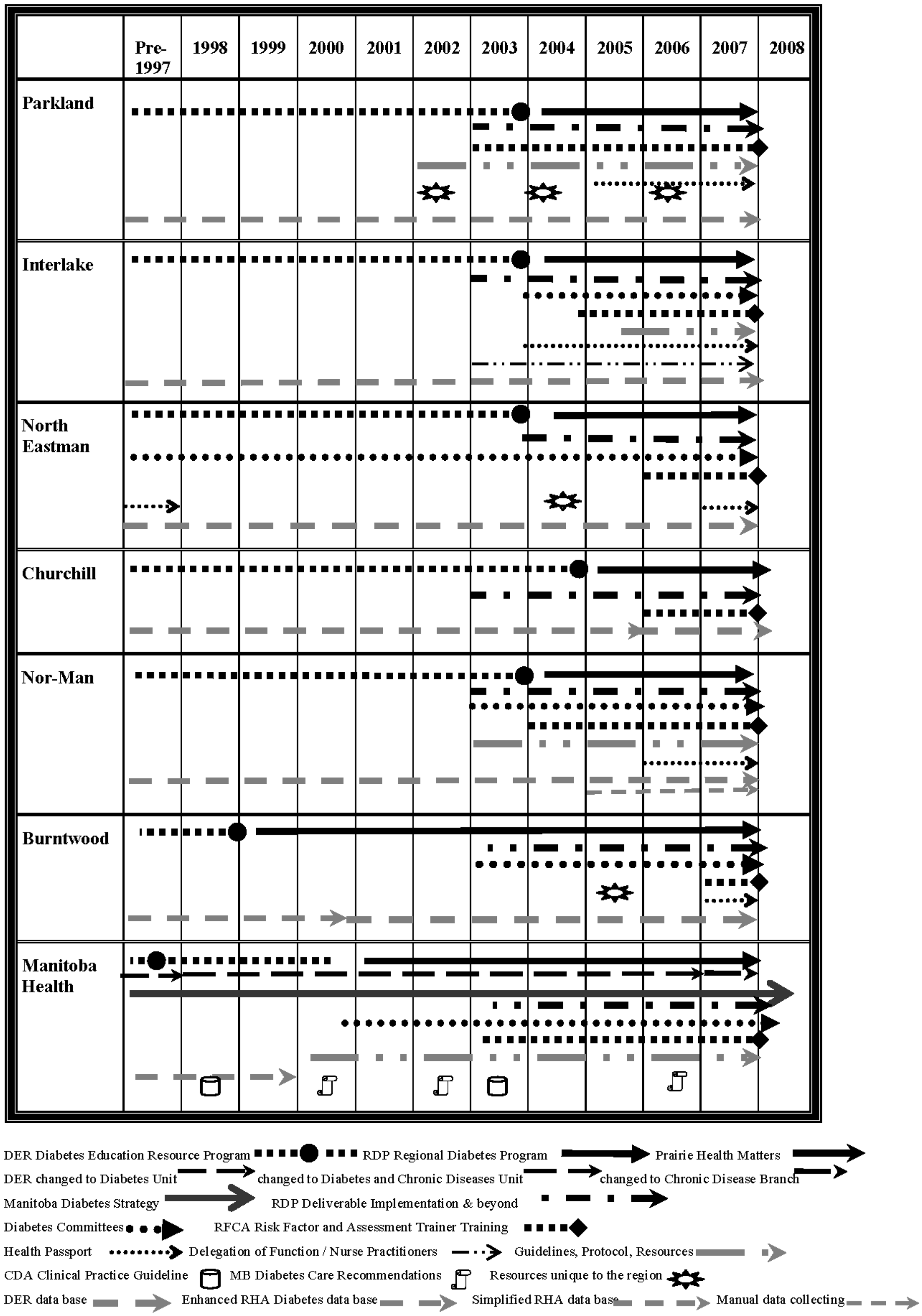
Age-adjusted annual rate of amputations per 1,000 diabetics in a three-year period, age 20-79, 1986/87-2003/04



Source: Manitoba Centre for Health Policy, 2008

Table 3.1 Diabetes programs and strategies by RHA




Pre-1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Parkland
Interlake
North Eastman
Churchill
Nor-Man
Burntwood
Manitoba Health
DER Diabetes Education Resource Program
RDP Regional Diabetes Program
Prairie Health Matters
DER changed to Diabetes Unit
changed to Diabetes and Chronic Diseases Unit
changed to Chronic Disease Branch
Manitoba Diabetes Strategy
RDP Deliverable Implementation & beyond
Diabetes Committees
RFCA Risk Factor and Assessment Trainer Training
Health Passport
Delegation of Function / Nurse Practitioners
Guidelines, Protocol, Resources
CDA Clinical Practice Guideline
MB Diabetes Care Recommendations
Resources unique to the region
DER data base
Enhanced RHA Diabetes data base
Simplified RHA data base
Manual data collecting

3.2 Discussion

What the figures and maps tell us about overall rates and trends in **diabetes prevalence**:

- Diabetes prevalence has increased substantially over time across all RHAs and most districts and across all Winnipeg CAs and NCs. Provincially, the rate has increased from 4.1% to 5.9% in the time period from 1988/89–1995/96 to 1996/97–2003/04. The North has seen the most dramatic overall changes during that time period, from 7.3% to 12.1%.
- There is a strong association between overall health status of a non–Winnipeg region and diabetes prevalence. There is increasing prevalence in regions with poorer overall health status. This is also evident in most sub–regional districts. The highest prevalence in the latest time period (1995/96–2003/04) in several districts within Burntwood (Island Lake at 28.5%, Shamattawa/York Factory/Split Lake/War Lake at 22.5%, Norway House at 21.2%, and Cross Lake at 19.6%) and the NE Northern Remote district of North Eastman RHA (21.4%).
- Within Winnipeg RHA, there is also a gradient with CAs in poorer health status having higher diabetes prevalence. However, the gradient is not as strong as in rural Manitoba. There also appear to be anomalous CAs with high diabetes prevalence despite relatively healthy populations—Transcona and Seven Oaks.
- Most of the aggregate regions of the province (see Figures 3.5 and 3.6) show the upward trend of diabetes prevalence with increases similar to the province as a whole. However, the North area shows not only higher rates, but also more rapidly increasing rates—from 6.5% to 13.1% in the interval from 1986/89 to 2001/04. Only the South region is "bucking the trend" by increasing at a slightly lower rate than the Manitoba time trend.
- The inequality gradient of diabetes in Manitoba appears to be increasing with a much greater spread between aggregate areas in the most recent time period compared to the earliest time period fifteen years before. So not only are rates increasing rapidly, but the increase is most rapid in the least healthy regions of the province.
- The maps in Figures 3.7 and 3.8 show that the very high rates are in the northern areas. Of serious concern are two districts: North Eastman's Northern Remote district and the Island Lake district in Burntwood; both show very high prevalence values (red on first map) which are increasing faster than the provincial average (pink on the second map).

What the regression modeling[1] tells us about **diabetes prevalence** in the years 2001/02–2003/04 (for the complete regression model, refer to Appendix 4)

- Individual characteristics that **increased** the likelihood of having diabetes—being older; having mental or physical health problems; and being **female, but only if you live** in North Eastman, Nor–Man, Burntwood, Churchill, and the two Winnipeg CAs of Point Douglas and Downtown.

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[1] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

- Individual characteristics that **decreased** the likelihood of having diabetes—living in a neighbourhood of higher average household income and being **female but only if you live** in Central, South Eastman, Brandon, Assiniboine, and most parts of Winnipeg.
- After controlling for individual effects, **geographical** characteristics that **increased** the likelihood of having diabetes—living in Burntwood RHA and in the Winnipeg CAs of Assiniboine South, Fort Garry, Transcona, and Seven Oaks. Surprisingly, after controlling for individual effects, geographical characteristics that **decreased** the likelihood of having diabetes—living in Point Douglas and Downtown CAs of Winnipeg or living in the RHAs of Central, North Eastman, South Eastman, Parkland and Assiniboine.
- The area level breastfeeding rates in 1988/89 were negatively associated with the district's diabetes prevalence—higher district breastfeeding initiation rates, lower district diabetes rates 15 years later. Due to the complex social issues potentially involved, this is an association which needs further study.

What the figures and maps tell us about overall rates and trends in **lower limb amputation rates with diabetes comorbidity:**

- The rate of amputation for people with a diagnosis of diabetes has not changed over time with Manitoba rates being relatively stable at 13.6 per thousand in 1986/87–1994/95 and 14.5 per thousand in 1995/96–2003/04.
- However, there appears to be a significant gradient in amputation rates by overall health status with higher rates experienced in people with diabetes living in areas of poorer health status both in rural Manitoba and in Winnipeg. Comparing the South to the North in 1995/96–2003/04, rates of amputation are double for people with diabetes living in the North (14.2 versus 29.8 per thousand people with diabetes).
- Most of the aggregate regions of the province (in Figure 3.13 and 3.14) show a similar trend of lower limb amputation rates over time with high rates in people with diabetes in the early to mid–1990s and decreasing thereafter to 2001/04. Brandon RHA is the only area that shows a statistically significant improvement in amputation rates. Not only are Brandon's rates lower than the rest of the province (see Figure 3.9 and Figure 3.13), but area rates also appear to be decreasing more rapidly than the Manitoba time trend.
- The inequality gradient of lower limb amputation for people with diabetes appears to be increasing with a much greater spread between aggregate areas in the most recent time period compared to the earliest time period fifteen years before, in non–Winnipeg and Winnipeg aggregate regions (Figure 3.13 and 3.14). The North, the Mid regions, and Winnipeg's Least Healthy regions have amputation rates above the provincial average.
- The maps in Figures 3.15 and 3.16 are only shown for RHAs due to the relatively small number of procedures. The RHAs of Brandon and Interlake appear to have rates that are not increasing as rapidly in the rest of the province. The RHA of Burntwood appears to have very high rates that are increasing more rapidly than the Manitoba time trend.

What the regression modeling[2] tells us about **lower limb amputation rates with diabetes comorbidity** in the years 2001/02–2003/04 (for the complete regression model, refer to Appendix 4):

- Individual characteristics that **decreased** the likelihood of having a lower limb amputation if a person had diabetes—being female, living in an area with a higher average household income, and having good continuity of care by a physician.
- Individual characteristics that **increased** the likelihood of having a lower limb amputation if a person had diabetes—having physical illnesses.
- Individual characteristics that did not affect the likelihood of having a lower limb amputation if a person had diabetes—having a mental illness.
- After controlling for individual effects, **geographical** characteristics that **decreased** the likelihood of having a lower limb amputation if a person had diabetes—living in Brandon or Assiniboine RHAs or living in River Heights CA of Winnipeg.
- After controlling for individual effects, **geographical** characteristics that **increased** the likelihood of having a lower limb amputation with diabetes comorbidity—living in Burntwood or Churchill.

How the above information on diabetes and related amputations are associated with descriptive information on policy, program or support initiatives to decrease diabetes and its adverse effects:

- The results show the likelihood of being diagnosed with diabetes in the 2001/02–2003/04 time period is increased when a person has comorbid physical and mental illnesses. This reinforces the primary care approaches that are being used in most of the regions presently, knowing that people with diabetes often have other physical illnesses. However, these results add the importance of the co–occurrence of mental illness.
- The two RHAs that show a significant protective effect for lower limb amputations are Brandon and Assiniboine. This correlates with the fact that these two RHAs also appear to have the most long–standing regional diabetes initiatives in the province (since before 1997). In Figure 3.9, it is also important to note that Brandon and Winnipeg RHAs are the only two RHAs to have statistically lower rates of amputation in the 1995/96–2003/04 time period than the province overall (Brandon 8.0, Winnipeg 10.0, Manitoba overall 14.5 amputations per 1,000 people with diabetes). Two RHAs that have low rates but are not statistically different from the provincial average: South Eastman (10.8) and Assiniboine (12.5). It is interesting to note that Brandon, Winnipeg, South Eastman and Assiniboine began their regional diabetes initiatives sooner than other RHAs.
- Lack of continuity of care was associated with higher amputation rates for people having diabetes. Many RHAs have begun initiatives to increase continuity of care through such things as regional diabetes programs, use of alternative health care providers like nurse practitioners, and use of health "passports" in the years after the present study. Interlake is one of the RHAs that has a nurse practitioner–based program for those having diabetes; and according to the

[2] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

map in Figure 3.16, Interlake and Brandon RHAs are the only two that show rates of amputation improving faster than the Manitoba time trend.

- The relationship of higher area level breastfeeding rates with lower diabetes rates also reinforces the importance of looking at regional perinatal programs (such as Canada Prenatal Nutrition Program or *Healthy Baby*) as preventive strategies not only for child health, but also potentially for long–term adult health in communities (see the review of the literature for more studies that reinforce this approach).

3.3 Comparison of Pertinent Literature Reviews and *Our Study Results*

3.3.1 Diabetes Prevalence and Lower Limb Amputation Rate Comparisons:

According to the Canadian Community Health Survey in 2003 (Table 105–0292, Statistics Canada 2003), the overall diabetes prevalence for those 12 years old or older was 4.6% with a slightly higher rate in males (4.9%) compared to females (4.3%). In Manitoba, the self–reported diabetes prevalence was higher than the Canadian average, at 5.3% (males 6.6% and females 4.1%). However, the CCHS Manitoba rates exclude all people living in First Nations communities, so caution must be exerted as this is a high percentage of the population in some northern RHAs. Therefore, the Manitoba prevalence is most likely underestimated by the CCHS survey.

Even within two years from 2003 to 2005, self–reported diabetes prevalence has increased in Canada from 4.6% to 4.9% overall (Table 105–04000, Statistics Canada 2003 and 2005) and for both sexes (males 4.9% to 5.3%; females 4.3% to 4.4%). An Ontario study showed quite substantial increases within a four year span, from 4.7% in 1995 to 6.2% in 1999 (Hux and Tang, 2003). Similar increases have been shown in various studies in the USA from around 3% in the 1980s (Honeycut et al. 2003), 5% in the early 1990s (Cowie et al. 2006), over 6% in the late 1990s (Mokdad et al. 2000; Eliasson et al. 2002), and 7–8% in the early 2000s (Mokdad et al. 2003; Cheng 2005). The USA projected prevalence for 2050 is close to 10% (Honeycut et al. 2003); but given rising rates even within the last decade, this seems somewhat of an underestimate. England has also seen rising self–reported rates, from 2% in the early 1990s to 4% in a 2003 health survey.

Our own study found Manitoba diabetes prevalence to be 3.7% in 1986/89 to 6.4% in 2001/04. This is higher than that reported in the CCHS (5.3% in 2003) probably for two reasons—first, First Nations community residents were excluded from the CCH, and second, the CCHS is reported for those aged 12 and over, but our prevalence is for those aged 20–79. However, the actual increases seen in Manitoba over the last decade (4.3% in 1991/94 to 4.8% in 1995/98 to 6.4% in 2001/04) are very similar to those reported by Hux and Tang (2003) in Ontario. The issue is critical in northern Manitoba where prevalence was high two decades ago and is over double the provincial value presently (North 6.5% in 1986/98 to 13.1% in 2001/04). These prevalence estimates are well above any other reported data.

The interesting interaction effect showing higher female rates in northern areas and male rates in southern areas has been noted in a previous MCHP report (Fransoo, Martens et al. 2005). See Chapter 3, Figure

3.4.1 in that report for further details—essentially, male diabetes prevalence is higher except in the three northern RHAs (Churchill, Burntwood and Nor–Man) where diabetes prevalence is statistically higher for females.

Lower limb amputation rates per thousand for people with diabetes varies across the world, with widely varying rates reported for the 1990s: 3.6/1000 in the Netherlands, 5.0 in California, and 6.6/1000 in Germany (Jeffcoate and van Houtum 2004). Although the overall USA rate was 5.5/1000 in 2001 (CDC in Bartus and Margolis 2004), rates varied substantially from 3.8/1000 for Medicare claims (Wrobel et al. 2001) to 5.0 in California and 7.2 in Louisiana public hospitals (Jeffcoate and van Houtum 2004). In the Netherlands, lower limb amputation rates for those with diabetes have decreased over time, from 5.5 to 3.6 per thousand in the decade from 1991 to 2000 (van Houtum et al. 2004).

In an Ontario study using administrative data (Hux et al. 2003), overall age–adjusted amputation rates for those having diabetes were 15.6 per 1000 in 1999 and had decreased slightly from the 1995 rate of 19.5/1000. Having a lower limb amputation is a severe adverse outcome of diabetes and as such indicates poor health generally. Survival rates are low for people with diabetes who experience an amputation with estimates ranging from a 50% three year survival rate (Servold 1991), a median survival rate of 1 year 5 months for women and 2 years 8 months for men in Finland (Pohjolainen and Alaranta 1998), and a 30% mortality rate by 1 year post–amputation in Ontario (Hux et al. 2003). Since all people experiencing a non–injury related amputation may have high comorbidity, it is not surprising that two studies have found little difference in mortality rates between people with and without diabetes post–amputation (Hux et al. 2003; Tentlouris et al. 2004).

The ICES study in Ontario (Hux et al. 2003) examined the independent effects of various factors on amputation rates for people with diabetes and found that the likelihood of amputation increased with age, but decreased with rising neighbourhood income levels. As well, males were more likely than females to have an amputation (adjusted OR 1.71, 95% CI 1.62–1.82) and residents of northern Ontario had elevated risk compared to those living in Toronto (adjusted OR 1.48, 95% CI 1.34–1.64). Access to regular care was also found to be important. For people with diabetes, those having a regular primary caregiver were less likely to have amputation (adjusted OR 0.87, 95% CI 0.79–0.96). The authors note that reduced access to primary and specialist care, earlier onset of diabetes in Aboriginal people groups, and higher rates of unmeasured factors such as smoking in rural Ontario could explain some of the elevated risks they observed.

Our study showed amputation rates at 13.9/1000 people with diabetes in 2001/04. The rate has been somewhat erratic over a 15–year period, with a low of 12.8/1000 in 1986/89 and a high of 19.0 in 1995/98. These rates are comparable with the Ontario rates, but are extremely high compared to rates around the world. Risk factors found in the Ontario study are also reflective of the risks found in our study—females have lower amputation rates (OR 0.54, 95% CI 0.44–0.65), Burntwood RHA has higher (OR 1.64, 95% CI 1.54–1.76), good continuity of care is associated with lower rates (OR 0.77, 95% CI 0.71–0.82), and higher neighbourhood income is associated with lower rates (0.77, 95% CI

0.71–0.82). This is similar to the Ontario study that found elevated rates in males in the North, in people not having good access or continuity of care, and in lower income neighbourhoods. Our study also found that even within the population of people with diabetes, those having greater comorbidity were more likely to have amputation.

3.3.2 Policy and Program Initiatives Pertinent to Decreasing Diabetes and its Adverse Outcomes:

(a) Preventing or delaying onset of type 2 diabetes:

- ***Lifestyle modification*** is the most effective way of preventing or delaying the onset of type 2 diabetes, but ***medication interventions*** have also shown positive results (Cheng 2005; Gillies et al. 2003; Krentz and Bailey 2005). Lifestyle modification requires discipline by patients which may hamper its effectiveness at a population level (Cheng 2005), so some researchers propose medication interventions as a good alternative.
    - ***Intensive lifestyle intervention*** can be more effective than drug therapy at least when evaluated in the setting of interventional clinical trials (Krentz and Bailey 2005).
    - Delayed progression from glucose intolerance to type 2 diabetes in high–risk individuals with glucose intolerance has been demonstrated with the ***medications*** troglitazone, metformin, olistat and acarbose (Krentz and Bailey 2005; Padwal et al. 2005). However, no antidiabetic drugs are presently licensed for use in pre–diabetic individuals, and many of the trials suffer from short follow–up or loss–to–follow–up (Padwal et al. 2005).
    - ***Lifestyle changes and treatment with metformin*** are effective in preventing type 2 diabetes. However, using strategies at a population level to ***prevent people from becoming overweight*** would be the most effective public health strategy with an estimated 12–13% reduction in overall type 2 diabetes rates and a possible 60% or more reduction in groups that have a tendency to overweight (Burke et al., 2003)
    - A systematic review and meta–analysis found lifestyle interventions (Hazard Ratio 0.51, 95% CI 0.44–0.60 compared to standard advice) to be more effective than ***oral diabetes drugs*** (0.70, 95% CI 0.62–0.79 compared to placebo) in reducing the rate of progression to type 2 diabetes in people with impaired glucose tolerance (Gillies et al. 2007).
    - A ***variety of efforts*** are needed to have a lasting impact on the prevention and control of diabetes in the community: implementing and sustaining community–wide programs (i.e., those that target risk factors such as obesity related to diet and lack of physical activity), community support for getting policy and environmental changes that support behaviour changes, community coalitions that unite diverse sectors of the community, and academic–community partnerships that contribute to technical capacity building at the community level and increase academic understanding of the issues faced by the community (Cohen and Ingram, 2005).
- Systematic reviews as well as several cohort and case–control studies have shown that ***breastfeeding may be protective*** against development of type 2 diabetes and early–onset adolescent type 2 diabetes in the breastfeeding infant and type 2 diabetes in the breastfeeding mother

(Ip et al. 2007; Taylor et al. 2005; Young et al. 2002; Pettitt et al. 1997; Pettitt and Knowler 1998). Breastfeeding may lower both maternal and pediatric rates of diabetes. Taylor et al. (2005) conclude that women with diabetes should be strongly encouraged to breastfeed because of maternal and childhood benefits specific to diabetes that are above and beyond other known benefits of breastfeeding. These are complex social issues that need further study.

- A study (Martens et al. 2007) examining ecologic associations (i.e., area–level outcomes) with diabetes and amputation rates for First Nations people living "on–reserve" found that ***diabetes was higher*** in Tribal Council areas of l***ower average household income*** and higher in ***southern*** First Nations compared to northern First Nations. However, the only significant predictor of ***lower limb amputation*** for people with diabetes was ***access to healthcare services***—higher specialist consult rate, lower amputation rate.

(b) <u>Controlling diabetes and preventing adverse outcomes (amputation due to diabetes):</u>

- ***Foot care*** for people with diabetes is important. Because foot ulcers are a significant risk factor for amputation, preventing their development or healing them once they occur will reduce the rate of amputations. Thus, all strategies for prevention of foot ulcers (i.e., improved glycaemic control, reducing micro– and macro–vascular disease, optimized foot care, multidisciplinary foot–care systems) are important for amputation prevention (Bartus et al., 2004). Multidisciplinary foot–care teams implementing risk assessment, therapeutic foot wear and patient education have shown a 50–85% decreased risk for ulcer and amputation (Mayfield et al. in Wrobel et al., 2001).
- Weak evidence suggests that ***patient education*** for people with diabetes may reduce foot ulceration and amputations, especially in high–risk patients. Foot care knowledge and behaviour of patients seem positively influenced by patient education in the short term, but more RCTs of better quality are needed (Valk et al. 2005).
- A systematic review indicates that ***Telemedicine solutions*** for diabetes care are feasible and acceptable, but evidence for their effectiveness in improving HbA1c or reducing costs while maintaining HbA1c levels, or improving other aspects of diabetes management is not strong at present (Farmer et al. 2005).
- ***Self–monitoring of blood glucose*** has shown effective for people using insulin for both type 1 and type 2 diabetes. Evidence may point to its effectiveness in improving glycaemic control in patients with type 2 diabetes who are not using insulin, but better randomized studies are required (Welschen et al. 2005).
- A Cochrane review by Thomas et al. (2006) demonstrates through a meta–analysis that ***exercise significantly improves*** glycaemic control and reduces visceral adipose tissue and plasma triglycerides in people with type 2 diabetes, even without weight loss. Another systematic review suggests that ***regular exercise*** may promote better glycaemic control in people having type 2 diabetes, but all the studies were at high risk of bias (Nield et al. 2007).
- Adherence difficulties and psychological problems are associated with poor glycaemic control in diabetes. For people with type 2 diabetes, a systematic review has shown that ***psychological therapies*** improve long–term glycaemic control and psychological distress, but not weight control or blood glucose concentration (Ismail et al. 2004).

- Most quality improvement strategies for glycaemic control in people with type 2 diabetes result in small to modest improvements in glycaemic control, although the studies are limited in this area. ***Team changes and case management*** show more robust improvements, especially for interventions in which ***case managers could adjust medications without awaiting physician approval.*** (Saxena et al. 2007; Shojania et al. 2006). Improvements in the way in which health care providers interact with type 2 diabetes patients (***central computerized tracking systems, nurses who regularly contact the patient***) has been shown to be effective in changing diabetes management (Renders et al. 2001). As well, a review by van Dam et al. (2005) indicates that various forms of social support may have benefits for people with type 2 diabetes, including: ***group consultations*** (better HbA1c and lifestyle), ***Internet*** (improved perceived support), ***telephone–based peer support*** (increased physical activity), and ***social support groups*** (improved knowledge and psychosocial functioning). No improvement in diabetes control was seen for support from spouse or family and friends. The authors suggest that these forms of social support be incorporated in the work of diabetes teams. However, Wens et al. (2007) caution that the effectiveness of various forms of educational intervention (face–to–face, group, and distance education through telemedicine) is under debate given the paucity of strong research studies.
- A systematic review showed that a system of reminders, improved medication packaging and patient education by ***pharmacists*** improved medication adherence in type 2 diabetes and was associated with lower glycated hemoglobin levels (Lindenmeyer et al. 2006). ***Shared care***, defined as the joint participation of primary care physicians and specialists, was found to improve prescribing practices, but had mixed or non–consistent effect on physical health outcomes (Smith et al. 2007).

From the above literature review, an integrated regional diabetes prevention and monitoring strategy would be multi–faceted. Prevention or delay of onset of diabetes, according to the literature, is best done through lifestyle programs (including exercise programs), potentially through medication programs (although this may be costly and is not as effective), and integrated approaches that focus on good nutrition—including breastfeeding promotion strategies. RHAs that have lower prevalence of diabetes after controlling for individual characteristics include Central, North Eastman, South Eastman, Parkland and Assiniboine. Despite the high rates of diabetes in the Point Douglas and Downtown CAs of Winnipeg (8.3% and 7.5% respectively, from 1995/96–2003/04) and given the socioeconomic and physical health burdens of the individuals living in those areas, the regression model indicates that these rates are lower than expected. For the non–Winnipeg RHAs, their lower–than–expected diabetes prevalence may partly be due to the unmeasured individual risk factors (Central, South Eastman and Assiniboine RHAs are "healthy" RHAs overall with possibly less comorbidities and protective lifestyle behaviours). As well, genetic predisposition may also influence the onset of diabetes, so RHAs with larger "at risk" populations (such as Aboriginal people) may have higher diabetes prevalence despite integrated efforts at prevention strategies. Despite these limitations, it is noteworthy that North Eastman and South Eastman have had longstanding regional diabetes initiatives. Parkland, South Eastman and Central all had targeted resource materials for diabetes education earlier than other RHAs, plus Winnipeg, Brandon, and Parkland have had longstanding guidelines and protocols.

The decreased likelihood of amputation as an adverse outcome of diabetes may be more directly related to regional initiatives than is the overall prevalence of diabetes. "What works" in preventing amputation, according to the literature review, includes: team approaches and case management (especially if other health care providers are able to adjust medication), regular nurse contact, access to good care, good tracking systems and reminders (including pharmacist reminders), and social support options beyond the family or friends (such as peer telephone support or group consultations). Living in Brandon or Assiniboine RHAs was associated with lower risk of amputation, after controlling for individual risk factors. As well, Brandon and Winnipeg area the only two RHAs with statistically lower rates of amputation over the most recent 8–year period (see Figure 3.9), with South Eastman and Assiniboine showing a trend towards having lower rates (but it is not statistically significant).

It is interesting to see a statistically significant reduction in amputation rates for Brandon and Assiniboine. These two RHAs have the most long–standing regional diabetes initiative in the province (since before 1995) with integrated teams of nurses and nutritionists/dietitians. Two educators (RN and Dietitian) worked out of Brandon General Hospital to service Brandon residents. The Prairie Health Matters program (Diabetes and Heart Health) also included education and health promotion for clients at risk for or with diabetes or heart disease. Education was offered through group classes, one–on–one counseling and through public forums. Referrals to this program occur through health professionals or self–referral. Besides the teams of nurse/dietitian, some physician clinics offer diabetes clinics regularly in the Assiniboine RHA.

As well, Burntwood, Winnipeg and South Eastman began their regional diabetes initiatives earlier than most other RHAs reflecting systematic reviews which emphasize the need for good continuity of care, team management, regular nurse contact, and good access to health care providers. Along with Interlake, North Eastman, Churchill and Nor–Man, Winnipeg has a higher percentage of the population receiving good continuity of care (Fransoo et al. 2005).

Table 3.2: Population Attributable Risk for diabetes associated with low regional breastfeeding rates (OR = 1.1559, RR = 1.11402)

Prevalence of breastfeeding initiation in the region	Prevalence of NOT breastfeeding in the region	PAR: % of diabetes due to not breastfeeding
90%	10%	1.10%
80%	20%	2.20%
70%	30%	3.30%
60%	40%	4.40%
50%	50%	5.40%
40%	60%	6.40%
30%	70%	7.40%
20%	80%	8.40%
10%	90%	9.30%

Table 3.3: Population Attributable Risk for amputation in people with diabetes associated with lack of continuity of care (i.e., less than 50% of the annual physician visits to the same physician) (OR = 1.31321, RR = 1.30957)

Prevalence of Good Continuity of Care (% of population receiving at least 50% of their care from the same physician)	Prevalence of Lack of Good Continuity of Care (% of population NOT receiving at least 50% of their care from the same physician)	Population Attributable Risk of amputation for diabetics due to lack of good continuity of care (i.e., % of amputations in the diabetic population that are "due" to lack of CC)
10%	90%	21.80%
20%	80%	19.90%
30%	70%	17.80%
40%	60%	15.70%
50%	50%	13.40%
60%	40%	11.00%
70%	30%	8.50%
80%	20%	5.80%
90%	10%	3.00%

With the multitude of strategies and efforts at the provincial and regional levels, it is difficult to "sort out" what works in diabetes prevention and management. However with amputation rates showing recent declines, the effects of the many efforts at team management approaches, early identification and treatment and better monitoring of patients, it will be important to continue to look at future rates and trends.

Population Attributable Risk (PAR) is a term used in epidemiology to determine a theoretical benefit of certain interventions. This is a mathematical calculation that depends both on the magnitude of the risk associated with a certain "exposure" and the magnitude of the whole population that would be exposed to that particular "exposure". The "answer" from a PAR calculation gives you an estimate of the proportion of the outcome (such as having diabetes or having an amputation in people with diabetes) that could be "attributed" to being exposed to something (like lack of continuity of care or not being breastfed). See Chapter 1, Section 1.6, for a thorough discussion of this.

3.4 Recommendations

- With recent concerted effort in diabetes prevention and monitoring throughout the province (especially since 2003/04), it will be important to continue to monitor "what works" as various RHAs develop different strategies
- Given the fact that the Brandon/Assiniboine RHA diabetes strategy is associated with a lower likelihood of amputations after controlling for possible individual risk factors, further study into their programs could help with an understanding of what features could be adapted by other RHAs.

- Knowing that good continuity of care was associated with lower risk of amputation for people with diabetes, it is important to continue an overall primary care strategy to ensure good access and good continuity of care models for people throughout Manitoba.
- Knowing that breastfeeding rates at the RHA level correlate with lower diabetes rates in a regression modeling and that other studies have verified this correlation at an individual level, it is important to "link" diabetes strategies with breastfeeding promotion, protection and support strategies in Manitoba (such as perinatal programs, Healthy Child Manitoba programs, hospital policy).

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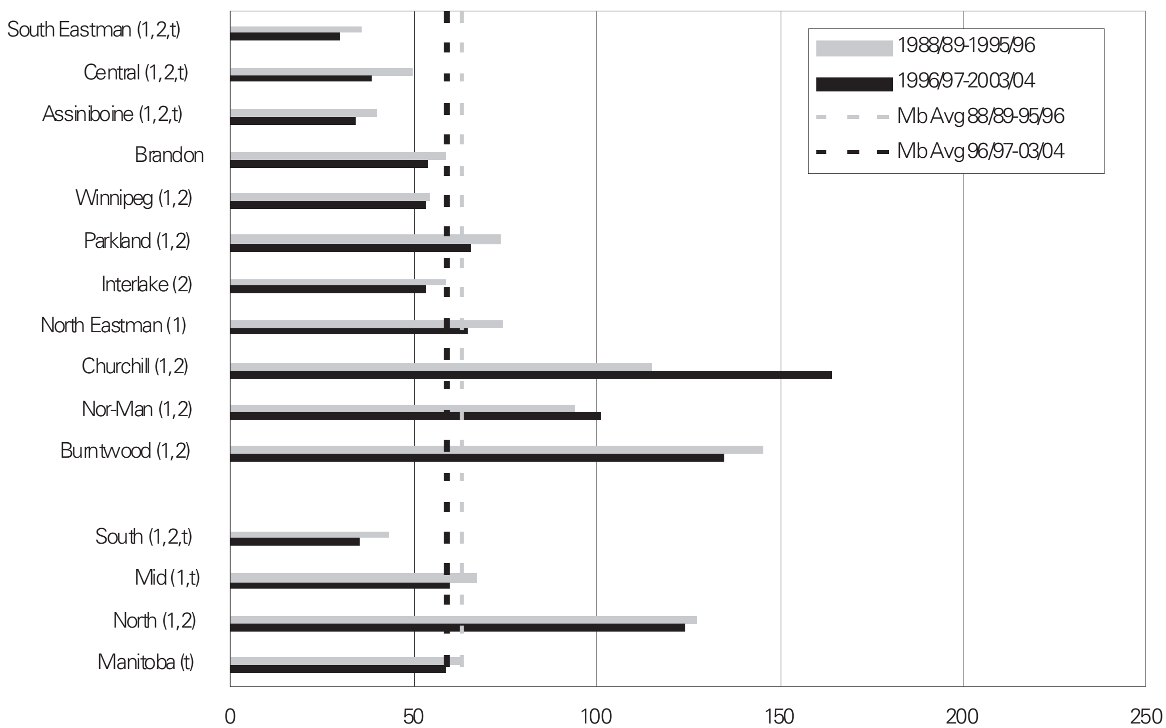
CHAPTER 4: TEEN PREGNANCY

4.1. Definition, Graphs and Maps

Teen pregnancy is defined as the number of pregnancies per thousand females aged 15 through 19. Pregnancies include live births, stillbirths, abortions and ectopic pregnancies, as indicated through a hospitalization with any of the following diagnosis codes: V27 (live birth), 632 (missed abortion), 633 (ectopic pregnancy), 634 (spontaneous abortion), 635 (legally induced abortion), 636 (illegally induced abortion), 637 (unspecified abortion) or 656.4 (intrauterine death); or with one of procedure codes: 66.62 (salpingectomy with removal of tubal pregnancy), 69.01 (dilation and curettage for termination of pregnancy), 69.51 (aspiration curettage of uterus for termination of pregnancy), 74.3 (removal of extratubal ectopic pregnancy), 74.91 (hysterotomy to terminate pregnancy) or 75.0 (intra–amniotic injection for abortion).

Figure 4.1: Teen Pregnancy Rates by RHA

Age-adjusted rate of teen pregnancies per 1,000 females age 15-19

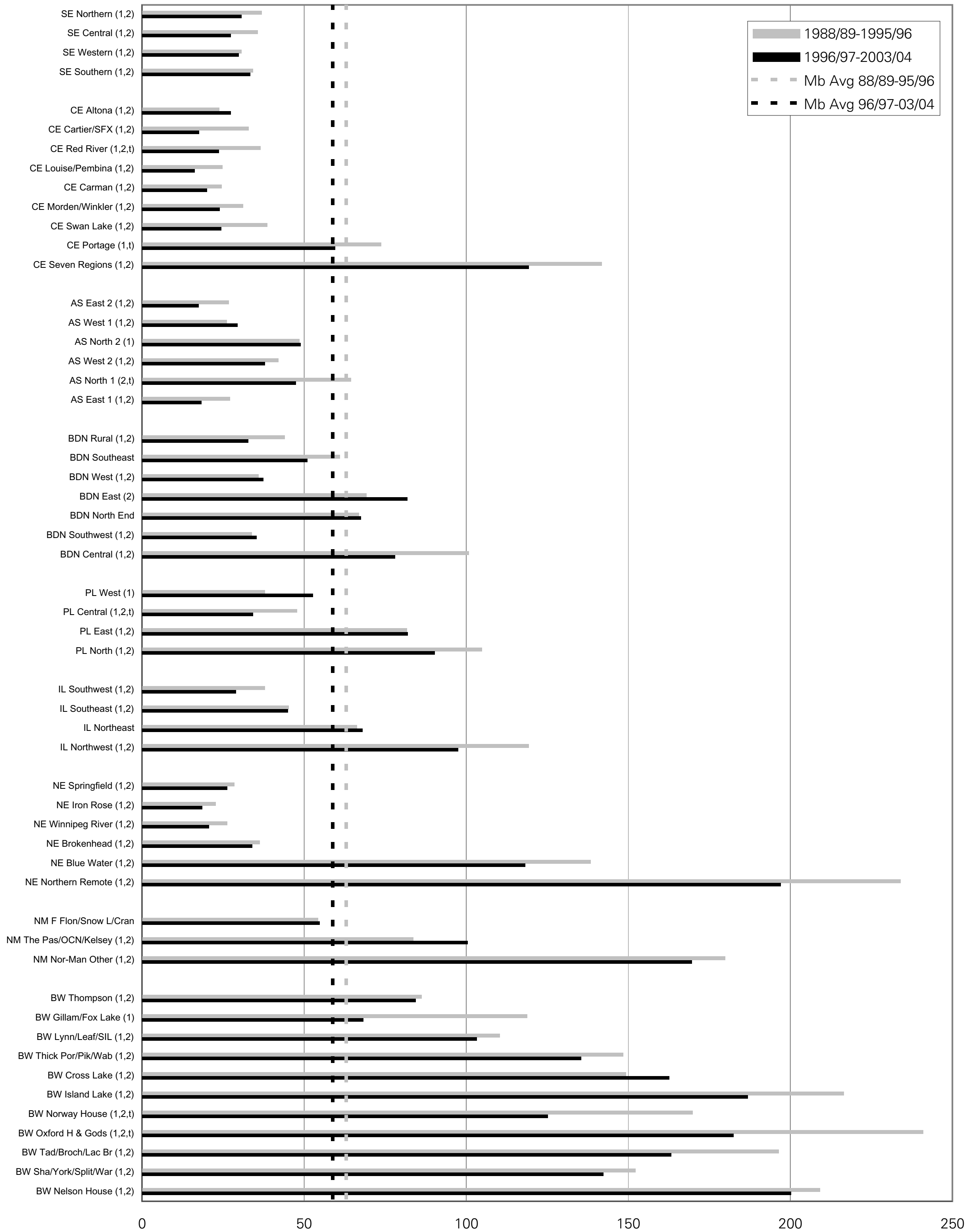


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 4.2: Teen Pregnancy Rates by District

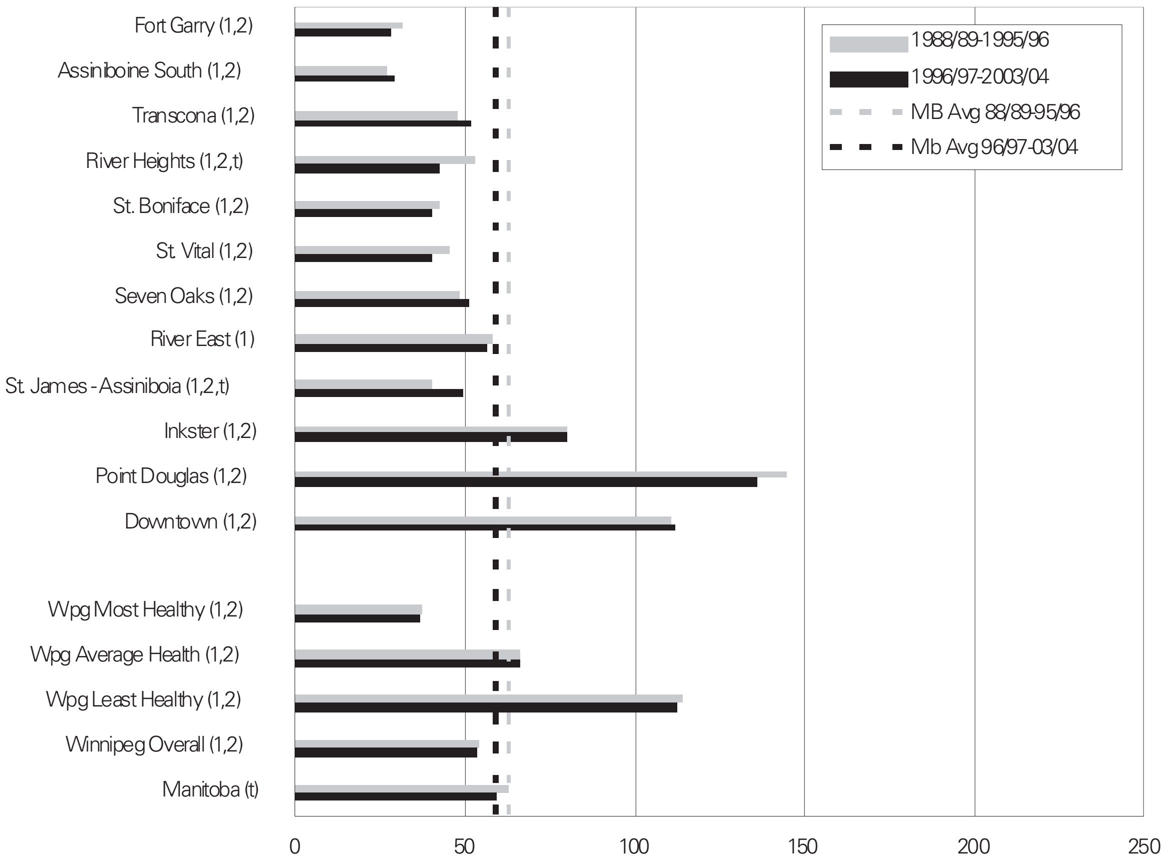
Age-adjusted rate of teen pregnancies per 1,000 females age 15-19



Source: Manitoba Centre for Health Policy, 2008

Figure 4.3: Teen Pregnancy Rates by Winnipeg Community Areas

Age-adjusted rate of teen pregnancies per 1,000 females age 15-19



'1' indicates area's rate was statistically different from Manitoba average in first time period

'2' indicates area's rate was statistically different from Manitoba average in second time period

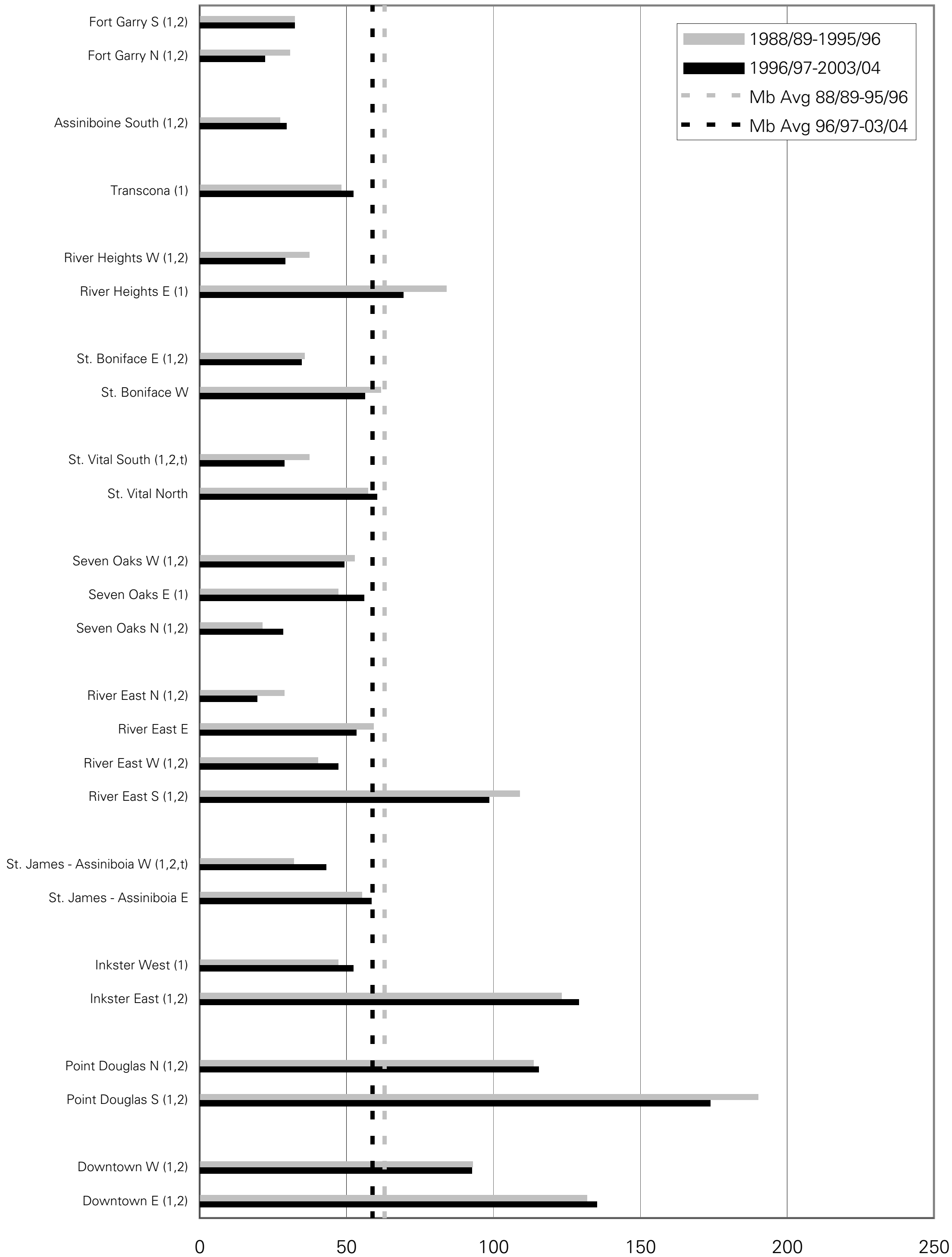
't' indicates change over time was statistically significant for that area

's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 4.4: Teen Pregnancy Rates by Winnipeg Neighbourhood Clusters

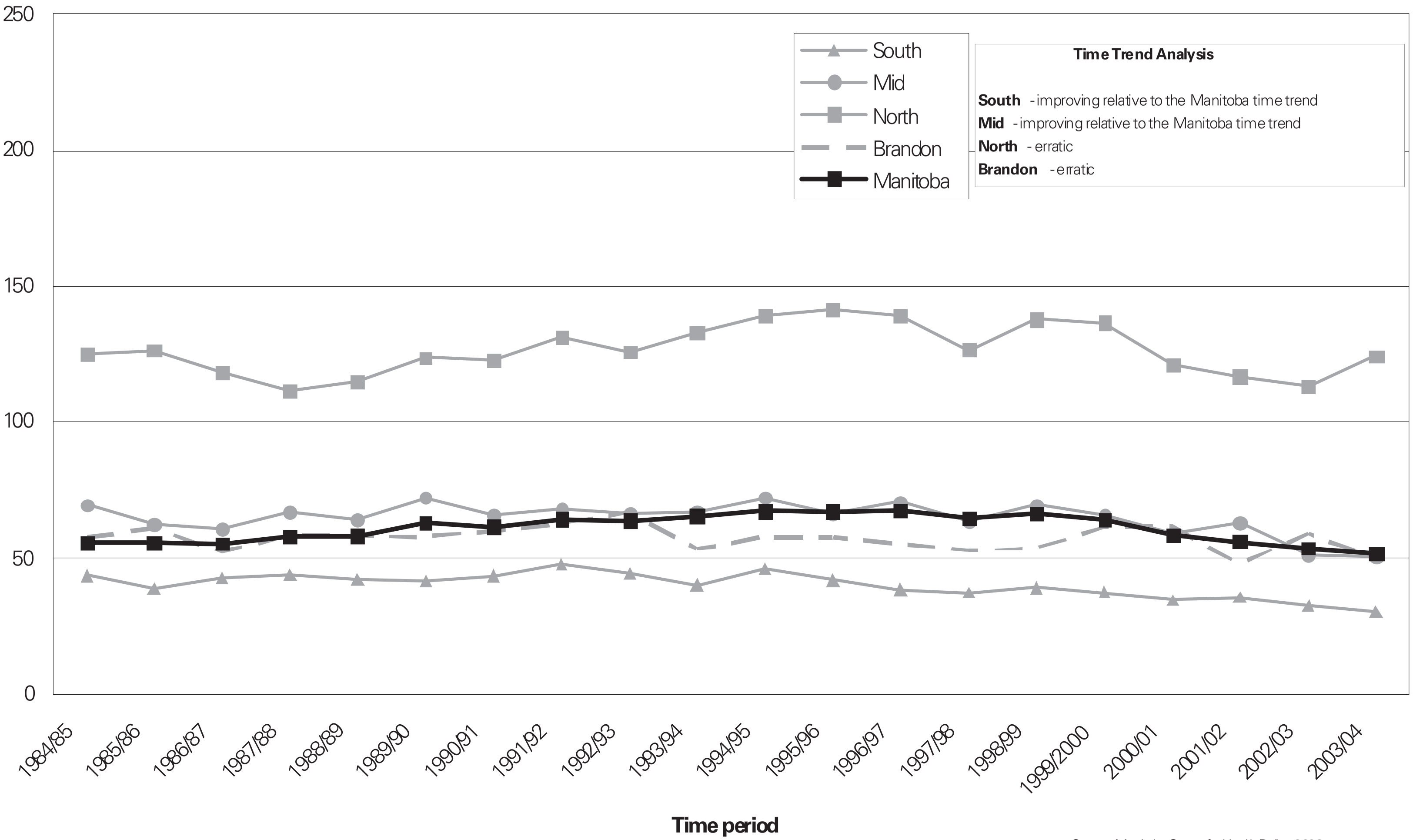
Age-adjusted rate of teen pregnancies per 1,000 females age 15-19



Source: Manitoba Centre for Health Policy, 2008

Figure 4.5: Trends in Non-Winnipeg Teen Pregnancy Rates by Aggregate Areas

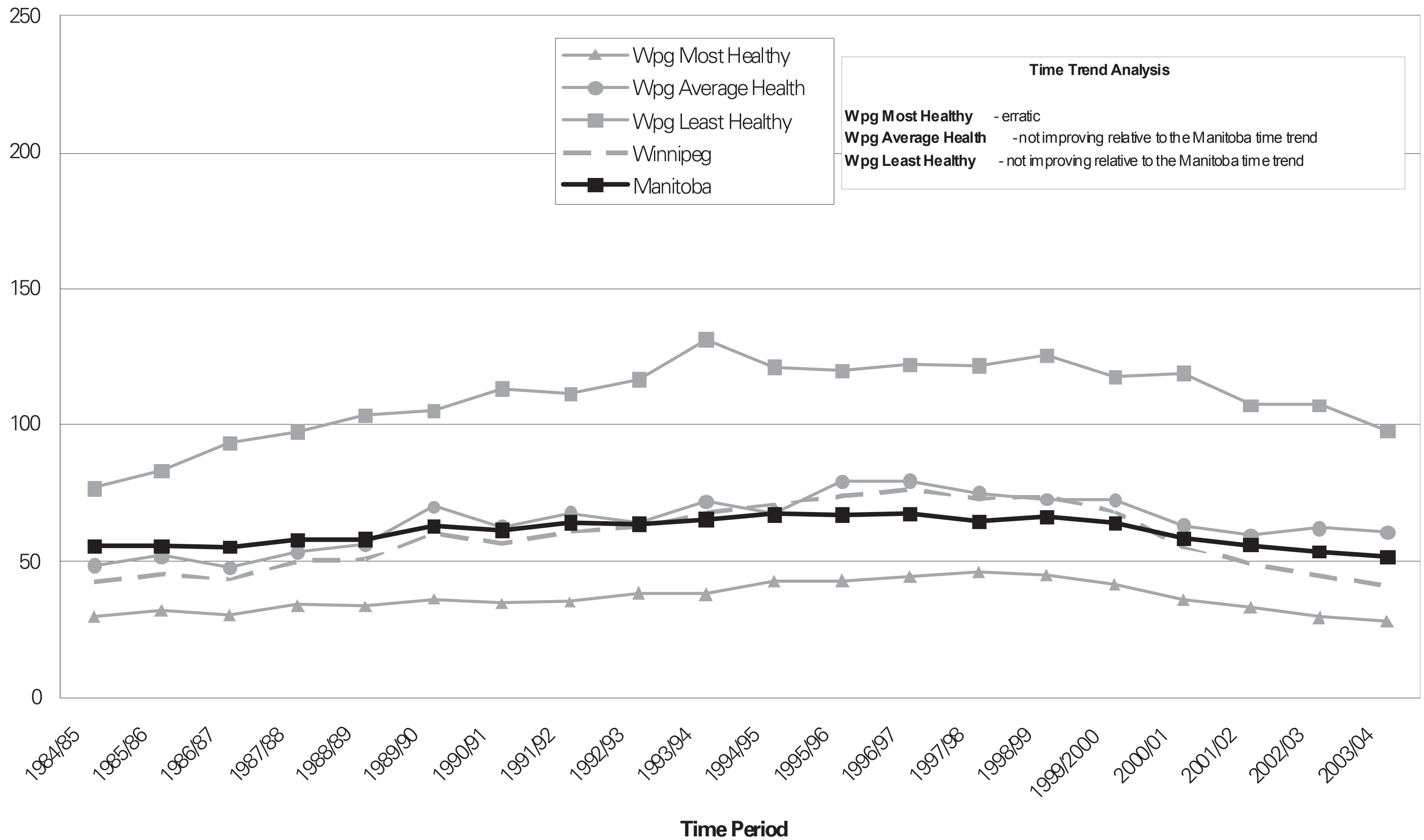
Age-adjusted rate of teen pregnancies per 1,000 females age 15-19



Source: Manitoba Centre for Health Policy, 2008

Figure 4.6: Trends in Winnipeg Teen Pregnancy Rates by Aggregate Areas

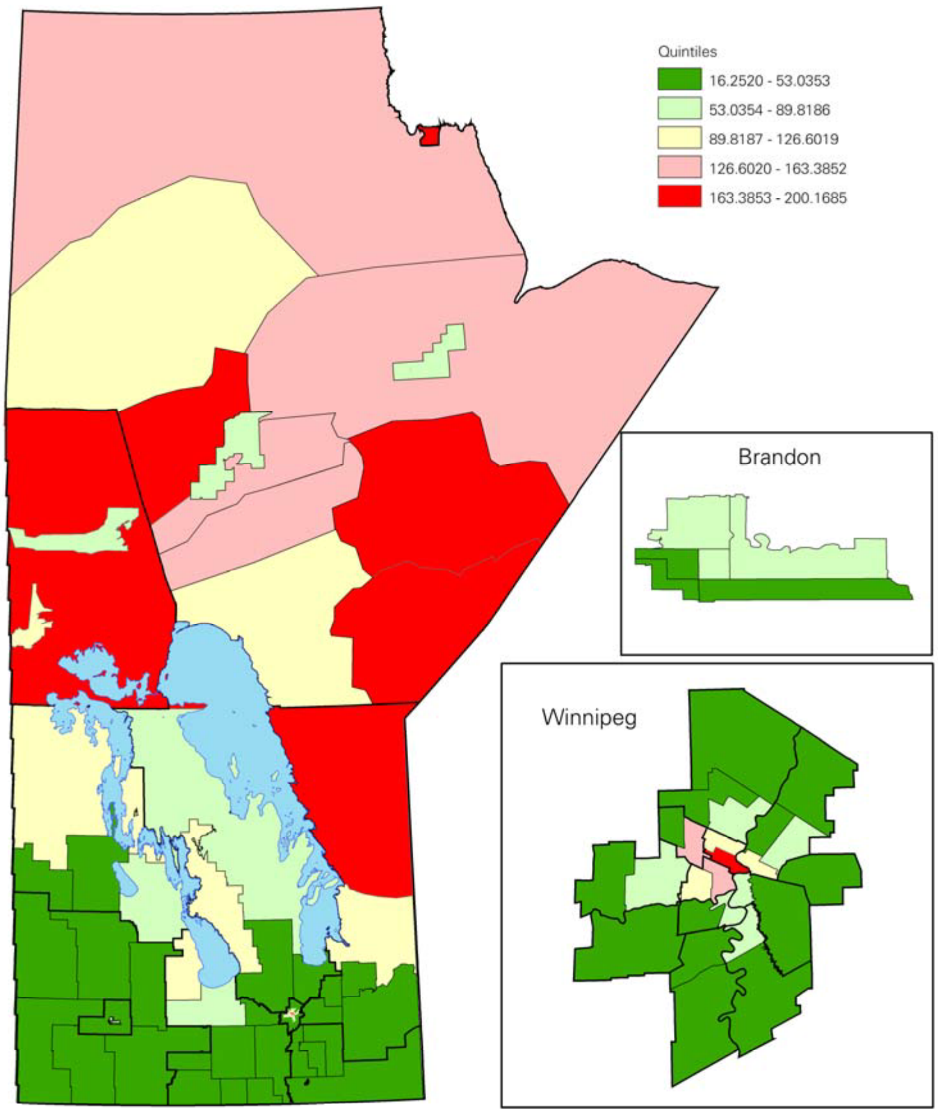
Age-adjusted rate of teen pregnancies per 1,000 females age 15-19



Source: Manitoba Centre for Health Policy, 2008

Figure 4.7: Teen Pregnancy Rate Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

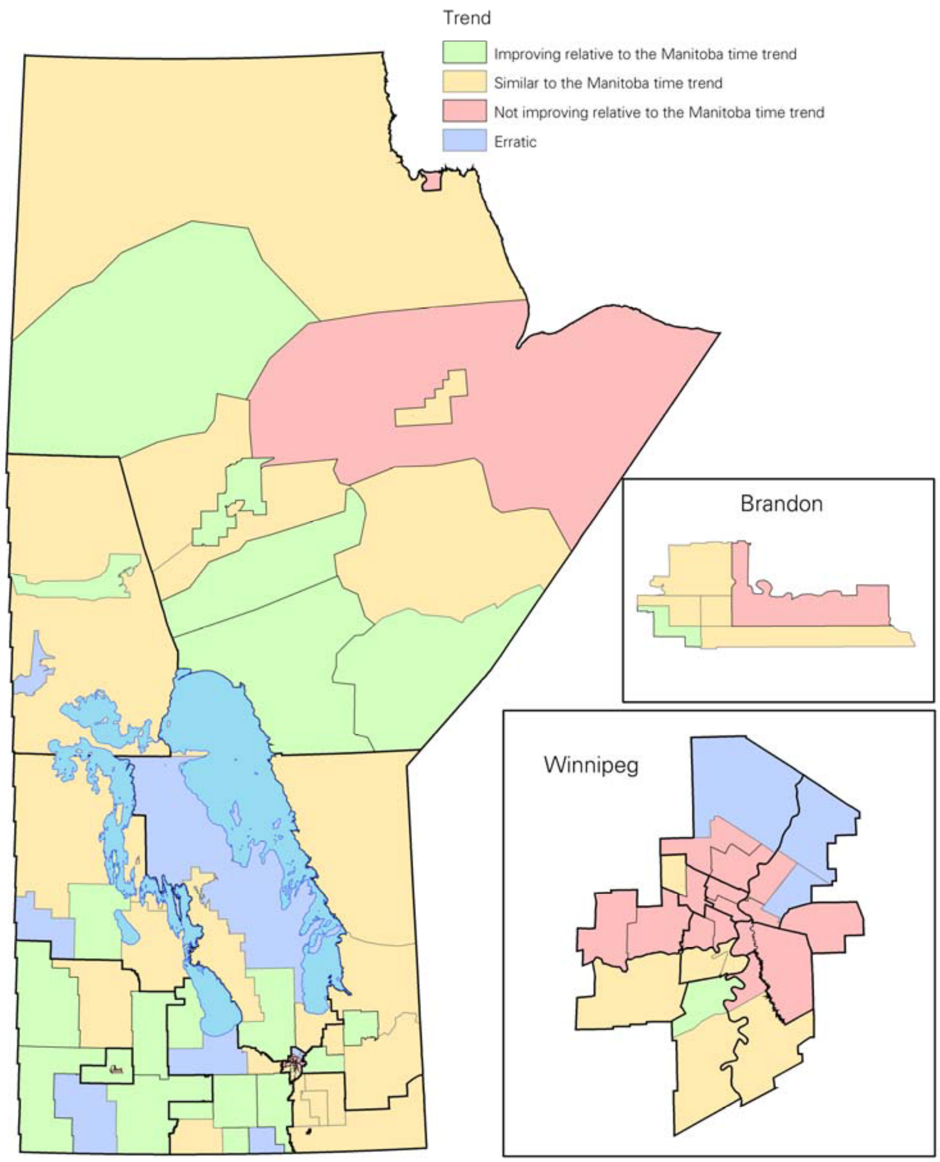
Adjusted rate of teen pregnancies per 1,000 females age 15-19, 1996/97-2003/04



Source: Manitoba Centre for Health Policy, 2008

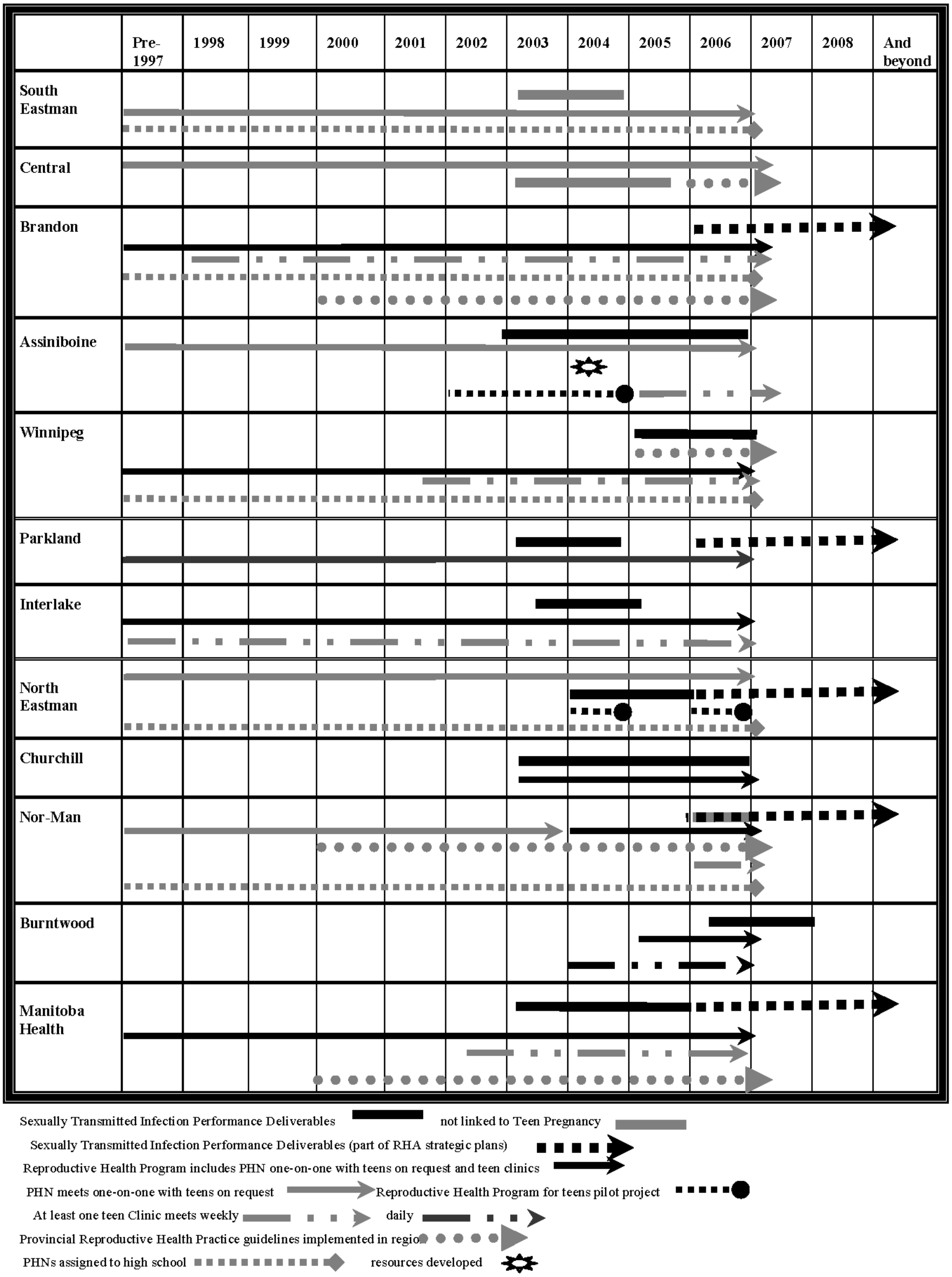
Figure 4.8: Trends in Teen Pregnancy Rates by RHA Districts and Winnipeg Neighbourhood Clusters

Adjusted rate of teen pregnancies per 1,000 females age 15-19, 1984/85-2003/04

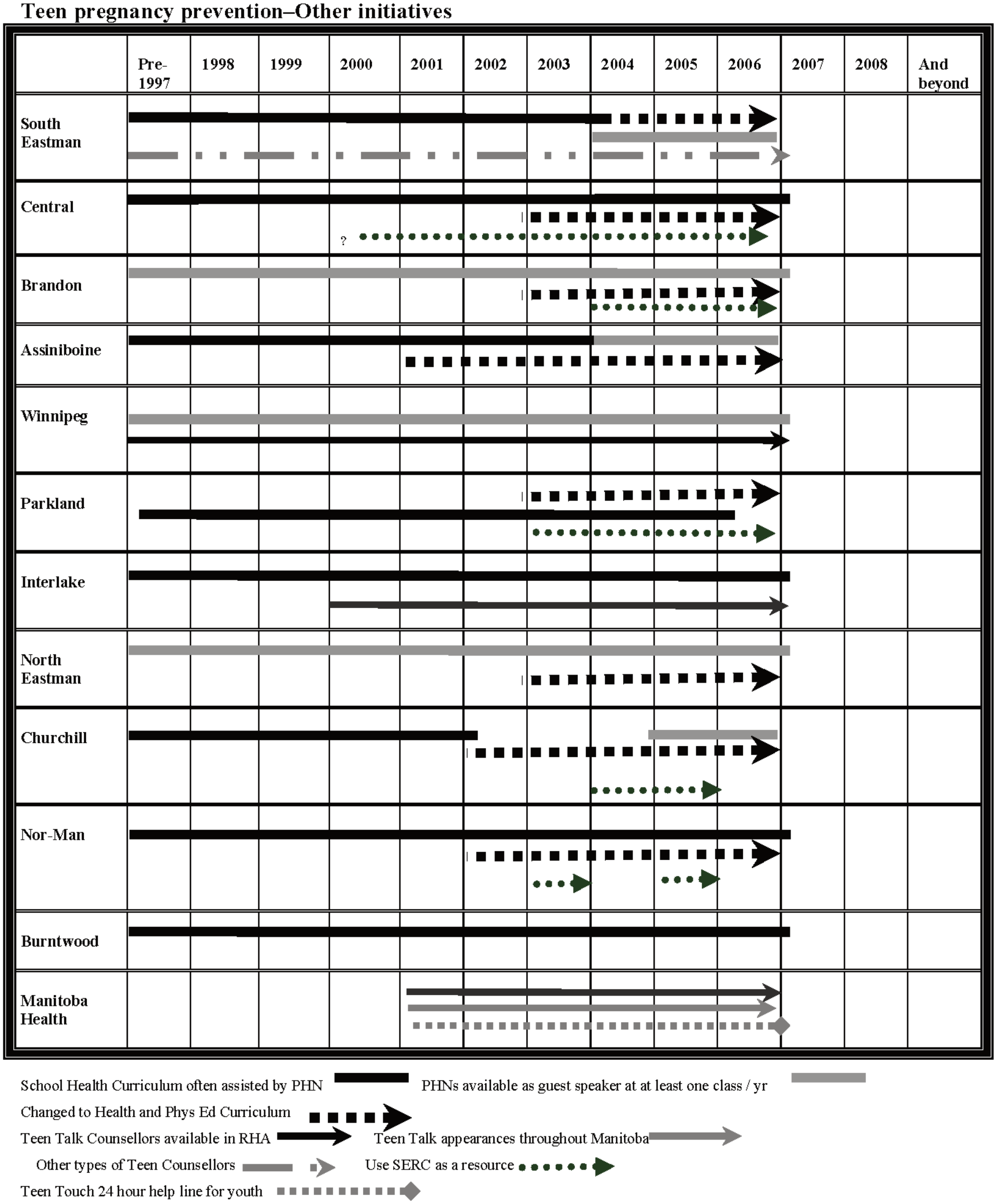


Source: Manitoba Centre for Health Policy, 2008

Table 4.1: Teen pregnancy prevention initiatives–Policy initiatives



Teen pregnancy prevention–Other initiatives



4.2 Discussion

What the figures and maps tell us about overall rates and trends in teen pregnancy:

- Generally, teen pregnancy rates are higher in areas that have the poorest overall health status both in non–Winnipeg RHAs/districts and in Winnipeg CAs/NCs.
- The lowest teen pregnancy rates are generally in the southern section of the province with rates increasing the further north the RHA or district is located. Exceptions occur in Flin Flon/Snow Lake/Cranberry Portage, Thompson and Gillam/Fox Lake districts.
- In Winnipeg, the lowest teen pregnancy rates are in the outer "ring" with increasing rates towards the inner (core–area) city.
- From 1984/85 to the mid 1990s, the provincial teen pregnancy rate increased, then it leveled off. Around the late 1990s, a drop in teen pregnancy occurred to the point that the 2003/04 rate is the lowest in two decades (55.6 per thousand in 1984/85; a high of 67.5 in 1996/97; 51.7 in 2003/04). By aggregate area, South and Mid show improvement over time, whereas the North is high with erratic trends (sometimes improving, sometimes getting worse, and sometimes plateauing), and Brandon is low or average with trends similar to the Manitoba time trend. As a result, the disparity within non–Winnipeg aggregate areas has remained about the same throughout the past twenty years.
- In Winnipeg, the three aggregate areas mirror the Manitoba time trends with increases to the mid–1990s and decreases especially evident since the late–1990s. The disparity between the most healthy and least healthy aggregate areas of Winnipeg has increased over the past twenty years; mostly, this has been driven by the rapidly increasing rates in the least healthy areas from 1984/85 to the mid–1990s. One concern in Winnipeg is that several of the NCs with low teen pregnancy rates have not been improving as fast as the Manitoba time trend, and in some cases, have actually seen no change over time or a worsening (see Figure 4.4 for examples such as Transcona, St. James–Assiniboia West, and St. Boniface East).
- Assiniboine RHA may be able to give clues as to "what works" as 4 of its 6 districts show low rates and faster improvement than the Manitoba time trend. Similarly, several of the southern districts of Central RHA, the Winnipeg NC of Fort Garry North, and isolated districts in Brandon, Parkland, Interlake and North Eastman have the same results. In the North, two districts could be of interest given the generally high northern rates and trends problems—the Flin Flon/Snow Lake/Cranberry Portage district of Nor–Man (it has low rates and is improving faster than the provincial average) and the Island Lake district of Burntwood (which has very high rates and a trend that is improving faster than the Manitoba time trend).
- Places of particular concern (high and worsening rates) are Churchill RHA, Shamattawa/York Factory/Split Lake/War Lake district of Burntwood and the Winnipeg NCs Point Douglas South, Inkster East and Downtown East.

What the regression modeling[1] tells us about predictors of teen pregnancy in the year 2003/04 (for the complete regression model, refer to Appendix 4)

- Individual characteristics that **increased** the likelihood of teen pregnancy—higher teen's age (i.e., 19–year–olds are more likely to become pregnant compared to 15–year–olds etc.), lower teen's own mother's age at the birth of her first child, lower average household income of the neighbourhood of residence, and if the teen has either physical or mental health difficulties.
- An individual characteristic that **did not affect** the likelihood of teen pregnancy was the use of oral contraceptives as measured by pharmaceutical prescriptions for birth control pills. This could indicate erratic use of the pill, which does not necessarily protect the teen. We were unable to measure the use of condoms or any non–prescription pharmaceutical using the Repository data. Use of oral contraceptives may be under–reported in administrative data where teens receive free birth control pills.
- Geographical characteristics that **decreased** the likelihood of teen pregnancy in 2003/04, after controlling for all other—residing in Assiniboine, Central, North Eastman, South Eastman, Interlake and Parkland RHAs. Note that no CA of Winnipeg was associated with a statistically significant decrease beyond what could be explained by individual factors.

How the above are associated with descriptive information on policy, program or support initiatives to reduce teen pregnancy:

- Assiniboine RHA shows low teen pregnancy rates and faster improvement over time compared to the provincial average. This effect is persistent even after controlling for individual factors with Assiniboine showing the lowest odds (OR=0.46, 95% CI 0.35–0.59) of teen pregnancy for any RHA or Winnipeg CA. This RHA has developed resources, been involved in a pilot project of a Reproductive Health Program for teens, and had a long–standing one–on–one involvement between public health nurses and weekly teen clinics. The STI performance deliverable has also been linked to teen pregnancy issues.
- In areas that have ongoing programs through public health nurse consultations and clinics, low teen pregnancy rates or faster improvement in districts of the region were seen. To yield ideas on "what works", those regions may have insights into which programs or policies were initiated in different parts of their regions.
- Churchill and Burntwood RHAs appear to have the most recent introduction (2003 and forward) of initiatives. Churchill and the Burntwood district of Shamattawa/York Factory/Split Lake/War Lake have both a high rate and a worsening trend. Burntwood, despite high rates, has several districts showing improvement similar to the Manitoba time trend (or as in the case of Island Lake, faster improvement).
- In Nor–Man's Flin Flon/Snow Lake/Cranberry Portage district, rates are lower and trends are improving faster than Manitoba overall. There appear to be several ongoing initiatives (see descriptive information in Appendix 4) in certain districts of Nor–Man RHA which may be

[1] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

related to these positive results including reproductive health clinics, primary health care centres, teen clinics, a teen pregnancy prevention working group in Flin Flon, and Teen Talk programs. This may provide a model applicable to other Northern areas.

4.3 Comparison of Pertinent Literature Reviews and *Our Study Results*

4.3.1 Teen Pregnancy Rates:

In comparison with other countries, Canada has moderate teen pregnancy rates, higher than rates in Germany and the Northern European countries, about the same as Australia and Britain, and much lower than the USA which has the highest rate of any industrialized country at 84 per thousand females aged 15 through 19 in the year 2000 (Dryburgh 2000; The Alan Guttmacher Institute 2000; The Alan Guttmacher Institute 2004; Blum 2001).

Canadian teen pregnancy rates have shown interesting trends over the past 30 years, including periods of decrease, increase and then decrease again. Teen pregnancy rates for females ages 15 through 19 were 53.7 per thousand in 1974, declining to a low of 44.1 in 1987, climbing once again to a high of 48.8 in 1994 with a rapid declines to 42.7 in 1997 and 38.2 in 2000 (Wadhera and Millar 1997; Dryburgh 2000; Statistics Canada CANSIM Table 106–9001). Within the most recent years, the most common outcome of pregnancy among females aged 15 through 17 was abortion; whereas for aged 18 and 19, it was live birth (Dryburgh, 2000). In general, teenage pregnancy rates are higher in the North and the Prairie provinces, and lower in the Atlantic region.

Manitoba has been noted as having the highest provincial rate (excluding the territories) at 65 per thousand females ages 15 through 19 in 1997 (Dryburgh 2000). The most recent (2000 Statistics Canada CANSIM Table 106–9001) figures available show a continuation of the difference with Manitoba teen pregnancy rates at 58.7 per thousand. Our rates are substantially higher than the next highest provinces of Saskatchewan (48.2) and Alberta (44.5) and much higher than the Atlantic provinces: Newfoundland and Labrador (28.5), PEI (30.4), Nova Scotia (31.5) and New Brunswick (33.4).

In our Manitoba study, Manitoba's teen pregnancy rate in 2003/04 was 51.7 per thousand females ages 15 through 19. This is still much higher than the Canadian rate (38.2 in 2000). The only aggregate areas or urban centres in Manitoba which are close to or lower than the Canadian rate, using the most recent data from 2003/04, were: the aggregate area of the South (30.1), Winnipeg overall (41.1), and Winnipeg's most healthy area (27.9). Although Winnipeg's overall rate is low, the city shows both extremes as the least healthy area of Winnipeg has a rate of 98.1. Due to high rates, those areas of particular concern are Winnipeg's least healthy area and the North aggregate area.

South Eastman RHA has the most consistently low rates in all of its districts, averaging 29.3 from 1996/97 to 2003/04, followed by Assiniboine RHA at 33.7. Both of these RHAs show statistically significant decreases over time (see Figures 4.1 and 4.2). Within Winnipeg, the two Community Areas with the *lowest overall rates were Fort Garry (28.3) and Assiniboine South (29.3) from 1996/97–2003/04, but neither of these rates showed a statistically significant drop over time (see Figure 4.3).*

The Manitoba trend in teen pregnancy is similar to the Canadian trend of low rates in the early to mid–1980s which increased to the mid–1990s, and then declined again through 2003/04. However, Manitoba trends seem to show a slight time delay of two years or so with the recent decline only beginning in the late 1990s. In Manitoba and Canada, the 2003/04 rate is lower than the 1984/85 rate.

4.3.2 Policy and Program Initiatives Pertinent to Decreasing Teen Pregnancy:

According to Dryburgh (2000), teen pregnancy appears to be associated with low birth weight for babies and for mothers: anemia, hypertension, renal disease, eclampsia and depression. Moreover, when teens have unprotected sex, there is additional risk of sexually transmitted infections (STIs) (SOGC 2000; Turner et al. 1990; Combes–Orme 1993). There may also be economic consequences, including curtailing of the teen's education, a consequent reduction in employment opportunities, and greater reliance on social assistance due to higher risk of single parenthood (The Alan Guttmacher Institute 1999).

In the area of policy and programs, the characteristics of teen pregnancy interventions with the most positive outcomes include not only the programs themselves, but characteristics of who leads the program, who supports the program, and how the program is taught including:

- Peer–led sex education (vs. teacher–led) (Stephenson et al. 2004).
- Comprehensive multi–component school and community intervention (Paine 1999).
- A program that extends beyond reproductive health to include life options such as education and job skills (Nitz 1999).
- Community coalition models that were well established at the outset of a grant, led by paid staff and had an area–wide focus, a steering committee, and a hub that was not a community–based organization. Coalitions comprised mainly of community members were difficult to maintain (Kramer et al. 2005).
- Many of the most successful interventions—whether pregnancy, violence, or substance abuse reduction—focus not only on reducing problem behavior, but also on building upon young people's strengths (Blum 2001).
- Abstinence–only sexual education programs have shown only modest effectiveness in delaying initiation of sex in younger virgins, but no behaviour change in already sexually active teens. Students in comprehensive sex education classes do not engage in sexual activity more often or earlier, but do use contraception and practice safer sex more consistently when they become sexually active (Planned Parenthood Fact Sheet 2005; Trenholm et al. 2007; Topolak et al. 2001; The Alan Guttmacher Institute 2002; Jemmott et al. 1998; Kirby 1999; Shafii et al. 2007).
- Among adolescents aged 15 to 17 in the USA, 77% of the recent decline in pregnancy risk was attributable to improved contraceptive use (Santelli et al. 2007).
- The European approach to reducing teen pregnancy through widespread provision of confidential medically accurate information and accessible contraceptive services for adolescents

helps explain the rapid decline in teen pregnancy in northern and western European countries (Singh and Darroch 2000).

- A study by the World Health Organization (WHO) showed that an educational program combining abstinence, contraception, and information about preventing sexually transmitted diseases was the most effective in delaying sex and promoting contraceptive use in teens (Topolak et al. 2001).
  - Overall, educational programs alone are not having the desired effect, as 4 out of 5 teens engage in sex by age 18 years and teen pregnancy rates remain high
  - The current literature indicates that (i) interventions must occur at young ages to have an impact, (ii) knowledge alone is not sufficient to change teen behavior, but rather peer guidance and role–playing are important to affect behavioural change, (iii) parental involvement in the sexual education programs helps promote communication, and (iv) several social variables interact to create unique social pressures on teens to engage in sex (e.g., age, sexual experience, geographical location, economic status) so programs must be tailored to each specific population.

Our descriptive findings show that many areas of Manitoba use a combination of school–based education and community–based programs (including public health nurse involvement and available clinics). As well, some RHAs have linked STI initiatives and teen pregnancy prevention initiatives through provincial performance deliverables. This may be particularly relevant given the fact that condom use is important in both strategies. The potential for improper adherence to oral contraceptives instructions and a lack of simultaneous use of condoms to prevent STI transmission are problems with using oral contraceptives for the purpose of avoiding unintended pregnancy in teens (see Martens et al. 2002 for a more complete discussion of this). Our finding that oral contraceptive use did not reduce teen pregnancy risk (in 2003/04) may reflect improper use of birth control pills by teens. The finding that medically accurate information, accessible contraceptive services and linking information to STI reduction has been shown to be related to low and declining rates of teen pregnancy in Europe leads us to speculate that similar strategies may be successful in Manitoba.

Provincial teen pregnancy rates dropped in the late 1990s especially in 2000/01 and 2001/02. There were more rapid declines throughout most of the Winnipeg aggregate areas, the North and Mid aggregate areas and lesser effects in Brandon and the South. Several province–wide programs began in 2001 including the Healthy Child Manitoba Healthy Adolescent Development strategy, a provincial media blitz called Think Again, Teen Talk (a youth health education program using teachers and peer trainers), Teen Touch (a 24–hour province–wide telephone help line for youth) and (establishment of) the Sexuality Education Resource Centre (SERC).

Beyond policies and programs, attention to individual factors may also help reduce teen pregnancy rates. Adolescent females that experienced mental health issues were at higher odds of becoming pregnant (OR = 1.7, 95% CI 1.5 to 2.0). Even physical health were related to increased odds, but to a lesser extent (OR = 1.2, 95% CI 1.1 to 1.4). Clinics and public health programs may wish to give extra attention to *teens experiencing physical and mental difficulties to ensure that they are receiving counseling in reproductive health issues as well.*

Inter–generational effects are also important because daughters of teen mothers are more likely to become teen mothers themselves (Brownell 2006). Long–term family counseling of women who were themselves teen mothers, as well as their children, may be one way to assist these children when they become adolescents.

4.4 Recommendations

- Ensure that teen pregnancy reduction programs are also linked to STI reduction strategies so that condom use is recommended for all teens, even those on birth control pills. This may have the dual effect of protecting against inconsistent pill use and STI transmission.
- Continue to monitor the trends of teen pregnancy and aim for a reduction of Manitoba's teen pregnancy rates to or lower the Canadian average.
- Continue to study areas of the province where teen pregnancy rates are low and decreasing faster than Manitoba time trends. This could include Assiniboine RHA plus parts of other RHAs (southern Central RHA, southern Interlake, parts of North Eastman closer to Winnipeg, Dauphin area of Parkland, and Flin Flon/Snow Lake/Cranberry Portage in the North). The Island Lake district of Burntwood could also be studied as it showed a rapid decrease in an area with a previously high rate. It might provide particularly good lessons for other area with high rates—especially in the North.
- Groups which could be targeted for one–on–one counseling, peer counseling, accurate medical information and available clinics:
    - Teens living in families where the mother had her first child at an early age.
    - Teens experiencing mental health issues (and possibly additional physical health issues).
    - Teens living in areas with high and/or increasing rates: parts of Burntwood, Nor–Man and North Eastman, and Winnipeg (Inkster, Point Douglas and Downtown), plus Churchill.

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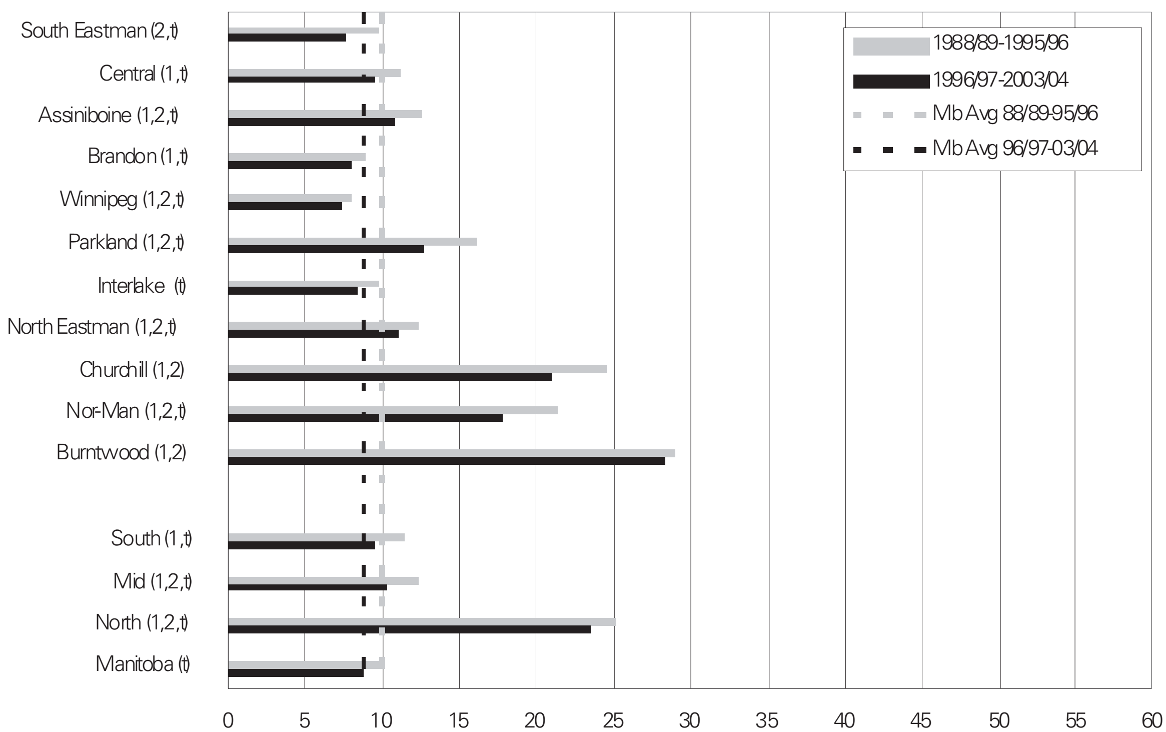
CHAPTER 5: INJURY HOSPITALIZATION OR DEATH

5.1 Definition, Graphs and Maps

Injury related hospitalizations or death were analyzed from 1984/85 through 2003/04. Injury deaths were defined by Vital Statistics data, using ICD–9–CM E–codes (converted from ICD–10 after January 1, 2001 using the CIHI conversion file). Injury hospitalizations were defined by ICD–9–CM E–codes in any diagnosis field. Newborn birth injuries or death, stillborns and brain deaths are excluded from injury rates. Hospital episodes were counted, not individual separations, so that transfers between hospitals for the same injury do not result in double counting. If a hospital separation and death occurred within 1 week, they are counted as the same injury. Or, if a hospital separation and death occurred within 1 month and both records have the same E–code, they were counted as the same injury. Age was calculated as of December 31 of each year in both the numerator and the denominator. Region of residence was assigned based on the first record in the study period.

Figure 5.1: Injury Hospitalization or Death Rates for Females by RHA

Age-adjusted rate of injuries per 1,000 females

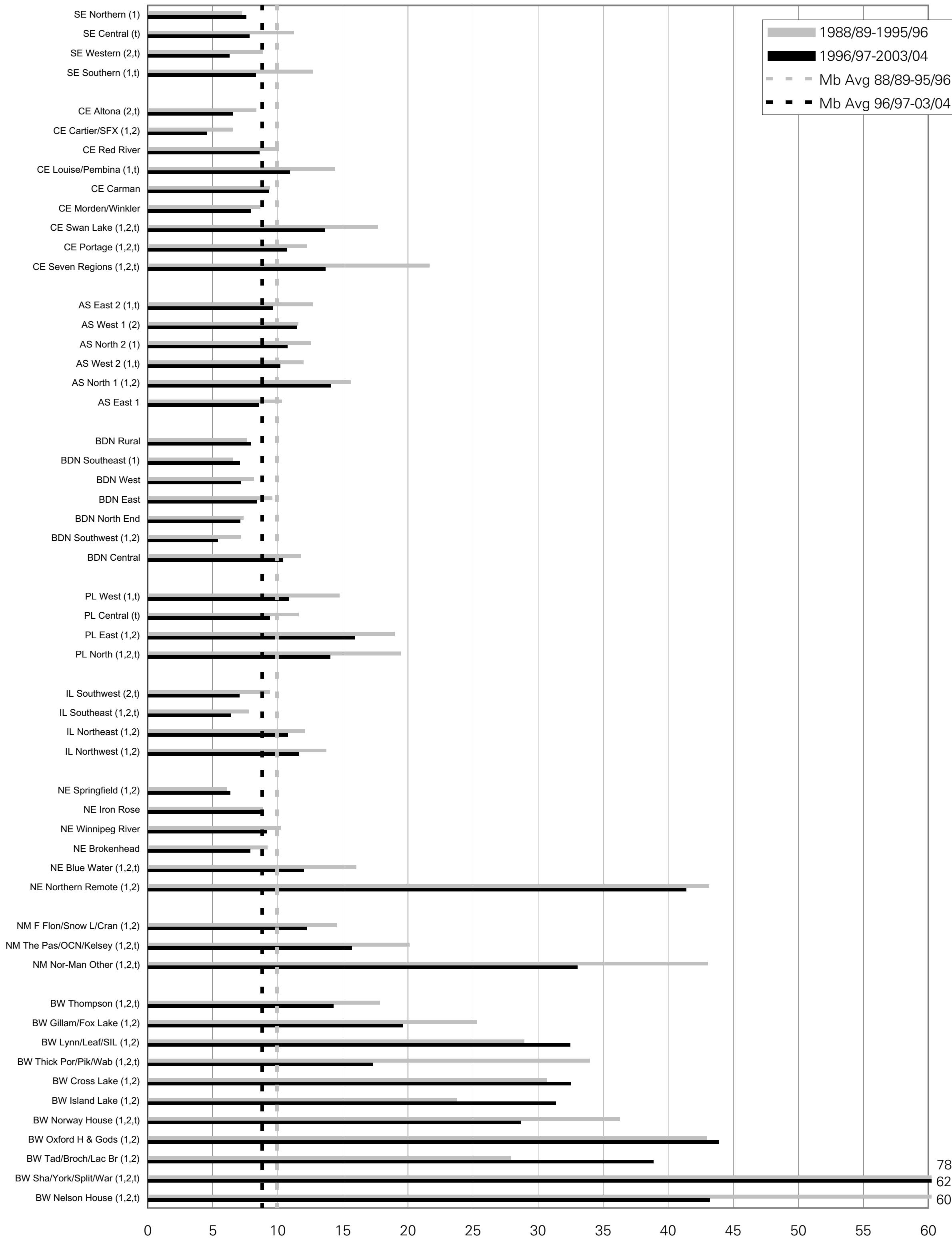


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 5.2: Injury Hospitalization or Death Rates for Females by District

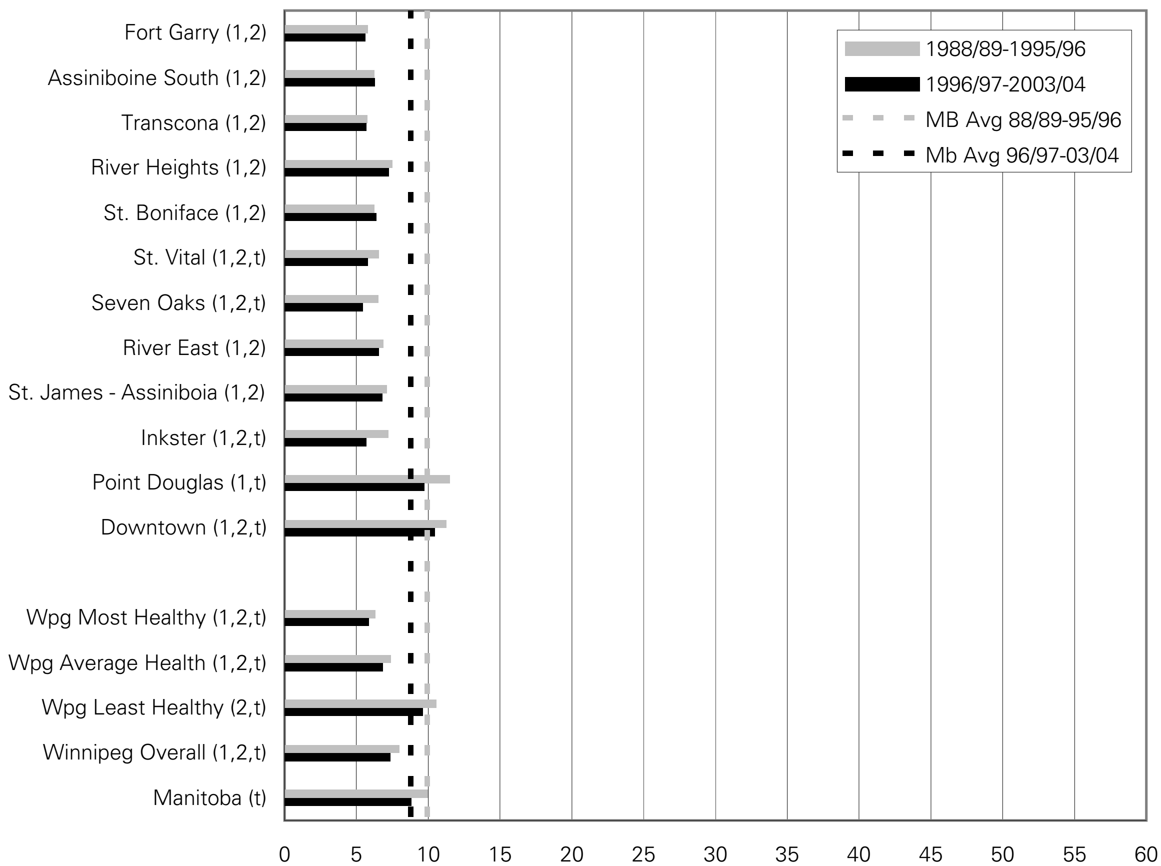
Age-adjusted rate of injuries per 1,000 females



Source: Manitoba Centre for Health Policy, 2008

Figure 5.3: Injury Hospitalization or Death Rates for Females by Winnipeg Community Areas

Age-adjusted rate of injuries per 1,000 females

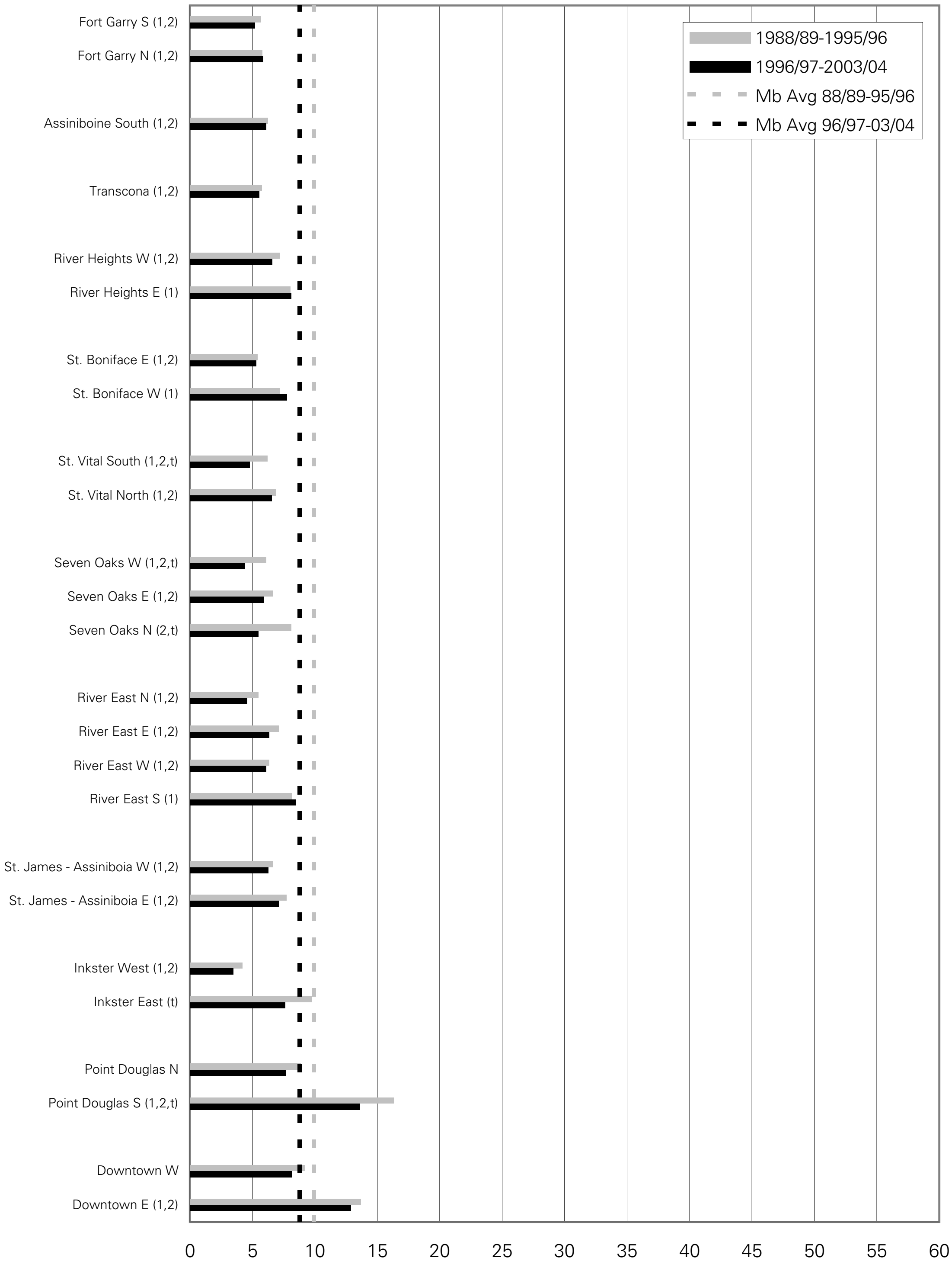


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 5.4: Injury Hospitalization or Death Rates for Females by Winnipeg Neighbourhood Clusters

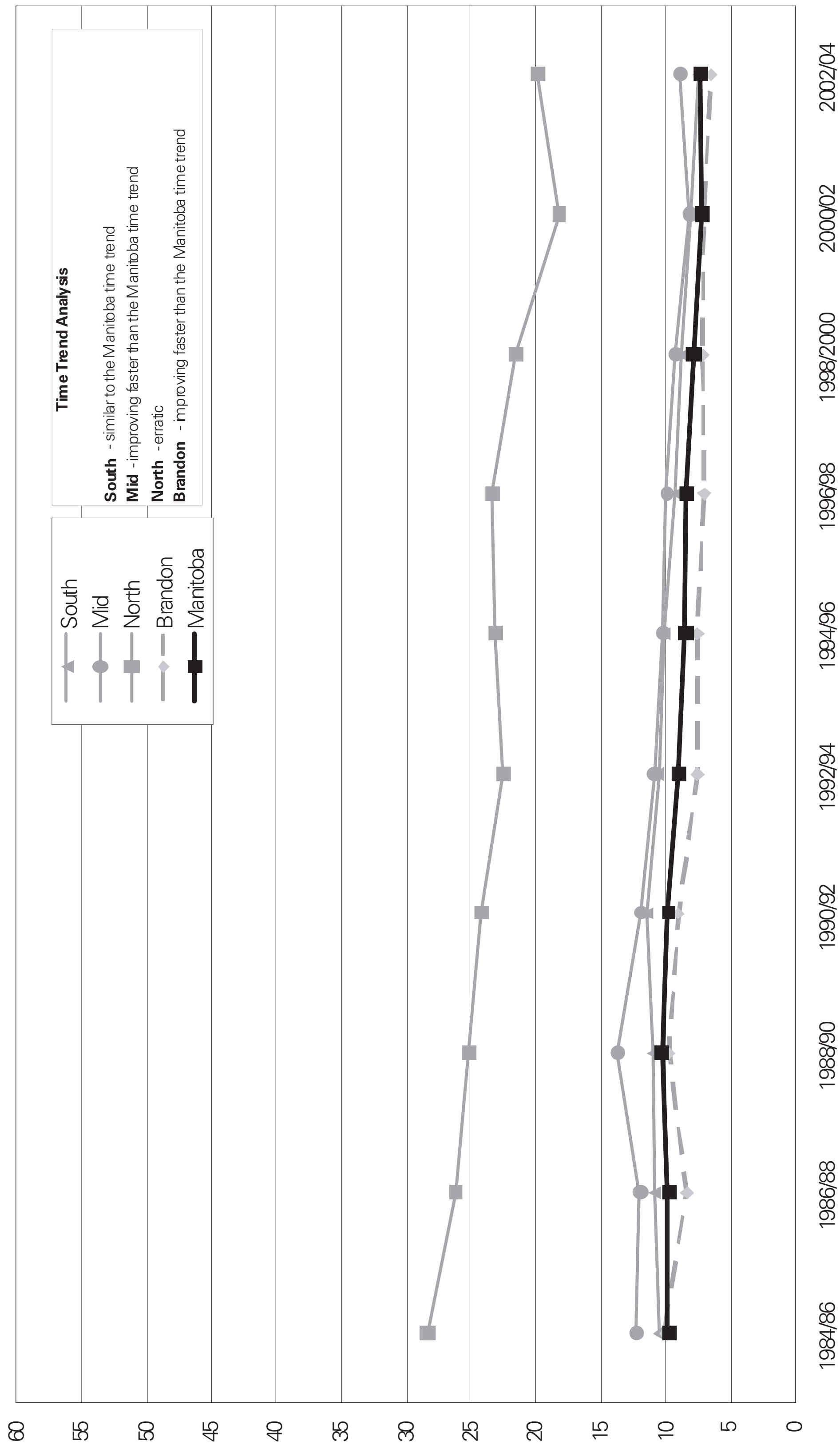
Age-adjusted rate of injuries per 1,000 females



Source: Manitoba Centre for Health Policy, 2008

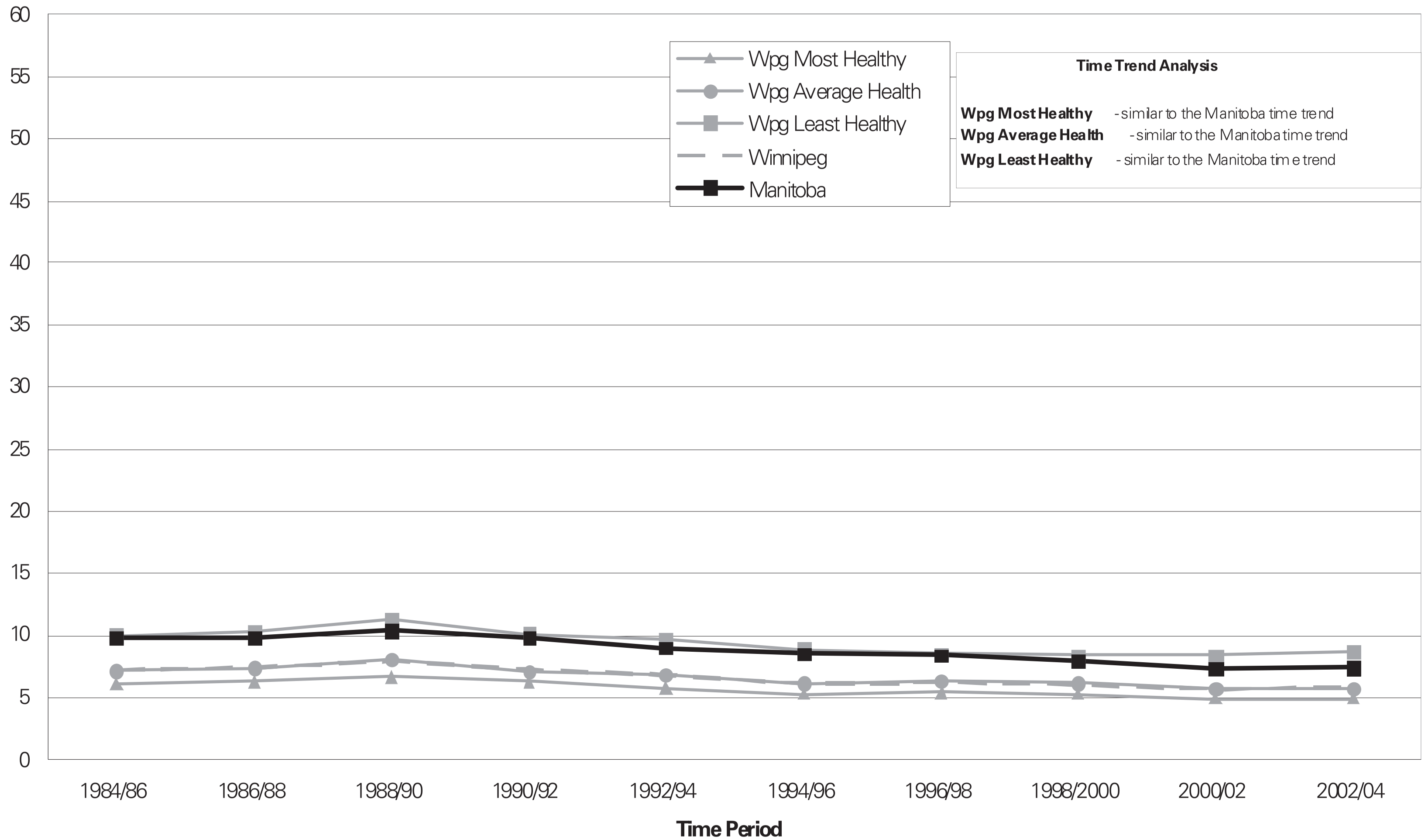
Figure 5.5: Trends in Non-Winnipeg Injury Hospitalization or Death Rates for Females

Age-adjusted rate of injuries per 1,000 female residents



Source: Manitoba Centre for Health Policy, 2008

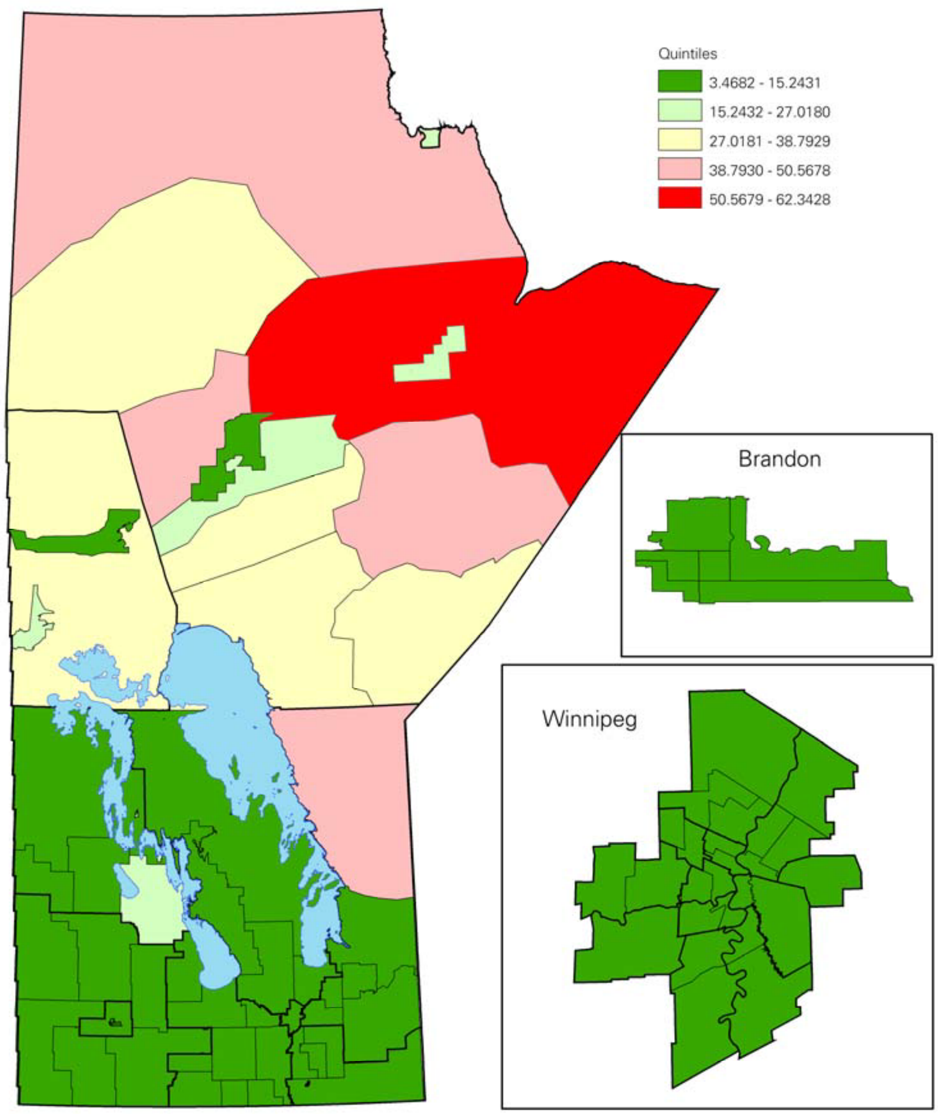
Figure 5.6: Trends in Winnipeg Injury Hospitalization or Death Rates for Females
Age-adjusted rate of injuries per 1,000 female residents



Source: Manitoba Centre for Health Policy, 2008

Figure 5.7: Female Injury Hospitalization or Death Rate Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

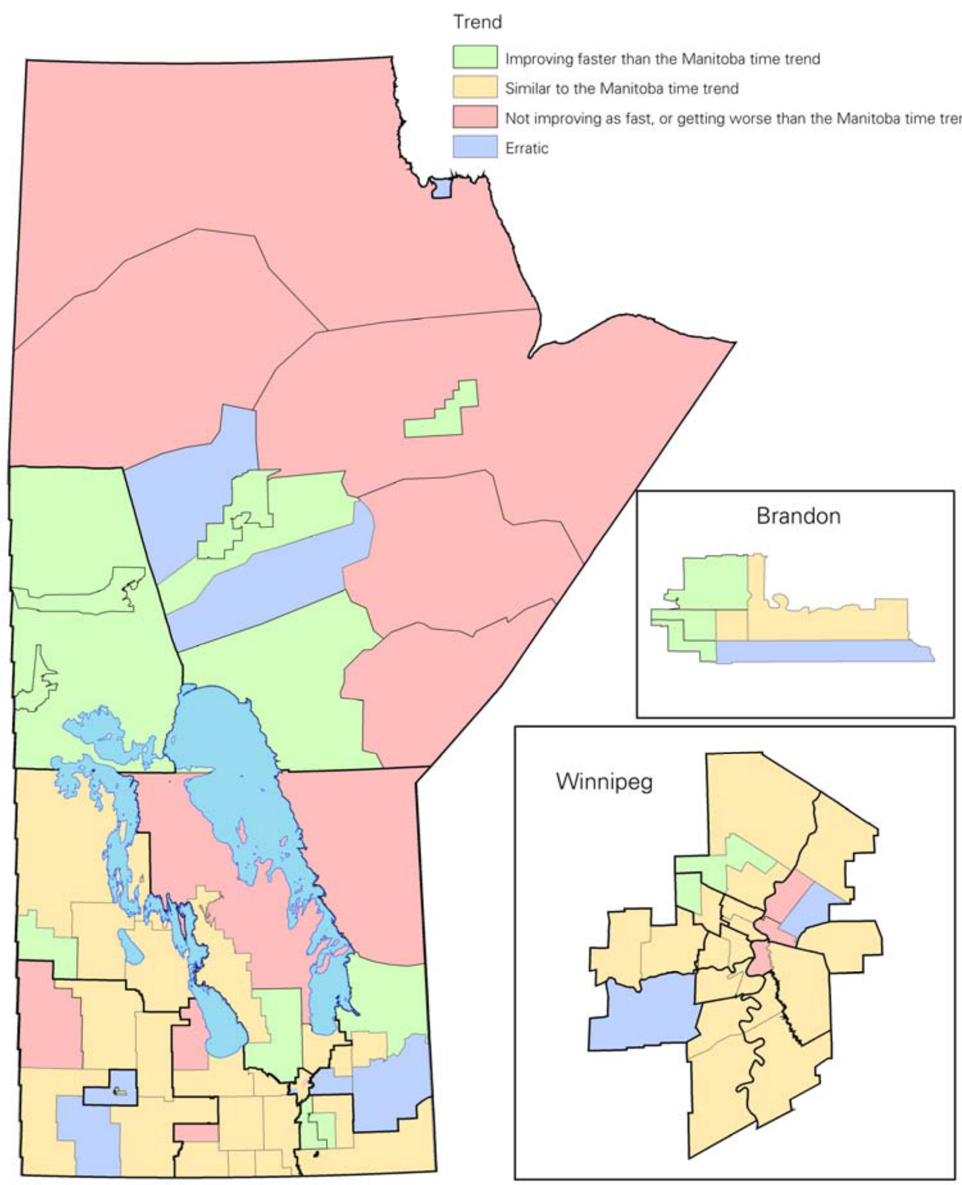
Age-adjusted rate of injuries per 1,000 females, 1996/97 – 2003/04



Source: Manitoba Centre for Health Policy, 2008

Figure 5.8: Trends in Female Injury Hospitalization or Death Rates by RHA Districts and Winnipeg Neighbourhood Clusters

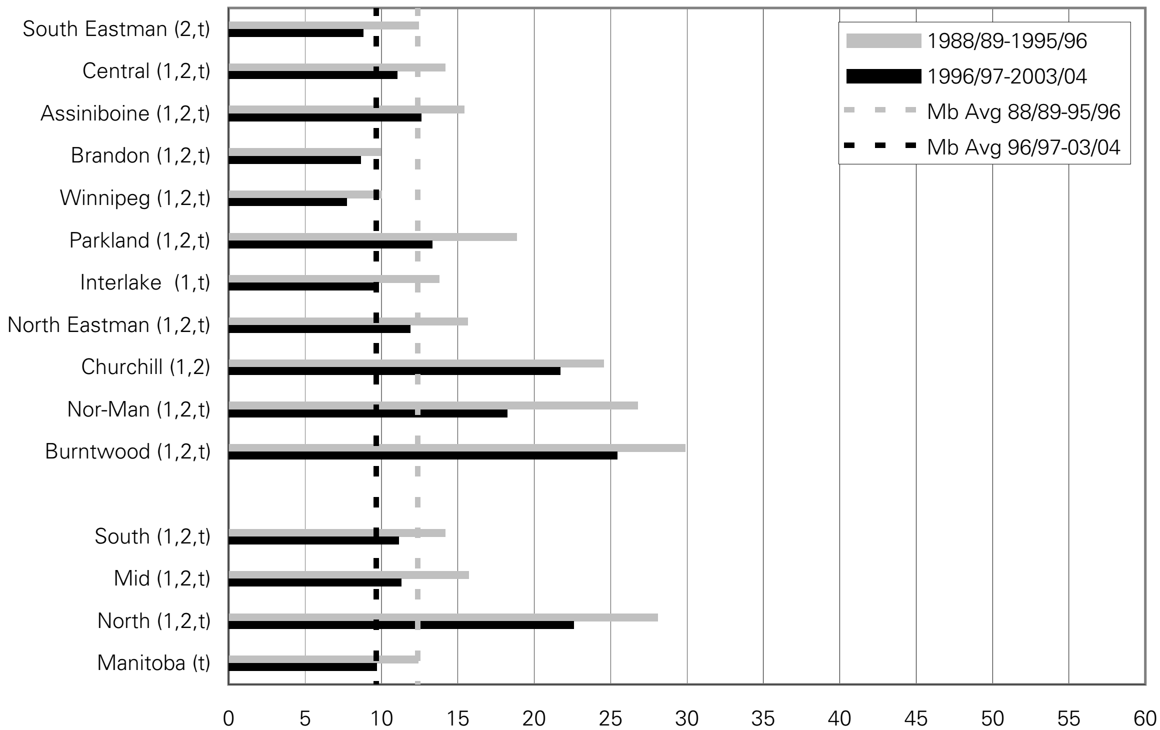
Age-adjusted rate of injuries per 1,000 females 1984/85 – 2003/04



Source: Manitoba Centre for Health Policy, 2008

Figure 5.9: Injury Hospitalization or Death Rates for Males by RHA

Age-adjusted rate of injuries per 1,000 males

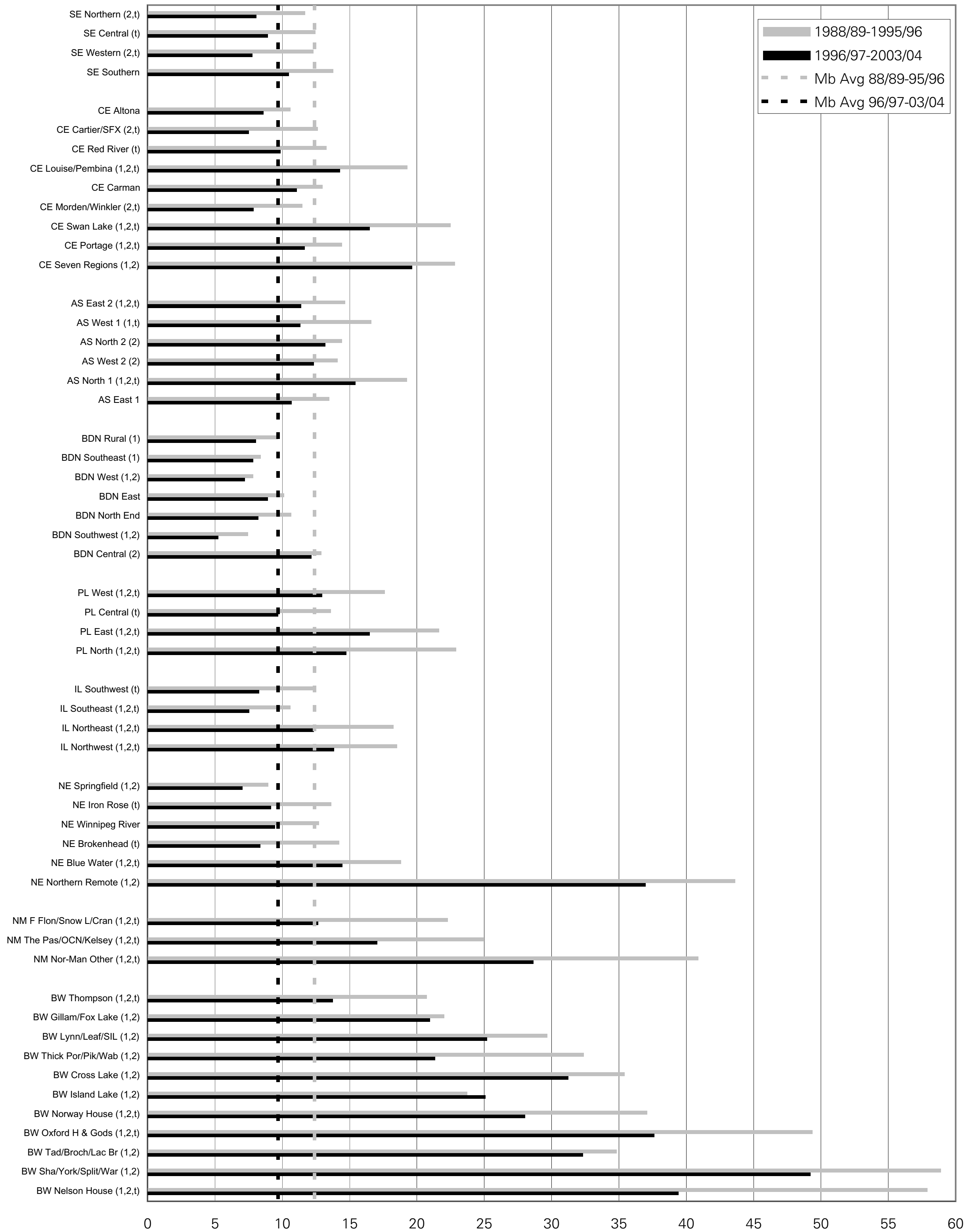


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 5.10: Injury Hospitalization or Death Rates for Males by District

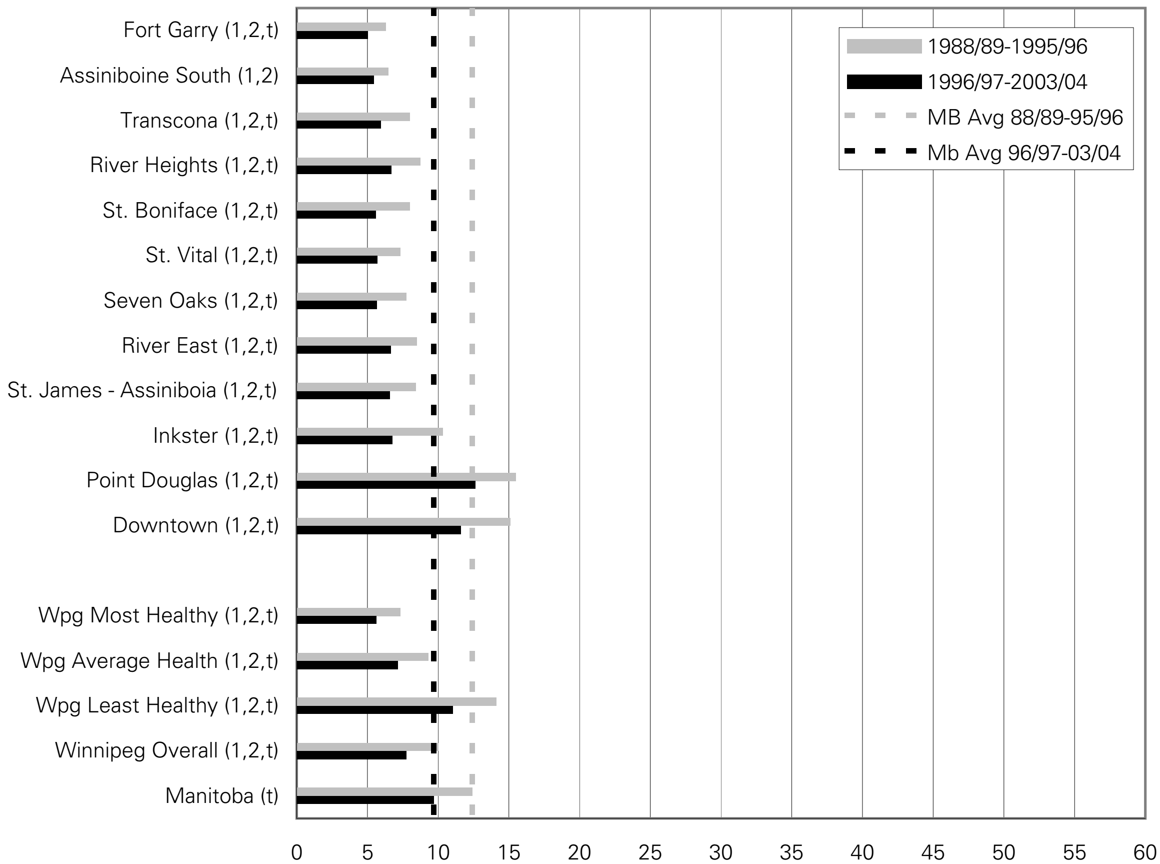
Age-adjusted rate of injuries per 1,000 males



Source: Manitoba Centre for Health Policy, 2008

Figure 5.11: Injury Hospitalization or Death Rates for Males by Winnipeg Community Areas

Age-adjusted rate of injuries per 1,000 males

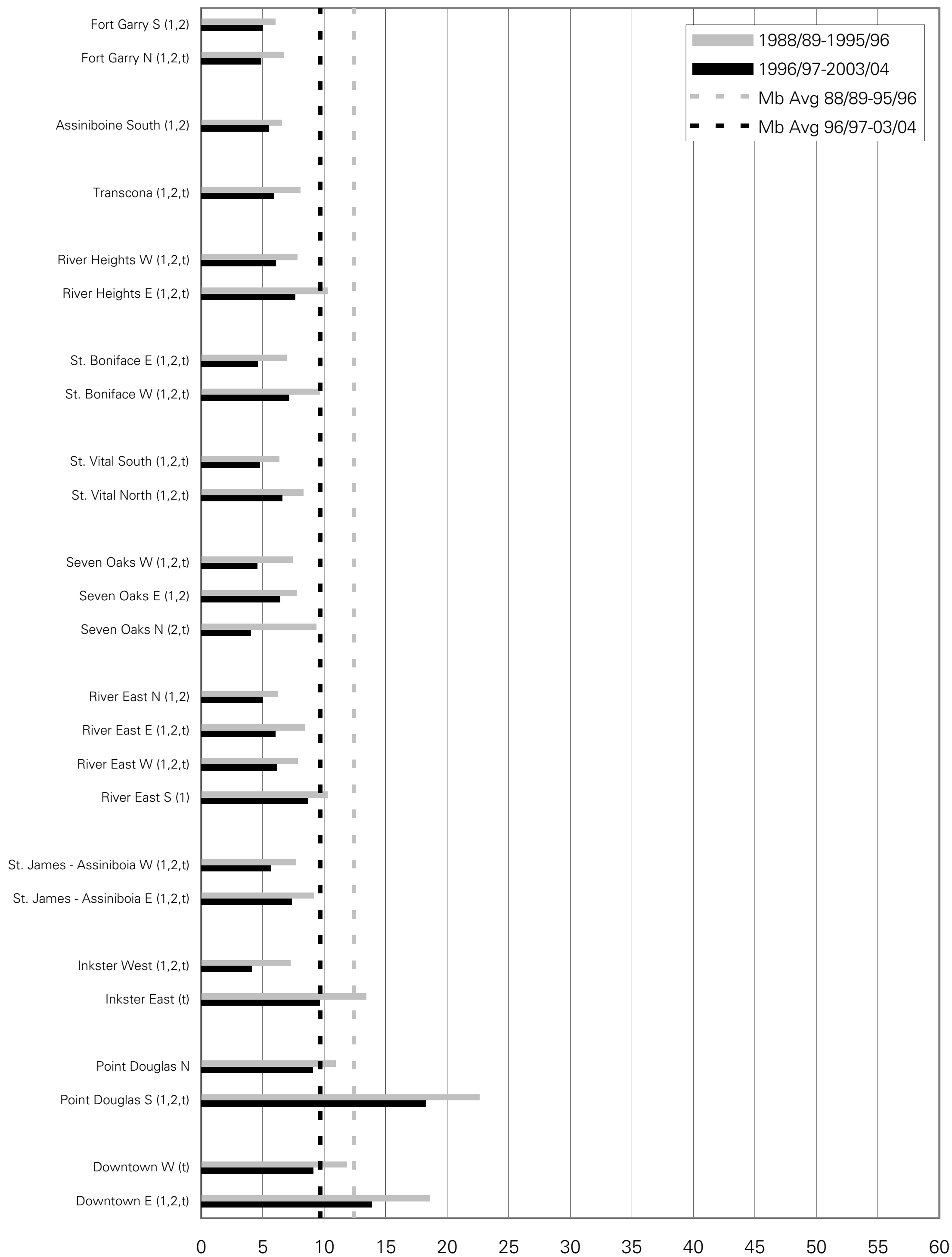


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 5.12: Injury Hospitalization or Death Rates for Males by Winnipeg Neighbourhood Clusters

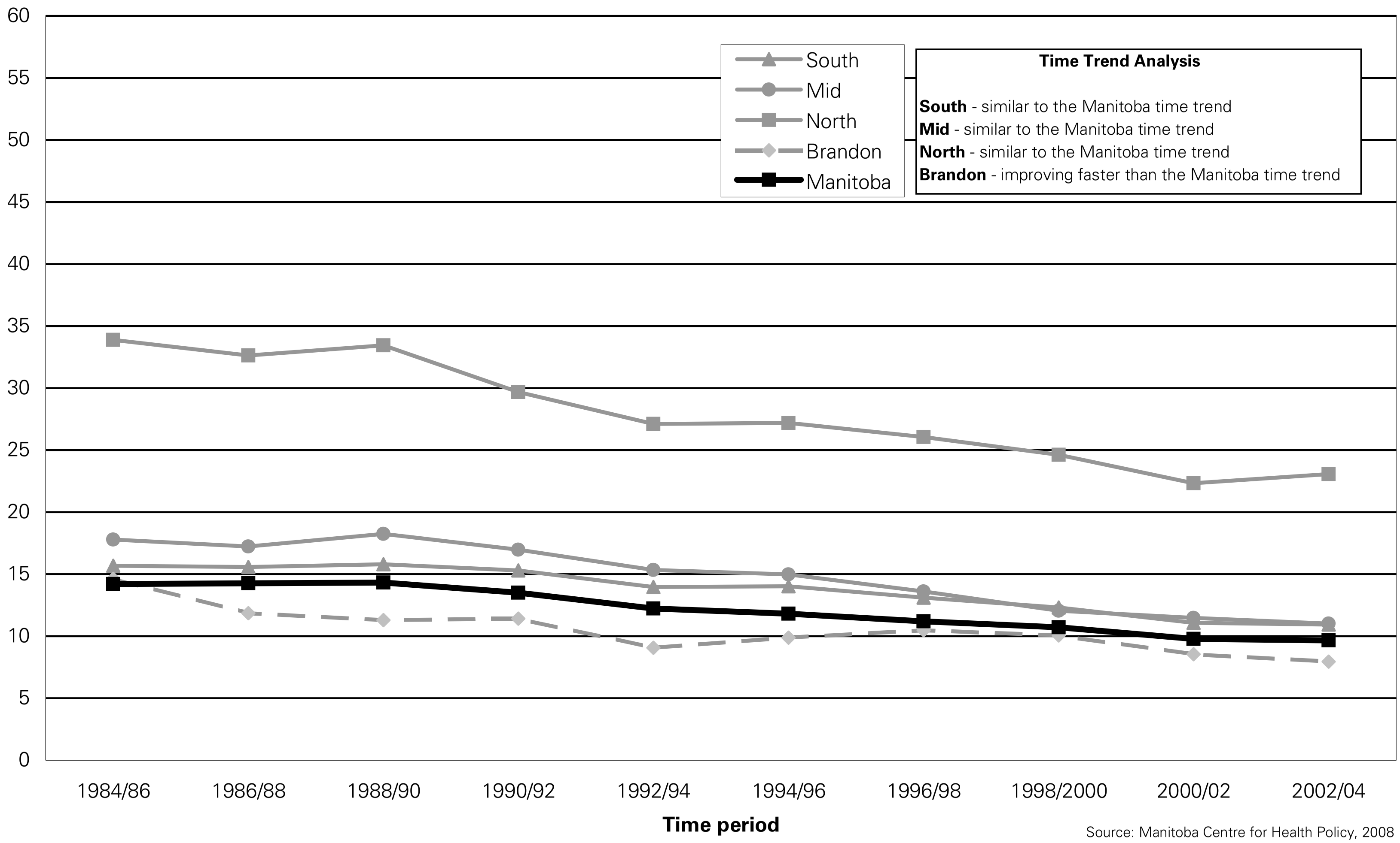
Age-adjusted rate of injuries per 1,000 males



Source: Manitoba Centre for Health Policy, 2008

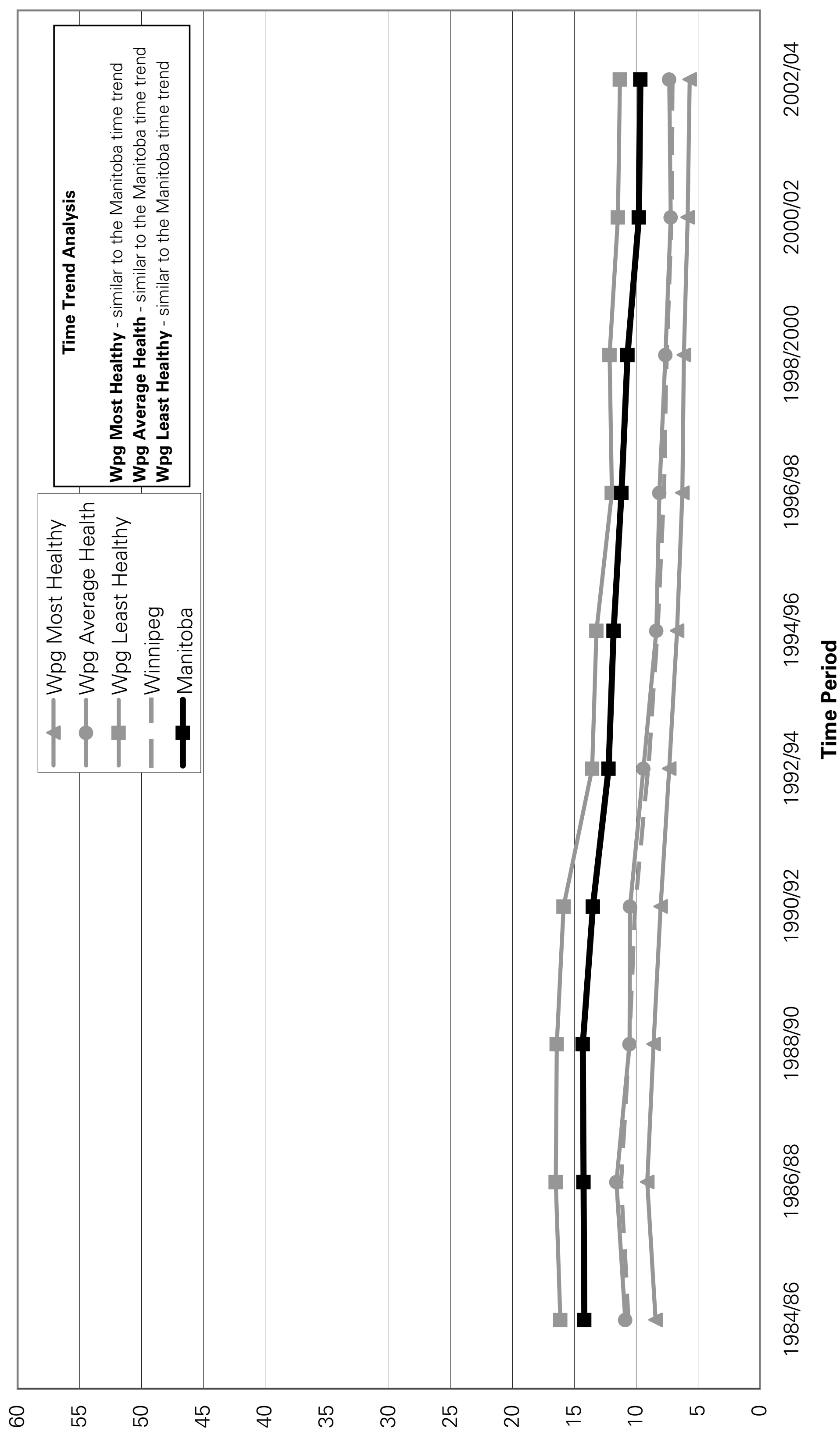
Figure 5.13: Trends in Non-Winnipeg Injury Hospitalization or Death Rates for Males

Age-adjusted rate of injuries per 1,000 male residents



Source: Manitoba Centre for Health Policy, 2008

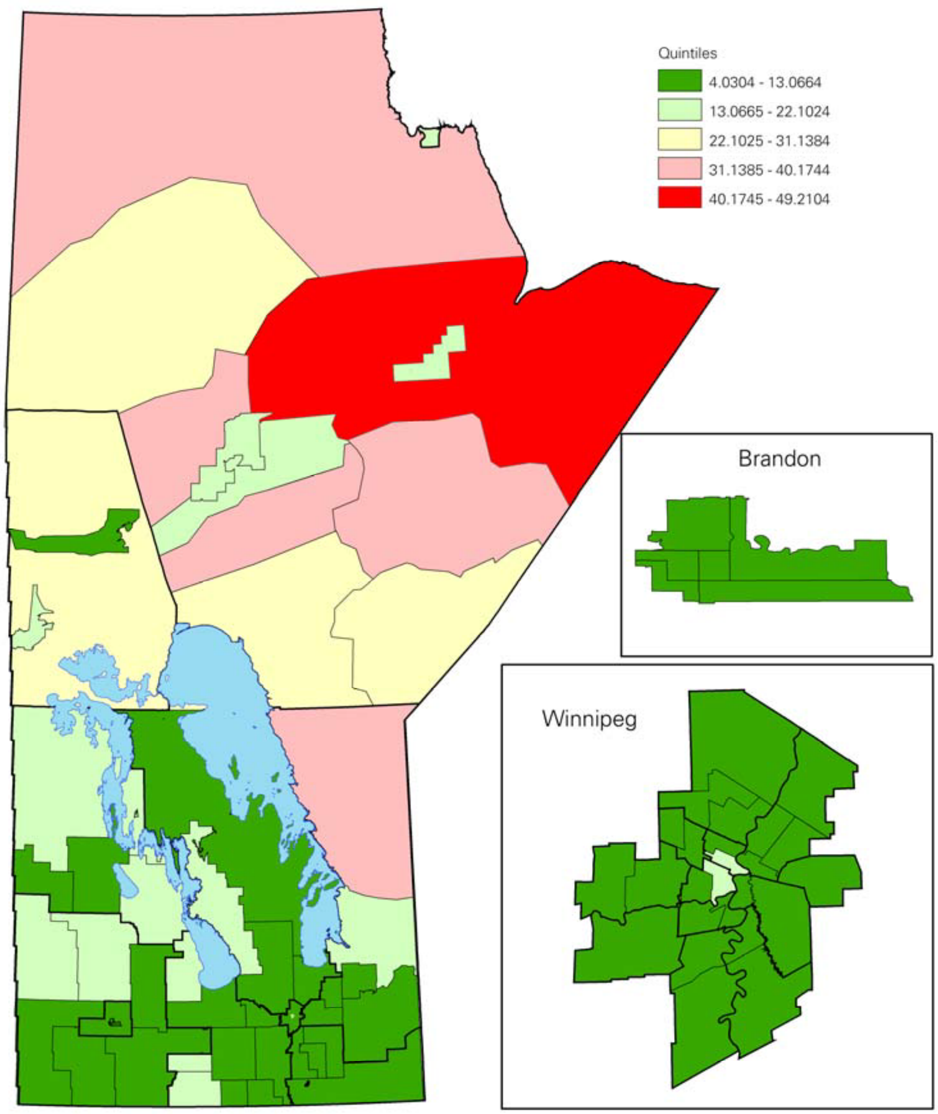
Figure 5.14: Trends in Winnipeg Injury Hospitalization or Death Rates for Males
Age-adjusted rate of injuries per 1,000 male residents



Source: Manitoba Centre for Health Policy, 2008

Figure 5.15: Male Injury Hospitalization or Death Rate Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

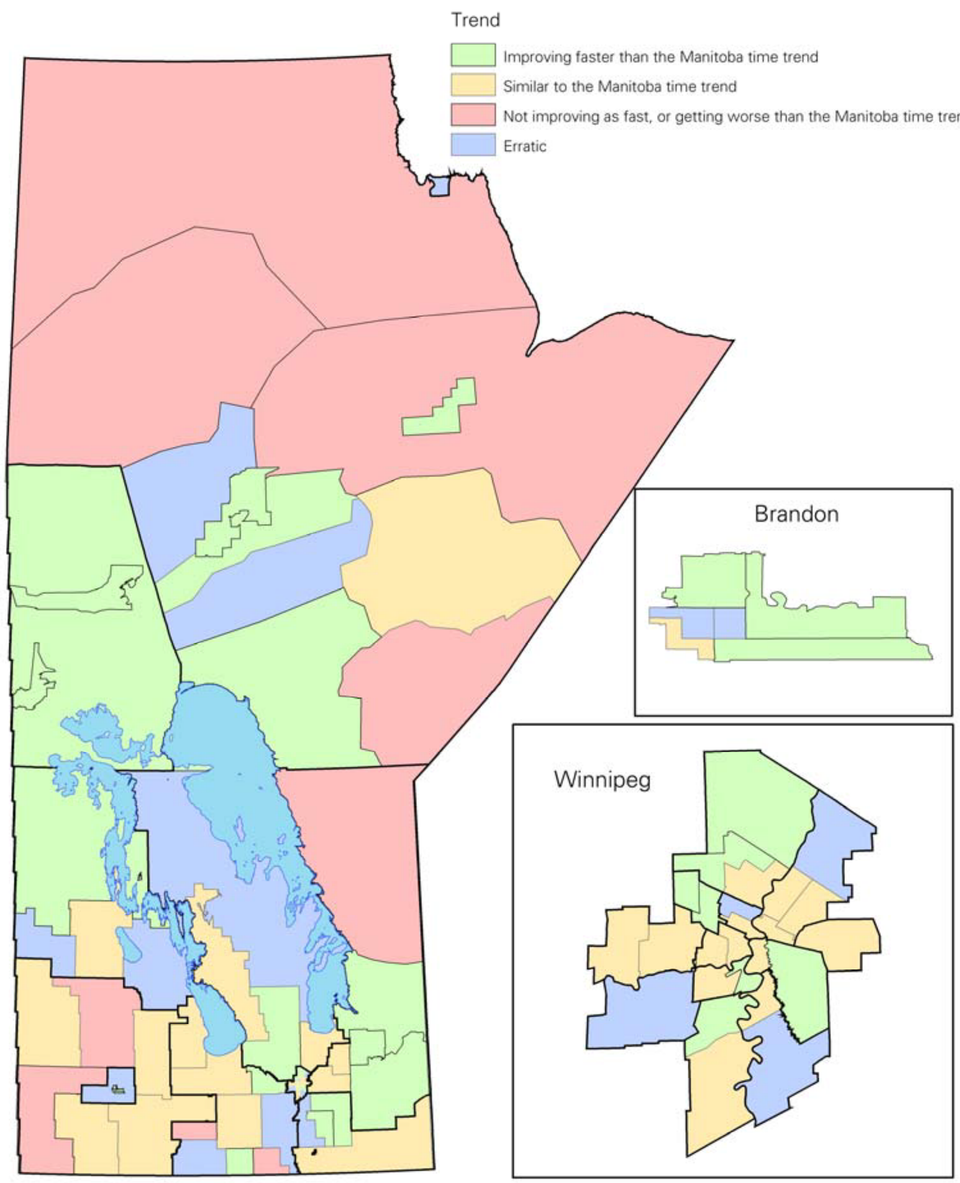
Age-adjusted rate of injuries per 1,000 males, 1996/97 – 2003/04



Source: Manitoba Centre for Health Policy, 2008

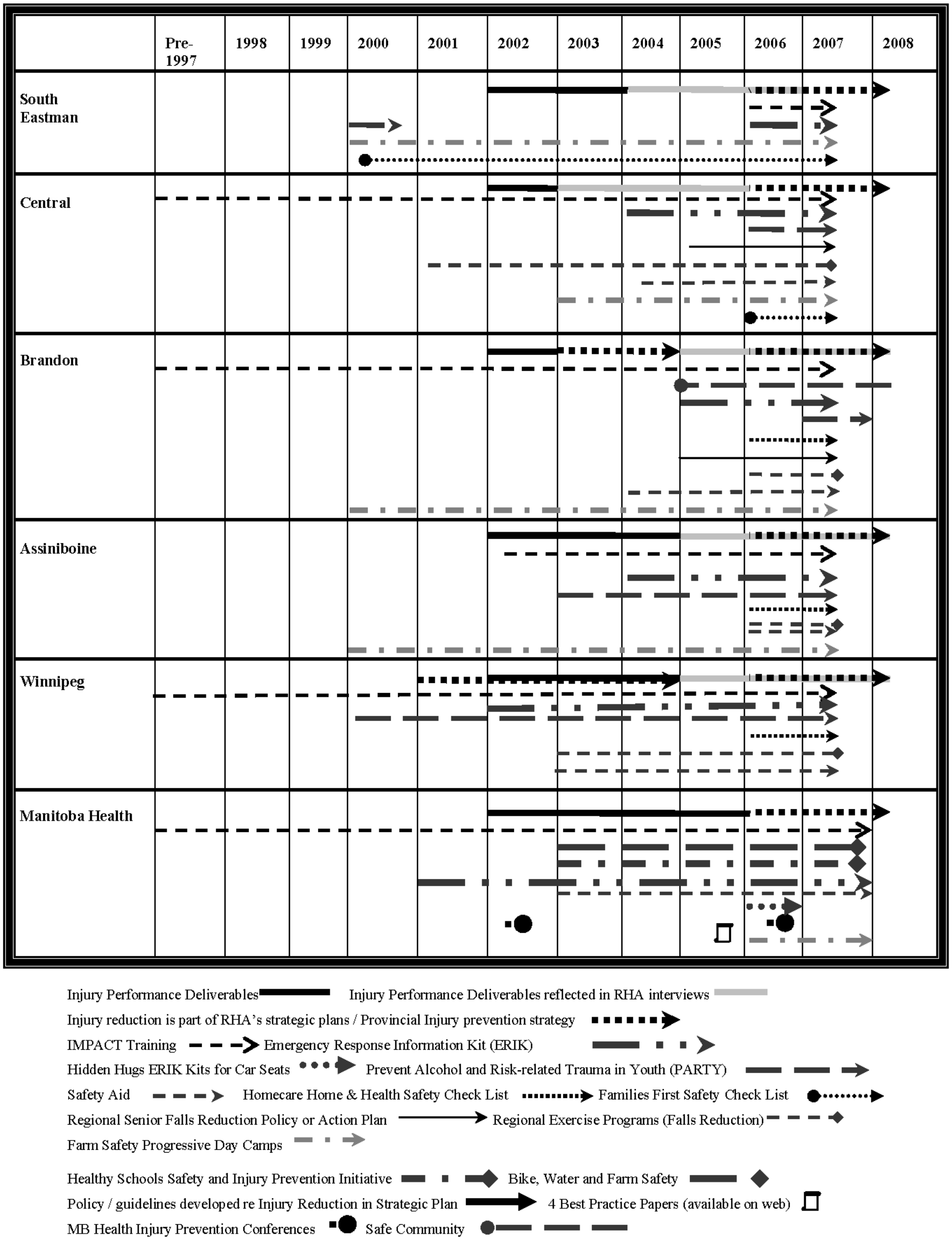
Figure 5.16: Trends in Male Injury Hospitalization or Death Rates by RHA Districts and Winnipeg Neighbourhood Clusters

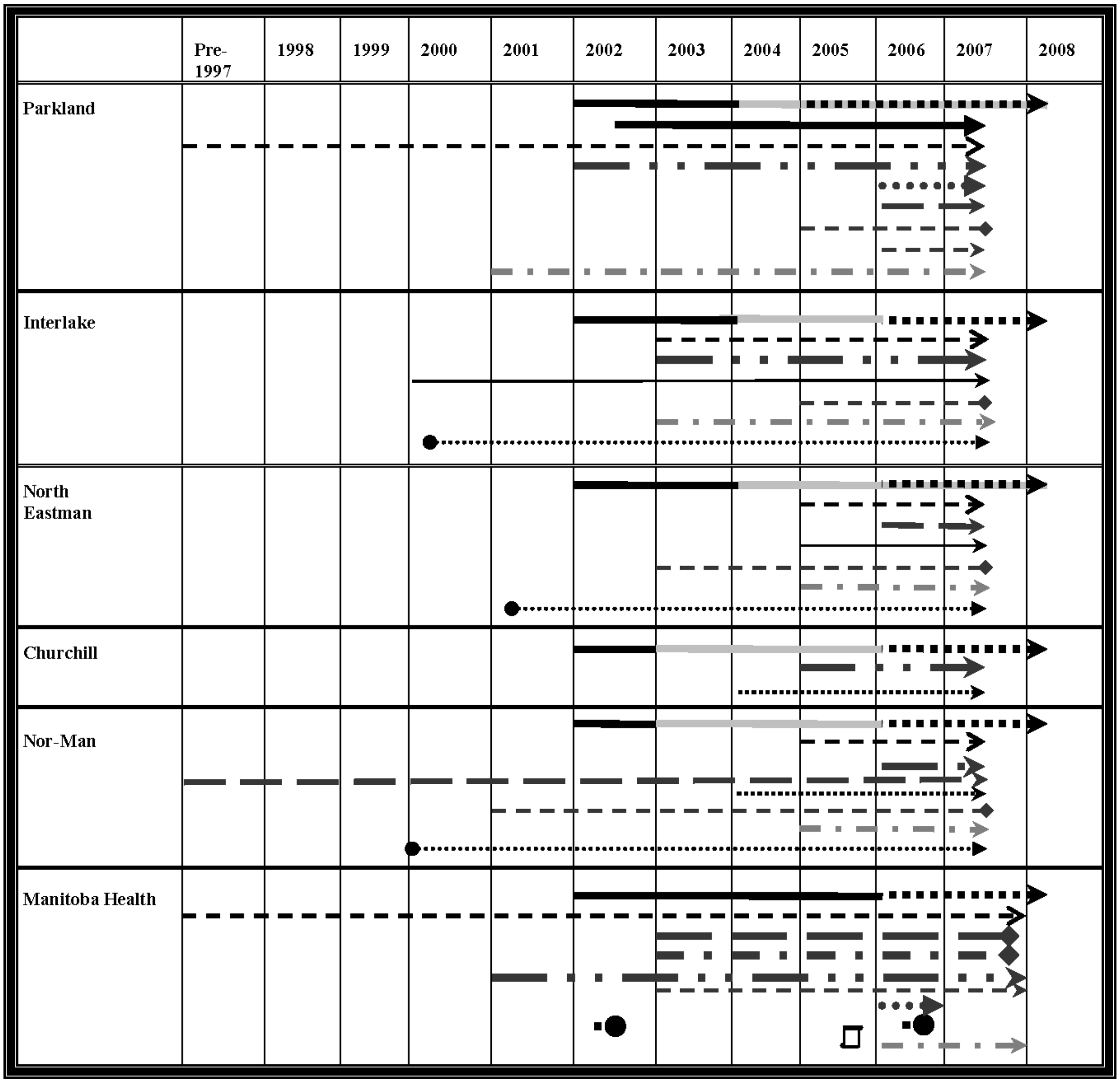
Age-adjusted rate of injuries per 1,000 males 1984/85– 2003/04



Source: Manitoba Centre for Health Policy, 2008

Table 5.1: Policy and programs in injury prevention





Injury Performance Deliverables Injury Performance Deliverables reflected in RHA interviews

Injury reduction is part of RHA's strategic plans / Provincial Injury prevention strategy

IMPACT Training Emergency Response Information Kit (ERIK)

Hidden Hugs ERIK Kits for Car Seats Prevent Alcohol and Risk-related Trauma in Youth (PARTY)

Safety Aid Homecare Home & Health Safety Check List Families First Safety Check List

Regional Senior Falls Reduction Policy or Action Plan Regional Exercise Programs (Falls Reduction)

Farm Safety Progressive Day Camps

Healthy Schools Safety and Injury Prevention Initiative Bike, Water and Farm Safety

Policy / guidelines developed re Injury Reduction in Strategic Plan 4 Best Practice Papers (available on web)

MB Health Injury Prevention Conferences Safe Community

Table 5.2: Causes of hospitalization and death due to injury: Crude rate and percent by sex and aggregate area, 1994/95–2003/04

	South				Mid				North				Brandon			
	Male		Female		Male		Female		Male		Female		Male		Female	
	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region
Accidental Falls	4.09	34.34	6.23	59.64	3.79	30.71	5.39	52.41	5.11	22.32	5.21	27.95	3.45	38.63	4.80	58.74
Motor Vehicle Traffic Accidents	1.43	12.03	0.91	8.73	1.46	11.85	1.01	9.87	1.44	6.28	1.40	7.52	0.73	8.21	0.58	7.15
Machinery/Explosions/Electricity	1.27	10.66	0.29	2.74	1.10	8.89	0.26	2.52	1.61	7.01	0.51	2.75	0.53	5.97	0.15	1.79
Homicide/Injuries, Inflicted by Others	0.58	4.84	0.20	1.95	0.99	8.03	0.37	3.64	3.55	15.50	1.50	8.05	0.58	6.47	0.19	2.28
Struck by/Caught between Objects	0.80	6.74	0.21	2.05	0.80	6.52	0.22	2.18	1.12	4.90	0.31	1.64	0.68	7.67	0.19	2.33
Late Effects of Accidental Injury	0.34	2.85	0.19	1.82	0.45	3.65	0.12	1.21	0.48	2.11	0.17	0.91	0.22	2.44	0.09	1.14
Suicide & Self-Inflicted Injury	0.53	4.42	0.75	7.22	0.65	5.26	0.99	9.65	2.07	9.05	4.05	21.73	0.76	8.51	1.05	12.91
Other Environmental Accidents	0.42	3.54	0.33	3.12	0.50	4.09	0.36	3.54	2.86	12.49	1.74	9.32	0.36	4.08	0.19	2.38
Overexertion, Strenuous Movements	0.36	3.00	0.24	2.34	0.34	2.76	0.22	2.16	0.31	1.37	0.18	0.99	0.29	3.29	0.15	1.79
Motor Vehicle Non-Traffic Accidents	0.55	4.60	0.11	1.06	0.55	4.47	0.14	1.31	0.80	3.48	0.36	1.93	0.17	1.94	0.06	0.79
Natural/Environmental Accidents	0.42	3.50	0.20	1.95	0.43	3.45	0.22	2.18	0.50	2.19	0.27	1.42	0.17	1.94	0.14	1.69
Other Road Vehicle Accidents	0.27	2.24	0.17	1.67	0.22	1.78	0.14	1.35	0.24	1.04	0.14	0.73	0.25	2.84	0.12	1.49
Submersion/Suffocation/Foreign Bodies	0.22	1.85	0.12	1.12	0.26	2.07	0.14	1.38	0.68	2.97	0.48	2.60	0.14	1.54	0.16	1.94
Injury Undetermined	0.13	1.11	0.13	1.24	0.20	1.65	0.29	2.80	0.94	4.12	1.56	8.34	0.14	1.54	0.08	0.94
Accidental Drug Poisoning	0.15	1.28	0.19	1.78	0.16	1.27	0.21	2.06	0.32	1.39	0.39	2.09	0.19	2.09	0.15	1.79
Fire/Flames Accidents	0.18	1.47	0.05	0.44	0.24	1.97	0.07	0.66	0.44	1.93	0.17	0.93	0.08	0.90		
Accidental Poisoning, Other	0.13	1.07	0.08	0.81	0.11	0.93	0.08	0.78	0.23	1.00	0.12	0.62	0.10	1.14	0.05	0.60
Water Transport Accidents	0.01	0.06	0.01	0.10	0.03	0.24	0.01	0.11	0.07	0.29	0.02	0.09	0.03	0.30		
***Other**	0.05	0.40	0.02	0.23	0.05	0.41	0.02	0.18	0.13	0.56	0.07	0.37	0.04	0.50	0.01	0.10

- order of injuries based on Manitoba males 1984/85–1993/94
- blank cells = suppressed values

*'Other' categroy includes: vehicle accidents, other; air and space transport accidents; railway accidents; legal intervention; and injury due to war operations

Source: Manitoba Centre for Health Policy, 2008

Table 5.2: Continued

	Winnipeg Most Healthy				Winnipeg Average Health				Winnipeg Least Healthy				Manitoba			
	Male		Female		Male		Female		Male		Female		Male		Female	
	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region	crude rate per 1,000	% of injuries within region
Accidental Falls	2.14	39.39	3.73	64.48	2.52	34.54	4.34	61.95	3.82	32.29	6.08	57.49	3.26	32.58	4.93	55.46
Motor Vehicle Traffic Accidents	0.52	9.52	0.39	6.81	0.62	8.50	0.49	6.97	0.94	7.96	0.66	6.25	0.96	9.65	0.69	7.76
Machinery/Explosions/Electricity	0.44	8.03	0.14	2.35	0.65	8.89	0.21	3.01	1.00	8.44	0.32	3.07	0.87	8.73	0.24	2.68
Homicide/Injuries, Inflicted by Others	0.29	5.30	0.07	1.22	0.79	10.77	0.18	2.63	2.13	18.03	0.61	5.76	0.96	9.62	0.31	3.46
Struck by/Caught between Objects	0.34	6.25	0.09	1.59	0.37	5.14	0.11	1.53	0.47	4.00	0.16	1.53	0.58	5.82	0.16	1.80
Late Effects of Accidental Injury	0.19	3.45	0.10	1.73	0.27	3.66	0.09	1.26	0.39	3.27	0.17	1.58	0.31	3.11	0.13	1.46
Suicide & Self-Inflicted Injury	0.38	6.99	0.48	8.33	0.58	8.01	0.64	9.08	0.97	8.22	1.08	10.21	0.67	6.74	0.93	10.49
Other Environmental Accidents	0.24	4.47	0.19	3.23	0.30	4.10	0.19	2.70	0.35	2.94	0.24	2.30	0.51	5.10	0.34	3.78
Overexertion, Strenuous Movements	0.18	3.26	0.09	1.53	0.19	2.66	0.09	1.26	0.16	1.37	0.14	1.28	0.25	2.50	0.15	1.68
Motor Vehicle Non-Traffic Accidents	0.11	2.11	0.03	0.56	0.12	1.64	0.06	0.81	0.12	1.02	0.06	0.54	0.31	3.10	0.09	1.00
Natural/Environmental Accidents	0.09	1.66	0.08	1.31	0.15	2.03	0.10	1.47	0.20	1.67	0.12	1.13	0.25	2.54	0.14	1.61
Other Road Vehicle Accidents	0.11	2.10	0.07	1.24	0.12	1.64	0.07	0.95	0.16	1.35	0.08	0.76	0.18	1.79	0.11	1.19
Submersion/Suffocation/Foreign Bodies	0.15	2.81	0.08	1.43	0.17	2.39	0.10	1.44	0.30	2.51	0.22	2.11	0.23	2.34	0.14	1.61
Injury Undetermined	0.06	1.10	0.07	1.22	0.14	1.93	0.12	1.70	0.31	2.61	0.28	2.65	0.20	1.97	0.23	2.61
Accidental Drug Poisoning	0.06	1.16	0.12	2.03	0.11	1.55	0.14	2.05	0.25	2.11	0.21	1.97	0.15	1.45	0.18	1.97
Fire/Flames Accidents	0.05	0.90	0.02	0.35	0.07	0.93	0.04	0.51	0.13	1.07	0.06	0.58	0.14	1.40	0.05	0.54
Accidental Poisoning, Other	0.03	0.51	0.02	0.29	0.07	0.96	0.03	0.40	0.07	0.62	0.06	0.58	0.09	0.88	0.05	0.59
Water Transport Accidents	0.01	0.27	0.00	0.07	0.01	0.16			0.02	0.17			0.02	0.19	0.01	0.08
***Other**	0.04	0.69	0.01	0.24	0.04	0.51	0.02	0.24	0.04	0.36	0.02	0.19	0.05	0.48	0.02	0.23

- order of injuries based on Manitoba males 1984/85–1993/94
- blank cells = suppressed values

*'Other' categroy includes: vehicle accidents, other; air and space transport accidents; railway accidents; legal intervention; and injury due to war operations

Source: Manitoba Centre for Health Policy, 2008

5.2 Discussion

Manitoba Health has completed an extensive report on injuries (Manitoba Health 2004) which details specific causes of injury. In our report, we only used one indicator of injury—injury hospitalization or death. This was a way to 'operationalize' a concept of serious injury, i.e., injury that resulted either in a hospitalization or in death rather than more minor injury that may have been treated in a physician's office or in an emergency room, but did not result in a consequent hospitalization or death. This was considered a way to avoid potential bias in an analysis that covered 20 years, since people who incurred a serious injury that resulted in death 20 years ago may have received more advanced life–saving technological interventions in recent years. So combining the two indicators of injury hospitalization and injury death avoids the potential bias of 'drift' between the two categories over time.

Note that the Repository housed at MCHP contains both hospital discharge abstracts and vital statistics information, so deaths due to injury that occur outside of a hospital will also be counted in the injury death rate.

What the figures and maps tell us about overall rates and trends in injury hospitalization and death:

- Generally, injury rates, for both females and males, are higher in areas that are less healthy.
- Generally, injury rates, for both females and males, are lowest in the South, Mid and urban areas of Manitoba (with Winnipeg rates being the lowest) and higher in the North.
- Provincially, and in most RHAs and districts, injury rates decreased over time from the time period 1988/89–1995/96 to the time period 1996/97–2003/04 for both females (Manitoba rate: 9.9 to 8.8 per 1,000) and males (12.4 to 9.7 per 1,000) with male injury rates dropping faster over time which reduced the sex difference.
- Over the 20–year period from 1984/86 to 2002/04, injury rates decreased substantially for both females (9.8 to 7.4 per 1,000) and males (14.2 to 9.7 per 1,000).
- From 1984/86–2002/04, injury rates have shown a gradual decrease paralleled in most aggregate regions, with the North being an exception—showing more rapid decrease. The variation between non–Winnipeg aggregate areas has decreased for both sexes. In Winnipeg, rates are low and gradually decreasing in all aggregate areas, so the gradient is similar over the past 20 years for females, and slightly reduced for males, but both sexes show a much smaller disparity than in non–Winnipeg areas (see Figures 5.5, 5.6, 5.13, 5.14).
- Several districts in Burntwood, along with northern districts in Mid RHAs, have trends that are not improving as fast as Manitoba for both females and males (see Figures 5.8 and 5.16).
- Nor–Man RHA is exemplary in that all of its districts show a faster drop in injury rates compared to the Manitoba time trend, for both females and males.
- Sub–regions of various other RHAs also show faster drops in injury compared to the Manitoba time trend. One RHA of particular interest is Burntwood, which has four districts (Norway House, Thompson, Thicket Portage/Pikwitonei/Wabowden, and Gillam/Fox Lake) showing faster improvement for both females and males. This is particularly important in the North, where injury rates tend to be very high.
- Sub–regions of Brandon, Winnipeg, Central, North Eastman, South Eastman (and to a lesser extent, Interlake and Parkland) show improvement for males in particular.

- Particular districts of concern for both female and male injury rates (i.e., areas of high rates, not improving as fast as the Manitoba time trend) are: Burntwood RHA's districts of Shamattawa/York Factory/Split Lake/War Lake and Tadoule Lake/Brochet/Lac Brochet, and North Eastman's Northern Remote district.
- Most of the non–Winnipeg RHAs had higher rates but showed larger percentage drops (around 30% or so) in female injury rates, whereas Winnipeg started with lower rates and showed smaller percentage drops varying from 11% to 20%. The actual (and percentage) drop from 1984/86 to the 2002/04 rate for **females** by aggregate area is: North 8.5 (30% drop), Mid 3.4 (28% drop), South 3.1 (29% drop), Brandon 3.6 (36% drop), and Manitoba 2.4 (24% drop). In Winnipeg, the actual (and percentage) drop in this twenty–year period is: Least Healthy 1.3 (13% drop), Average Health 1.4 (19% drop), and Most Healthy 1.2 (20% drop).
- Most of Manitoba has seen large percentage drops (around 30% drops) with some of the highest percentage drops (and actual rate drops) in Brandon, Mid and North Manitoba. The actual (and percentage) drop from 1984/86 to the 2002/04 rate for **males** by region is: North 10.8 (32% drop); Mid 6.8 (38% drop); South 4.8 (31% drop); Brandon 6.6 (45% drop); Manitoba 4.5 (32% drop). In Winnipeg, the actual (and percentage) drop for males in this twenty–year period is: Least Healthy 4.8 (30% drop); Average Health 3.6 (33% drop); Most Healthy 2.7 (32% drop). So for males, injury rates have changed dramatically across the province though rates in the North remain higher than elsewhere.
- Table 5.2 shows that the profile of injury hospitalizations or death varies by area and especially by sex. For **males,** the leading cause of injury is "accidental falls" (32.58%). Vehicle injury is a large contributor to male injury rates (total of 14.54%) with "motor vehicle traffic accidents" at 9.65%, "motor vehicle non–traffic accidents" at 3.10%, and "other road vehicle accidents" at 1.79%. Possible work–related injury in the form of "machinery/explosions/electricity" at 8.73% and "struck by/caught between objects" at 5.82% yield a total in these two categories alone of 14.55% of male injuries. "Homicide and injuries inflicted by others" is a major contributor at 9.62% and so is "suicide and self–inflicted injury" at 6.74%.
- For **females,** the leading cause of injury is also "accidental falls" (55.46%), contributing over half of the female injury hospitalizations or death in Manitoba. Vehicle injury is less of a factor than for males (total of 9.95%), with female "motor vehicle traffic accidents" at 7.76%, "motor vehicle non–traffic accidents" at 1.00%, and "other road vehicle accidents" at 1.19%. Possible work–related injury in the form of "machinery/explosions/electricity" at 2.68% and "struck by/caught between objects" at 1.80% yield a total of 4.48% of female injuries, only one–third the percentage for males (14.55%). "Homicide and injuries inflicted by others" at 3.46% is much lower than the male percentage (9.62%). However "suicide and self–inflicted injury" is a larger contributor to female injury hospitalization or death at 10.49% of all female injuries (versus 6.74% for males).
- Causes of injury also vary by region of the province. South/Mid males have lower homicide and suicide rates, but higher vehicle injury rates; whereas males living in the North have very high "homicide/injuries inflicted by others" and "suicide/self–inflicted injury" rates compared to the provincial average. Brandon males have more "accidental falls" and "suicide/self–inflicted injury", but fewer vehicle injuries and "homicide/injuries inflicted by others" compared to provincial

rates. Winnipeg male injuries vary by aggregate area: males living in the most healthy area have a greater percentage of injuries due to "accidental falls" and much lower rates of "homicide/injuries inflicted by others"; males in the average health areas have fewer vehicle injuries; males in the least healthy Winnipeg area have fewer vehicle injuries, but their "homicide/injuries inflicted by others" rate of 18.03% is almost double the provincial rate.

- Causes of injury for females also vary by area. Females living in the South aggregate area have slightly higher rates of "accidental falls", but percentages attributable to "homicide and injuries inflicted by others" (1.95% vs. 3.46%) and "suicide and self–inflicted injury" (7.22% vs.10.49%) are much lower than the provincial percentages. Females living in the Mid area have slightly lower fall rates, but slightly higher vehicle injury rates. Females living in the North have very high "homicide/injuries inflicted by others" (8.05% vs. 3.46%) and "suicide/self–inflicted injury" percentages (21.73% vs. 10.49%) compared to the provincial average. Winnipeg female injuries vary by aggregate area: females living in the most healthy and the average health areas have a higher percentage of their injuries attributable to "accidental falls" and a much lower percentage attributable to "homicide and injuries inflicted by others" and "suicide and self–inflicted injury". Females in the least healthy Winnipeg area have fewer vehicle injuries, but their "homicide/injuries inflicted by others" is higher than the provincial percentage for females (5.76% vs. 3.46%).

What the regression modeling[1] tells us about predictors of injury hospitalization and death in the year 2003/04 (for the complete regression model, refer to Appendix 4):

- Individual characteristics that **decreased** the likelihood of injury—for females, being younger or for males, being older (see Figure 5.17); being a resident in a neighbourhood of higher income; and not having physical or mental health problems.
- Geographical characteristics that **decreased** the likelihood of injury hospitalization or death after taking into account all of the individual characteristics—living in South Eastman or living in any of the Community Areas of Winnipeg excluding Point Douglas and Downtown.
- Although male injury is higher among the young, the escalation of injury rates with age is quite dramatic, increasing rapidly after aged 60 for both males and females (with females higher than males in the older adult).

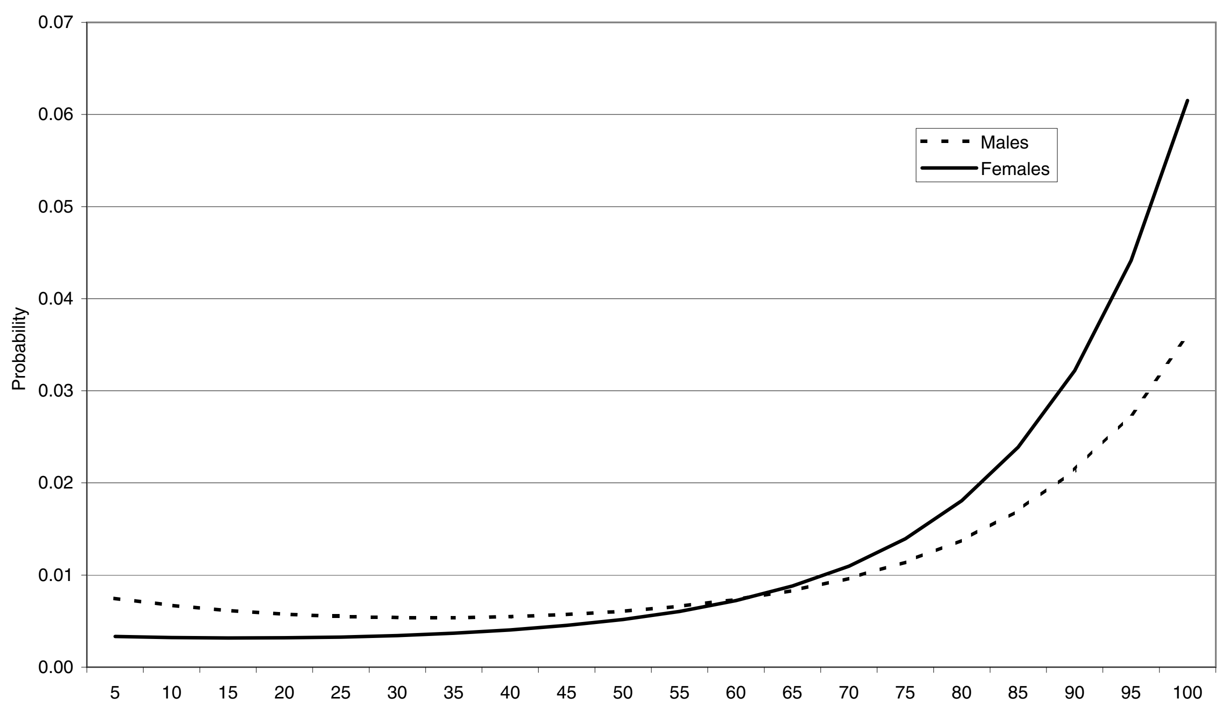
How the above information is associated with descriptive information on policy, program or support initiatives to reduce injury hospitalization and death:

- There have been multi–level strategies and programs on injury prevention throughout the province with Manitoba Health mandating injury performance deliverables as part of RHA strategic planning. The good news throughout the province is that injury rates in general are declining over time.

[1] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

- The areas of the province of particular interest in terms of large drops in the rate of injury over a twenty–year period— for females, the North had the highest "real drop" of 8.5 per thousand and Brandon had the largest percentage drop of 36%; for males, the highest "real drop" was also in the North at 10.8 per thousand and the largest percentage drops were in Brandon (45%) and Mid (38%) aggregate areas. Although this study has limitations in assessing the causal relationship between policies/programs and outcomes (see Chapter 1), some RHAs show promising results that warrant further study. For example, Brandon particularly "sticks out" as an area with low rates in all districts and trends as good as or better than the provincial decreases. Brandon has demonstrated a multi–faceted approach to injury prevention, including PARTY programs in high schools, ERIK kits, and Seniors falls reduction strategies (including regional exercise programs for falls reduction, a Seniors for Seniors group, home safety checks and a policy and action plan for fall reduction). Since 2004, Brandon has had a "Safe Communities" approach (see http://www.safecommunities.ca/) with emphasis on falls for seniors and children, suicide prevention, and vehicle injury prevention.
- Nor–Man is also a particularly interesting "case study" of injury prevention as it has had rapid improvement for both males and females compared to Manitoba time trends. It also has much lower district injury rates compared to many other districts in the North. Nor–Man has had the longest running PARTY program of any RHA in the province, as well as a long–standing falls–reduction exercise program and several recent initiatives including IMPACT and Homecare home safety checklists. Although we cannot imply causation, further study is indicated to determine which of these interventions has a population–based effect in injury reduction.

Figure 5.17: Probability of Injury Hospitalization or Death by Age and Sex, 2003/04
based on the regression modelling



Source: Manitoba Centre for Health Policy, 2008

- Looking at Figure 5.17 underscores the importance of both a youth and an elderly injury prevention strategy. Although males are substantially more likely than females to experience injury in the early years, females are more likely in the 75 or older group and the risk is much higher in the elderly than in the young.

5.3 Comparison of Pertinent Literature Reviews and *Our Study Results*

5.3.1 Injury Rates:

In Canada, injury is the leading cause of death for persons under 45 years, and the fourth leading cause of death overall (Public Health Agency of Canada 2006). According to Health Canada (2006), the estimated economic burden of unintentional and intentional injuries combined is at least $12.7 billion per year, representing at least 8% of the total costs of illness. This ranks fourth after cardiovascular disease, musculo–skeletal conditions and cancer. Angus et al. (1998), in a paper titled, "The Economic Burden of Unintentional Injury in Canada", estimated that unintentional injuries alone created a cost of more than $8.7 billion annually which is almost three times the annual HIV costs. The authors therefore suggest that Canadians should invest up to $240 million or $8 per capita in the fight to prevent the "silent injury epidemic." A parallel Manitoba study completed for IMPACT by SMARTRISK (2003) estimated that preventable intentional injuries cost Manitoba $819 million in 1999/2000. Therefore this underestimates total cost of all injuries. Falls accounted for 41% and motor vehicle crashes 15% of the total. On average, each injury cost Manitobans $5,179 in direct and indirect costs.

According to the latest Canadian statistics from 2004/05, age–adjusted injury hospitalization rates were 5.43 per thousand (95% CI 5.40–5.45) (CIHI 2007). The Prairie provincial rates were the highest (excluding the territories)—Manitoba 6.72, Saskatchewan 8.39, and Alberta 7.56 per thousand. The Ottawa Safe Communities Network (2004) states that for each death due to injury in Canada there are 45 hospital admissions and 1,500 emergency department visits.

Canada's National Trauma Registry Hospital Injury Admissions Report (CIHI, 1998/99) shows that over the five year period from 1994/95–1998/99, there was an overall decline of 19% in hospital admissions injury (7.7 to 6.2 per 1,000), with falls decreasing by 18% and motor vehicle collisions by 22%. Manitoba and Saskatchewan only showed drops of 9.5% and 9.8% respectively. It should be noted that only Health Sciences Centre (HSC) participates in this report, therefore, caution should be used when comparing Manitoba's rates to another province's rates. In addition, caution should be used when comparing CIHI's reported Manitoba rates to other non–CIHI reported rates. The CIHI rate is obtained from only the HSC data and other source's reports of Manitoba rates may include other Manitoba facilities. The 2006 National Trauma Registry Report (CIHI 2006) states that there were close to 200,000 injury hospitalizations in 2004/05. This accounts for close to 2 million days in hospital for a mean hospital length of stay of 10 days which increases with age. Males comprised 53% of all cases. Death in hospital occurred for 4% of all injury hospitalizations. The leading cause of injury hospitalization for Canada was unintentional falls (57%). Motor vehicle collisions accounted for 14%. Being struck by objects or colliding with another person was the third leading cause (5%), followed by injury inflicted by another person (4%).

These results are also consistent with previous research from MCHP (Fransoo et al. 2005; Martens et al. 2003).

Compared to 11 other developed countries, Canada had the 5th lowest injury mortality rate and the 7th lowest rate for suicide (Fingerhut et al. 1998). The Canadian childhood injury mortality rate (9.7 deaths per 100,000 aged 1 through 14) is significantly higher than the rates of several other industrialized nations (Sweden 5.1; UK 6.1 deaths per 100,000), but significantly lower than the USA rates at 14.1 deaths per 100,000 (Sibbald 2001). In 1971–1975, Canada and the USA had similar injury–related childhood mortality rates (24.8 and 27.8/100,000 respectively), but by the 1990s Canada had reduced its rate to 9.7 while the USA rate reduced to only 14.1 per 100,000 children.

The current study indicates that injury hospitalization or death rates in 2002/04 were 7.4 per 1,000 females and 9.7 per 1,000 males, considerably lower than the 1984/86 rates of 9.8 per 1,000 females (a drop of 24%) and 14.2 per 1,000 males (a drop of 32%). The "average" adjusted injury hospitalization or death rate for males and females combined in Manitoba in 2002/04 was 8.55 per 1,000, higher than that stated by CIHI at 6.72. This may be due to several reasons: the fact that the Repository housed at MCHP includes both out–of–hospital and in–hospital deaths due to injury and the fact that CIHI only used one year of data (2004/05) more recent than ours (and rates may still be falling).

In the mid– to late–1990s, the female injury rate decreased by 7.9% (from 8.5 to 7.9 per 1,000) while the male injury rate decreased by 9.3% (11.8 to 10.7 per 1,000). This is similar to the 9.5% drop reported by CIHI for Manitoba (1999). However, the Canadian decline in injury rates during the mid– to late–1990s was 19%, suggesting that Manitoba rates are not dropping as fast as national rates. Manitoba rates dropped substantially from the mid–1980s to the early 2000s (24% drop for females, 32% drop for males), but the most rapid decreases in injury rates occurred before the mid–1990s with further decline in the late 1990s and into 2000+.

For Manitoba overall, the leading causes of injury hospitalization for the most recent decade were "falls" (55%), vehicle injuries (10.0%, including 7.8% motor vehicle traffic injuries, 1.0% motor vehicle non–traffic injuries, and 1.2% other road vehicle injuries), "suicide and self–inflicted injury" (10.5%), "homicide and injuries inflicted by others" (3.5%), and possible occupational hazards (4.5%, including 2.7% machinery, explosions and electricity, and 1.8% "struck by or caught between objects"). The leading causes of injury hospitalization throughout Canada were also unintentional falls (57%) and motor vehicle collisions (14%). However, the dramatic difference in Manitoba injury rates is the high "suicide and self–inflicted injury" percentage which accounts for 1 in 10 of the injuries.

5.3.2 Policy and Program Initiatives Pertinent to Decreasing Injury Hospitalizations and Death:

Knowing that injury is a complex issue which often involves social, economic, environmental and behavioural factors, prevention approaches need to be multi–level and multi–faceted to reduce rates and inequities (Pressley et al. 2005). It has been noted that socio–economic variations in injury are much greater for children than for older adults (Lyons, Jones et al. 2003), and Canadian adolescents with supportive home and school environments experience much lower odds of engaging in risk–taking behaviour and injury (Pickett et al. 2006). Multi–faceted approaches at the individual, family, community and provincial/national (legislative) levels are all important public health intervention strategies. Juarez et al. (2006) outline a conceptual framework for reducing teen motor vehicle injuries, where policy and environmental changes often show the most effects (such as seat belt legislation and accompanying penalties, and alterations to dangerous road conditions through such additions as four–way stops and speed bumps).

Various conceptual frameworks have proven useful in injury prevention. The three Es of injury prevention (Hanson et al. 2007; Queensland Government 2007) are:

1. Environment and product design or modification
2. Enforcement of legislation and policies
3. Education

The first E, environment and product design or modification, is a passive but universal strategy not requiring individual action for protection. As such, these strategies are considered more effective than active strategies that require continued individual effort. Similarly, healthy public policies instituted through legislation are considered highly effective for individuals and organizations. Education in injury prevention is designed to influence stakeholders at all levels (from the individual to the family, community, health care providers, the media and policy–makers) by attempting to increase knowledge, change attitudes and thereby change behaviour. This is a more active intervention; hence it requires consistent individual effort. Therefore, it has limited results unless combined with the first two strategies. That being said, it is important to realize that a strategy combining all three E's is necessary since changes in structure, design, environment or legislative often rely on societal change through education which necessitates active approaches and passive protection approaches simultaneously (see Hanson et al. 2007).

However, there are very few rigorous studies in the area of injury intervention strategies, and meta–analyses often find little or no effect. The Cochrane Database Systematic Reviews contain several reviews pertinent to policies and programs to reduce injury hospitalization and death. The Cochrane reviewers have found the following effects:

(a) Traffic (motor vehicle and pedestrian) interventions

- Speed enforcement detection devices to reduce traffic injuries (Wilson et al. 2006)—Compared with controls, the relative improvement in pre/post crash numbers resulting in any type of injury ranged from 5% to 36%. Therefore the authors conclude that speed enforcement detection devices **show promise** as an intervention to reduce the rates of road traffic injuries and death.
- Post–licence driver education (including group or individual, advanced or remedial education) to prevent road traffic crashes (Ker et al. 2003)—A systematic review provides **no evidence** that post–licence driver education is effective in preventing road traffic injuries or crashes.
- Area–wide traffic "calming" schemes that discourage through traffic on residential roads (Bunn et al. 2003)—The review suggests that this **may be a promising intervention** for reducing the number of road traffic injuries, and death, but further rigorous evaluations of this intervention are needed.

- Red–light cameras for the prevention of road traffic crashes (Aeron–Thomas et al. 2005)—The review suggests that red–light cameras are **effective** in reducing total casualty crashes, but it is less conclusive on total collisions, specific casualty collision types and violations. Larger and better–controlled studies are needed.
- Helmets for preventing injury in motorcycle riders (Liu et al. 2004)—This review found evidence that motorcycle helmets could **reduce the risk** of head injury by about 72% (OR 0.28, 95% CI 0.23, 0.35) with effects modified by speed. Global efforts to reduce traffic injuries should incorporate increased helmet use.
- Bicycle helmet legislation for the uptake of helmet use and prevention of head injuries (Macpherson and Spinks 2007)—This review found that bicycle helmet legislation appears to be **effective** in increasing helmet use and decreasing head injury rates.
- Safety education of pedestrians for injury prevention (Duperrex et al. 2002)—This review found that pedestrian safety education can result in improved knowledge and road crossing behaviour in children, but there is **no evidence** as to how this translates into reductions in pedestrian motor vehicle collision and injury. As well, knowledge and behaviour effects decline over time which implies that safety education must be repeated regularly.
- Interventions in the alcohol server setting for preventing injuries (Ker and Chinnock 2006)—This review found **no reliable evidence** that interventions in the alcohol server setting are effective in reducing injury since compliance with interventions seems to be problematic. Authors suggest that mandated interventions may be more likely to show an effect. Further studies are needed.

(b) Home and business environmental interventions

- Modification of the home environment to reduce injuries (Lyons et al. 2006)—This review found **insufficient evidence** to determine the effects of interventions to modify environmental home hazards. Authors call for further intervention studies (and larger sample sizes) that better evaluate specific modification strategies for the home environment. An RCT in 2007 (Sangvai et al.) found similar results. A child caregiver program of education and receipt of home environment safety devices designed to reduce childhood injury showed little effect on actual injury rates. However, a systematic review of group–based injury prevention interventions targeting young children suggested that these could enhance children's safety behaviors during early childhood (3–6 years) from diverse neighborhoods and socioeconomic backgrounds (Bruce and McGrath 2005). Regardless of the safety issue addressed, positive results were demonstrated this suggests that it is possible to positively influence the development of safety behaviors in children using group interventions.
- According to the Workers' Compensation Board of Manitoba (WCB and Government of Manitoba 2005), there was a 21% reduction in work time loss due to injury over the five year period from 2000 to 2004 (5.8 time loss injuries per 100 FTE workers in 2000 to 4.6 in 2004). The report did not link prevention efforts with outcomes directly, but hypothesizes that this could be due to increased injury prevention efforts of employers, increased awareness of workplace safety and health issues through the SAFE Work campaign, financial incentives for employers to prevent injuries (including a Scorecard System), and improved inspection and

enforcement, especially of high–hazard workplaces. However, it should be noted that injuries counted by WCB may not result in hospitalization or death.

(c) Protection for the older adult or in institutional settings

- Hip protectors for preventing hip fractures in the elderly (Parker et al. 2004)—The review found no evidence of protection for individuals in an institution or living at home; but cluster randomized trials shows that for those living in institutions with high hip fracture rates, a program of providing **hip protectors appears to reduce hip fracture** incidence rates. The authors point out that acceptability by the users is problematic due to the discomfort or practicality of using hip protection. A review and meta–analysis in 2007 (Oliver et al.) did find a **protective effect on hip fracture when hip protectors were used** in nursing homes (RR = 0.67, 95% CI 0.46 to 0.98); but none of the other interventions (multifaceted interventions in care homes, removal of physical restraints in either setting; fall alarm devices in either setting, exercise in care homes; calcium/vitamin D in care homes, changes in the physical environment in either setting, or medication review in hospital) showed significant effects. This is possibly due to poor study design or small samples.

It is interesting to note in the above Cochrane Collaboration reviews and meta–analyses that the most successful interventions in injury reduction were either environment/product design (red–light cameras, traffic "calming", and hip protectors) or legislation and policies (speed enforcement, helmet use and legislation for motorcycles and bicycles, and hip protector policies in nursing homes). Few of the education interventions showed noticeable injury reductions.

For the most part, provincial and regional strategies rely heavily on educational initiatives. These are considered the least effective strategies because they require active injury prevention at the individual level. There are also environmental and enforcement–related initiatives to reduce injuries due to falls in the older adults. These solutions rely more on a regional exercise program and institutional policies for fall management strategies. In addition, there are provincial enforcement efforts regarding motor vehicle injury prevention which includes photo radar detection and harsher penalties for drinking and driving.

Nor–Man shows the highest actual reduction in injury rates for both females and males over the last 20 years. As well, all of Nor–Man's districts show consistently faster drops in injury rates compared to the Manitoba time trend. From descriptive information, it appears that Nor–Man has been putting considerable effort into injury prevention including making this a regional priority. Nor–Man has been using an injury surveillance tracking tool and ER auditing to produce an Injury Awareness Model through Health Canada funding. The PARTY program has also been delivered since 2002/03 in Flin Flon/Snow Lake/Cranberry Portage district. This is probably the region with the longest track record of the program outside Winnipeg. There is also an exercise program through the Movements that Matter initiative, to reduce fall injuries in adults. Multi–faceted approaches are evident through the number of different stakeholders involved in various injury prevention strategies including the RHA Board, a regional Health Canada–funded program and surveillance initiative, staff training, distribution of ERIK kits throughout the region, education in high schools through PARTY, home *safety audits, RCMP involvement in schools, annual media campaigns, exercise programs throughout the region, and farm safety awareness campaigns. Although it is difficult to attribute any one program or policy to the injury rate reductions, it may be the result of a combination of programs, policies and education throughout Nor–Man.*

Brandon RHA showed the largest percentage drops in injury hospitalization or death rates over the twenty–year period, for both females and males (although the downward trends in injury rates have not always been consistent). They have had programs to reduce child injury through car seat safety programs and older adult injury through a Seniors for Seniors initiative and Safe Community implementation. A combined injury prevention and education network with Assiniboine, Parkland and Brandon has been in place since the mid–1990s.

5.3.3 Legislation Related to Injury Prevention:

According to a CMAJ Editorial (2003), around 1,200 deaths and 1,000 injuries per year are caused in Canada by firearms. Gunshot wounds are the third leading cause of death for those aged 15–24. With the exception of the USA, most developed countries have adopted national programs or legislation to control gun ownership and use. In 1978, Canada adopted legislation to license new gun purchases. In 1991, additional requirements for owner screening and gun storage were added. In 1995, the controversial Firearms Act (Bill C–68) was passed. It provided for the centralized registration database as well as strengthening licensing provisions (background checks), notification of spouses of the acquisition of a gun, and renewal of licences every 5 years. Of all firearms–related deaths, 80% are deemed suicide and 15% homicide with the rest being some type of unintentional injury.

In our current study, the aggregate area of most concern in terms of firearms is the North where the second leading cause of injury hospitalizations and death was "homicide or injuries inflicted by others" (15.5% for males; 8.05% for females) and the third leading cause "suicide and self–inflicted injury" (9.05% for males; 21.73% for females)—both 1.5 to 2 times higher than the overall Manitoba percentages. Although it is difficult to state any causal effects, it is interesting to note that the North male injury rates first dropped substantially in 1990/92 and then leveled off somewhat until a further drop starting around 1996/98. This later drop included decreased rates both males and females living in the North. For more specific cause–related injury data, refer to the Manitoba Health (2004) injury report.

In Manitoba, seat–belt legislation in cars was established prior to the time period of this study (mid–1980s). Helmet legislation for motorcyclists came into effect in 1991/92 and was revised in 2000[2]. An article written for the American College of Preventive Medicine found that seat belt legislation led to higher rates of seat belt use and lower mortality/injury rates—a drop from 10%–20% to 45% –77% (Ferrini 1997). In addition, recent "natural experiments" throughout the USA show that rescinding helmet use legislation has been associated with substantial increases in fatalities from motorcycle use. A study using Florida as the intervention (i.e., rescinding its legislation in 2000) and Georgia as the control (maintaining its legislation) demonstrated significant deterioration in the three years after compared to

[2] According to the Safety Helmets Standards and Exemptions Regulation, Man. Reg. 167/2000, ss. 1(1), 1(2) and 187 accessed September 5, 2007 at http://web2.gov.mb.ca/laws/statutes/ccsm/h060_3e.php#187.

the three years before repeal. After the law changed from mandatory helmet to elective use, actual helmet use decreased from close to 100% before to 50%, fatalities increased by 71%, fatalities under 21 years old tripled, and head injuries increased by 80% in Florida. Georgia, on the other hand, continued to have a mandatory helmet law and rate changes did not take place (Kyrychenko and McCartt 2006; Canada Safety Council website).

In 2005, IMPACT completed a document titled, "Preventing Motor Vehicle Occupant Injuries in Manitoba: A review of best practices." This document is an excellent review of the research evidence for various preventive practices and policies (see the document for details regarding methodology of the review). IMPACT recommended the following:
Strongly Recommended—occupant restraint enforcement programs, primary enforcement laws, seat belt laws, .08g/100ml blood alcohol laws, minimum legal drinking age of 21 years, use of sobriety checkpoints, ignition interlock systems, child safety seat laws, daytime running lights
Recommended—random alcohol screening, server intervention training programs, graduated licensing, lower Blood Alcohol Content laws (zero tolerance), child restraint loan programs, community–wide information and health promotion programs to increase seat belt and child restraint use, enforcement of child restraint legislation, incentive programs, traffic calming programs, guardrails and crash cushions, problem driver improvement programs

In our report, descriptions of RHA programs for Nor–Man and Brandon incorporate many of the education–related programs listed by IMPACT. See descriptions above for these two RHAs. Provincial legislation already mandates both seat belt use and helmet use for motorcycles (and more recently, motorized bicycles). Interestingly, there was a substantial drop in male injury hospitalization and death rates during 1990/92–1992/94 in several areas of the province (see Figures 5.13 and 5.14). This may, in part, be due to the helmet legislation in 1991/92, although this is highly speculative and further study is required to link the legislation with any substantial reduction.

Legislation for environmental issues (urban planning for traffic calming and road construction which incorporates adequate safety features) and enforcement of child restraint may need to be considered. Other initiatives in Manitoba, such as graduated licensing, could potentially be studied using administrative claims data as well as injury surveillance data.

5.4 Recommendations

- Further time trend and regression analyses by specific causes of injury would be productive to study specific policy/program interventions and their effects on these specific injury categories.
- Given the continued high rate of injury hospitalizations and death for Manitobans in comparison with most other provinces outside the Prairie region, effort should be made to continue implementation of provincial and regional injury prevention strategies and to share and use best practices in injury reduction strategies for all age groups and in all regions. Sustainability of efforts to track injuries (such as IMPACT) needs to be considered.
- The high rate of falls indicates the need for regional and provincial injury reduction strategies especially in older adults.

- The high rate of suicide/self–inflicted injury indicates the need for mental health programs and integrated primary care programs to detect mental illness issues early with follow–up for high–risk situations.
- The high rate of homicide/injury inflicted by others indicates the need to explore issues of access to weapons, as well as issues of crime, justice and law enforcement. However, the underlying socio–economic determinants of health (poverty, lack of education, lack of mental health services, and lack of special services for those with particular health problems) must also be addressed.
- The high rate of vehicle injury indicates the need to explore legislative, environmental and educational approaches to reduce collisions or reduce the outcomes of collisions. Other possible areas of study include the use of booster seats for children and bicycle helmet legislation.
- The high rate of injuries to males that are related to machinery/explosions/electricity injuries, especially in the non–Winnipeg regions and in Winnipeg's least healthy area, need further study. Initiatives by the WCB are important, but these may not reach all workplace situations (such as the self–employed).
- For effective injury rate reduction to occur, passive interventions (environment and enforcement) are critical to reducing injuries, rather than a reliance on educational strategies.
- Injury surveillance databases to study the effectiveness of various intervention strategies should be maintained and enhanced, with consideration given to the development of databases to track less serious injuries in emergency rooms, physician and primary care offices.
- Exploring why Nor–Man RHA and Brandon RHA show injury rate decreases that are faster than the provincial trend is recommended. As well, South Eastman, with its low rates and consistent reductions in each of its districts, could be another promising area to include in further studies.

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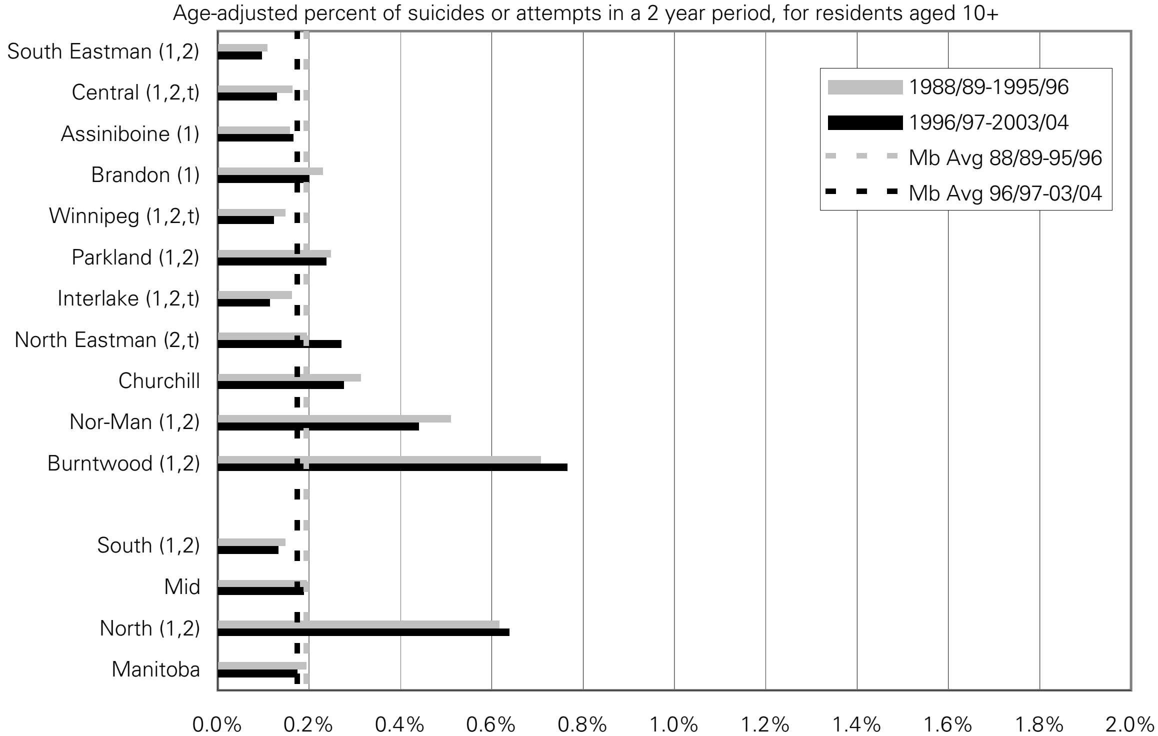
CHAPTER 6: PREVALENCE OF SUICIDE OR SUICIDE ATTEMPTS

6.1. Definition, Graphs and Maps

Suicide is the act of intentionally killing oneself. A suicide attempt, also known as "self–inflicted injury" or "para–suicide", is an incident which did not result in death. The two–year prevalence of suicide or suicide attempts is the percentage of the population age 10 or older who completed suicide or attempted at least once in a two year period in the fiscal years 1984/85–2003/04. The most recent event in the two–year period (suicide or suicide attempt) is counted, region of residence assigned, and age calculated at the time of the event. The denominator is the December 31 population age 10 or older in the second year of the two year period. Refer to the Glossary, Appendix 1, for a complete description of the ICD–9 and ICD–10 codes for suicide and for suicide attempts.

Figure 6.1: Prevalence of Individuals Completing or Attempting Suicide by RHA

Age-adjusted percent of suicides or attempts in a 2 year period, for residents aged 10+

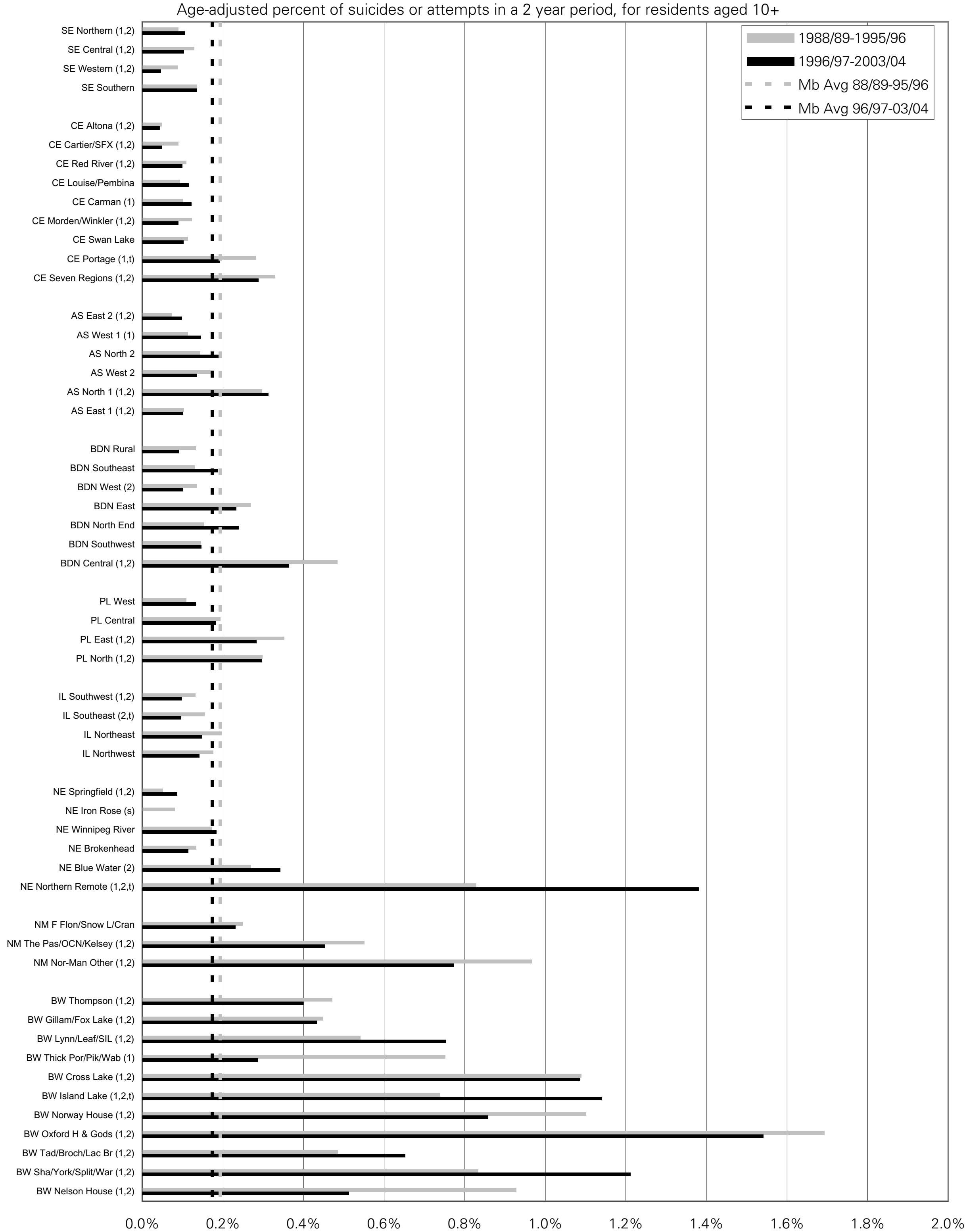


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 6.2: Prevalence of Individuals Completing or Attempting Suicide by District

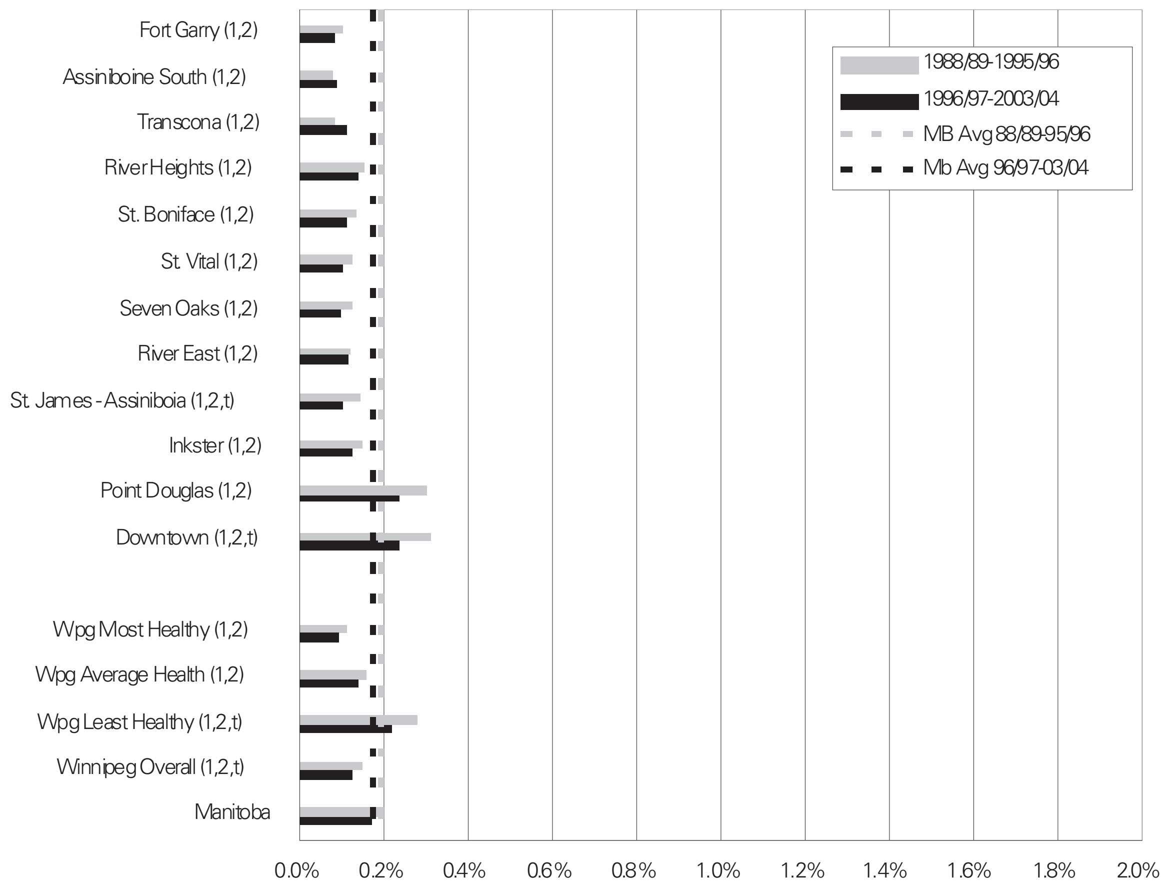
Age-adjusted percent of suicides or attempts in a 2 year period, for residents aged 10+



Source: Manitoba Centre for Health Policy, 2008

Figure 6.3: Prevalence of Individuals Completing or Attempting Suicide by Winnipeg Community Areas

Age-adjusted percent of suicides or attempts in a 2 year period, for residents aged 10+

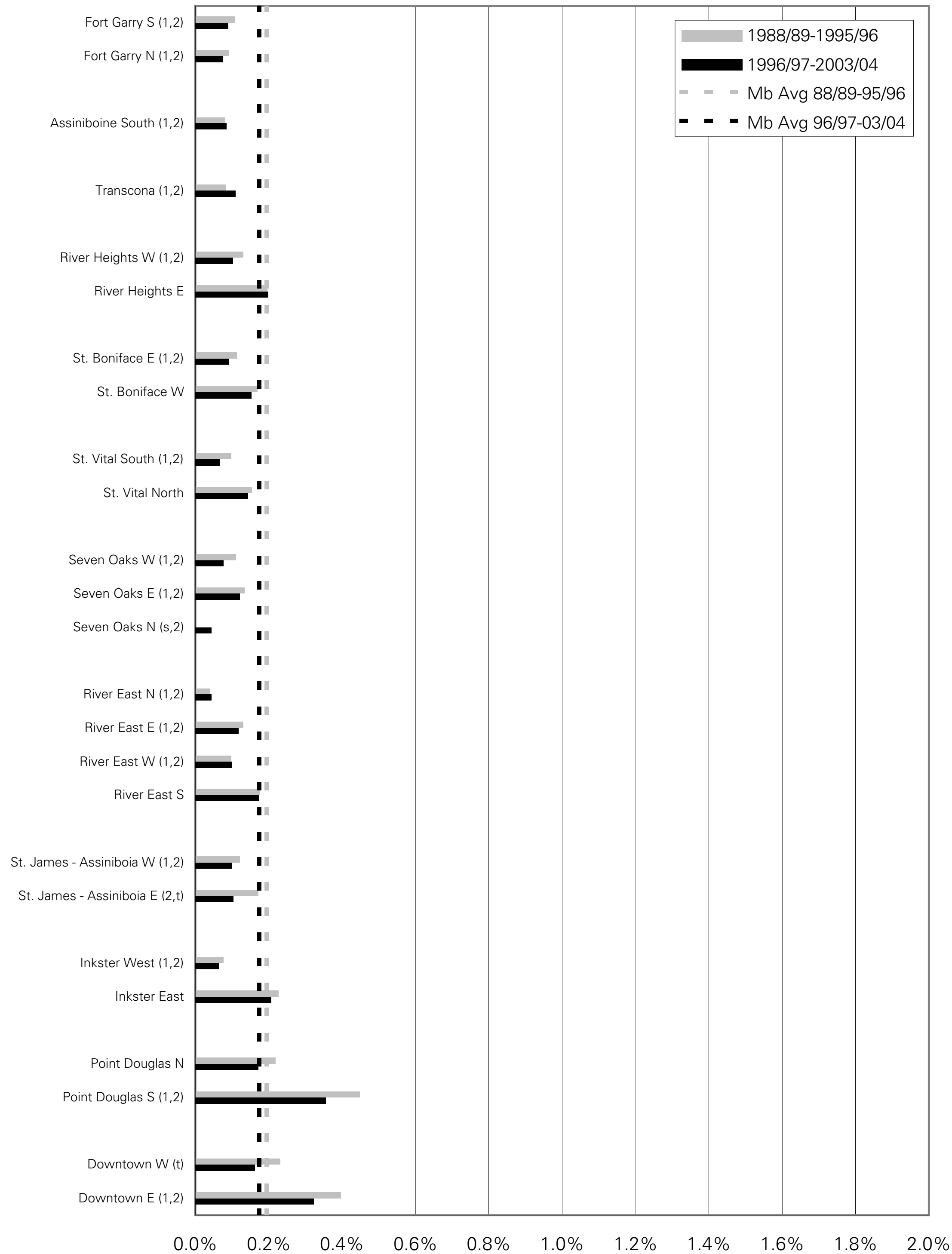


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 6.4: Prevalence of Individuals Completing or Attempting Suicide by Winnipeg Neighbourhood Clusters

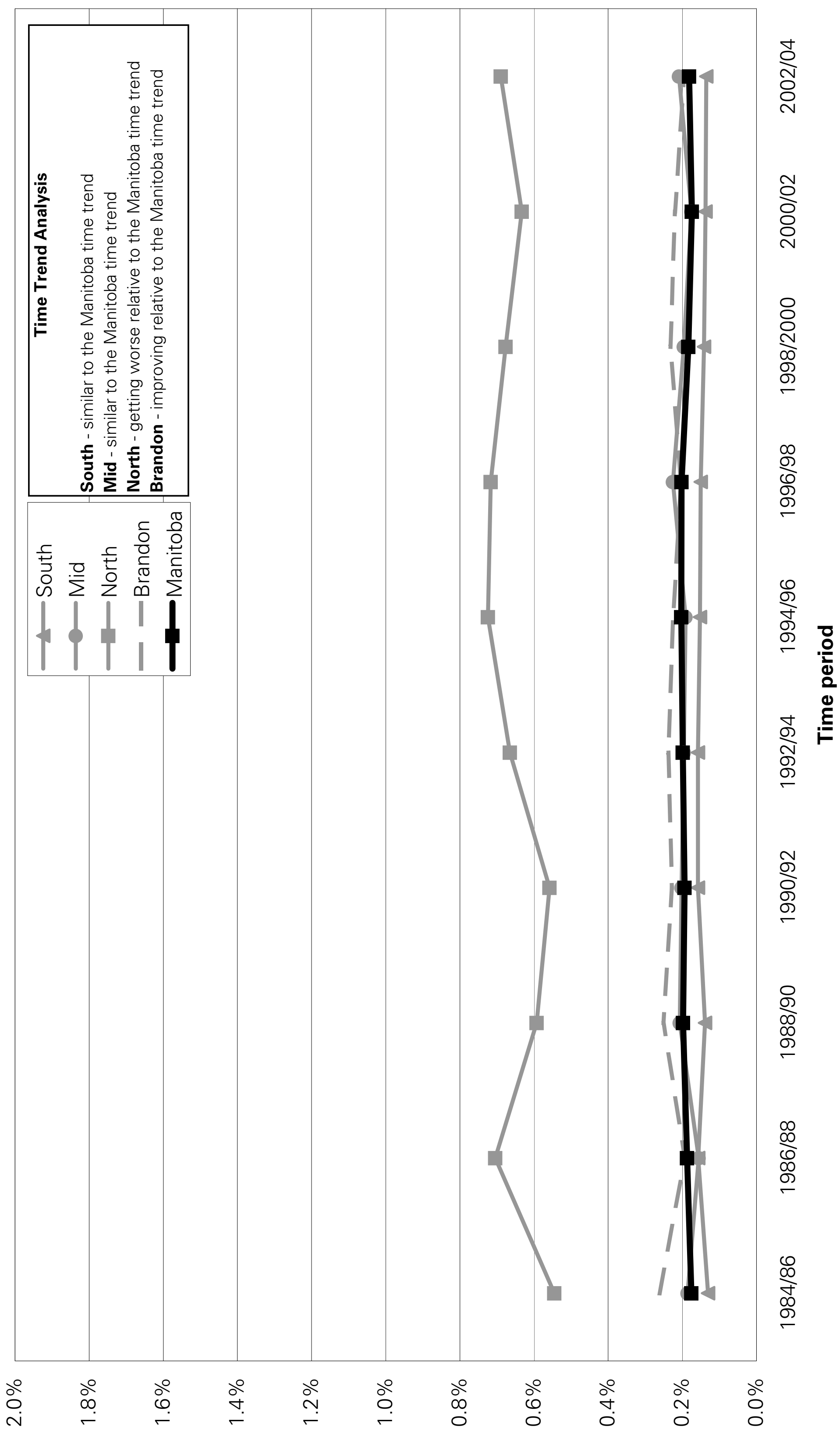
Age-adjusted percent of suicides or attempts in a 2 year period, for residents aged 10+



Source: Manitoba Centre for Health Policy, 2008

Figure 6.5: Trends in Non-Winnipeg Prevalence of Individuals Completing or Attempting Suicide

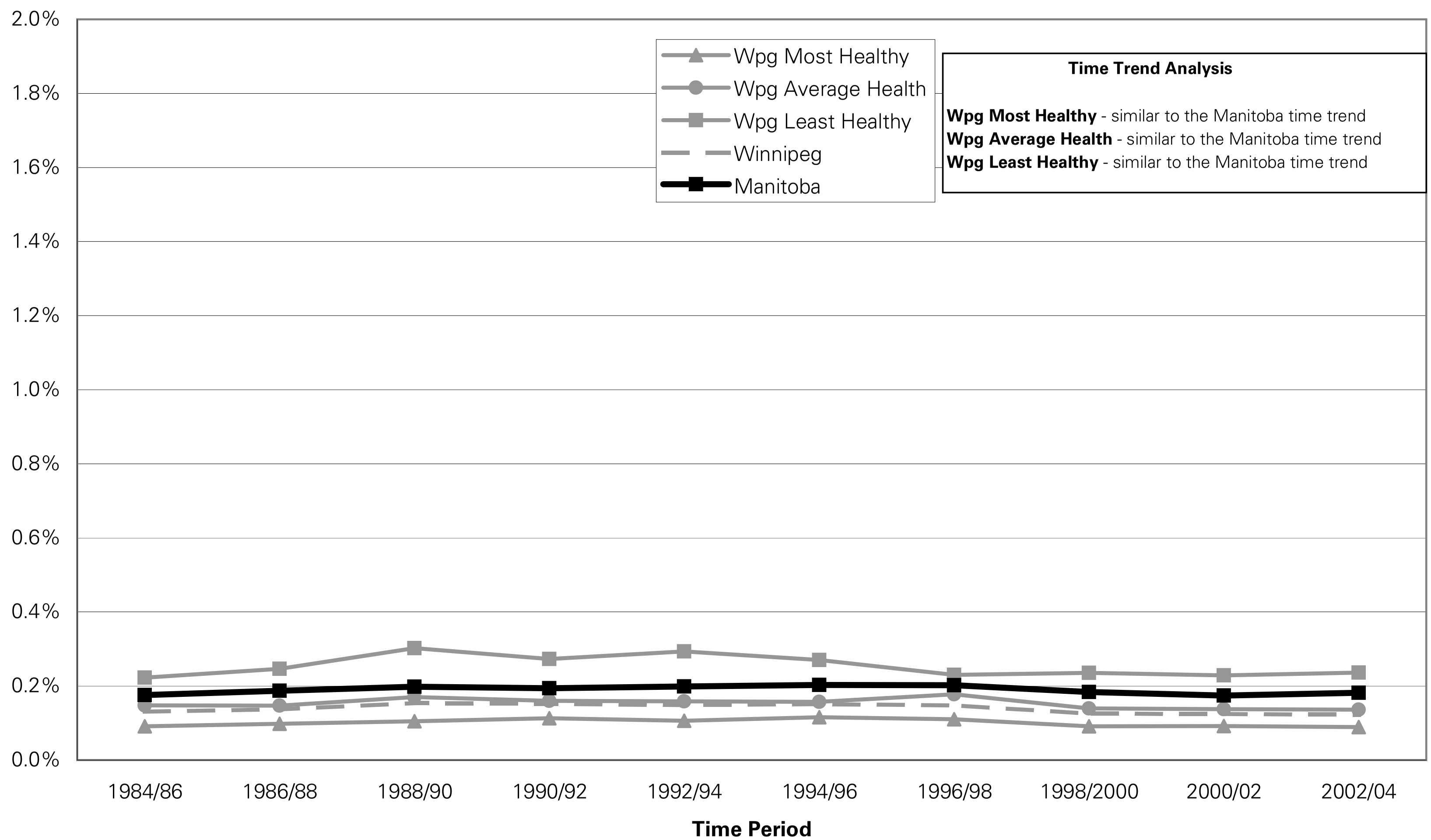
Age-adjusted percent of suicides or attempts for residents aged 10+



Source: Manitoba Centre for Health Policy, 2008

Figure 6.6: Trends in Winnipeg Prevalence of Individuals Completing or Attempting Suicide

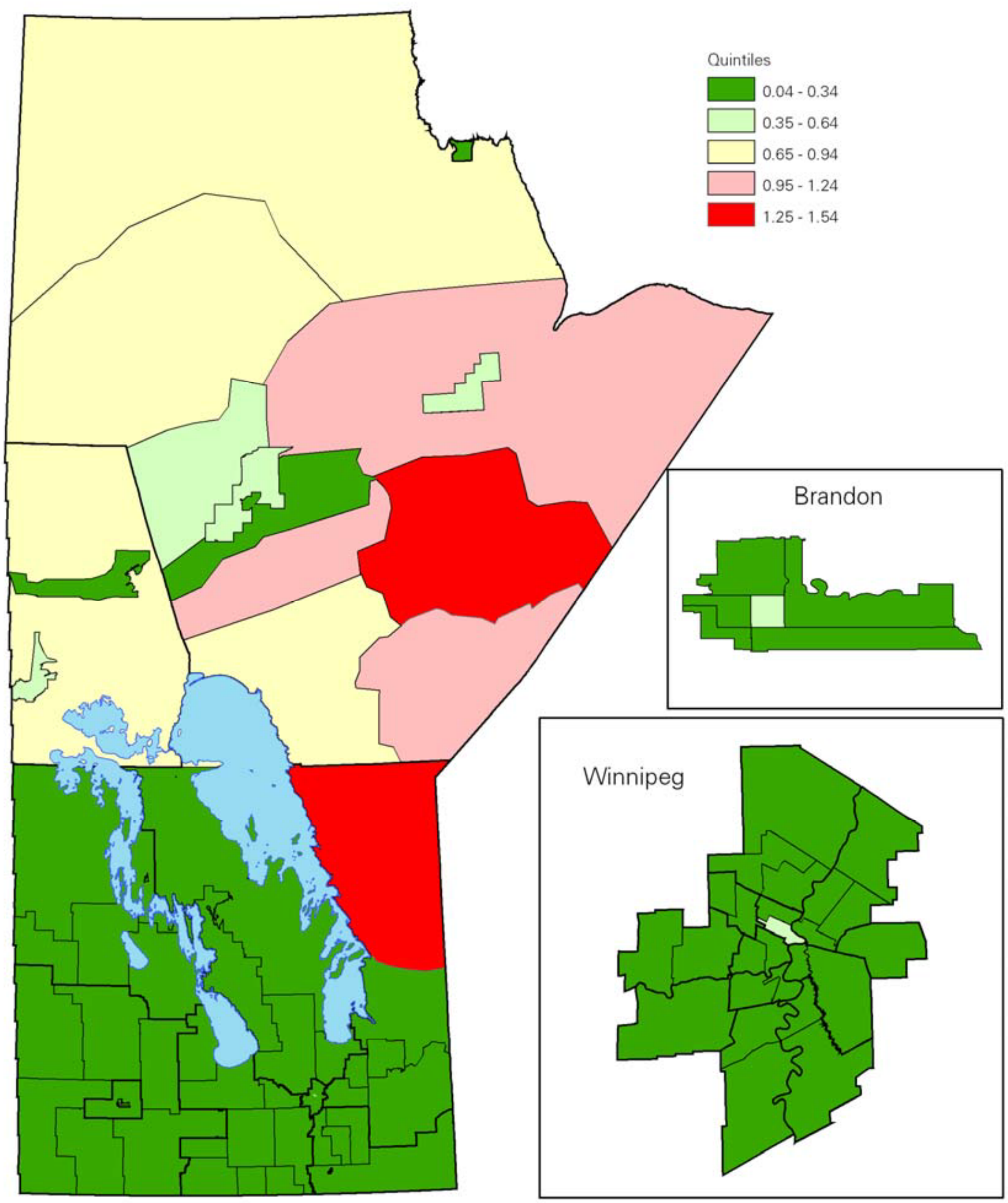
Age-adjusted percent of suicides or attempts for residents aged 10+



Source: Manitoba Centre for Health Policy, 2008

Figure 6.7: Suicide or Suicide Attempt Prevalence Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

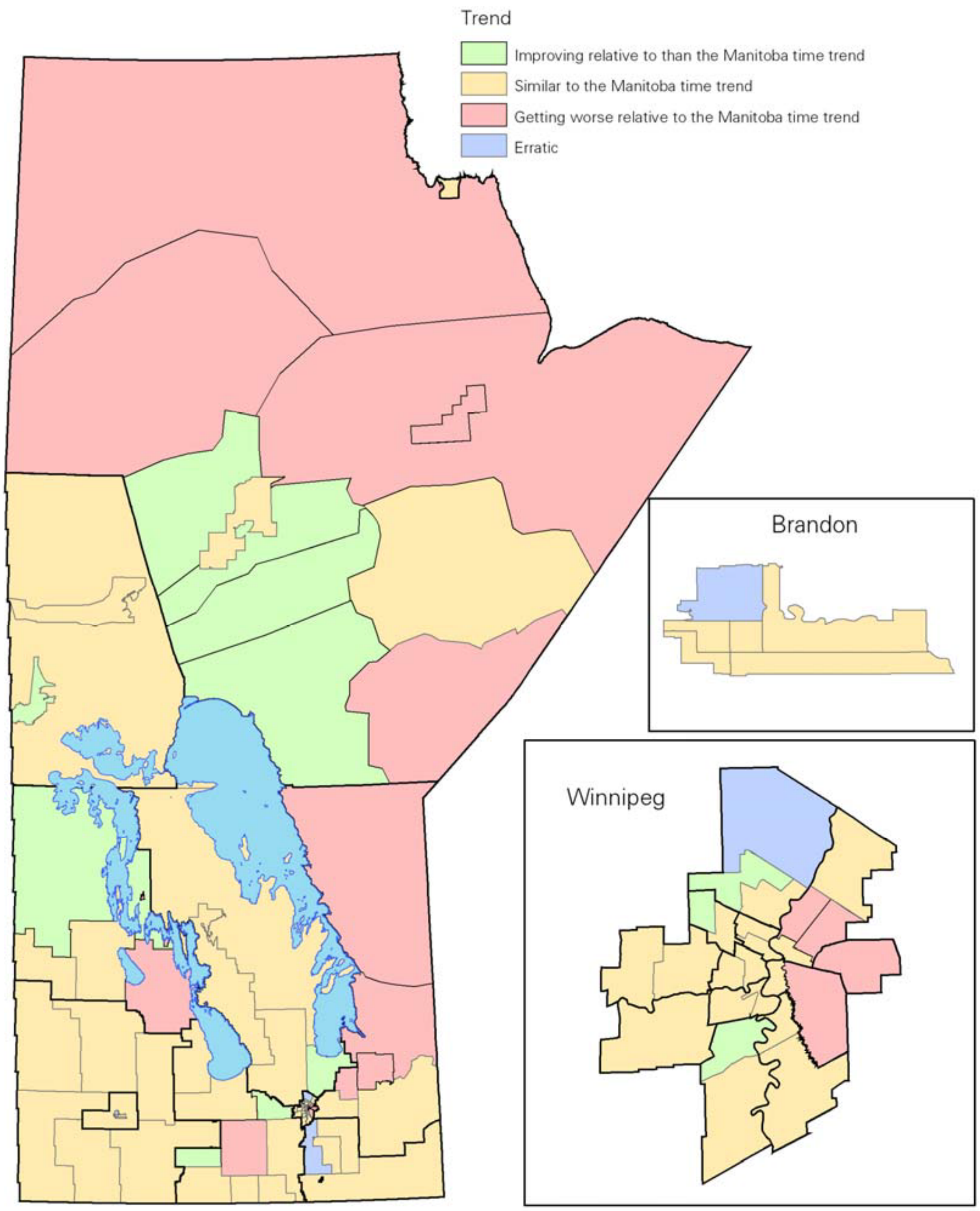
Age-adjusted percent of suicides or attempts for residents age 10+, 1996/97-2003/04



Source: Manitoba Centre for Health Policy, 2008

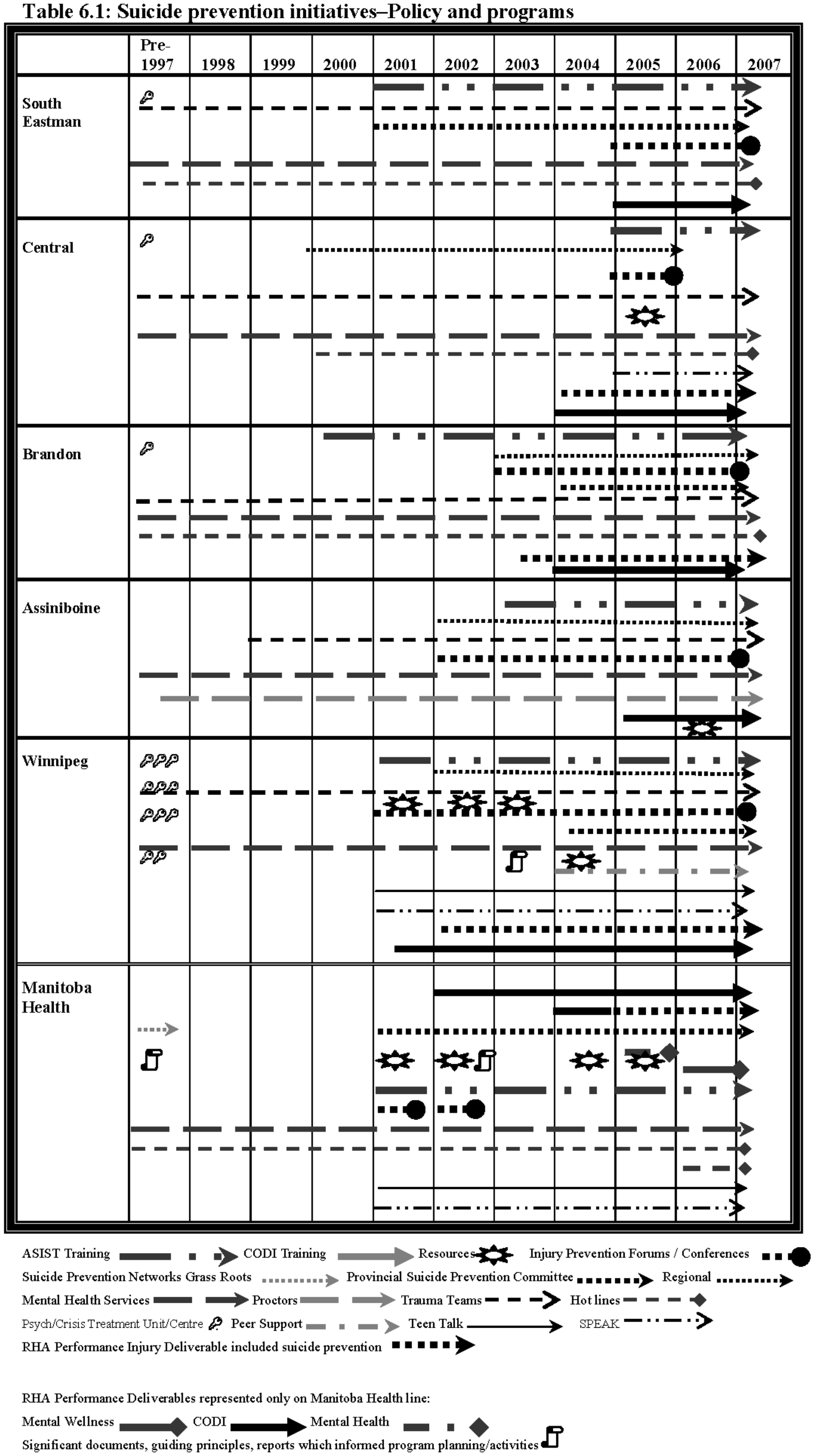
Figure 6.8: Trends in Suicide or Suicide Attempt Prevalence by RHA Districts and Winnipeg Neighbourhood Clusters

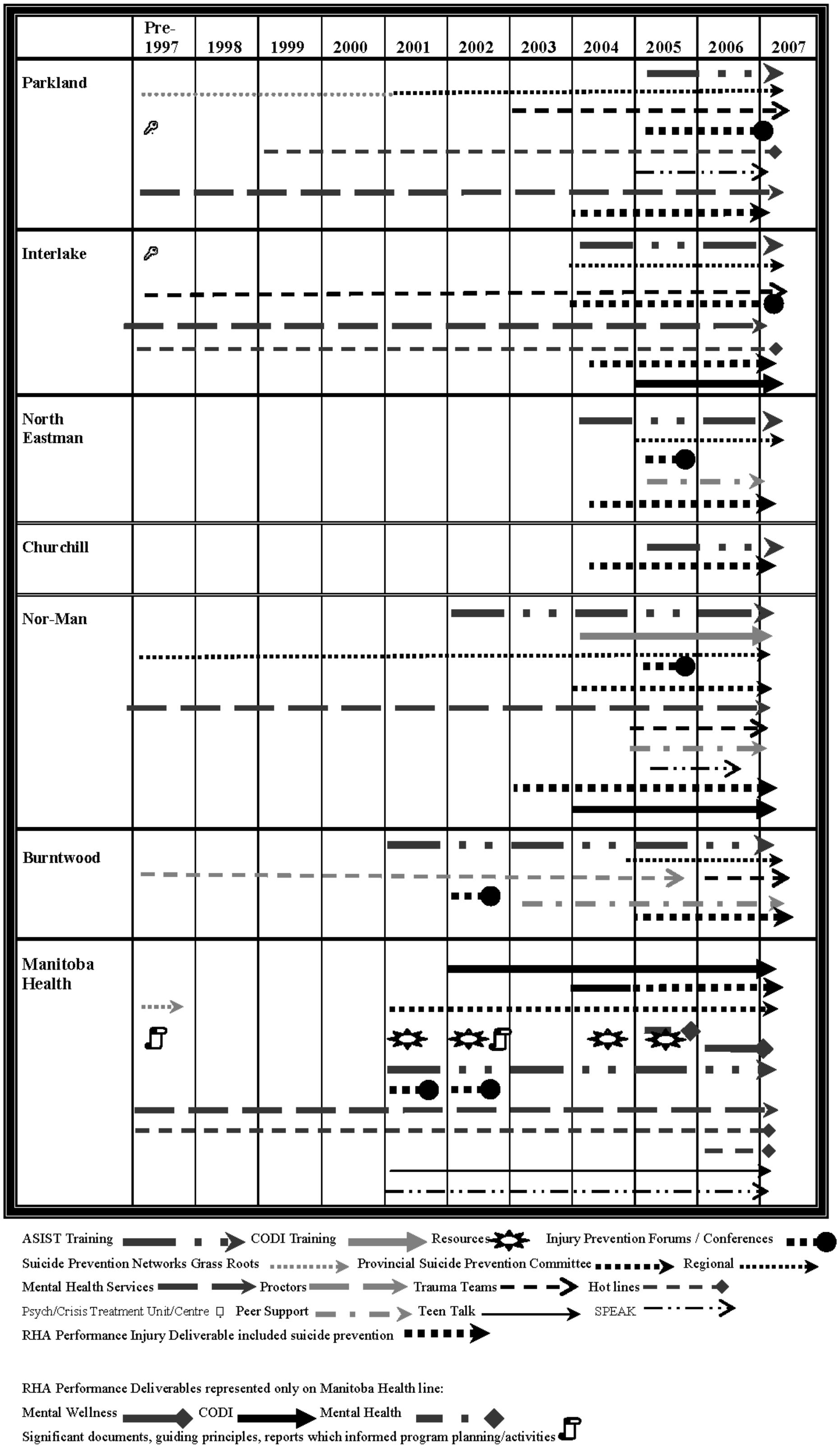
Age-adjusted percent of suicides or attempts for residents age 10+, 1984/85-2003/04



Source: Manitoba Centre for Health Policy, 2008

Table 6.1: Suicide prevention initiatives–Policy and programs





Pre-1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Parkland
Interlake
North Eastman
Churchill
Nor-Man
Burntwood
Manitoba Health
ASIST Training
CODI Training
Resources
Injury Prevention Forums / Conferences
Suicide Prevention Networks Grass Roots
Provincial Suicide Prevention Committee
Regional
Mental Health Services
Proctors
Trauma Teams
Hot lines
Psych/Crisis Treatment Unit/Centre
Peer Support
Teen Talk
SPEAK
RHA Performance Injury Deliverable included suicide prevention
RHA Performance Deliverables represented only on Manitoba Health line:
Mental Wellness
CODI
Mental Health
Significant documents, guiding principles, reports which informed program planning/activities

6.2 Discussion

What the figures and maps tell us about overall rates and trends in suicide and suicide attempts:

- Generally, suicide and suicide attempts are higher in areas that have the poorest overall health status in both rural and urban areas. Compared to rural areas, suicide and suicide attempt rates throughout Winnipeg RHA are low (except of two CAs—Point Douglas and Downtown). This cluster of NCs in the eastern part of the city show a trend of increasing suicide and suicide attempt rates over time despite initial low rates.
- Low suicide and suicide attempt rates are observed throughout South Eastman and Interlake RHAs.
- In the RHAs of Central, Brandon, Assiniboine, Parkland and North Eastman, most districts had low or mid–range rates, though some districts had high rates—Seven Regions district in Central, Central district in Brandon, North district in Assiniboine, East and North districts in Parkland, and Blue Water and Northern Remote district in North Eastman.
- The Northern Remote district of North Eastman is of particular concern with a high rate which increased over time from 0.6% in 1984/88 to 1.6% in 2000/04 (see Figure 6.2 plus website information). Many districts of Burntwood are also of concern due to very high rates. The highest rate in the province for the years 1996/97–2003/04 is Oxford House/Gods Lake district at 1.5% (see both Figure 6.2 and the map of Figure 6.7).
- The Manitoba trend over the twenty–year period from 1984/86 to 2002/04 has remained remarkably stable at 0.18% of people 10+ having either completed or attempted suicide in a two–year period. The Mid (0.19% to 0.21%), South (0.13% to 0.14%) and Winnipeg (0.13% to 0.12%) areas all have similar patterns with fairly consistent rates throughout the time period. The only two exceptions are the North where rates have increased from 0.55% to 0.69% and Brandon RHA where rates decreased slightly from 0.26% to 0.20% (see Figures 6.5 and 6.6).
- A subset of Burntwood districts would interesting to study further: the Thicket Portage/Pikwitonei/Wabowden, Nelson House, Cross Lake and Norway House districts show a wide range of rates from low to high, but they all show improvement at a rate faster than the Manitoba time trend.
- With rates staying similar over time for most parts of the South and Mid areas, but rates increasing in parts of the North, the disparity in non–Winnipeg areas has increased over twenty years. In Winnipeg, disparities increased, then decreased over time, due to changes in rates in the Least Healthy areas (see Figures 6.5 and 6.6).

What the regression modeling[1] tells us about predictors of **SUICIDE** or **SUICIDE ATTEMPTS** in the years 1996/97–2003/04 (for the complete regression models, refer to Appendix 4—note that two separate models were done, since predictors of suicide versus suicide attempts differ):

- The crude rates from Figure 6.7 show that the following areas had low suicide and suicide attempt rates: Winnipeg, South Eastman, Central, Brandon, Assiniboine, Parkland, Interlake, most districts in North Eastman, and a few in the North. However, the regression modeling

[1] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

shows that after accounting for a variety of factors, the areas with low **suicide** rates were: the South and the most healthy areas of Winnipeg. **Suicide attempts** were modeled separately and the areas with low rates were: Central, South Eastman, Interlake, Assiniboine, and the Winnipeg CAs of St. James, Fort Garry, St. Vital, St. Bonifice, River East, Seven Oaks, Inkster, and Downtown.

Suicide:

- Individual characteristics that **increased** the likelihood of **suicide**—being male, being older, residing in a lower income neighbourhood, and having physical and mental health problems (especially mental illness).
- Geographical characteristics that **decreased** the likelihood of **suicide**, after controlling for all other factors—living in the South or in the most healthy area of Winnipeg.

Suicide Attempts:

- Individual characteristics that **increased** the likelihood of **suicide attempts**—being female, being younger (this is particularly a factor for females since female rates are higher in the young, but become similar to male rates in the mid– to older adult range), residing in a lower income neighbourhood, and having both physical and mental health problems (especially mental illness).
- Geographical characteristics that **decreased** the likelihood of **suicide attempt**, after controlling for all other factors—living in Central, South Eastman, Interlake or Assiniboine RHAs or in most CAs of Winnipeg (no Winnipeg CA has an elevated risk once controlling for individual factors). The Downtown CA in Winnipeg actually has a **decreased** likelihood of suicide attempt compared to the province, when controlling for all of the individual characteristics (we could not do a similar analysis at the CA level for suicides given the relatively rare occurrence and the small populations).

How the above are associated with descriptive information on policy, program or support initiatives to reduce suicide and suicide attempts:

- Manitoba Health has consistently put effort into suicide prevention programs and support services over the entire twenty years of this report with interventions for health professional education, crisis services for mental health, rural/farm stress lines, the Manitoba Aboriginal Committee for Suicide Prevention, ASIST training (suicide awareness and intervention workshops), various mental health and addictions initiatives, and data surveillance through evaluation and research (see Appendix 5 for further details). Many of the provincial mental health programs address suicide prevention including mobile crisis units, crisis stabilization units and safe houses, crisis lines, and peer support help lines.
- Many RHAs have incorporated suicide prevention and mental health strategies since 2004. However, those regions that show the lowest rates of suicide and suicide attempts in the most recent period (according to the regression modeling) were: Central, South Eastman, Interlake, Assiniboine, and most of Winnipeg. According to the maps a trends Parkland and Brandon RHAs have the best long–term trends. These RHAs appear to have the most long–standing preventive programs including an emphasis on health care provision through Psychiatric Crisis Units and Centres and Trauma Teams and support through hot lines (and in Winnipeg, SPEAK and Teen Talk).

- There has been a proliferation of policies, programs and support systems since 2003 throughout the province. It will be particularly interesting to track the rates over the next ten years.

6.3 Comparison of Pertinent Literature Reviews and *Our Study Results*

6.3.1 Suicide, Suicide Attempt, and Suicidal Ideation Rates:

Using data from the Canadian Community Health Survey 2000/2001, the percentage of people aged 15+ who had suicidal thoughts (called "suicidal ideation") varied by area (Statistics Canada CANSIM Table 105–0070). Each of the percentages generated in this table had a note to interpret with caution, given the high coefficient of variation. Percentages of males considering suicide in the past 12 months varied from a low of 1.3% in Nova Scotia and Manitoba, to a high of 2.5% and 2.7% in Quebec and the Yukon respectively. Percentages of females considering suicide in the past twelve months varied from lows of 1.8–1.9% in Nova Scotia, New Brunswick and Manitoba to highs of 2.6% in the NWT, 2.8% in Quebec and 3.7% in Nunavut. Percentages of those actually attempting suicide in the past 12 months also varied across Canada—for males, most rates were suppressed, but Quebec was the highest at 0.5%. For females, the lowest was in Manitoba at 0.2%. Higher rates were 0.6% in Nova Scotia, Quebec, and Alberta, and the highest rate was in Nunavut at 4.9%. For both sexes combined, Manitoba's rate was 0.3% once again the lowest rate for all provinces. Nova Scotia was the highest at 0.6% overall. The territories of Nunavut (3.2%) and NWT (1.6%) were extremely high compared to the rest of Canada.

Interestingly, in our current study the rate of suicide or suicide attempts for the province was 0.17% (two year prevalence) for the 1996/97–2003/04 time period. The one year CCHS prevalence of self–reported suicide attempts for both males and females was 0.3% (0.2% for females only). It is not surprising that the prevalence estimate from administrative data is lower than self–report rates because of coding issues (some may be coded unintentional injury) and because not all suicide attempts result in a contact with the health care system. However, a cautionary note must be made that CCHS does not include people living in First Nations communities, so the Manitoba CCHS rate may be understated. This is corroborated by the fact that our recorded suicide and suicide attempt rates are highest in the areas of the province having the greatest population living "on–reserve".

From our previous MCHP report on mental illness in Manitoba (Martens et al. 2004), the annual age– and sex–adjusted rates for aged 10+ years over the five year period 1997–2001 were: suicide rate—0.13 per 1000 aged 10+ years, suicide attempt rate—0.5 per 1000 males and 1.0 per 1000 females, and the prevalence of individuals who completed or attempted suicide—0.08% for males and 0.1% for females per year.

In our current report, we used the two year prevalence for modeling purposes. Our two year prevalence of individuals aged 10+ who completed or attempted suicide was 0.17% which is approximately double the annual prevalence (on average, around 0.9%) from the previous report. This in itself is interesting as it implies that the overlap of individuals from one year to the next is not substantial (i.e., there are almost twice as many unique people that require treatment in the two year period compared to the one year period).

Globally, in 2002, 877,000 lives were estimated to be lost because of suicide. This represents 1.5% of the global burden of disease or over 20 million disability–adjusted life years (Mann et al. 2005). The highest annual suicide rates are in Eastern Europe where 10 countries had over 27 suicides per 100,000 persons compared to 13 per 1000 in Manitoba. Latin American and Muslim countries had the lowest rates at less than 6.5 per 100,000. The USA rate was 11.0 per 100,000 per year (dropping from 19 per 100,000 in 1996) with a suicide attempt rate estimated at 0.6% and suicidal ideation rate at 3.3% (Clemmitt 2000; Mann et al. 2005).

According to the WHO, the Canadian suicide rate in the year 2000 was 15 per 100,000 (Canadian Mental Health Association 2006). However, Statistics Canada reported lower rates per 100,000 which were declining over time: 14.0 in 1981, 13.3 in 1991, 13.2 in 1996, and 12.3 in 1997 (Statistics Canada 2005). A study of Canadian suicide rates for ages 10+ from 1979 to 1998 (Leenaars and Lester 2004) showed a statistically significant decline (Pearson $r = -0.77$; two–tailed $p<.001$). By province, significant declines were found in Ontario, Manitoba, Saskatchewan and British Columbia; significant increases were found for Newfoundland and Quebec; and the remaining provinces showed no significant changes over this period.

In the most recent period for which there is data, Statistics Canada has found little change (possibly a decline, but erratic) with overall age– and sex–adjusted suicide rates per 100,000 at 11.7, 11.9, 11.6, 11.9 and 11.3 each year from 2000 through 2004 (Statistics Canada CANSIM Tables 102–0551 and102–0552). The male rates show more improvement at 18.0, 18.0, 17.7, 17.8 and 16.6 respectively; female rates tend to be level over these five years at 5.0, 5.0, 4.9, 5.1 and 5.1. For suicides that are related to firearms, male rates have decreased from 4.1 in 2000 to 3.2 per 100,000 in 2004. Female rates have remained steady at 0.2 per 100,000.

These Canadian trends are very similar to our Manitoba results from 2000 to 2004, Manitoba's overall age– and sex–adjusted suicide rates per 100,000 were 11.5, 11.2, 11.1, 14.2 and 11.3 respectively. Manitoba's age–adjusted male suicide rate declined from 18.1 to 15.7 per 100,000 for males, but female rates rose slightly from 5.3 to 6.8 per 100,000. Firearm–related suicides in Manitoba dropped overall from 2.6 per 100,000 in 2000 to 1.7 per 100,000 in 2004. The drop was mainly influenced by males (from 5.1 to 3.2 per 100,000), but remained somewhat steady (around 0.2 to 0.1 per 100,000) for females (Statistics Canada CANSIM Tables 102–0551 and 102–0552).

Excluding the territories, the provincial male suicide rates for 2004 were the highest in Quebec (21.8 per 100,000) and Alberta (20.8) for males, whereas females were highest in Quebec (7.0) and Manitoba (6.8). Manitoba's 2004 male rates were lower than the rest of the western provinces. Manitoba saw a substantial decline over the five years whereas Saskatchewan, Alberta and BC male rates all saw very little improvement or worsening rates. In contrast, Manitoba female suicide rates showed an increase over the five years opposite to the rest of the western provinces where declines were observed. So for the western provinces, Manitoba had the lowest rate for males and the highest rate for females in 2004 (Statistics Canada CANSIM Tables 102–0551 and 102–0552).

6.3.2 Policy and Program Initiatives Pertinent to Decreasing Suicide and Suicide Attempts:

There are multiple causes of suicidal behaviour, thus multi–faceted approaches to suicide prevention are required (Mann et al. 2005). **Psychiatric illness** is the major contributor, with over 90% of suicides having a DSM–IV psychiatric illness. Around 60% of those completing suicide have diagnoses of mood disorders, major depressive disorder and bipolar disorder (Mann et al. 2005). Other contributing factors include: availability of lethal means, alcohol and drug abuse, limited access to psychiatric treatment, cultural attitudes to suicide, avoidance of help–seeking behavior, physical illness, marital status, age, and sex. (Mann et al. 2005). In a recent Manitoba study on mental illness (Martens et al. 2004), predictors of those who attempted or completed suicide included: region of the province, sex, age, a mental illness diagnosis in the year previous, income, and physical illness. "Rural" residence is a strong risk factor for suicide and suicide attempts, both in our Manitoba studies and in Australia (Judd et al. 2006). Judd et al. (2006) attribute high suicide rates in rural Australia to socioeconomic decline, barriers to service utilization such as service availability and accessibility, rural culture, rural community attitudes to mental illness and help–seeking, and greater exposure to firearms.

So the question becomes, what works in suicide prevention?

- In an ecologic study by Leenaars et al. (2004), there was a significant inverse relationship between **suicide prevention centres** and suicide rate. The more suicide prevention centres there were in a Canadian province in 1984, the more likely the suicide rate declined during the twenty year period from 1979 to 1998 (Pearson $r = -.59$, two–tailed $p = 0.044$). This method does not take into account other social variables, but it mirrors a meta–analysis (Leenaars and Lester 1995) which found a similar result with earlier data.
- A Cochrane Collaboration review (Malone et al. 2007) of **community mental health team management** found that there was greater acceptance of this treatment by those with mental illness compared to standard care. Mental health teams may also reduce hospital admission and reduce suicide, but this needs further study.

In 2005, suicide experts from 15 countries convened to review the effectiveness of suicide prevention efforts; despite a lack of evidence about the effectiveness of some of the key components (Mann et al. 2005). Other review articles and intervention studies have strengthened this consensus and the following are considered the best strategies given the current level of knowledge:

- **Educating the general public and professionals** to improve recognition of suicide risk factors and reduce stigmatization of mental illness and suicide (Mann et al. 2005).
- **Educating physicians and 'gatekeepers'** (i.e., clergy, first responders, pharmacists, geriatric caregivers, and employees of schools, prisons and the military). This has shown the most promise regarding prevention effectiveness and "means" restriction (Mann et al. 2005; Goldney 2005). Because the highest incidence of self–inflicted poisoning in Canada is for women aged 20–40s by tranquillizers, analgesics, anti–depressants and other psychotropic medications, physicians and pharmacists must monitor such prescriptions carefully (Canada Safety Council 2006).
- **Screening** high–risk people to identify those at risk and direct them to treatment. Because up to 83% of suicides have had contact with a primary care physician within a year of their death and

up to 66% within a month, the key prevention strategy is **improved screening of depressed patients by primary care physicians** and better treatment of major depression (Mann et al. 2005). Linking any suicide prevention strategy to mental health programs in communities is essential (Potter et al. 1995).

- **Treating psychiatric disorders** through pharmacotherapy and psychotherapy and **ensuring follow–up** after suicide attempts (Mann et al. 2005; Goldney 2005). Although the use of antidepressant treatment has been posited as reducing teen suicide in the USA (Gould et al. 2003), a cautionary Cochrane review and meta–analysis (Fergusson et al. 2005) shows an increased risk for suicide if SSRIs are prescribed (compared to placebos and to antidepressants other than tricyclic antidepressants). In a review of prevention of self–harm (parasuicide), it was noted that certain forms of pharmacotherapy may show promise, as well as, behavioural therapy (Hawton et al. 1998).
- **Restricted access to lethal means**. Examples include firearms restrictions in Canada and Washington DC and barbiturate restriction in Australia (Mann et al. 2005). Besides physician and gatekeeper education, reducing access to guns results in a decrease in suicides (Canada Safety Council 2006). According to Haw et al. (2004), the international literature provides evidence of a strong association between rates of gun ownership and gunshot suicide and some evidence of a reduction in firearm suicide rates following the introduction of restrictive firearm legislation. For example, gunshot suicides in the UK have declined by over 50% in a twenty–year period where firearm legislation has become increasingly more restrictive and rates of gun ownership have declined.
- **Responsible media reporting.** Media blackouts on suicide reporting have coincided with decreases in suicide rates (Mann et al. 2005). If a suicide is covered, reporting must be responsible and sensitive (Canada Safety Council 2006). The media can help prevention by being a form of public education or hinder it by glamorizing suicide thus encouraging copycat suicides (e.g., publicizing suicide “hot spots” may encourage vulnerable people).

New Zealand also developed a suicide prevention strategy in 2006 (Beaudrais et al. 2007). Their review of the literature suggested that the most promising interventions were **physician and gatekeeper education** and **restriction of access to lethal means** of suicide. A review of the literature related to youth suicide in the USA (Gould et al. 2003) found that psychiatric disorders, a family history of suicide and psychopathology, stressful life events, and access to firearms are key risk factors. Plausible strategies suggested by this review also mirror those already listed above, as well as **school–based skills training for students**, screening for at–risk youths, education of primary care physicians, media education and lethal–means restriction. Given the interest in school–based education, it is also important to note that a Cochrane review (Merry et al. 2004) did not find universal programs to be effective in reducing depression (although **targeted programs** may show some benefit, it may be dependent upon gender), but more valid and reliable studies were encouraged.

Similar to the worldwide literature, our report found that the strongest predictor of suicide and suicide attempts was co–occurring mental illness. Geography (living in northern areas) was also a strong predictor. Patterns differed by age and sex (males were more likely to complete suicide while females were more likely to attempt suicide and the "gap" varied by age) and risk increased with lower socioeconomic status and with increasing physical comorbidities.

Interestingly, we observed that those RHAs with lower suicide and suicide attempt rates had: a long–term emphasis on heath care provision through mental health crisis units, centres and trauma teams; peer/professional support through "hot lines"; and urban educational programs. This parallels the findings from the literature where education of physicians and other gatekeepers, availability of psychiatric centres and mental health management teams are all related to decreasing suicide rates. Although it is difficult to tell without a much more rigorous analysis, gun legislation has become tighter in Canada, and this may be reducing gun–related suicide events.

6.4 Recommendations

- Continue to strengthen the accessibility of community mental health teams and crisis intervention units/centres. Suicide prevention strategies are closely intertwined with mental health initiatives. As such, physicians and other gatekeepers will need ongoing education for screening depressed patients, for referring them to mental health providers and for restricting access to lethal pharmaceuticals.
- Continue to strengthen primary care initiatives and the education of family physicians/other primary health care providers to screen and treat people with mental illness.
- Work with the media to ensure responsible media reporting of suicide events.
- Continue to study the effects of lethal weapon restrictions on reductions in suicide rates. According to worldwide reviews, gun legislation has been associated with reduced gun–related self–inflicted injuries and suicides, so we need to continue on this pathway given the current state of the evidence.
- Explore creative programs to reduce suicide and suicide attempts in "hot spots" within Manitoba, particularly in the North. Continue to evaluate some of the northern RHA and district programs which show particular promise in reducing suicide and suicide attempt rates.

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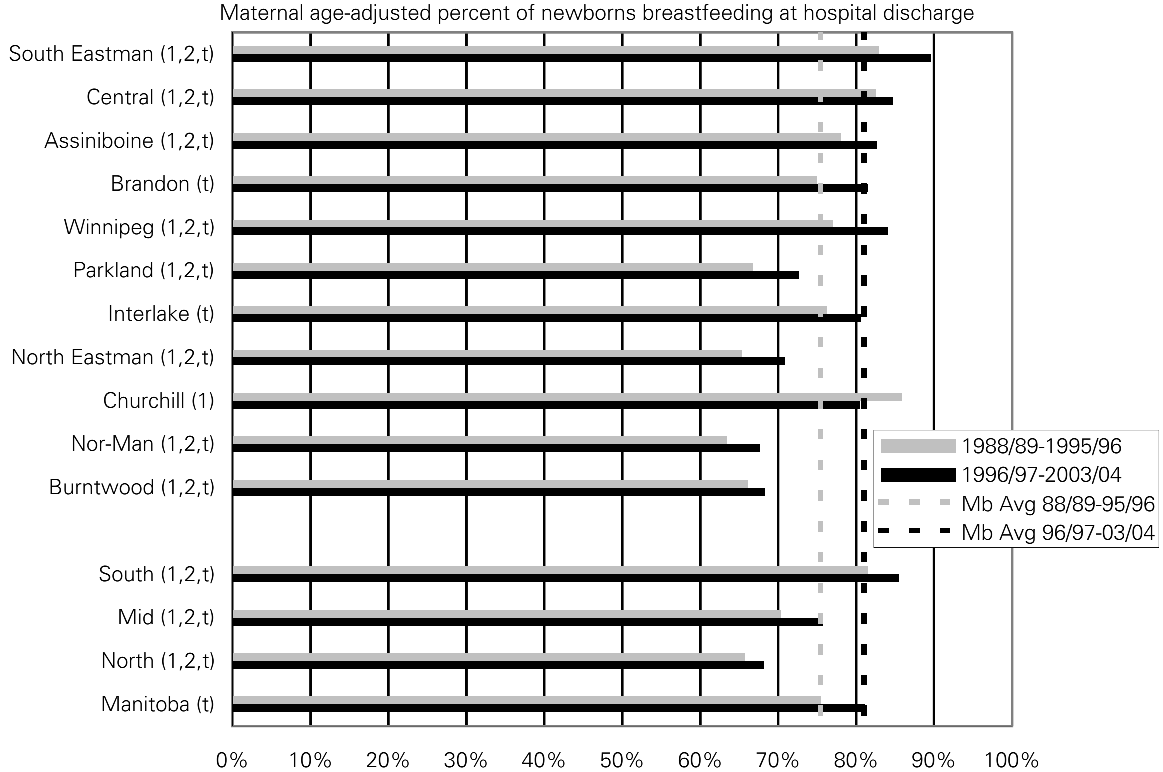
CHAPTER 7: BREASTFEEDING INITIATION

7.1 Definition, Graphs and Maps

Breastfeeding initiation rates are shown as the percentages of live born babies born in a Manitoba hospital who were exclusively or partially breastfed (information recorded on the hospital discharge abstract). Our analysis includes births from 1988/89–2003/04 fiscal years. Region of residence assignment is based on the hospital birth record. Live births are defined by newborn hospitalizations with one of diagnosis codes V30 to V39 in any diagnosis field. Breastfeeding is defined by the breastfeeding field on the hospital abstract equal to either 1 (breast) or 3 (both breast and artificial). Newborn hospitalizations with a missing value for breastfeeding are excluded from both the numerator and the denominator. For Manitoba overall, 2.6% of births had missing information, varying by year and by region (see Glossary under "breastfeeding initiation rate" for detailed information about missing information and out–of–province births). RHAs in recent years have relatively few births missing this information with the exceptions of Assiniboine and Parkland.

Figure 7.1: Breastfeeding Initiation Rates by RHA

Maternal age-adjusted percent of newborns breastfeeding at hospital discharge

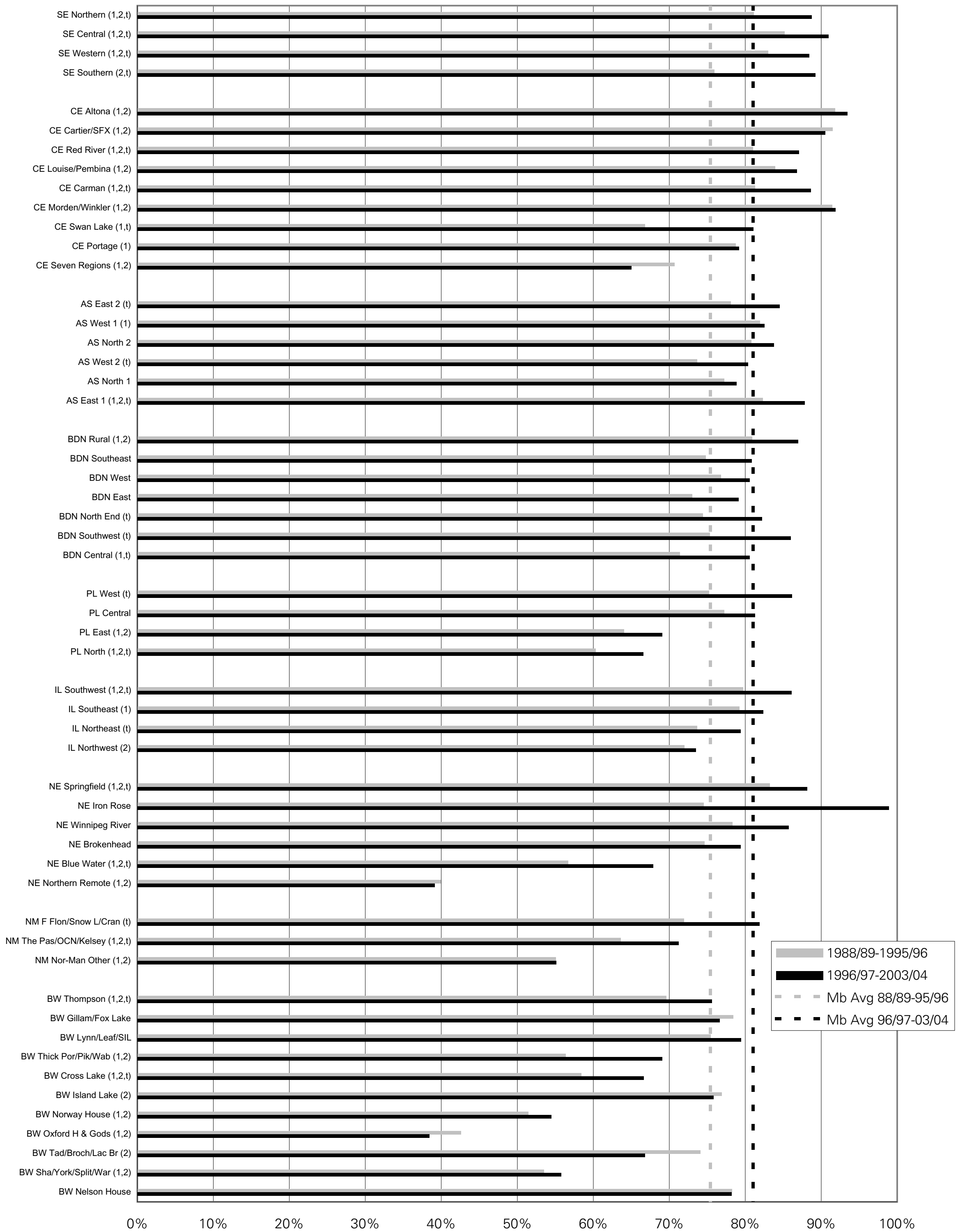


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 7.2: Breastfeeding Initiation Rates by District

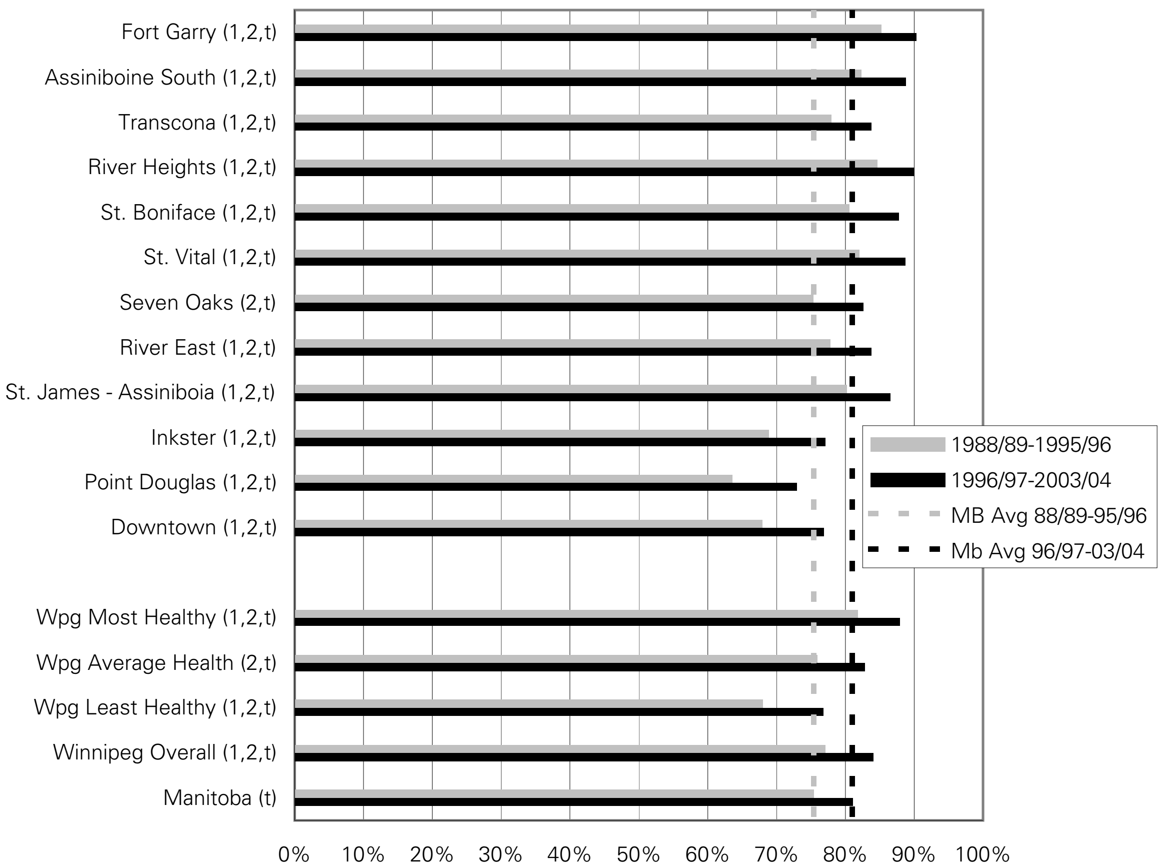
Maternal age-adjusted percent of newborns breastfeeding at hospital discharge



Source: Manitoba Centre for Health Policy, 2008

Figure 7.3: Breastfeeding Initiation Rates by Winnipeg Community Areas

Maternal age-adjusted percent of newborns breastfeeding at hospital discharge

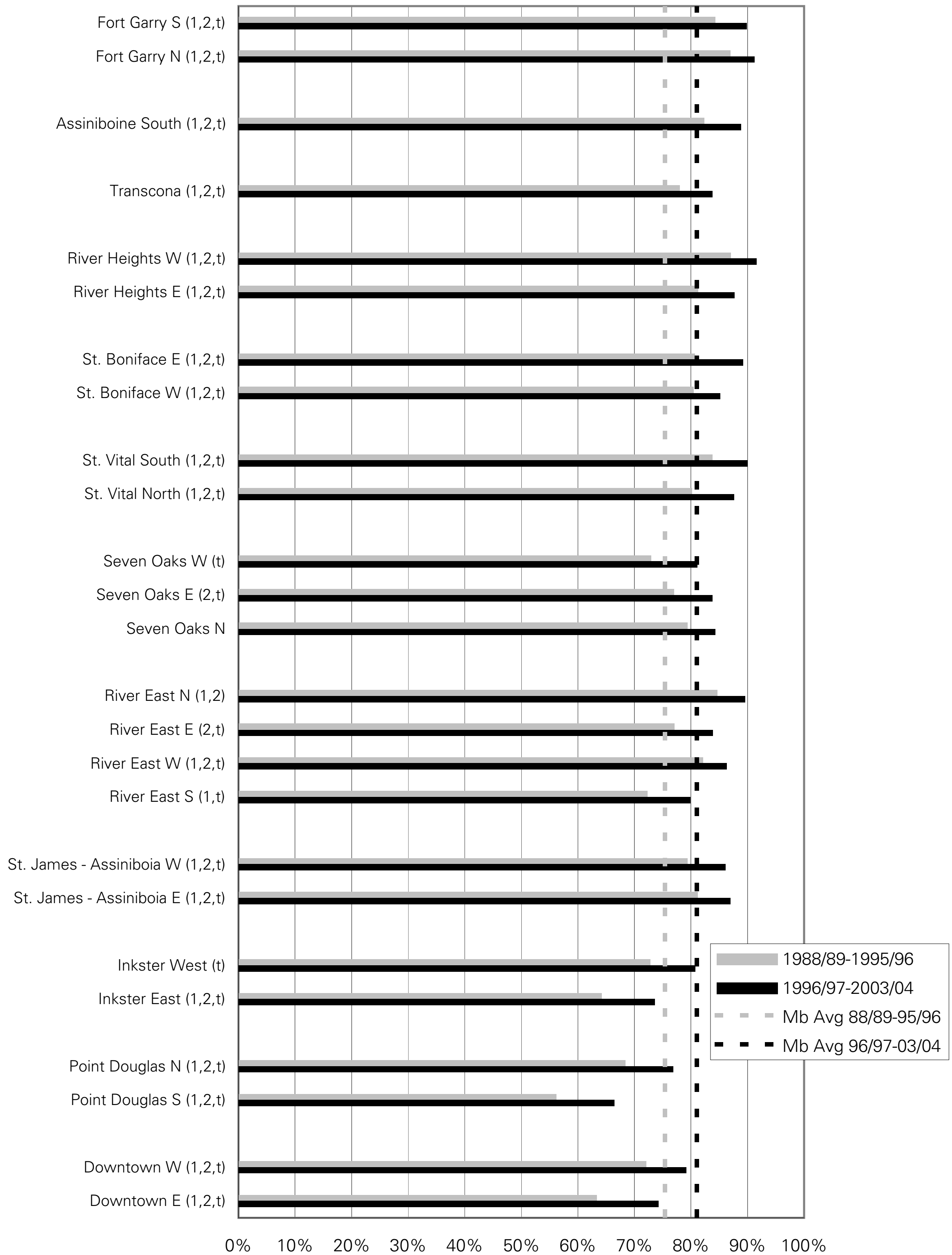


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 7.4: Breastfeeding Initiation Rates by Winnipeg Neighbourhood Clusters

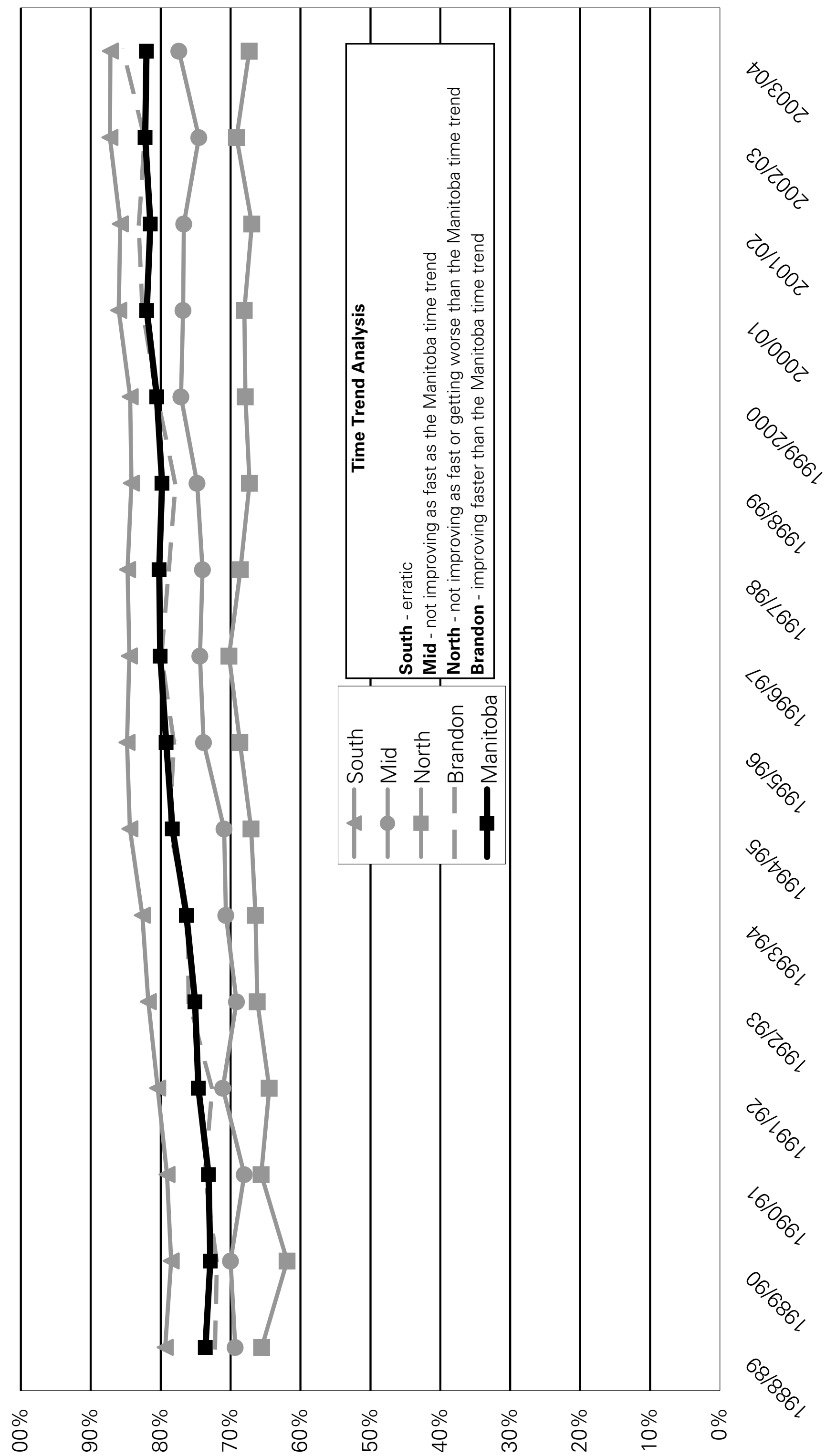
Maternal age-adjusted percent of newborns breastfeeding at hospital discharge



Source: Manitoba Centre for Health Policy, 2008

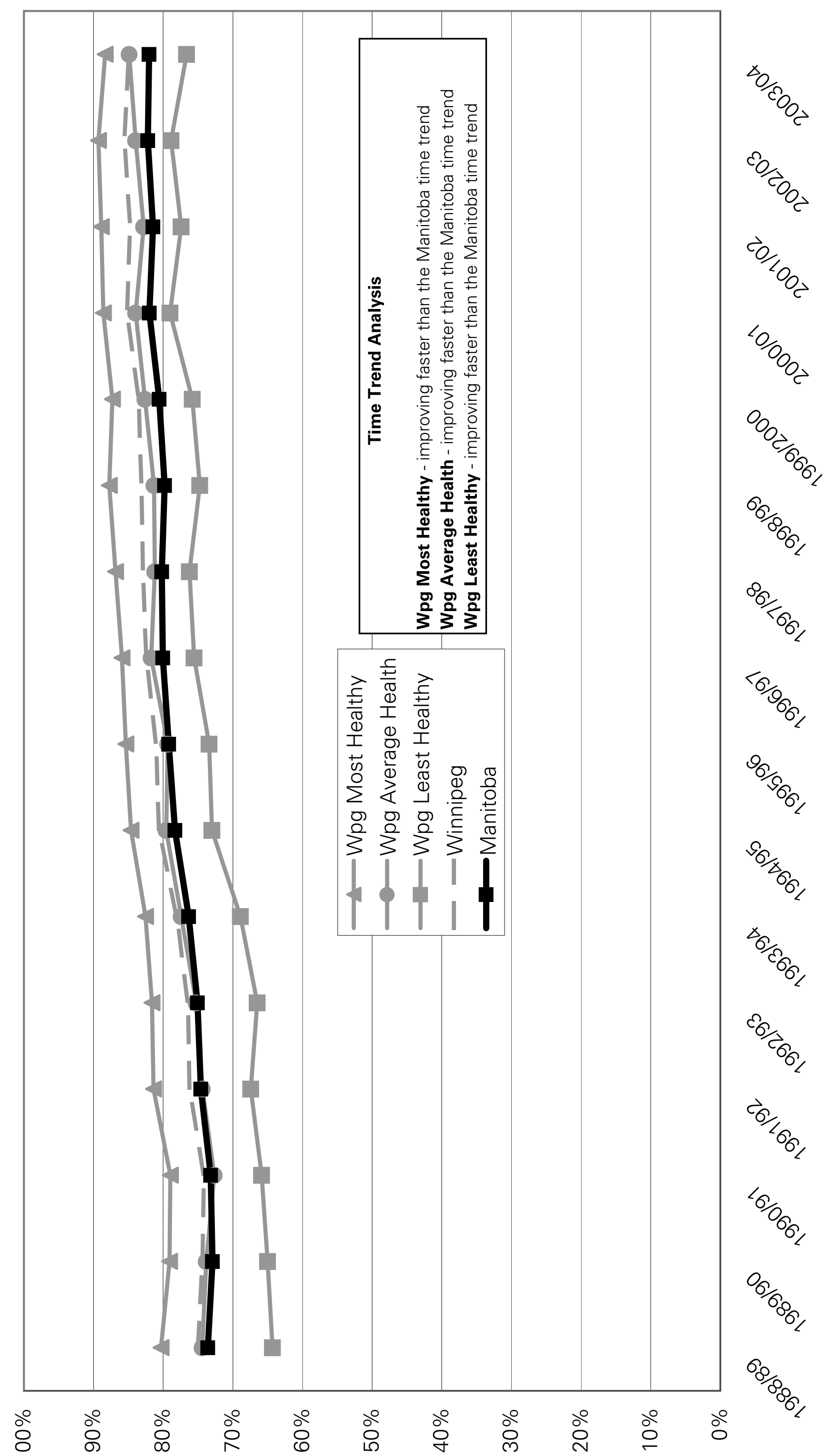
Figure 7.5: Trends in Non-Winnipeg Breastfeeding Initiation Rates

Maternal age-adjusted percent of newborns breastfeeding at hospital discharge



Source: Manitoba Centre for Health Policy, 2008

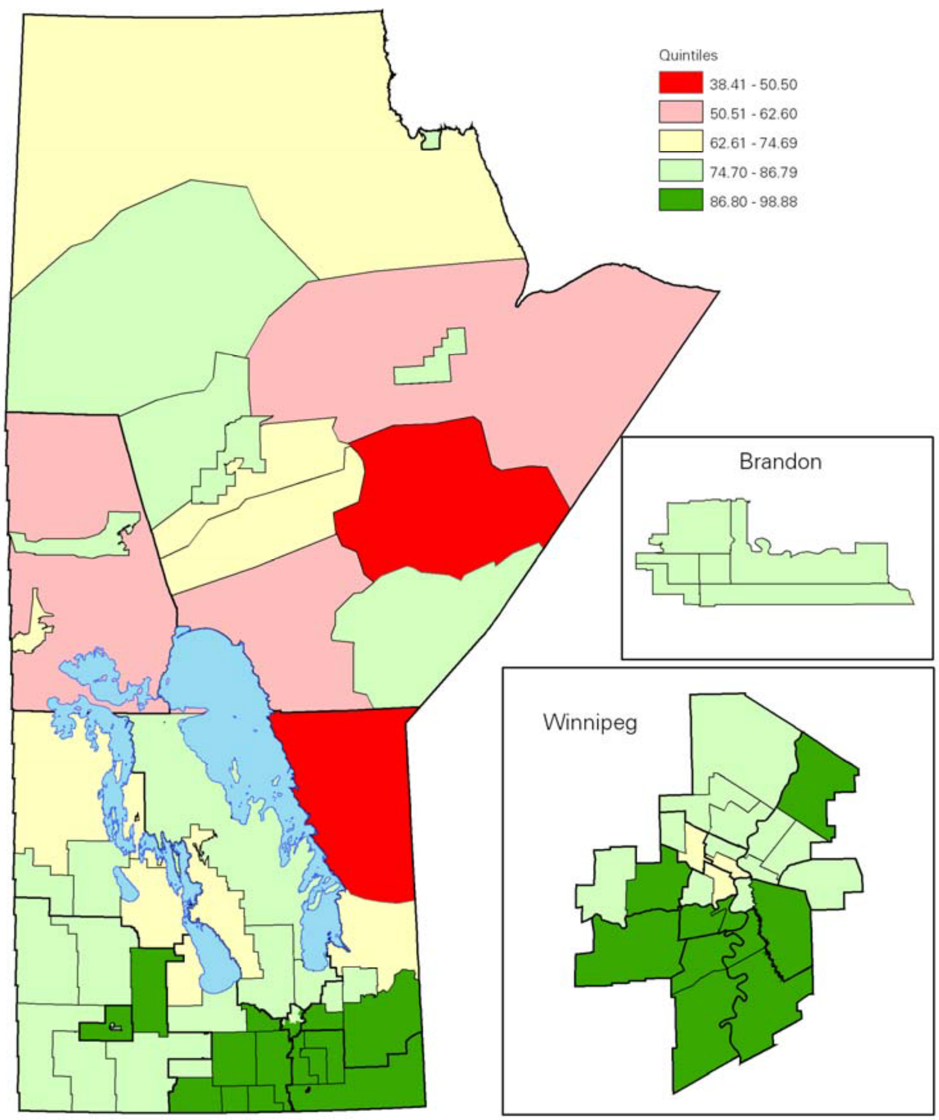
Figure 7.6: Trends in Winnipeg Breastfeeding Initiation Rates
Maternal age-adjusted percent of newborns breastfeeding at hospital discharge



Source: Manitoba Centre for Health Policy, 2008

Figure 7.7: Breastfeeding Initiation Rate Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

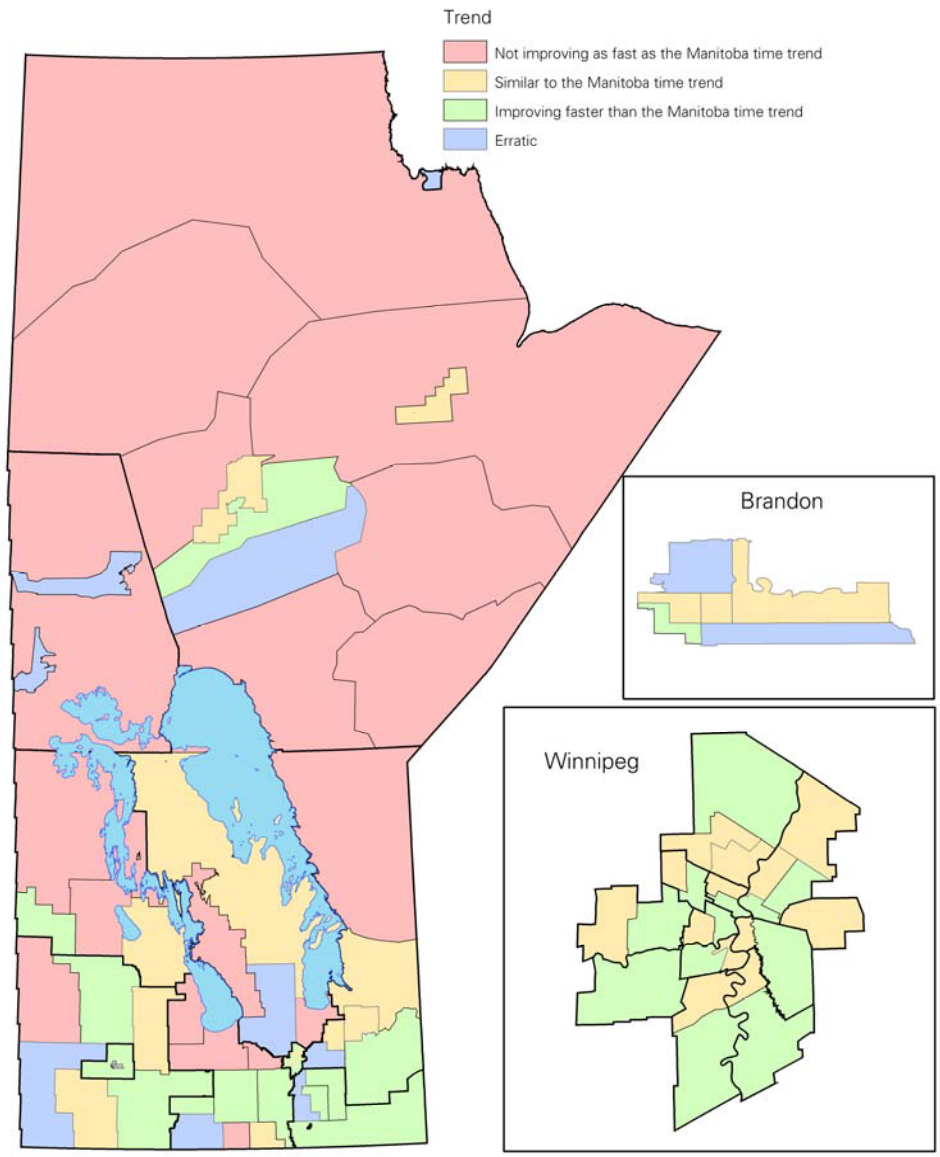
Maternal age-adjusted percent of newborns breastfeeding at hospital discharge 1996/97 – 2003/04



Source: Manitoba Centre for Health Policy, 2008

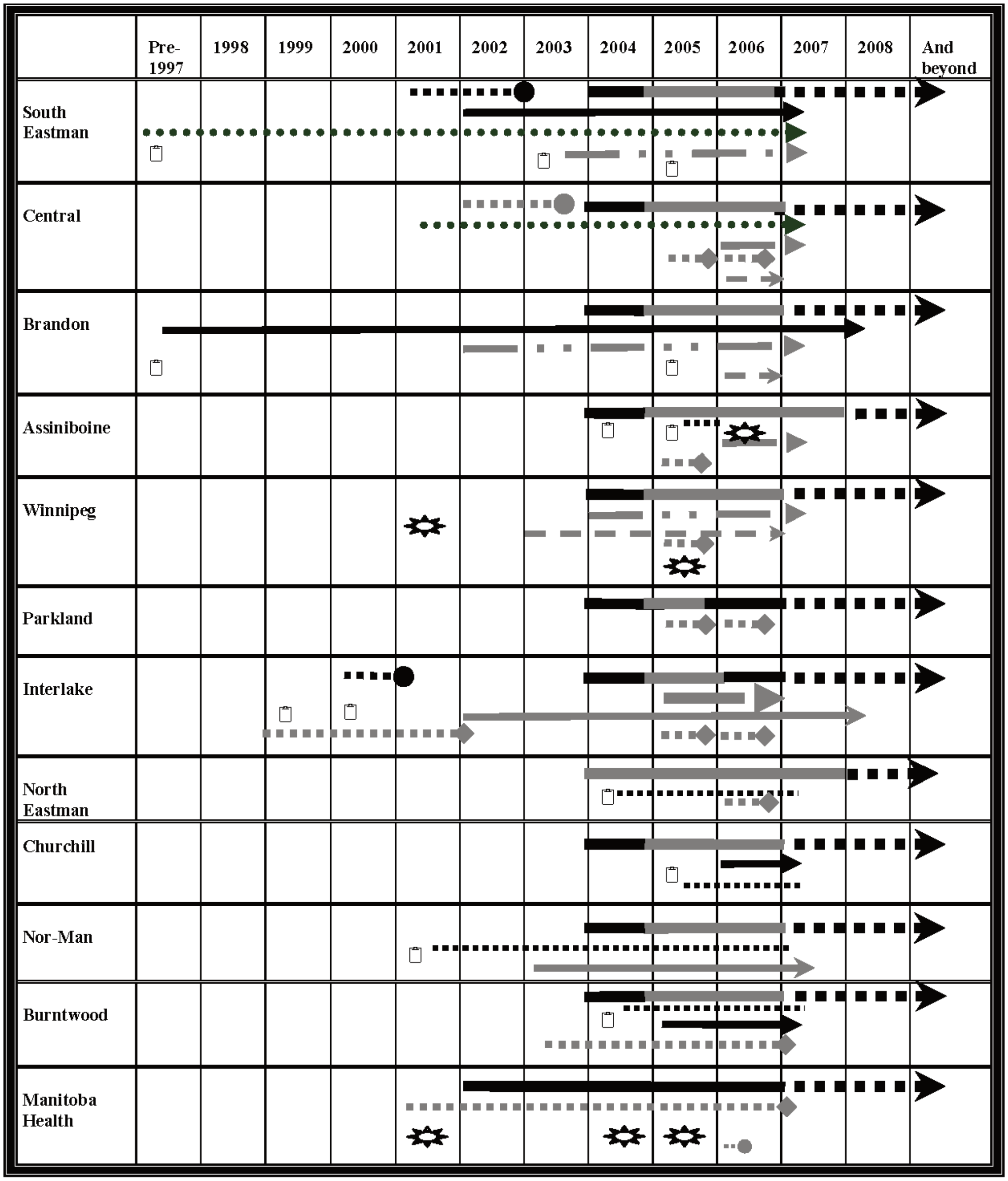
Figure 7.8: Trends in Breastfeeding Initiation Rates by RHA Districts and Winnipeg Neighbourhood Clusters

Maternal age-adjusted percent of newborns breastfeeding at hospital discharge 1988/89 – 2003/04



Source: Manitoba Centre for Health Policy, 2008

Table 7.1: Breastfeeding promotion, policy, and support initiatives



Most Breastfeeding Performance Deliverables incorporate Action Plans reflected in RHA interviews

Breastfeeding Performance Deliverables (transition to regional strategies with new reporting system)

Early Regional Strategy or Strategic Plan RHA re-priorized breastfeeding with re-organization

≥1 hospitals in region have baby friendly breastfeeding policies RHA Breastfeeding Policy

Breastfeeding guidelines implemented in region (incorporate 10 steps from Baby Friendly policy)

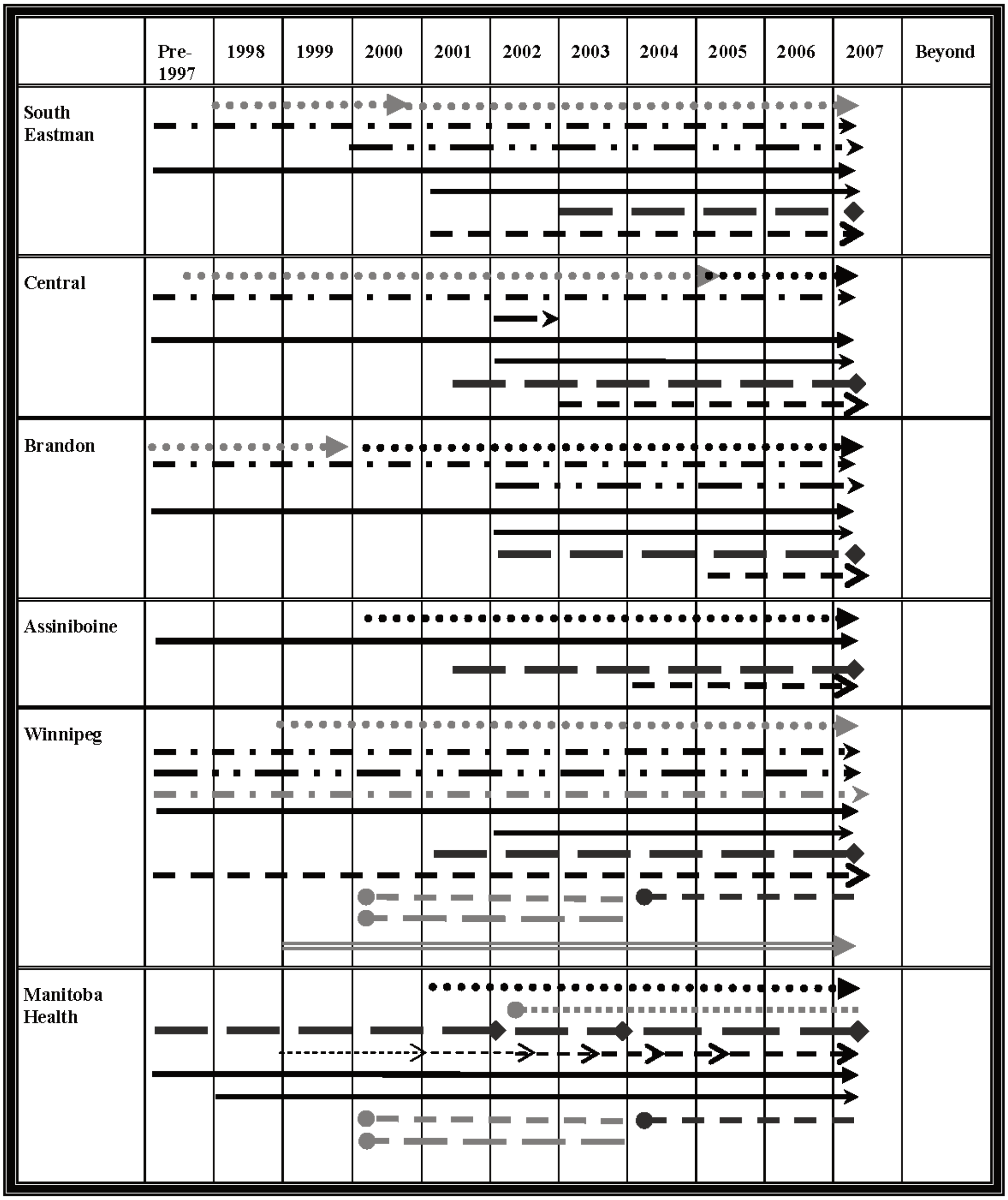
Meets WHO Baby Friendly standard to buy infant formula at wholesale prices in ≥1 hospitals in the region

Health provider education mandated to most regional antepartum staff Douglas College course available

RHA Breastfeeding survey RHA Breastfeeding data base

MB Healthy Baby / First breastfeeding education to all regions MB Health breastfeeding resources available to all regions

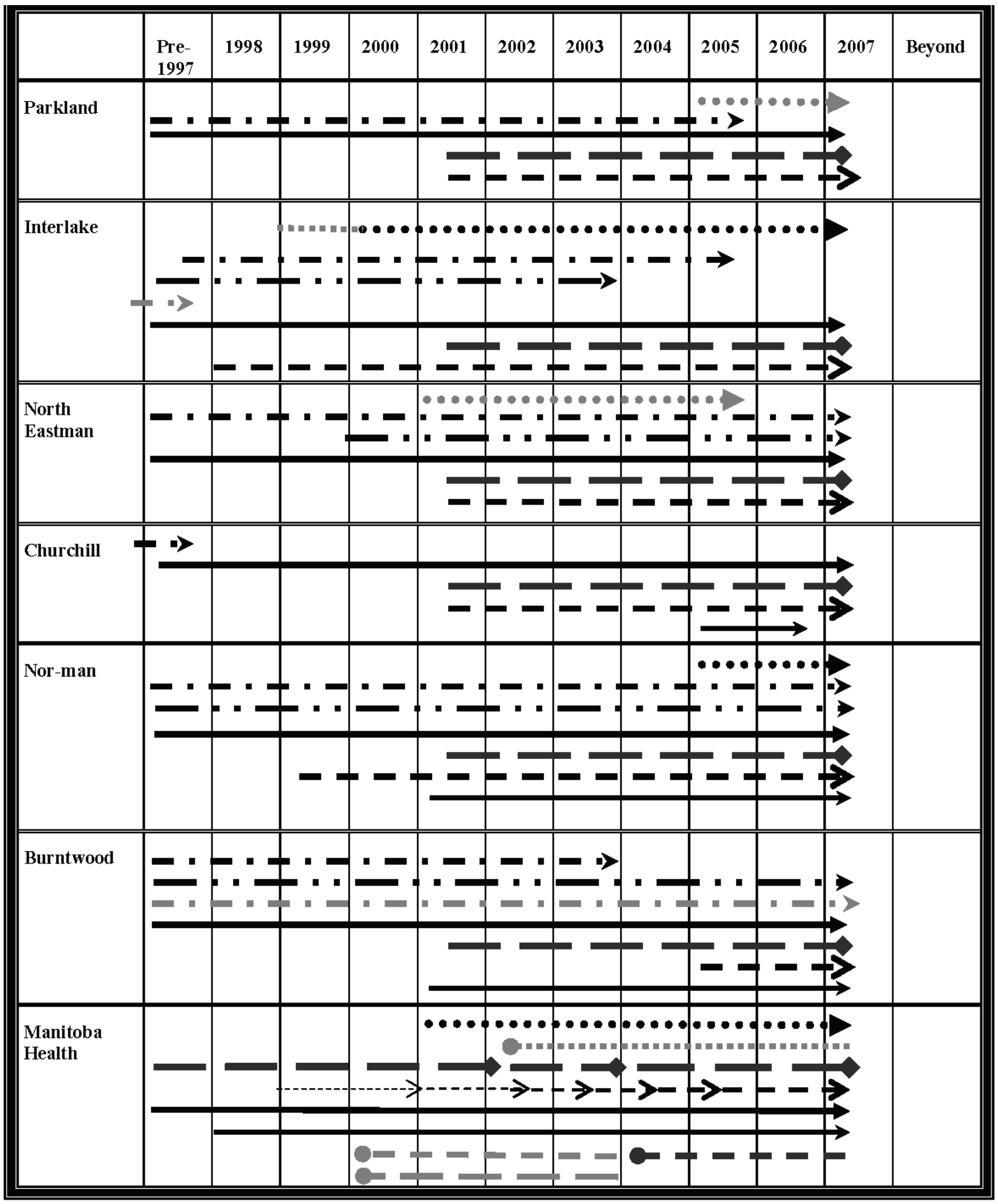
Table 7.2: Breastfeeding support–Healthy Baby, Families First, La Leche League, Lactation Consultants



International Board Certified Lactation Consultants in region Employed / Funded
La Leche League Leaders (volunteer support organization Other Bf Support Groups
Canada Prenatal Nutrition Programs (CPNP)

All RHas have the following programs. Program expansion shown on Manitoba Health only.
Public Health Nurse Programs MB Midwifery Program starts
MB Health Healthy Baby programs Program expanded
MB Health Families First programs Program expanded
Breastfeeding Hotlines - Women's Victoria Health Links took over
Breastfeeding Clinic

Table 7.2: Continued



International Board Certified Lactation Consultants in region — Employed / Funded
La Leche League Leaders (volunteer support organization) — Other Bf Support Groups
Canada Prenatal Nutrition Programs (CPNP)

All RHas have the following programs. Program expansion shown on Manitoba Health only.
Public Health Nurse Programs — MB Midwifery Program starts
MB Health Healthy Baby programs — Program expanded
MB Health Families First programs — Program expanded
Breastfeeding Hotlines - Women's — Victoria — Health Links took over
Breastfeeding Clinic

7.2 Discussion

What the figures and maps tell us about overall rates and trends in breastfeeding initiation:

- Generally, breastfeeding initiation rates are lower in areas that have the poorest overall health status both in non–Winnipeg RHAs and in Winnipeg CAs.
- The highest rates in the province are mostly in south and mid–Manitoba, Winnipeg and Brandon; the lowest rates are generally in northern RHAs (with the lowest rates in Oxford House/God's Lake district of Burntwood RHA and Northern Remote district in North Eastman RHA).
- There has been a steady increase in breastfeeding initiation rates over time provincially (75.4% to 81.0% from 1988/89–1995/96 to 1996/97–2003/04) with the rate at 73.6% in 1988/89 and 82.0% in 2003/04.
- The most rapid increases in breastfeeding initiation rates are seen mostly in southern Manitoba, including most of South Eastman RHA, parts of Central, Brandon, Assiniboine and Parkland RHAs and about half the NCs of Winnipeg. Some of the largest percentage increases are seen in the most vulnerable areas of Winnipeg (Inkster, Point Douglas, and Downtown).
- The "least healthy" aggregate grouping of Winnipeg demonstrates the most rapid "catch up" to the Manitoba average[1]. In contrast, the North aggregate area shows low rates and very little increase over time, basically leveling off since the mid–1990s.
- From 1988/89 to 2003/04, the disparity in breastfeeding rates in the non–Winnipeg aggregate areas has somewhat increased. This is due primarily to the very slow increase in rates in the North in contrast to the steadily increasing rates in the rest of the province. In Winnipeg, however, the disparity has decreased, due mainly to the more rapid increase in breastfeeding rates in the least healthy sub–region of Winnipeg, compared to the steadily increasing rates in the rest of Winnipeg.

What the regression modeling[2] tells us about predictors of breastfeeding initiation in the year 2003/04 (for the complete regression model, refer to Appendix 4):

- Individual characteristics that **increase** the likelihood of breastfeeding—the older the mother is at the birth of her firstborn child, higher average neighbourhood income of the area in which the mother lives, and higher newborn weight and gestational age.

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[1] A statistical testing of breastfeeding trends (GEE modeling) for the Winnipeg Least Healthy area indicates that using 1994 as the start of the "after" period (i.e., after the beginning of national and provincial programs such as CPNP), there was a significant trend to increasing breastfeeding rates ($p<.0001$) both before and after with no change in slopes ($p=.34$, NS). However, there was a significant "jump" in rates (i.e., the intercept of the model increased) after 1994 compared to before 1994 ($p<.0022$).

[2] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

- Individual characteristics that **decrease** the likelihood of breastfeeding—the greater the number of children born to the woman, having a C–Section birth, and the mother having physical health difficulties.
- Geographical characteristics that **increase** the likelihood of breastfeeding—residing in Central and South Eastman RHAs and the Winnipeg CAs of St. Vital and River Heights.
- Hospital characteristics that **increase** the likelihood of breastfeeding—giving birth in Steinbach Bethesda Hospital or Boundary Trails (Morden/Winkler) Hospital.

How the above are associated with descriptive information on policy, program or support initiatives:

- South Eastman is the most consistently positive RHA in the province for breastfeeding rates and trends. All districts have high breastfeeding rates, and most districts show trends increasing faster than the Manitoba time trend. This RHA is also the most active as far as consistent promotion, policy and support initiatives over the longest period of time. It is the only RHA that showed an independent positive effect on breastfeeding initiation rates in the regression modeling after controlling for measurable individual effects. Its major hospital, Steinbach Bethesda Hospital, also showed an independent positive effect. The effect of region and hospital may be associated with breastfeeding promotion initiatives or may also reflect unmeasured individual effects such as a cultural norm of breastfeeding.
- Assiniboine, Brandon, Central, Interlake, and North Eastman have the majority of their districts with relatively high rates; however, these districts have "patchy" time trends with some showing faster improvement, others not improving as fast, and others similar to the Manitoba overall time trend. This may indicate that the many policies, programs and supports in such places as Brandon, Interlake and Central were more recent initiatives or only available to certain districts or groups (i.e., programs that do not go into First Nations communities or programs designed for vulnerable families).
- The North, as an aggregate group, has the lowest rates in the province and also has the distinction of showing very little improvement over the past 15 years (in contrast with all other aggregate regions). Even after controlling for possible individual effects in the regression model, women living in Burntwood RHA are less likely to breastfeed. This is despite the fact that Burntwood initiated several support programs/policy initiatives, although these have mainly begun after 2003.
- Winnipeg's NCs have mostly high rates, and around half of the NC's rates are improving faster than the Manitoba time trend. Winnipeg is also an RHA showing one of the highest numbers of support programs for breastfeeding. Contrary to most RHAs that show low rates in the most vulnerable areas, Winnipeg's areas of the poorest health status (Inkster, Point Douglas and Downtown) have seen rapid increases in breastfeeding rates over time. This may in part be associated with the Canada Prenatal Nutrition Programs, The Baby Friendly Manitoba strategy, regional breastfeeding strategies, community breastfeeding support, and Healthy Child Manitoba initiatives. These programs have given breastfeeding, prenatal and postnatal education and support to families in the "inner city" areas since the mid–1990s (see the Trend graph, Figure 7.6). This "inner city" area had a sharp increase, and a continued rise, which lessens the disparity with the Manitoba time trend.

7.3 Comparison of Pertinent Literature Reviews and *Our Study Results*

7.3.1 Breastfeeding Initiation Rates:

Throughout Canada, breastfeeding initiation rates have increased over time with Canadian rates at around 25% in the mid–1960s, 79% in 1999, and the 2003 CCHS showing 84.5% for Canada (95% CI 83.2–85.8%) and 88.6% (95% CI 85.0–92.2%) for Manitoba (Millar 2005; Statistics Canada CANSIM 2003; Dennis 2002).

Our current study shows increases in Manitoba rates from 73.6% in 1988/89 to 82.0% in 2003/04. The most likely reason for such a discrepancy with the CCHS 2003 results is that Statistics Canada surveys exclude people living in First Nations communities who represent a large sector of the population especially in northern Manitoba RHAs. Even given this exclusion, the higher rate may also reflect the wording of the CCHS question which ask mothers whether they "breastfed or tried to breastfeed their child even for a short time". This may be in contrast with our report data which uses the hospital discharge abstract to measure breastfeeding. Therefore, one would assume that women who attempted even one breastfeed in the hospital and then switched to formula feeds may have been recorded in the CCHS data, but not in the Manitoba hospital discharge abstract data. The 2003/04 breastfeeding initiation rates vary dramatically by geographical area—from 67.3% for the North to 88.3% for the most healthy aggregate area of Winnipeg.

7.3.2 Policy and Program Initiatives Pertinent to Increasing Breastfeeding Rates:

The World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF) have protected, promoted and supported breastfeeding since 1978 through ongoing development of international standards and policies (Dennis 2002). These include such sentinel documents as the WHO *International Code of Marketing of Breast Milk Substitutes* (1981), *Protecting, Promoting and Supporting Breastfeeding* (1989), and the *Baby Friendly Hospital Initiative* (1992). The latter document set forth maternity hospital policy called the *Ten Steps to Successful Breastfeeding* and began a world–wide accreditation process to designate hospitals who comply with these as "Baby–Friendly" (UNICEF 2007). In Canada, this accreditation is overseen by the Breastfeeding Committee for Canada. As of June 2000, there were already close to 15,000 hospitals accredited around the world (de Oliveira, Bastos Camacho, and Tedstone, 2001). Current estimates are that over 19,000 hospitals are accredited (BFHI USA 2007). As of July 2007, there are 4 BFHI–accredited hospitals in Canada (three in Quebec and one in Ontario).

Although our own study can only measure breastfeeding initiation rates using the Repository housed at MCHP, a review of the literature demonstrates that a combination of policy, program and support initiatives shows the most success in influencing both breastfeeding initiation and duration rates at a population level (Kramer et al. 2001; Merten et al. 2005). In the one randomized trial of introducing BFHI policy and practices in maternity hospitals (Kramer et al. 2001), this intervention increased the duration of breastfeeding and the degree of exclusivity of breastfeeding. It also decreased the risk of gastrointestinal tract infections and atopic eczema in the first year of life. Data from Scandinavian countries over the past 30 years shows that four interventions contributed to an increase in breastfeeding (Fairbank et al. 2000): increased problem–based informational material about breastfeeding (written mostly by and for mothers), increased availability of mother–to–mother support groups, maternity ward practices changing toward significantly greater mother–infant contact and autonomy, and increased paid maternity leave with guaranteed return to previous employment. Note that the first three reflect parts of the BFHI's Ten Steps to Successful Breastfeeding strategy.

Several reviews of the literature also demonstrate the importance of individual support for the mother. De Oliveira et al. (2001) found that successful interventions to increase breastfeeding initiation incorporated the following characteristics: combined face–to–face information, guidance, and support that are long–term and intensive; spanned the prenatal period or both the prenatal and postnatal period rather than only the postnatal period; prenatal group sessions and postnatal home visits; gave accurate information to mothers and sometimes family members related to the benefits of breastfeeding and the importance of early initiation, cue–based feeding, exclusive breastfeeding for the first six months, and the hazards of not breastfeeding; and guidance on positioning and attachment, expression and storage of breast milk, combining breastfeeding and work, and overcoming problems. The effectiveness of the intervention did not seem to be related to the kinds of personnel involved (health professionals or lay peer counselors). Dennis (2002) also found face–to–face interventions increased breastfeeding duration, and peer support may be successful for vulnerable populations.

In a systematic review, Fairbank et al. (2000) found that most studies (41/48) found a positive effect of health promotion interventions on breastfeeding initiation rates. Breastfeeding literature alone, or even in conjunction with non–interactive health education models, had limited success in increasing initiation rates. Institutional changes in hospital practices (rooming–in and early contact), peer support programs, and national health education sessions showed evidence of effectiveness in increasing initiation and duration of breastfeeding. For low–income women, peer support was successful for those intending to breastfeed but not for those who intended to bottle feed.

After controlling for other factors, our current study showed an association between high breastfeeding initiation rates and certain RHAs and hospital locations. Individual characteristics associated with higher likelihood of initiating breastfeeding were: higher age of mother at first birth, higher neighbourhood average household income, women who have fewer children, greater newborn birth weight and gestational age, not having a C–Section birth, and the mother not having major physical health problems.

However, beyond the individual characteristics, those areas (in particular South Eastman, but also sub–regions of Winnipeg and some southern districts of Central) that have the highest breastfeeding rates are also increasing the fastest. These areas have a combination of efforts in terms of hospital policy (efforts towards realizing WHO/UNICEF BFHI® and the International Code of Marketing of Breastmilk Substitutes), regional strategic plans and policies, ongoing surveys, and a combination of peer support groups and provincial support programs for vulnerable families. Both of the hospitals that showed an independent positive effect in the regression modeling for breastfeeding rates (Steinbach's Bethesda Hospital and Boundary

Trails Hospital in Winkler/Morden) have made progress towards BFHI policy including purchasing formula rather than receiving it free.

One of the profound findings of our study is the shrinking gradient in Winnipeg. The relatively high and rapidly increasing breastfeeding rates in the most vulnerable (least healthy) sub–regions of Winnipeg coincides with national and provincial perinatal programs existing since the mid–1990s. This reflects the review of the literature which suggests multi–factorial policies and programs must be in place to affect breastfeeding initiation and duration rates at a population–level.

7.4 Recommendations:

- Set up an evaluation of the Breastfeeding Performance Deliverables built into the RHA Strategic Plans. Continue to monitor breastfeeding initiation rates and trends, as well as descriptive information on policy and program initiatives, to determine the effectiveness of having breastfeeding built into the planning process by the provincial government.
- Collect breastfeeding duration information for all infants in Manitoba. Although our Manitoba population–based data are limited to breastfeeding initiation (i.e., hospital discharge information), a continued effort at collecting population–based data on breastfeeding duration should be made. The most effective method will probably be accomplished through collecting data from health care provider contacts with infants, administrative billing claims data or universal program information (e.g., through physician billing claims data, immunization recording, or other common points of collection for all babies). Relying on CCHS or NLSCY Statistics Canada surveys has the distinct disadvantage of excluding a major portion of Manitoba's population—"on–reserve" First Nations people—as well as including only small samples of the whole population (with its corresponding limitation of no information for smaller RHAs or districts).
- Further explore why one region (South Eastman RHA) and two hospitals (Steinbach's Bethesda Hospital and Morden/Winkler's Boundary Trails Hospital) show a positive and unique effect of high breastfeeding initiation rates even after controlling for other measurable maternal/newborn and socioeconomic factors. These two hospitals have worked on baby–friendly policies (although neither are BFHI accredited to date) including purchasing formula in accordance with WHO *International Code of Marketing of Breast Milk Substitutes* (1981) rather than receiving it free of charge.
- Continue to support expansion of BFHI Accreditation in Manitoba (through RHA efforts and support by the provincial Manitoba Baby Friendly Committee) because those types of policy initiatives were associated with higher breastfeeding rates.
- Further explore the effectiveness of peer and professional support programs in reducing the inequalities in breastfeeding rates and trends as seen in inner city Winnipeg's vulnerable populations.
- Many of the districts in the northern and midsections of the province show low breastfeeding rates and trends that are not improving as fast as the Manitoba average. In the case of the North aggregate area, the rates appear to be leveling off. Examining "what works" in different regions of the province, especially inner city Winnipeg with its parallel poorer health status, may benefit the northern districts and RHAs.

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CHAPTER 8: COMPLETE IMMUNIZATIONS AT TWO YEARS

8.1 Definition, Graphs and Maps

Immunization is an intervention to initiate or increase resistance against infectious disease. Rates (percentages) of complete immunization schedule compliance were calculated for two–year–old children born in fiscal years 1988/89–2001/02, and followed from birth to age two. Analyses for this report include only children born in and continuously resident in Manitoba for the complete two years. The recommended immunization schedule for children under two years of age includes (see Glossary in Appendix 1 for further detail):

a) Four Diphtheria, tetanus, pertussis (DTP or DTaP) vaccines, given at 2, 4, 6 and 18 months

b) Three to four inactivated Polio (IPV) vaccines, given at 2, 4 and 18 months of age, with an optional vaccine at 6 months

c) Four Haemophilus influenzae type b (Hib) vaccines, given at 2, 4, 6 and 18 months (Hib is only required for children born after May 1, 1992)

d) One Measles, Mumps and Rubella (MMR) vaccine, usually given at 1 year or later

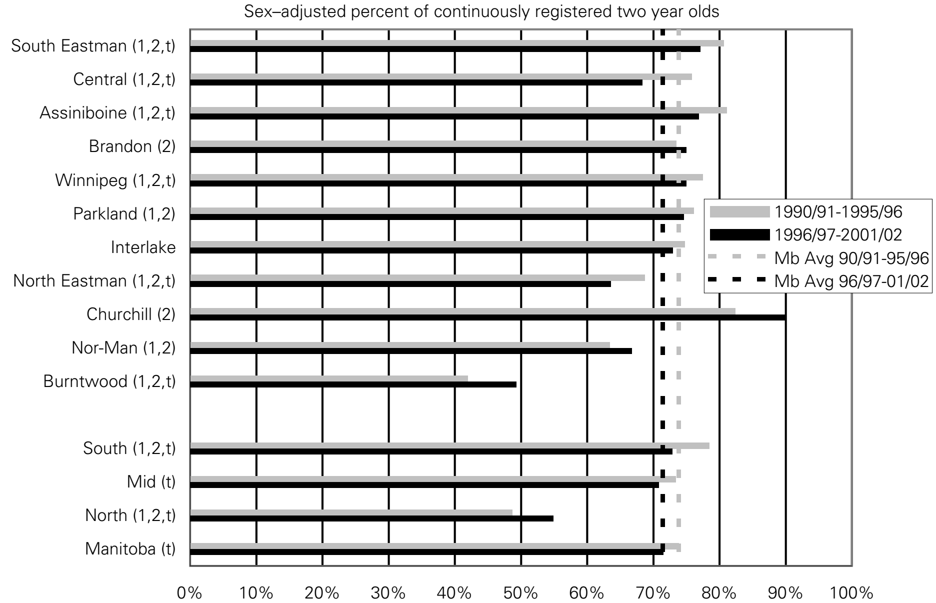
e) Note: The Hepatitis B (Hep B) vaccine may be given to high risk infants, but is routinely provided to children in Grade 4. It is offered to infants of Hep B mothers. Others can buy it with a prescription.

Information was derived from the Manitoba Immunization Monitoring System (MIMS).

In this report, two year olds were considered to have a complete immunization schedule if they had records for the following: four DTP/DTaP, three Polio, plus one MMR if born before May 1, 1992; four DTP/DTaP, three Polio, four Hib plus one MMR if born after May 1, 1992.

Figure 8.1: Proportion of Children Born in 1990/91 to 2001/02 With Complete Immunizations at Two Years by RHA

Sex–adjusted percent of continuously registered two year olds

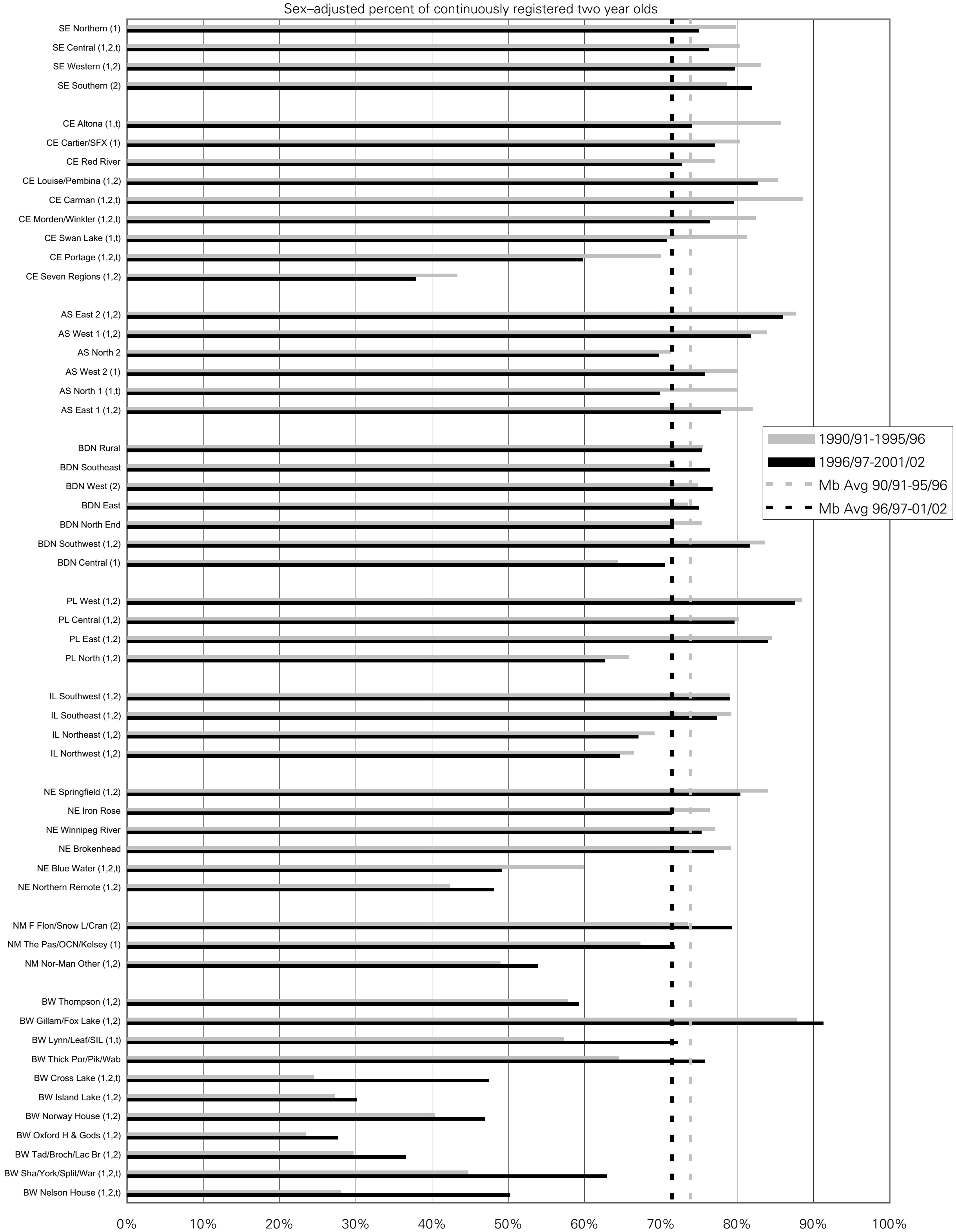


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 8.2: Proportion of Children Born in 1990/91 to 2001/02 With Complete Immunizations at Two Years by District

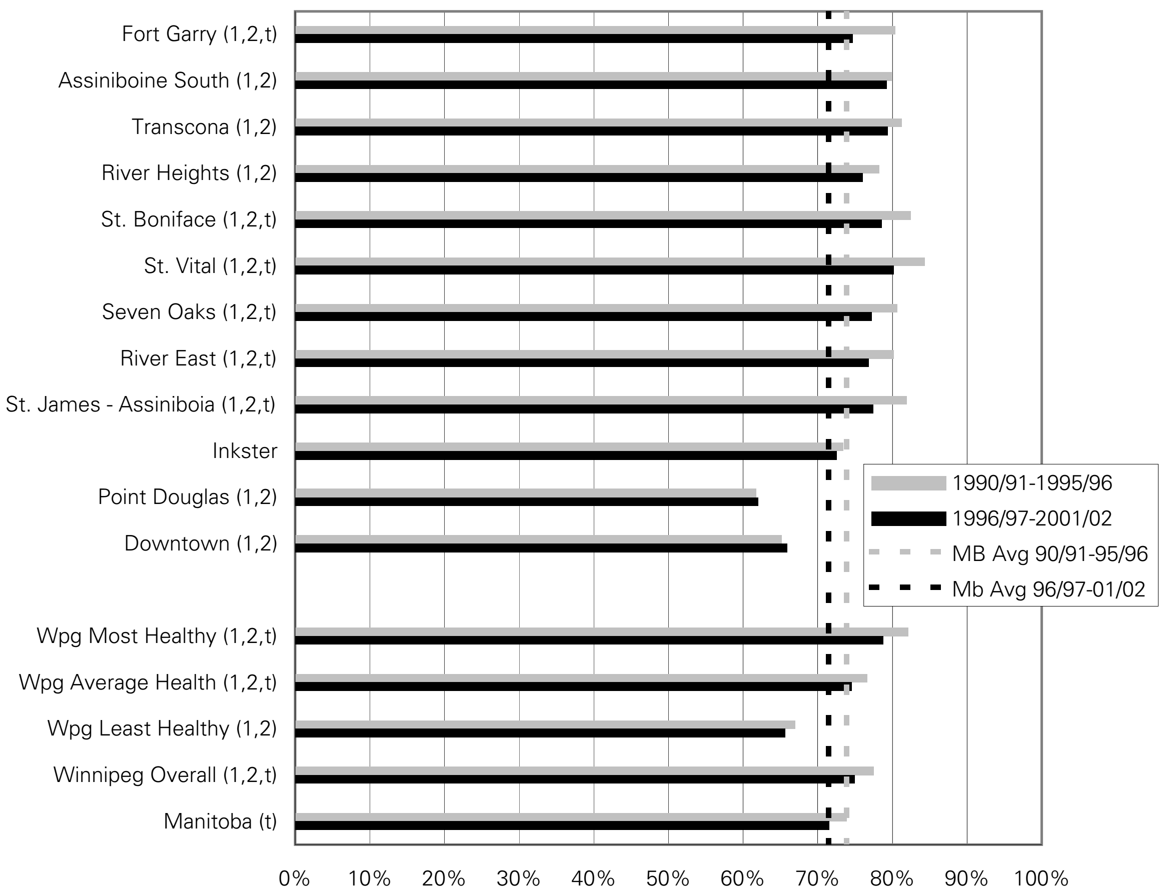
Sex–adjusted percent of continuously registered two year olds



Source: Manitoba Centre for Health Policy, 2008

Figure 8.3: Proportion of Children Born in 1990/91 to 2001/02 With Complete Immunizations at Two Years by Winnipeg Community Areas

Sex–adjusted percent of continuously registered two year olds

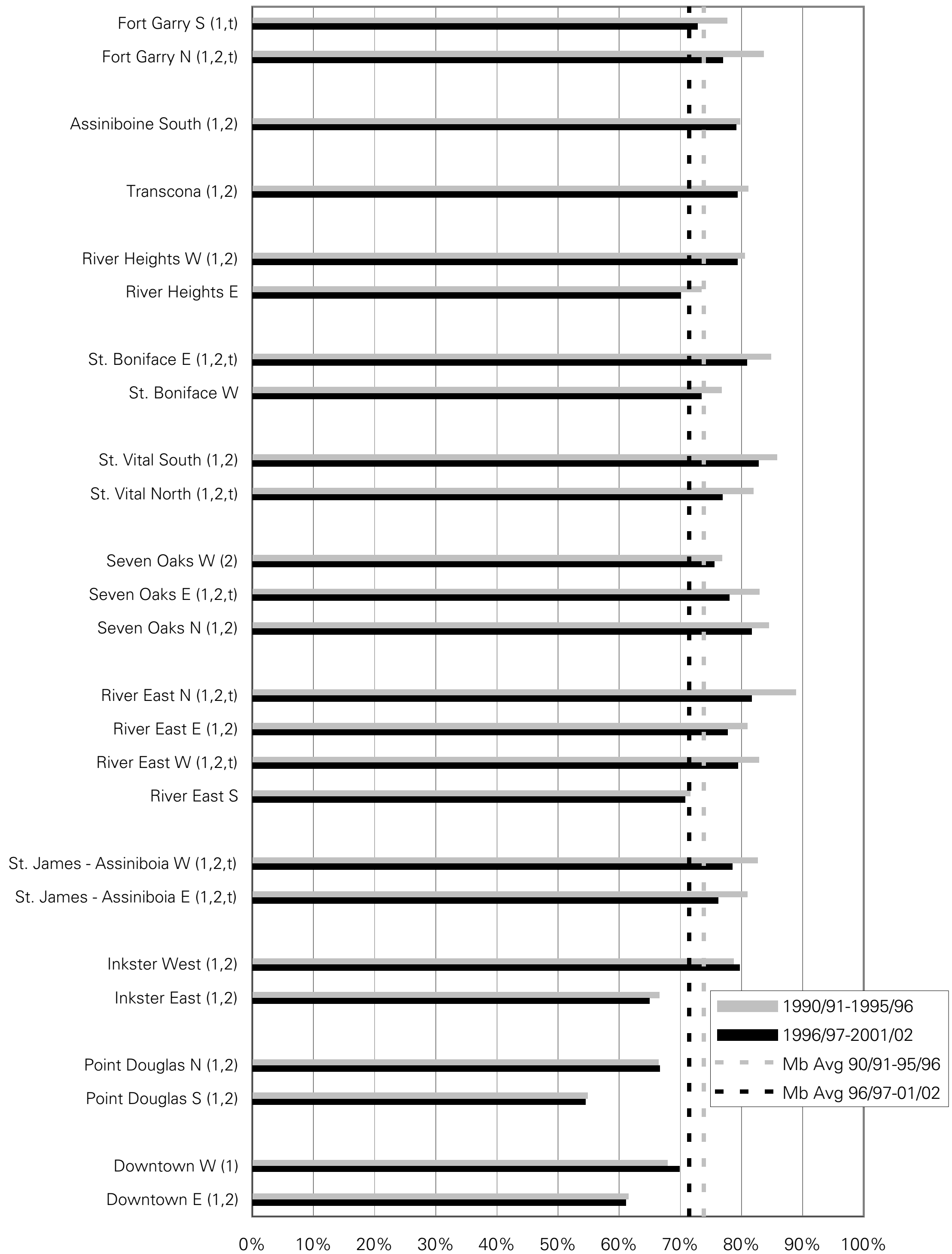


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 8.4: Proportion of Children Born in 1990/91 to 2001/02 With Complete Immunizations at Two Years by Winnipeg Neighbourhood Clusters

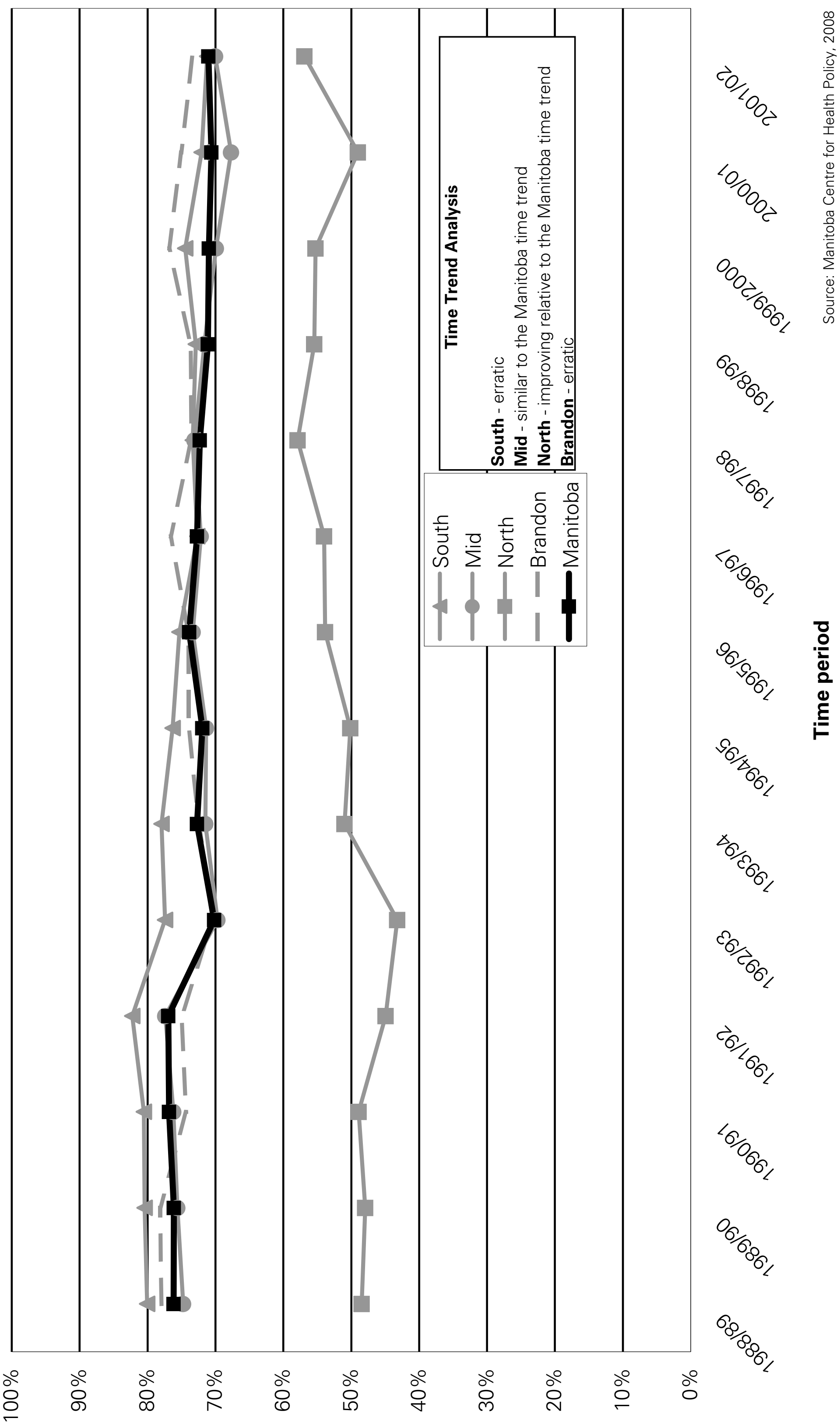
Sex–adjusted percent of continuously registered two year olds



Source: Manitoba Centre for Health Policy, 2008

Figure 8.5: Trends in Non-Winnipeg Proportion of Children Born in 1988/89 to 2001/02 With Complete Immunizations at Two Years

Sex–adjusted percent of continuously registered two year olds



Source: Manitoba Centre for Health Policy, 2008

Figure 8.6: Trends in Winnipeg Proportion of Children Born in 1988/89 to 2001/02 With Complete Immunizations at Two Years

Sex–adjusted percent of continuously registered two year olds

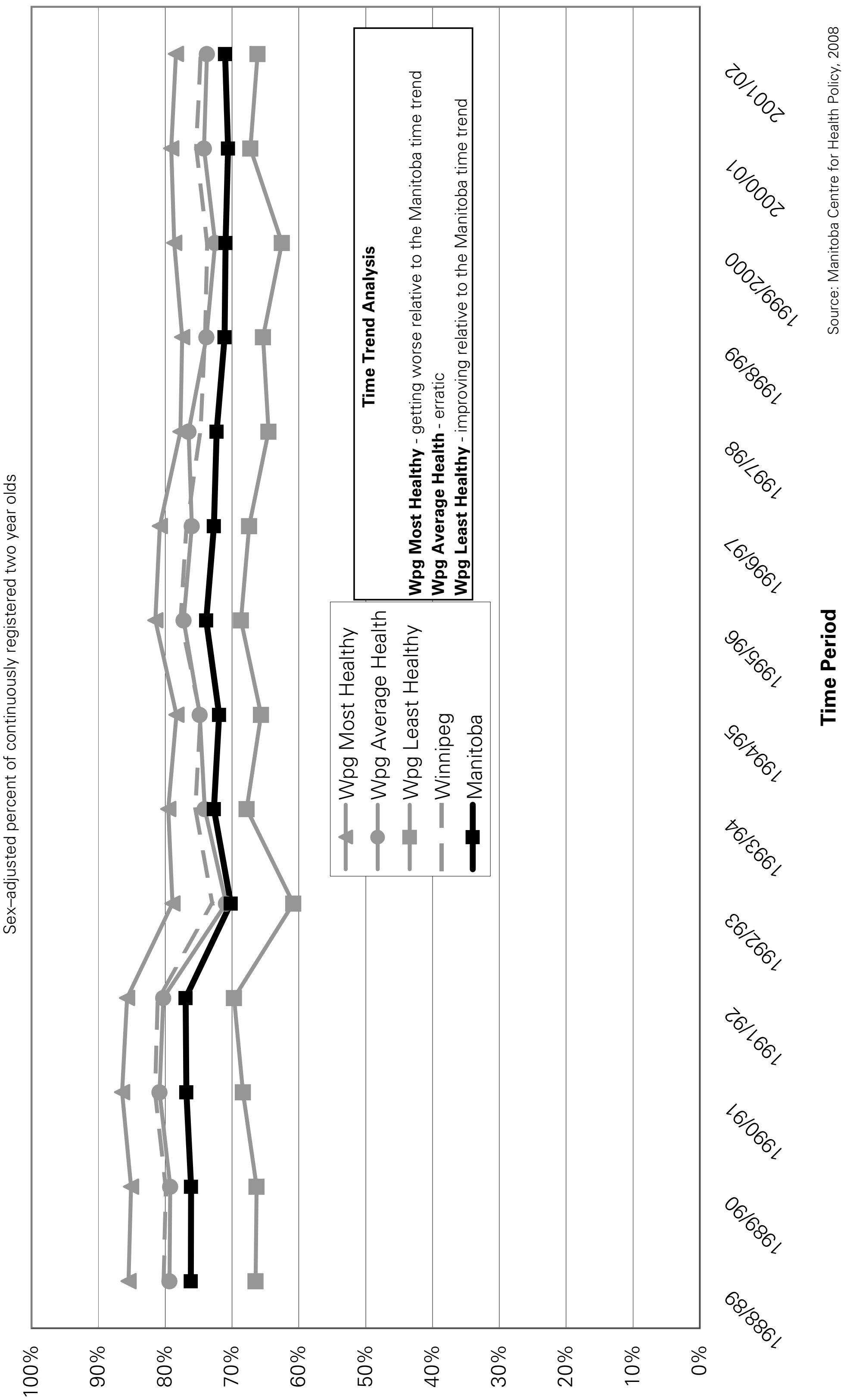
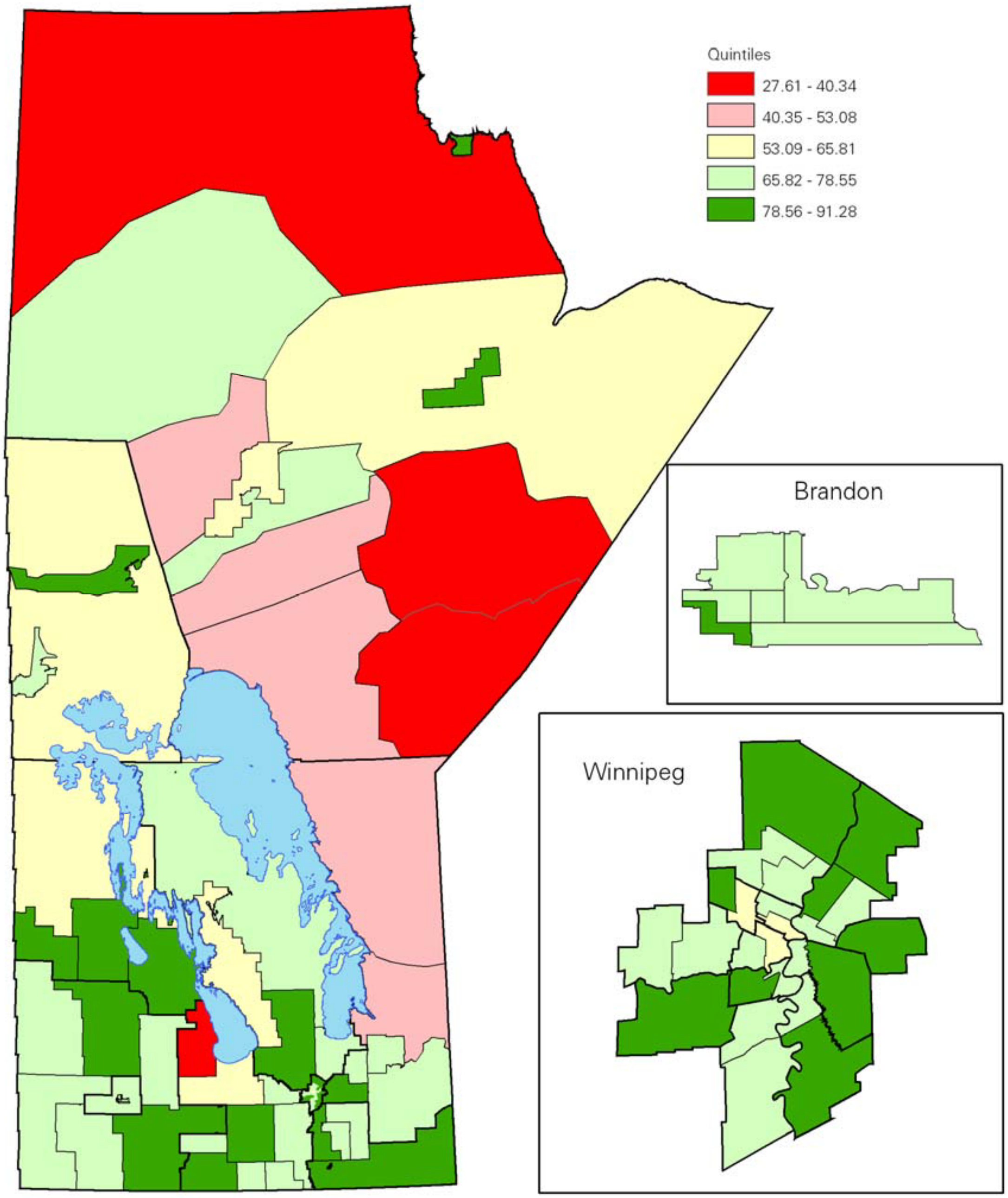


Figure 8.7: Two-year Immunization Rate Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

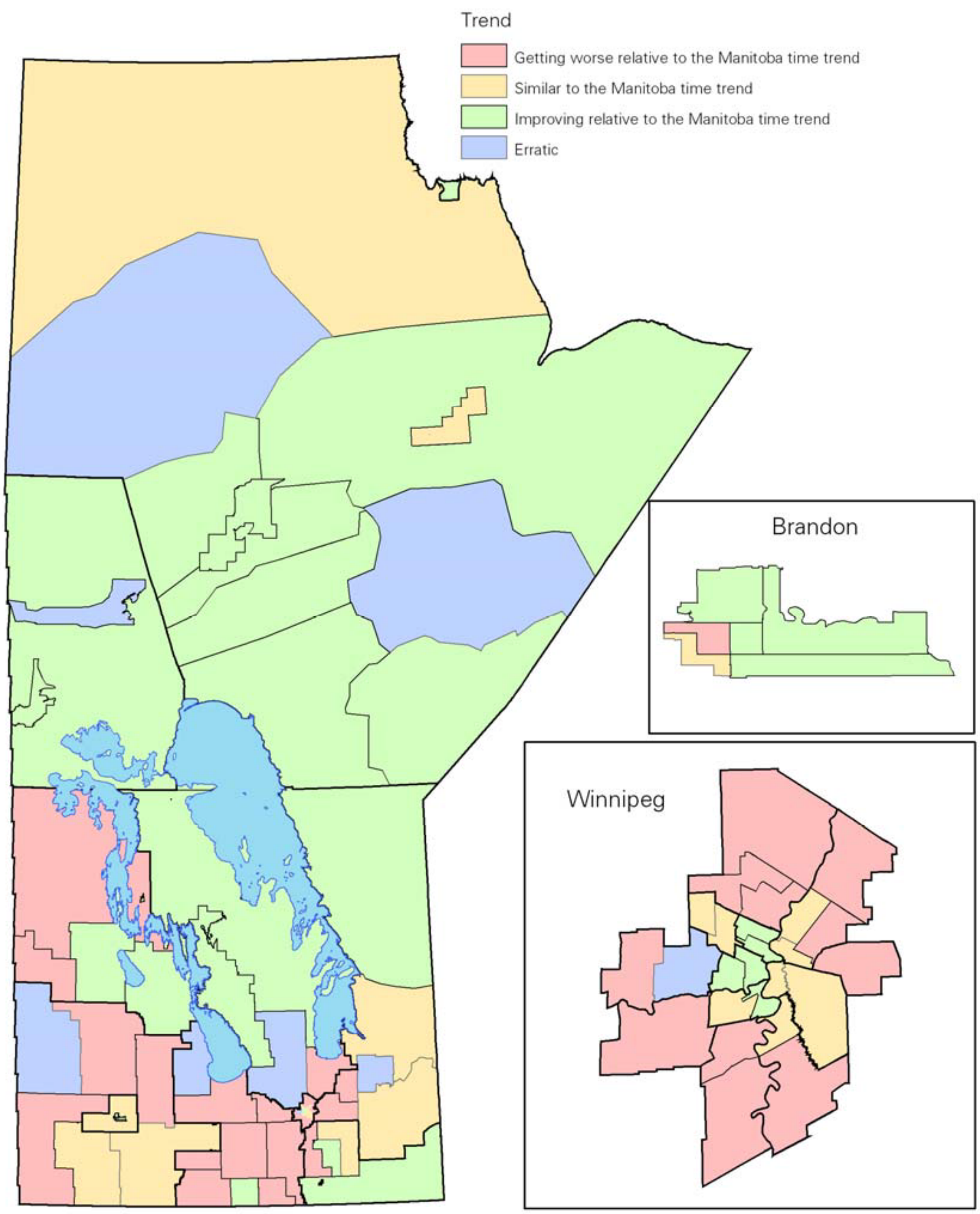
Sex–adjusted percent of continuously registered two year olds, 1996/97-2001/02



Source: Manitoba Centre for Health Policy, 2008

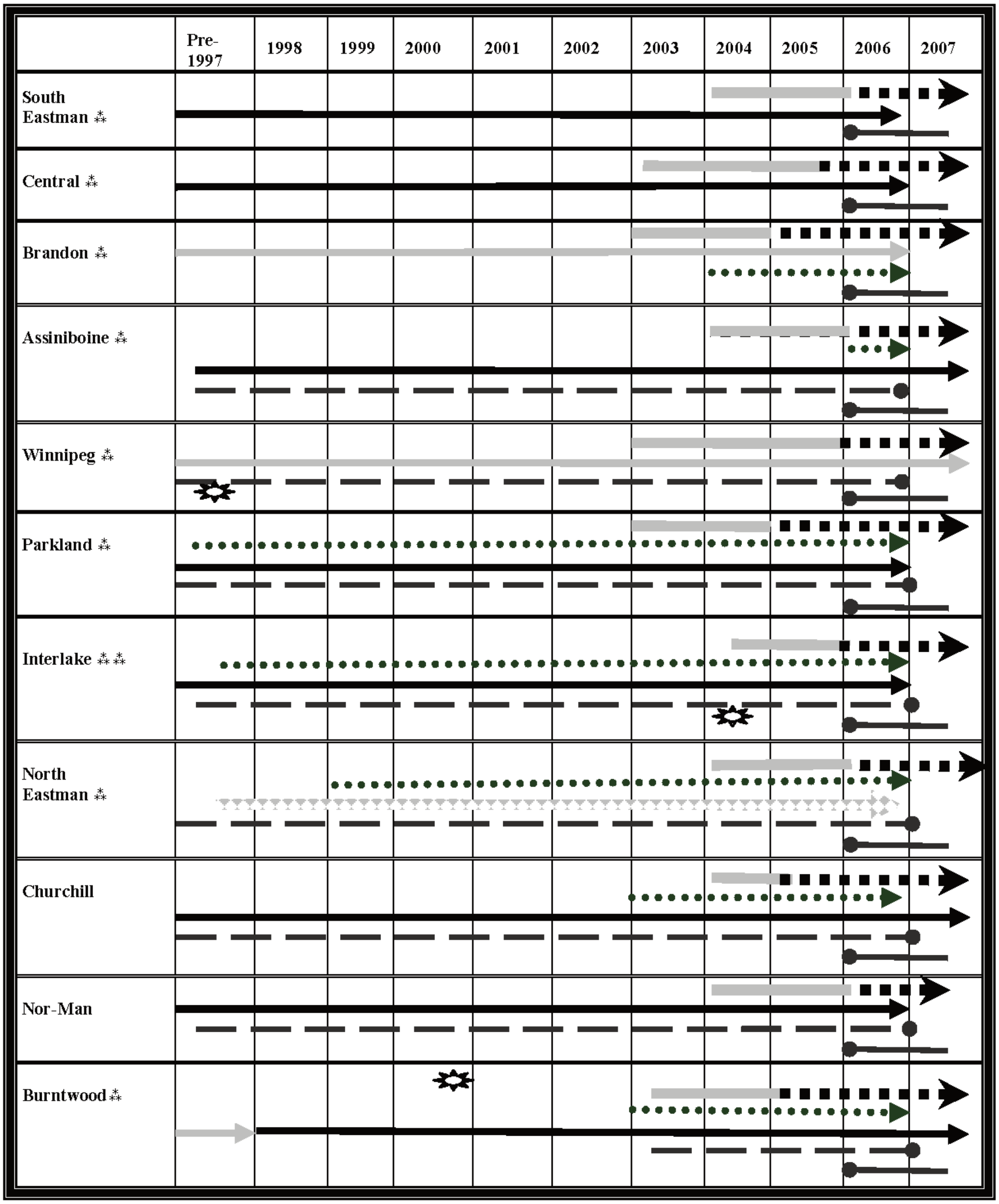
Figure 8.8: Trends in Two-year Immunization Rates by RHA Districts and Winnipeg Neighbourhood Clusters

Sex–adjusted percent of continuously registered two year olds, 1988/89 – 2001/02



Source: Manitoba Centre for Health Policy, 2008

Table 8.1: Immunization promotion initiatives (infants to two years of age)



Immunization Performance Deliverables reflected in RHA interviews   Transition to part of RHA strategic plans

Tracks own Immunization statistics   MIMS sends family reminders at 20 mon

PHNs do most of immunizations   Physicians do most of immunizations   Immunizations done by both

Who does immunizations may differ in a few districts or communities ⁂

PHN follow-up and monitoring (contact by phone & letter)

Time after which hospital / emergency has access to MIMS data (Interlake, Burntwood, WRHA)

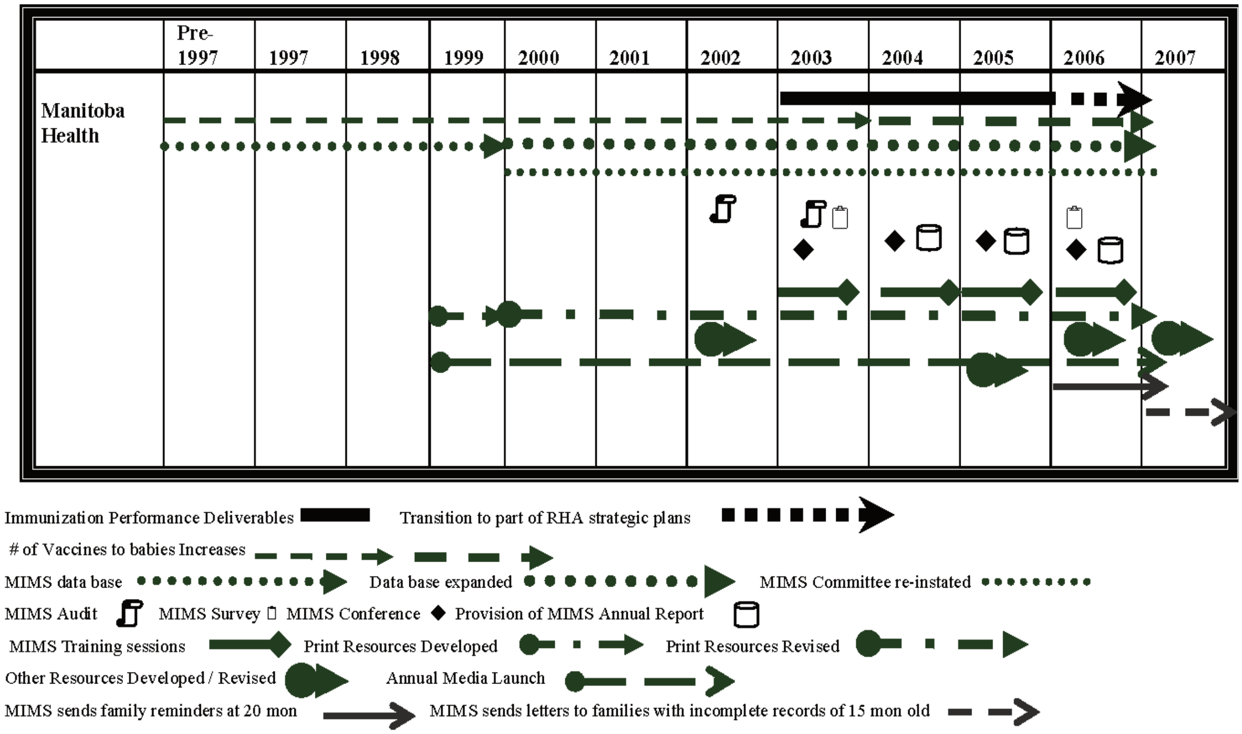

Pre-1997
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Manitoba Health
Immunization Performance Deliverables
Transition to part of RHA strategic plans
# of Vaccines to babies Increases
MIMS data base
Data base expanded
MIMS Committee re-instated
MIMS Audit
MIMS Survey
MIMS Conference
Provision of MIMS Annual Report
MIMS Training sessions
Print Resources Developed
Print Resources Revised
Other Resources Developed / Revised
Annual Media Launch
MIMS sends family reminders at 20 mon
MIMS sends letters to families with incomplete records of 15 mon old

Table 8.2: Trends in proportion of children born in 1990/91–2001/02 with complete immunizations of MMR, Polio, DTP and Hib at two years, by aggregate areas

DTP														
area	**1988/89**	**1989/90**	**1990/91**	**1991/92**	**1992/93**	**1993/94**	**1994/95**	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/2000**	**2000/01**	**2001/02**
South	81.08	81.19	81.44	83.90	82.94	82.49	79.56	77.18	74.59	74.51	73.56	75.27	72.86	72.20
Mid	75.83	76.65	77.32	79.30	80.55	80.03	77.44	76.67	75.99	74.92	73.26	72.08	69.70	71.75
North	50.54	50.42	51.39	48.85	56.01	60.55	58.55	60.24	60.01	60.89	58.17	59.17	55.69	59.83
Brandon	79.12	79.04	75.25	76.41	74.97	75.67	77.87	74.69	78.13	75.00	74.83	77.96	76.17	74.60
Wpg Most Healthy	86.69	86.26	87.33	87.29	87.35	86.35	84.50	84.45	83.85	80.33	80.07	80.75	81.23	80.20
Wpg Avg Health	80.88	80.26	82.03	81.93	81.50	81.18	80.14	80.93	79.11	78.52	76.24	74.94	75.88	75.67
Wpg Least Healthy	68.49	68.62	69.42	71.45	72.04	74.95	71.50	72.27	70.55	67.01	67.28	65.37	68.98	68.72
Winnipeg	81.71	81.29	82.60	82.83	82.84	82.64	80.70	81.08	79.92	77.18	76.51	76.10	77.32	76.67
Manitoba	77.50	77.41	77.99	78.85	79.32	79.53	77.47	77.12	75.89	74.38	73.03	73.13	72.75	72.89

MMR														
area	**1988/89**	**1989/90**	**1990/91**	**1991/92**	**1992/93**	**1993/94**	**1994/95**	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/2000**	**2000/01**	**2001/02**
South	92.67	92.98	93.79	94.06	94.67	93.74	92.58	91.71	89.76	88.65	87.86	90.40	88.12	88.10
Mid	90.85	91.87	92.73	93.32	95.40	94.22	93.14	92.45	91.76	91.26	89.34	89.25	87.72	88.92
North	81.41	83.47	85.19	82.73	86.27	88.44	87.27	86.51	87.45	86.92	85.38	85.73	83.67	87.29
Brandon	92.65	93.16	90.01	91.10	91.66	90.65	89.41	91.21	91.52	91.37	88.31	92.33	91.99	91.94
Wpg Most Healthy	94.56	94.91	96.26	95.17	95.92	95.19	93.69	93.48	93.32	91.63	91.00	91.71	91.88	91.77
Wpg Avg Health	91.63	92.21	93.60	93.22	93.78	93.30	91.88	91.72	92.13	91.38	89.24	89.12	90.60	89.71
Wpg Least Healthy	85.89	85.84	88.25	88.28	90.19	90.84	87.51	89.18	88.43	86.77	86.58	83.91	87.23	86.70
Winnipeg	92.28	92.67	94.28	93.43	94.32	93.84	92.03	92.15	92.07	90.64	89.70	89.56	90.68	90.25
Manitoba	90.96	91.55	92.65	92.28	93.50	93.10	91.56	91.40	90.94	89.87	88.60	89.09	88.93	89.22

Polio														
area	**1988/89**	**1989/90**	**1990/91**	**1991/92**	**1992/93**	**1993/94**	**1994/95**	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/2000**	**2000/01**	**2001/02**
South	86.06	84.76	84.68	86.06	85.05	85.10	81.90	80.09	80.60	90.23	90.06	92.27	90.42	90.26
Mid	82.98	82.81	83.34	83.48	84.78	83.85	81.55	80.89	81.83	92.40	93.16	92.05	90.70	90.91
North	61.59	61.63	61.64	59.41	62.24	65.80	66.35	66.03	69.49	85.53	84.74	85.41	80.47	86.41
Brandon	81.91	80.23	78.26	77.35	77.28	77.45	79.30	78.55	83.90	91.55	91.74	92.91	94.41	95.57
Wpg Most Healthy	94.40	93.19	94.05	93.23	92.25	92.16	91.57	90.41	90.61	93.91	94.27	94.80	94.69	93.72
Wpg Avg Health	91.39	90.21	91.86	90.54	89.74	88.83	88.58	87.99	87.41	93.42	93.74	93.18	93.91	92.45
Wpg Least Healthy	80.82	80.50	82.22	80.86	80.16	83.35	80.04	79.68	81.67	90.09	89.88	88.96	90.42	90.89
Winnipeg	91.48	90.25	91.54	90.42	89.46	89.61	88.69	87.80	88.09	93.05	93.39	93.36	93.76	92.88
Manitoba	85.63	84.70	85.27	84.84	84.51	84.81	83.46	82.48	83.40	91.48	91.50	91.82	91.14	91.37

HiB														
area	**1988/89**	**1989/90**	**1990/91**	**1991/92**	**1992/93**	**1993/94**	**1994/95**	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/2000**	**2000/01**	**2001/02**
South	*	*	*	*	78.42	79.06	77.37	76.76	74.27	74.65	73.56	75.38	73.30	72.16
Mid	*	*	*	*	71.22	72.84	73.47	75.25	75.49	74.37	73.21	72.24	69.82	71.39
North	*	*	*	*	49.09	56.54	54.93	57.28	57.34	60.68	58.11	57.50	51.71	59.01
Brandon	*	*	*	*	72.42	73.42	76.29	74.68	78.47	75.36	75.43	78.35	77.28	75.21
Wpg Most Healthy	*	*	*	*	79.19	80.92	80.01	83.40	83.48	80.57	79.73	80.75	81.07	80.11
Wpg Avg Health	*	*	*	*	71.19	75.62	76.41	79.42	78.89	78.75	76.19	74.94	76.16	75.72
Wpg Least Healthy	*	*	*	*	62.11	69.52	67.61	70.40	70.10	67.32	67.34	65.84	69.22	69.02
Winnipeg	*	*	*	*	73.49	77.04	76.45	79.67	79.49	77.42	76.18	76.02	77.21	76.55
Manitoba	*	*	*	*	71.50	74.51	73.90	75.82	75.32	74.46	72.96	73.06	72.51	72.79

* HiB vaccine was not mandatory for children born prior to May 1, 1992.

8.2 Discussion

What the figures and maps tell us about overall rates and trends in two–year–old complete immunizations:

- Generally, immunization rates are lower in areas that have the poorest overall health status both in non–Winnipeg RHAs and in Winnipeg CAs.
- The highest immunization rates in the province are mostly in south and mid–Manitoba; the lowest rates are generally in northern RHAs. Notable exceptions in the north are Churchill RHA with the highest RHA rate[1] in the province (89.9% for children born 1996/97–2001/02) and Gillam/Fox Lake district of Burntwood with the highest district rate (91.3%).
- Very low immunization rates in certain districts often correspond with "on–reserve" First Nations populations (such as Island Lake, Oxford House/Gods Lake, Tadoule/Brochet/Lac Brochet, and Seven Regions). It is possible that this is due to an undercount, if immunization records are not put into the Manitoba Immunization Monitoring System (MIMS), not coded by physicians, or difficulties accessing remote populations.
- There has been a decline in complete immunization rates over time provincially (73.9% to 71.5% from those born 1990/91–1995/96 to those born 1996/97–2001/02). The rate moved from 76.1% for those born in 1988/89 to 71.0% for those born in 2001/02. The vast majority of regions and sub–regions of Manitoba have much lower rates of immunization coverage than the 95% coverage rate recommended by the Public Health Agency of Canada (see PHAC 2006).
- The most promising trends in immunization are, in general, seen in the regions of poorest health status which includes many parts of the north, northern districts of mid–RHAs, and Winnipeg's "Least Healthy" aggregate area. This has resulted in a remarkable shrinking of the disparity in immunization rates in the province. The most vulnerable population rates have become closer to the overall average of the province; whereas the other areas have experienced a decline in immunization rates.
- Many of the healthiest areas of the province (southern Manitoba and suburbs of Winnipeg) are showing trends of not improving as fast as the Manitoba time trend or even getting worse than the provincial trend. This is especially problematic given our much lower than recommended provincial immunization rates.
- Provincially, the inclusion of an additional recommended immunization vaccine (Haemophilus influenzae type b (Hib)) in 1992 was associated with a drop in complete coverage of children. Since then, overall coverage rates have never attained the pre–1992 levels in any of the aggregate areas of Manitoba and Winnipeg. The exception is the North where rates have increased steadily over time. It is possible that this is due to an undercount, if immunization records are not put into the Manitoba Immunization Monitoring System (MIMS), not coded by physicians, or difficulties accessing remote populations.

[1] Note that Churchill's immunization rate is not statistically different than the Manitoba average at time 1. This is due to very small numbers of children which can produce a highly fluctuating rate from year to year. However, Churchill had the highest RHA rate in both time periods (Figure 8.1) which indicates a high rate that is most likely maintained over time.

- To further understand the rates of complete immunizations for two year olds, each of the components was separately run. See Table 8.2 for the trends of each of the four component parts of a "complete immunization". For children born in 2001/02, the MMR rate was 89.2%, the Hib was 72.8%, DTP was 72.9%, and Polio was 91.4%. The "driver" of the lowest rates is the required fourth immunization (required for both Hib and DTP), since those that require only three (Polio) or one (MMR) have the highest completion rates.
- There was an upward trend of the Polio completion rate over a very short time period; for those born in 1996/97, the rate was 83.4% which increased to a much higher rate for those born in 1997/98 (91.5%). This was the year the Polio immunization changed from an activated oral form to the inactivated form, and incorporated with DaPTHib to be administered in one vaccine.
- Provincially, there has been a slight, but noticeable, decline in MMR rates beginning with children born around 1993. During the 1990s, there have also been controversies about the link of MMR vaccine with other diseases including the controversial research report in 1998 that mistakenly linked the MMR vaccine with autism (the link was later disproven in the literature—see the review section below). We do see declines, especially in areas of Winnipeg and in the South aggregate area.
- Areas of the province which potentially have clues as to "what works" (i.e., higher rates plus improving faster than the Manitoba time trend) are: Churchill RHA, most districts of Brandon RHA, The Pas in Nor–Man RHA, Thicket Portage/Pikwitonei/Wabowden in Burntwood RHA (as well as a very high rate in Gillam/Fox Lake which continues to trend similar to the Manitoba time trend), the Central and East districts of Parkland RHA, Morden/Winkler in Central RHA, and the Central and Southern districts in South Eastman RHA.

What the regression modeling[2] tells us about predictors of complete immunizations in the year 2003/04 (for the complete regression model, refer to Appendix 4):

- Individual characteristics that **increase** the likelihood of immunization—higher mother's age at the birth of her first child, higher average household income of the neighbourhood of residence, higher gestational age or birthweight of the newborn, if the child was breastfed, and if the child received good "continuity of care" by a physician (i.e., at least 50% of visits are to the same physician within two year).
- Individual characteristics that **did not affect** the likelihood of immunization—whether or not the baby was male or female and whether or not the mother visited a chiropractor in the past year.
- Geographical characteristics that **increase** the likelihood of immunization, after controlling for all other factors—residing in Parkland RHA and in Winnipeg's St. Vital community area.

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[2] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

- Note that Winnipeg's Fort Garry and River Heights CAs were associated with a decrease in the likelihood of immunization after controlling for all other factors. In other words, they were lower than one would expect given their demographic characteristics.

How the above are associated with descriptive information on policy, program or support initiatives:

- Churchill RHA, with its extremely high immunization rates and trend towards improving faster than the Manitoba time trend, had a system of reminders (letters and telephone calls) tied in with its electronic database. As well, public health nurses do the majority of immunizations for the RHA.
- After controlling for individual factors, Parkland RHA showed an increased likelihood of having complete immunizations at two years of age in the year 2003/04 (for those born 2001/02). Although not statistically significant, Assiniboine also shows a trend to higher likelihood of immunization. These two RHAs had very similar approaches historically to Churchill including public health nurses giving most of the immunizations, as well as follow–up and monitoring through telephone and letter reminders.
- Starting in 2006, MIMS–generated reminders are being sent to families when the child is 20 months old. However, our data only records rates to 2003/04.
- The generally declining rates of immunization began around 1991/92 which could be associated with the onset of an additional recommended immunization (Hib). What most drives the rates for lack of completion is the requirement for four immunizations (DTP, Hib). Polio only requires three. These are presently counted as any three. If the requirement for Polio included the 18–month immunization plus two others, rather than any three in the two years, these rates may show much lower completion as well.
- Note that Winnipeg's Fort Garry and River Heights CAs were associated with a decrease in the likelihood of immunization after controlling for all other factors. In other words, rates are lower than one would expect given demographic characteristics. This could be due to unmeasurable variables in our study, and it needs further study to see why these two CAs in Winnipeg tends to under–immunize.
- The low rates observed in North Eastman and Burntwood RHAs may be, in part, due to under–reporting into the MIMS systems for those children immunized in First Nations communities.

8.3 Comparison of Pertinent Literature Reviews and *Our Study Results*

8.3.1 Complete Immunizations at Two Years Old:

Canadian immunization rates of two year olds in a 2004 survey demonstrate high levels of coverage for certain vaccines, such as an MMR coverage rate of around 95% (close to the goal of 97%). This rate is up slightly from 2002 (Belzak 2004). However, DPT, IPV and Hib coverage fell far below the 95% target—ranging from 75% for Hib to 90% for Polio (IPV).

According to Briss et al. (2000), vaccination coverage levels in the USA are reported at over 90% for DTP (3 or more doses), IPV (3 or more doses), MMR (1 or more doses), and Hib (3 or more doses). Lower coverage rates are seen for 4 or more doses of DTP at 81%, and are significantly lower for low–income populations. In comparison, Mexico has a 96% vaccination rate for children ages 1 to 4, compared to 79% overall for USA two year olds (Hegstrom 2002).

In our Manitoba study, we only looked at complete immunizations; hence the rates will reflect the lowest "rate determining" vaccines. Our 2004 provincial rates were 71.0%, slightly lower but in a similar range to the Hib rate of 75% nationally. Compared to benchmarks in the USA and Mexico, our rates of coverage are low and need to improve drastically to meet targets of 95% or higher.

Routine childhood immunization coverage of two year olds from the National Immunization Coverage Surveys in 1997, 2002 and 2004 (PHAC 2006) indicated decreasing rates from 1997 to 2004 for the 4–dose Diphtheria (84% to 78%), the 4–dose Pertussis (83% to 74%), the 4–dose Tetanus (83% to 73%), and the 4–dose Hib (72% to 70%). Polio (IPV) coverage rose from 85% to 89%. MMR remained basically the same at around 94 to 95%.

In our Manitoba study, complete coverage rates decreased slightly from 72.3% to 71.0% from 1997/98 to 2003/04. These rates reflect the decline/plateauing of immunization rates for two year olds nationally and also reflect the low rates of Hib and DTP coverage as the "rate determiner" for low coverage.

8.3.2 Policy, Practice and Program Initiatives Pertinent to Increasing Immunization Rates

RRO effects (reminder, recall and outreach):

In a review of the evidence, Briss et al. (2000) found that client reminders, provider reminders, provider feedback and recalls show strong scientific evidence in relation to increased immunization rates. Multi–component strategies that include education (outreach) also increase immunizations rates. However, education alone (community, clinic–based or physician–based) was not sufficient. One study in the USA state of New York (Szilagyi et al. 2002a) found that an RRO implemented in eight city practices dramatically increased immunization rates for two year olds from 1993 to 1999 (inner city 55% to 84%, rest of city 64% to 81%, suburbs 73% to 88%, rural county 66% to 86%). This also reduced the regional disparity, such that the 1999 rates were not statistically different by geographical location whereas the 1993 rates showed great disparity ($p<.001$). As well, Szilagyi et al. (2002b) did a Cochrane systematic review of the evidence and found that patient reminder/recall systems were effective in improving immunization rates in the range of 5 to 20%. Thirty–three of 41 studies show effects irrespective of baseline immunization rates, patient ages, type of setting (private practice and public health clinics), or type of vaccination. All types of reminders were effective. These included postcards, letters, telephone or auto dialer calls, with telephone being the most effective, but most costly.

In order to have the databases necessary for complete coverage of any reminder and recall program, accurate records must be readily available and in electronic form. The importance of provincial electronic records for immunization has been highlighted by the public health community of Canada (Kondro 2007) and is critical to the National Immunization Strategy. Manitoba was one of the leaders in creating electronic immunization records. The Manitoba Immunization Monitoring System (MIMS) has electronic records for children born in 1980 and later. As of 2007, the 14 jurisdictions recognized under the National Immunization Strategy are at various stages of creating electronic systems. Those that have systems already in place are BC, Saskatchewan, Manitoba, PEI and New Brunswick. Those that are creating systems are Alberta, Ontario, Newfoundland and Labrador, and the First Nations communities across Canada. Those considering systems are the Northwest Territories and Quebec. Those that have no systems in place currently are the Yukon Territories, Nunavut and Nova Scotia.

A new initiative of Canada Health Infoway, called "Panorama", is the Pan-Canadian Public Health Communicable Disease Surveillance and Management Project (see http://www.epanorama.ca/en/faq.htm). Panorama will provide authorized Canadian health care providers with the ability to collect, share and analyze health information critical for the management of communicable diseases at the regional, provincial and national levels. This will include systems to capture information about immunizations and will give planners more accurate and timely information to assist in managing the public health system.

Financial incentives:

Free immunization through government subsidies has been shown through a randomized trial in the USA to reduce barriers to receiving this preventive measure, but rates were still low (Hemenway 1995). Only 59% of children aged 0–6 years received any immunizations during the three–year experiment, so completely free care did not guarantee that children would receive recommended levels of immunization.

Different parental financial incentives have been successful in increasing immunization rates. These have included lottery tickets to parents in Ohio (Yokley and Glenwich 1984) and payment to parents in Austria (Hemenway 1995). However, Briss et al. (2000) states that client or family incentives do not have sufficient scientific evidence to support their effectiveness.

Financial incentives to health care providers have been discussed as a way to increase immunization rates as demonstrated by an incentive program in Northern Ireland where physicians received bonuses for reaching targets (White et al. 1992; Hemenway 1995). Seventy–seven percent of physicians reached the targeted rates by 1991. However, there are contradictory findings with pay–for–performance (P4P) models. Two USA trials show no impact for physician bonuses or physician feedback (Fairbrother et al. 1999; Hillman et al. 1999). The Fairbrother et al. study did note improved rates due to the bonus, but this was primarily achieved through more thorough documentation (including children receiving vaccines outside the clinic) rather than truly improved rates. Critics of these two studies also cite small sample sizes, short follow–up, lack of clarity with physicians as to requirements for receiving a bonus, and lack of financial bonus outside the Medicaid population as problems with the study (refer to the Healthcare Economist website, accessed August 14, 2007 at http://healthcare–economist.com/category/supply–of–medical–services/physician–compensation/).

Required vaccinations:

Briss et al. (2000), in a review of the literature, found sufficient scientific evidence to support the effectiveness of requiring vaccinations for child care, school and college attendance in increasing immunization rates. In Monterrey, Mexico, a vaccination rate of 98% for children aged 1 to 4 has been achieved in the lowest socioeconomic regions of the city. A nurse is assigned sections of four square blocks each to ensure all children living in these sections receive timely immunizations. Home visits are done if the children are late in receiving the immunizations (Hegstrom 2002).

In our study, Churchill RHA shows consistently high and improving immunization rates for two year olds, and Assiniboine and Parkland RHAs had high likelihood of immunization in 2003/04 after controlling for all other influencing factors. All three of these RHAs have public health nurses doing most of the immunizations, and these nurses use follow–up and monitoring through telephone and letter reminders. Furthermore, Churchill RHA is a small geographical area (similar to the Mexico example cited by Hegstrom et al. 2002), so the public health nurses may have more direct access to the clientele. Nor–Man RHA has also used these approaches, and for the parts of their region under regional health authority jurisdiction, the rates and trends seem positive.

Many of the provincial initiatives have involved education, and in isolation, this has not shown to be effective in the literature. This requires a multi–factorial approach that includes reminders, recall and outreach. Presumably, the initiation of a 2006 MIMS reminder system for children aged 20 months will be a critical piece in this strategy to increase immunization rates, along with the integration of immunization plans into provincially required RHA strategic plans.

8.3.3 Effects of Media/Research/Health Professional Information on Immunization Rates:

In 1998, Wakefield et al. from UK published a paper in Lancet based only on 12 children, citing possible links between the MMR vaccination and gastrointestinal problems as well as developmental delays (in particular, the onset of autism). According to the authors, "Onset of behavioural symptoms was associated, by the parents, with measles, mumps, and rubella vaccination in eight of the 12 children, with measles infection in one child, and otitis media in another." Subsequently, there were many rebuttals, as well as further studies, which lead to the conclusion that there was no association between MMR and autism. According to a recent Cochrane Review (Demicheli et al. 2005), exposure to MMR was unlikely to be associated with Crohn's disease, ulcerative colitis, or autism. The supposed MMR–autism "link" created much media publicity around the world about the possible side effects of immunization. This publicity may have been related to of drops in immunization rates in several countries. Those rates only began to recover in 2004 (Burgess et al. 2006).

Parental decisions about childhood risk often involve complex decision–making regarding parental perceptions of what it means to be a 'good parent'. As Casiday (2007) noted in a qualitative research study involving parental focus groups in the UK discussing the immunization controversy, "Specific aspects of the MMR debate, namely, selecting between potentially competing risks, making risk judgments on behalf of dependent others, and tensions between private and public good, provide a platform for exploring how social theories of risk might be adapted for children's health controversies."

How public health officials react to anti–immunization "scares" is also a topic of great interest. Is there a way to curb the downward rates of immunization in situations such as when the 1998 Wakefield et al. study became a media event worldwide? Burgess et al. (2006) discuss this particular instance in terms of risk communication, exploring the question "could this public reaction have been predicted?" Their conclusion was yes. Using Sandman's conceptual framework to predict community outrage, they found that this particular MMR controversy fulfilled all 12 primary components and six of the eight additional components listed by Sandman. Therefore, they concluded that the Sandman model is a useful framework in trying to explain both the worldwide reaction and the subsequent decline in immunization rates. This model hypothesizes that risk = hazard + outrage (see Peter Sandman's website at http://www.psandman.com/).

In addition to research controversy, it has also been shown that one–third of American chiropractors believed that there was no scientific proof that immunization prevents disease, and that immunization caused more disease than it prevented. Thus the American Chiropractic Association's stance is that it supports the conscience clause in compulsory vaccination laws (Colley and Haas 1994; American Chiropractic Association 2002). However, the Canadian Chiropractic Association is more positive about immunizations, stating that "The CCA accepts vaccination as a cost–effective and clinically efficient public health preventive procedure for certain viral and microbial diseases, as demonstrated by the scientific community" (CCA Policy Manual 1993, CCA website). The CCA also states that this issue is not within the chiropractic scope of practice. However, there are still contrary views in the CCA as indicated by various newsletters containing anti–vaccination information (Campbell et al. 2000). For further information, refer to the Community Paediatrics Committee factsheet of the Canadian Paediatric Society (see CPS website reference).

In our study, we did note a decline in complete immunization rates beginning with the introduction of the Hib vaccine in 1992 (with a subsequent drop in "complete" immunizations possibly due to an omission of this new vaccine in cohorts close to this date). As well, there was the start of an upward trend after the 1992/93 cohort. This increase appears to have been interrupted for the 1996/97 cohort resulting in downward trends in immunization rates. This would potentially correspond to the birth cohort (1997/98 and onward) whose parents may have been affected by media reports on the MMR/autism association. In the latest years of data (children born in 2000/01 and 2001/02 who were two years old in 2002 through 2004), there appears to be a leveling off of the decline throughout the province and in most aggregate areas of Manitoba and Winnipeg. Possibly, this demonstrates that the counter–arguments to the adverse effects overcame the original declines.

One of the most profound "jumps" in immunization coverage occurred in the transition from the live oral Polio vaccine to the inactive Polio vaccine in 1997. This was probably due to concerns with the live Polio vaccine which was eliminated with the onset of the inactive formulation. Other potential reasons that could not be measured in this study could include personal choice and religious reasons.

In our study, a visit to a chiropractor by the mother did not affect the likelihood of immunization. This may reflect the Canadian Chiropractic Association stance that it is not an issue within the scope of chiropractic practice in Canada.

8.3.4 The Importance of High Immunization Coverage Rates:

Herd immunity refers to "the proportion of subjects with immunity in a given population" (John and Samuel 2000). The 'herd effect' of immunization refers to the indirect protection bestowed on the un–immunized portion of the population where a large portion of the population is immunized (i.e., has immunity). Thus, one definition of herd effect (John and Samuel 2000) is "the reduction of infection or disease in the unimmunised segment as a result of immunising a proportion of the population." Effective immunization programs must understand the variations by geography in order to ensure the eradication or control of vaccine–preventable infectious diseases. There will always be a certain segment of the population that for medical or belief–based reasons will not be immunized. The proportion of the population who need to be immunized for maximal population–protection varies by disease and is referred to as the 'herd immunity threshold'. Public health efforts aim to reduce vaccine–preventable diseases through attaining this threshold immunization rate (see Table 8.3). Other potential reasons that could not be measured in this study could include personal choice and religious reasons. Note that herd immunity is relevant for some vaccines, but this is not the only factor in setting national goals.

Table 8.3: Estimated Herd Immunity Thresholds for vaccine-preventable diseases (CDC and WHO – see references for URL)

Disease	**Transmission**	**R_0***	**Herd immunity threshold**	**Manitoba rates for those born 2001/02**
Diphtheria	Saliva	6-7	85%	72.9%
Measles	Airborne	12-18	83 - 94%	89.2%
Mumps	Airborne droplet	4-7	75 - 86%	89.2%
Pertussis	Airborne droplet	12-17	92 - 94%	72.9%
Polio	Fecal-oral route	5-7	80 - 86%	91.4%
Rubella	Airborne droplet	5-7	80 - 85%	89.2%
Smallpox	Social contact	6-7	83 - 85%	n/a

***R_0** is the basic reproduction number, or the average number of secondary infectious cases that are produced by a single index case in completely susceptible population.

In our study, the overall coverage rates of two–year–old children in Manitoba fall below 80% in most RHAs and Winnipeg Community Areas. However, when separating out the individual components, Measles, Mumps, Rubella, and Polio meet the threshold of herd immunity for all aggregate areas of the province. The problematic area is the vaccine containing D, T, (a)P and Hib antigens. Diphtheria and Pertussis are well below the desired threshold for ALL aggregate areas. Given the low coverage rates, some districts within these aggregate areas may be at particularly high risk for recurrences of various diseases.

8.4 Recommendations

- Evaluate the success of the MIMS–generated reminders which began in 2006. According to the literature and observations in our Manitoba study, recalls and reminders are associated with higher immunization coverage. Electronic databases can facilitate this. It has been noted that, as of 2006, MIMS–generated reminders are being sent to families at the child's 20–month age mark—essentially, this uses the best evidence to increase rates at a population–level. An evaluation of the effectiveness of the strategy, and factors associated with effectiveness, could be beneficial to the province in the near future. As well, the effects of on-going additions to the immunization schedule should be evaluated.
- Continue to monitor, understand and use risk communication strategies to increase immunization rates throughout the province. A dramatic effort is required to build up immunization rates to what would be considered at least herd immunity thresholds, and approach targets of 95% to 97%. Understanding barriers to immunization (such as the MMR media and research concerns in 1998 and its subsequent drop in rates) and effective strategies to deal with risk perceptions (such as Sandham's strategies) will be critical to avoid population–based rate declines. In addition, any introduction of new vaccines will require efforts beyond education alone to ensure rapid uptake of the newest recommended vaccine for complete coverage.
- Continue to track rates to ensure decreased disparity in coverage. Our report illustrated good news in that areas of poorest health status show the most rapid increases in immunization rates (i.e., the northern districts, core–area Winnipeg and areas that are primarily First Nations "on–reserve"); but the bad news is that the most healthy areas show declining rates. Disparity has decreased, but coverage is still less than optimal in any aggregate group both within Winnipeg and within most non–Winnipeg RHAs (with the exceptions of Churchill and sub–districts within other RHAs). Even though they are relatively small areas, Churchill RHA and the Gilliam/Fox Lake district in Burntwood have high rates and may provide lessons for other areas. (see the Discussion for a listing of areas/districts of interest in finding promising practice areas).
- Continue to encourage collection of electronic records for First Nations children. For First Nations communities, although rates are in general low, the rate of increase shows that these areas are improving faster than the Manitoba time trend. This could be due to a combination of increasing rates, and increased use of the MIMS system for inputting data.

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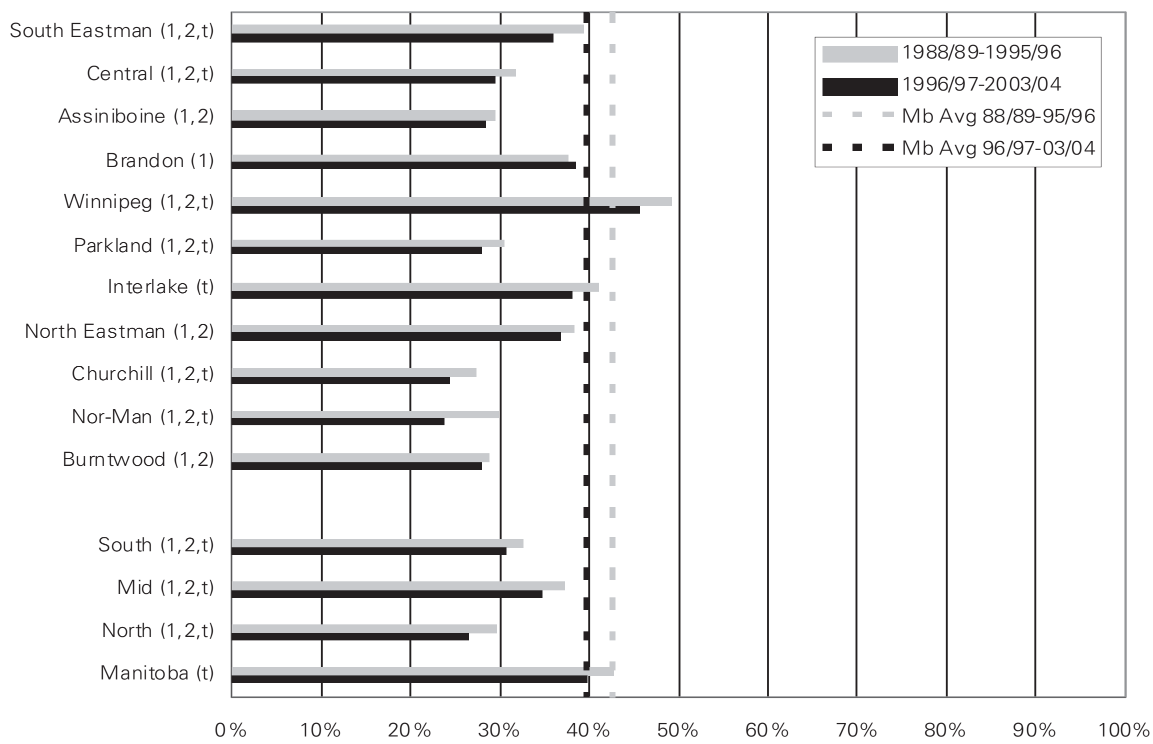
CHAPTER 9: COMPLETE PHYSICALS

9.1 Definition, Graphs and Maps

The rate of "complete physicals" is defined as the percentage of residents who received at least one Complete History and Physical Examination in any given fiscal year, from 1984/85–2003/04. For a description of physician tariff codes and allowable payments, see the Glossary in Appendix 1. Physical exams could be provided during an ambulatory visit to a physician or while in hospital. Approximately 6% of complete physicals were provided to patients while in hospital during the study period. The denominator is the entire Manitoba population as of December 31st of each fiscal year. Age is calculated as of the date of the physical in the numerator and as of December 31 of the fiscal year in the denominator. Region of residence is assigned based on the first record in fiscal year. Rates may be underestimated especially in the northern and remote areas since nurse practitioners, nursing station staff and some salaried physicians do not record in the physician billing claims data.

Figure 9.1: Complete Physical Exams by RHA

Age-adjusted annual average percent of residents with at least one complete history and physical exam

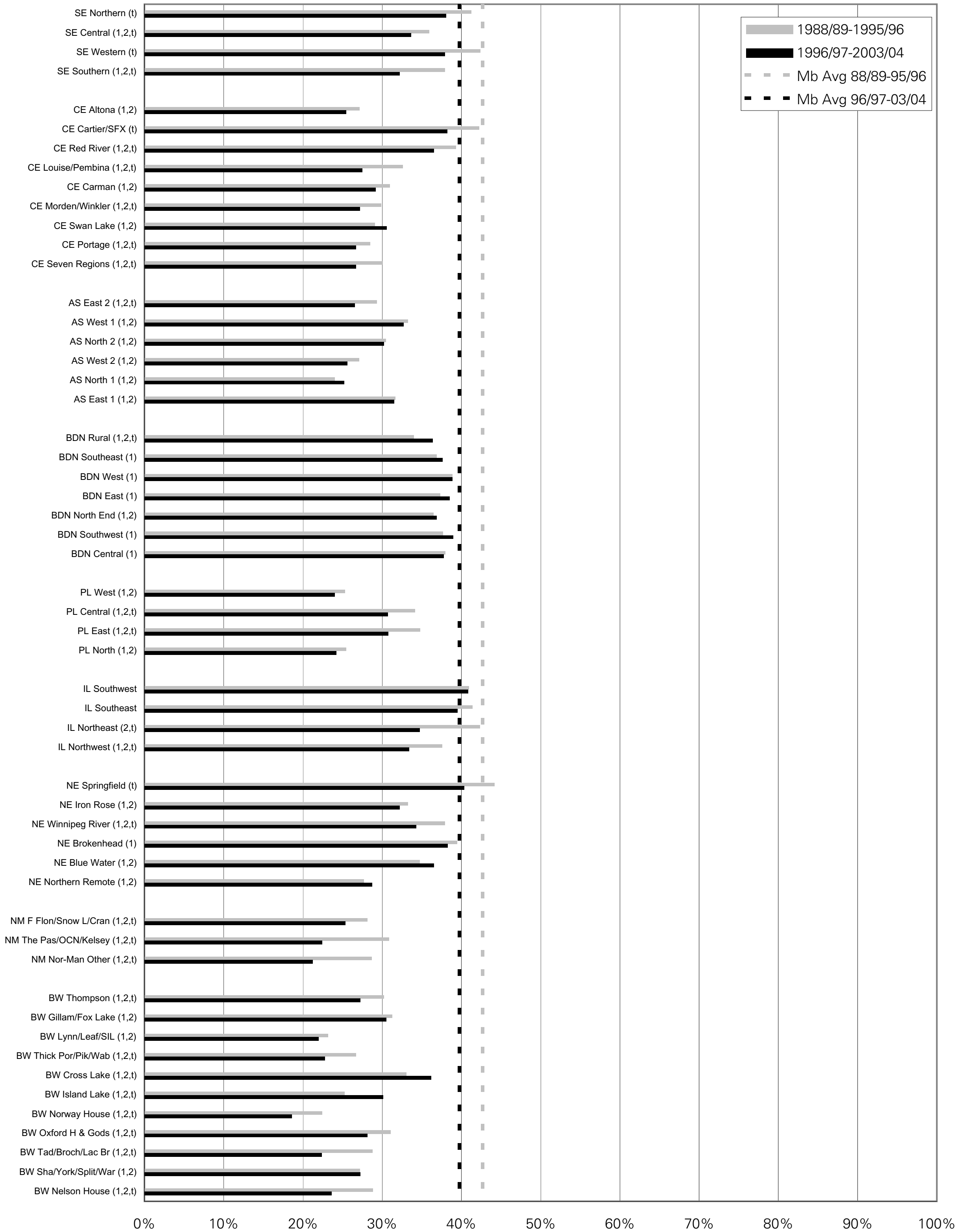


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 9.2: Complete Physical Exams by District

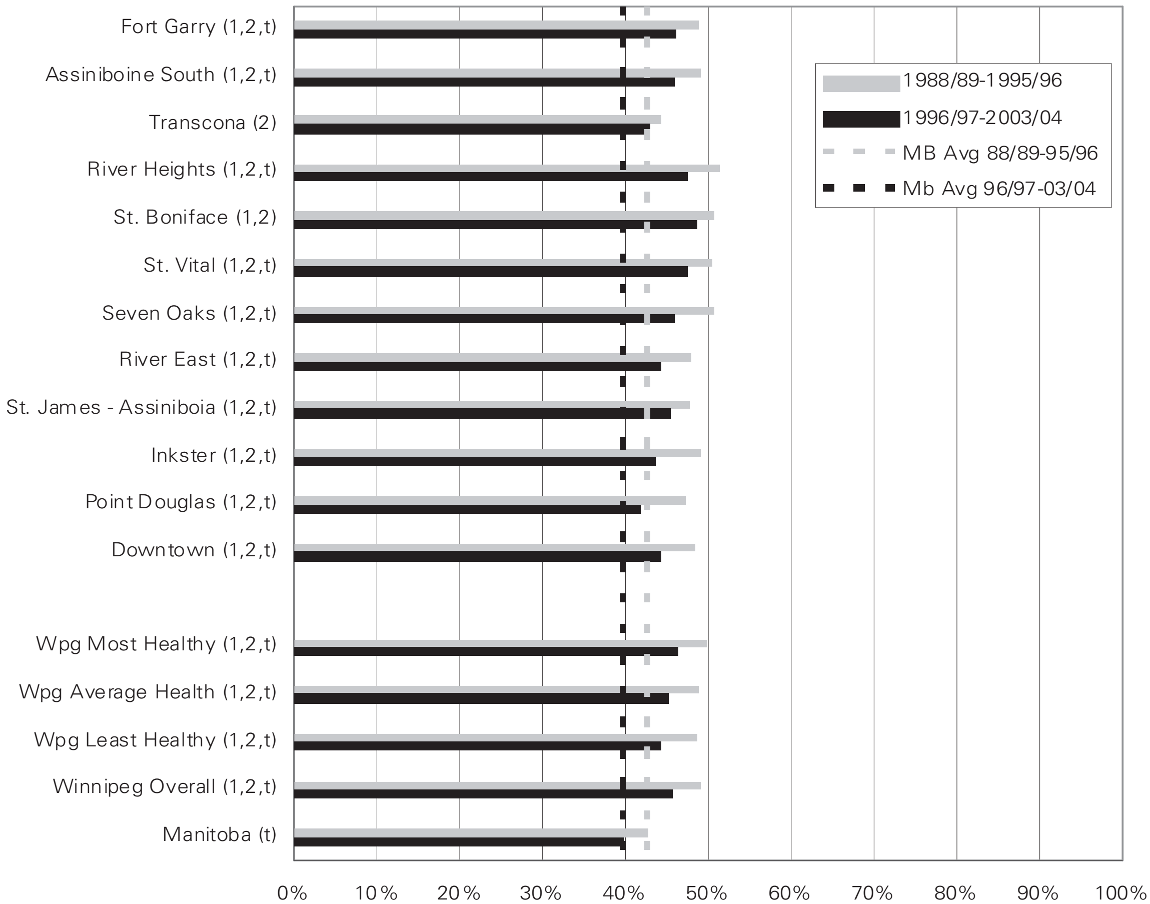
Age-adjusted annual average percent of residents with at least one complete history and physical exam



Source: Manitoba Centre for Health Policy, 2008

Figure 9.3: Complete Physical Exams by Winnipeg Community Areas

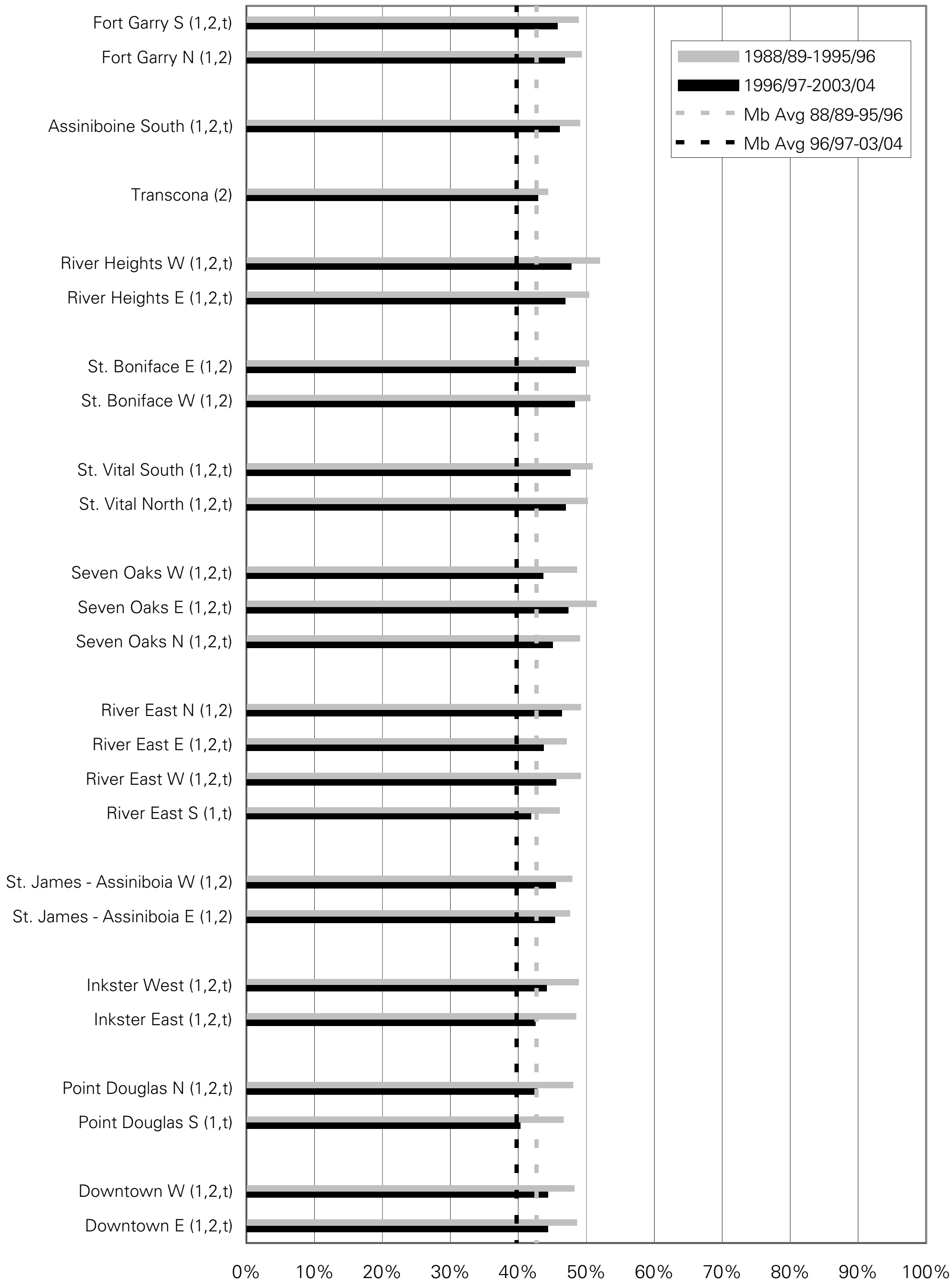
Age-adjusted annual average percent of residents with at least one complete history and physical exam



'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers Source: Manitoba Centre for Health Policy, 2008

Figure 9.4: Complete Physical Exams by Winnipeg Neighbourhood Clusters

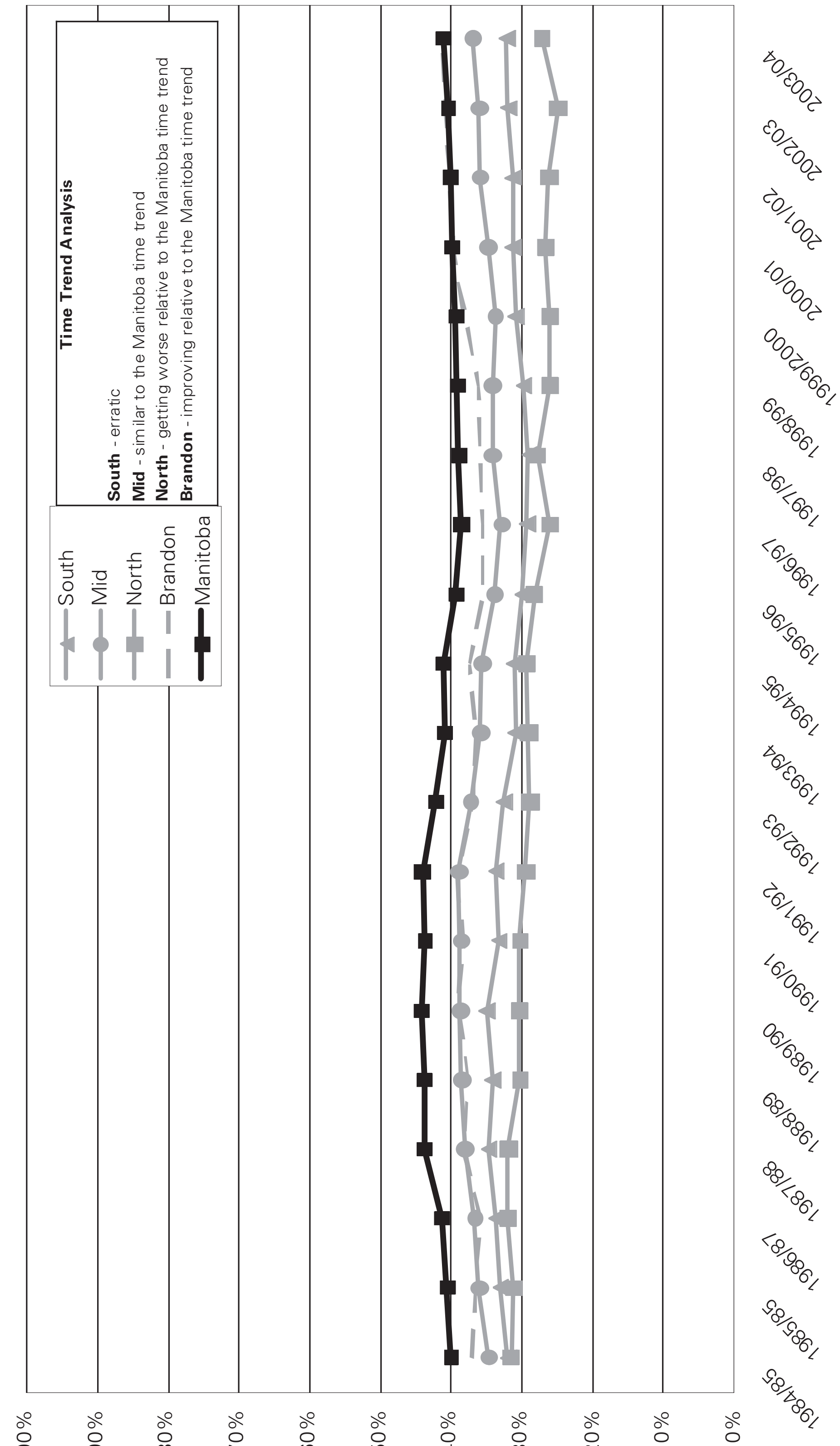
Age-adjusted annual average percent of residents with at least one complete history and physical exam



Source: Manitoba Centre for Health Policy, 2008

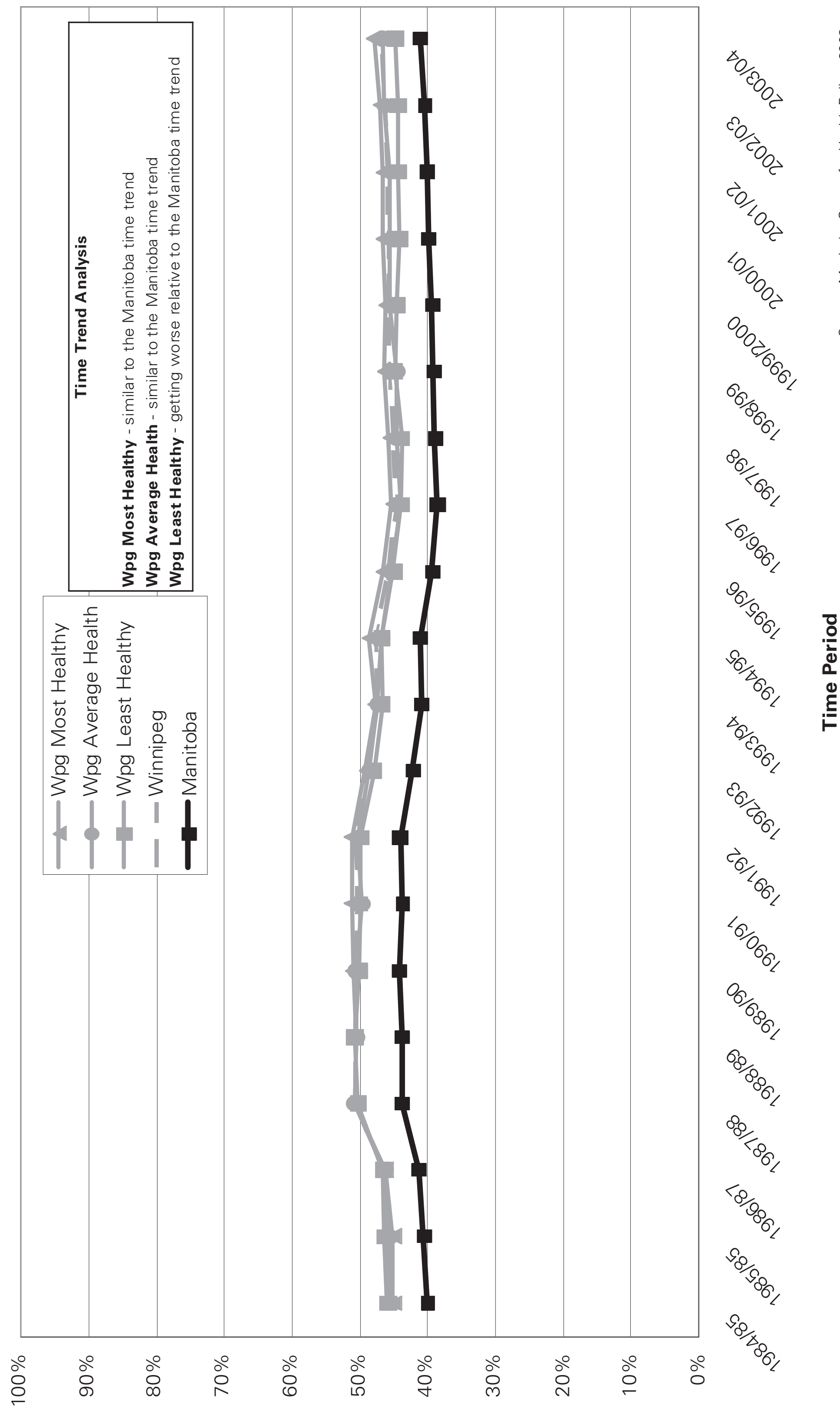
Figure 9.5: Trends in Non-Winnipeg Complete Physical Exams

Age-adjusted annual average percent of residents with at least one complete history and physical exam



Source: Manitoba Centre for Health Policy, 2008

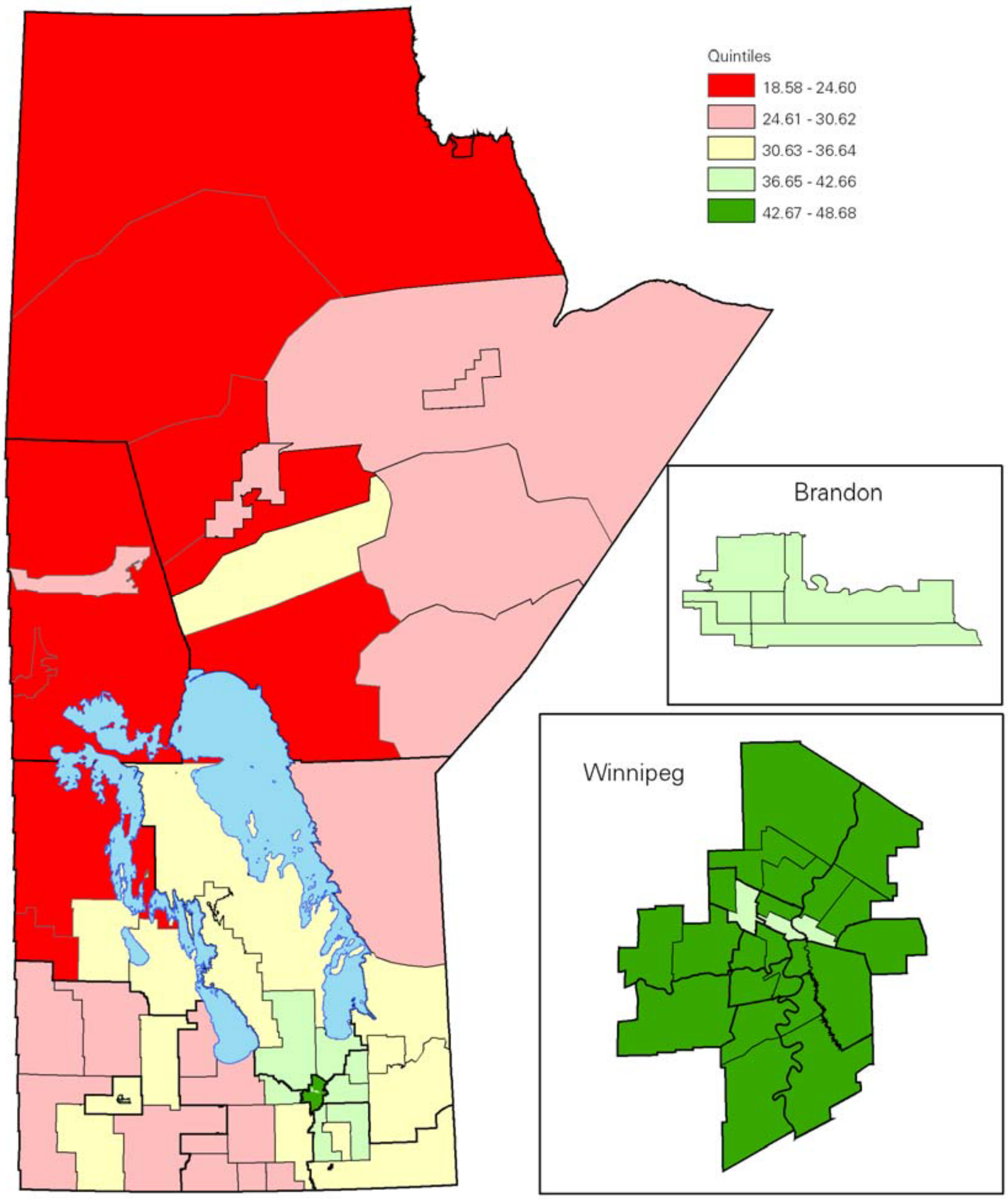
Figure 9.6: Trends in Winnipeg Complete Physical Exams
Age-adjusted annual average percent of residents with at least one complete history and physical exam



Source: Manitoba Centre for Health Policy, 2008

Figure 9.7: Complete Physical Exam Rate Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

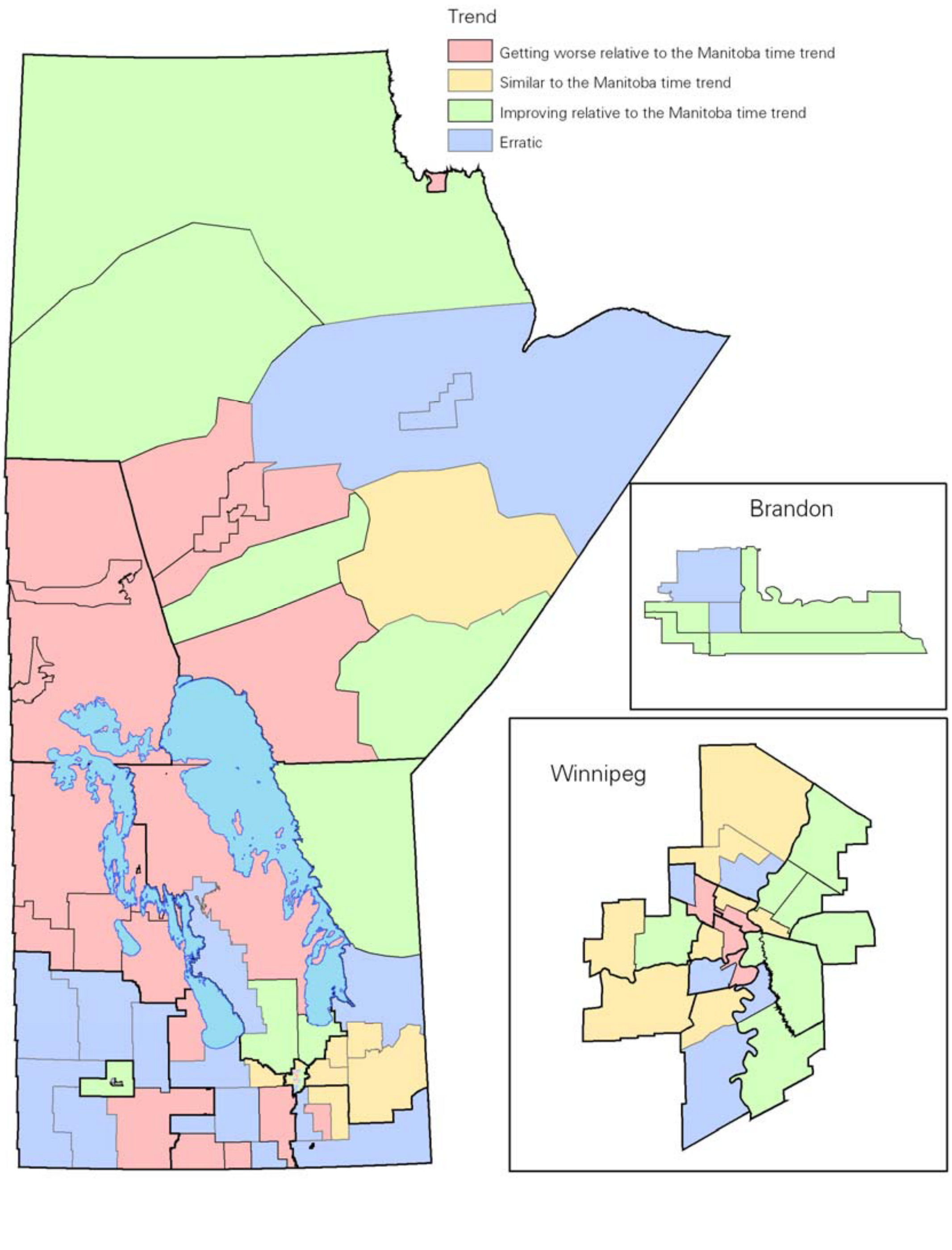
Age-adjusted annual average percent of residents with at least one complete history and physical exam, 1996/97-2003/04



Source: Manitoba Centre for Health Policy, 2008

Figure 9.8: Trends in Complete Physical Exam Rates by RHA Districts and Winnipeg Neighbourhood Clusters

Age-adjusted annual average percent of residents with at least one complete history and physical exam, 1984/85-2003/04



Source: Manitoba Centre for Health Policy, 2008

Table 9.1: Physicals (Periodic health examination – recommendations for adults)

Program	Policy / Program details	Timeline
What has been the recommended time for physicals since 1980? Once every five years, three years, two years, one year?	The recommendation for yearly exams changed in the 1990's, but many physicians and members of the public feel that annual physicals are an opportunity to do preventative education. College of Physicians & Surgeons of Manitoba (CPSM) does not presently have a Guideline or a Statement on this subject following the recommendation which may have originated through the College of Family Physicians of Canada some years ago that a routine physical examination is no longer appropriate. Previously, there was a College guideline on the annual P/E CPSM no longer operates the Clinical Practice Guidelines program CPG Files have been archived No information on standard previous to 1994 Websearch Journal articles referring to annual physical exams are found from 1992 – 2006.	

9.2 Discussion

What the figures and maps tell us about overall rates and trends in complete physicals initiation:

- Generally, the percentage of the population receiving annual complete physicals is highest in the two urban centres of Winnipeg RHA (45.7% in 1996/97–2003/04) and Brandon RHA (38.4%). RHAs that are in close proximity to Winnipeg have a rates above 35% (South Eastman, Interlake and North Eastman). Within Winnipeg, percentages across CAs and NCs are surprisingly similar with no apparent gradient across the most and least healthy sub–regions. Outside Winnipeg, there also appears to be very little pattern with the healthiness of the RHAs. In the northern RHAs, rates may be lower due to the fact that primary care is often provided by nurse practitioners; hence a complete physical tariff would not appear in the database.
- Over time within the province, there has been an overall decrease in the percentage of the population receiving a complete physical (42.7% to 39.8% from 1988/89–1995/96 to 1996/97–2003/04). This decrease is mirrored throughout most of the RHAs where percentages dropped or remained similar (see Figures 9.1 through 9.4).
- Figures 9.5 and 9.6 show time trends by year. In general, percentages rose slightly up to the early 1990s and have gradually decreased throughout the 1990s. There may be indications of a slight rise in percentages receiving complete physicals from 1996/97 to the present, but this is only a small effect provincially (from 38.6% to 41.2%, less than 3%). The Mid aggregate area shows the largest rise, but it is only 4% (from 33.0% to 37.0%).
- From 1988/89–2003/04, the disparity in complete physicals has increased in the non–Winnipeg aggregate areas due mainly to the North continuing to decline whereas all other areas have leveled off or risen slightly. Within Winnipeg, the most healthy, average health and least healthy groupings are all higher than the provincial average and very similar to each other, hence no significant increase in disparity (see Figures 9.5 and 9.6).
- The maps in Figures 9.7 and 9.8 tell a similar story. The highest rates are in the urban and proximal areas. Figure 9.8 shows several northern districts (such as Cross Lake, Tadoule Lake/Brochet/Lac Brochet, and Island Lake) where, despite their low rates, percentages of the population receiving complete physicals are increasing faster than the provincial average.

What the regression modeling[1] tells us about predictors of having a complete physical in 2001/02–2003/04 (for the complete regression model, refer to Appendix 4):

- Individual characteristics that **increase** the likelihood of having a complete physical—the strongest effects are being female, having good continuity of care, and having physical or mental illnesses. Small positive effects are also evident for being older and residing in a higher income neighbourhood.

[1] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

- Geographical characteristics that **increase** the likelihood of having a complete physical—residing in any CA of Winnipeg or in Brandon or Interlake RHAs.

How the above are associated with descriptive information on policy, program or support initiatives:

- There are no evidence–based physician guidelines or statements that currently recommend a periodic complete physical examination. This recommendation changed over the 1990s, but there are still physicians who see it as an opportunity to do preventive education and screening (personal communication with Dr. Alan Katz). Our research data validates this. Less than half of the provincial residents receive an annual physical. Rates declined over the early 1990s, but a persistent proportion of the population still received complete physicals from their physicians.

9.3 Comparison of Pertinent Literature Reviews and *Our Study Results*

9.3.1 Rates of Annual Complete Physical Examinations:

Canadian data for the percentage of the population having an annual complete physical is difficult to locate. However, 2003/04 data for Ontario indicates variation by age (42% for ages 2–17, 44% for ages 18–39, 55% for ages 40–64, 52% for ages 65–79, and 31% for ages 80+) (Shultz et al. 2006). Data for selected Saskatchewan health regions from the 2000 CCHS indicate a range from 26% to 35% of the population aged 12+ reporting the annual examination (Statistics Canada, Table 105–0064).

The percentage of Manitobans receiving an annual physical examination in the year 2003/04 was 41.2%, but varied by the location of residence with a low of 27.3% in the North and a high of 48.0% in the healthiest aggregate area of Winnipeg. These data are similar to those reported for Ontario (which appear to be close to Manitoba's higher rates) and Saskatchewan (which appear to be close to Manitoba's lower rates).

9.3.2 Policies and Opinions about the Efficacy of an Annual Complete Physical Examination (or Periodic Examination):

In 1979, the Canadian Task Force on the Periodic Health Examination recommended that the annual physical examination be replaced with case findings in the context of visits for other reasons (Prochazka et al. 2005). This was also reflected by the USA Preventative Services Task Force in 1996 which recommended against annual physical examinations since there was a lack of evidence to support the practice (O'Malley and Greenland 2005). Frame and Carlson (1975) did note the importance of a periodic health examinations based on age, sex and risk. Similarly in 1983, the American Medical Association Council on Scientific Affairs recommended periodic examinations every 5 years up to age 40, and every 1 to 3 years thereafter (Gordon et al. 1999). So the idea of periodic health examinations was endorsed by both the Canadian and US task forces (Gordon et al. 1999).

For an asymptomatic, non–pregnant adult, there is no evidence supporting the need for a traditional complete physical examination (Kowalczyk 1997; Oboler and LaForce 1989). However, there is a schedule of specific screening tests that are recommended by both Canadian and USA task forces, including checks on blood pressure, mammography and cervical cancer screening, and visits to test eyes, ears and teeth (Oboler and LaForce 1989). Carrying out these recommendations has been shown to be difficult, so a two–page guideline has been produced (Milone and Lopes Milone 2006) to help guide primary care physicians. The downside is the time required to satisfy task force recommendations. According to Yarnall et al. (2003), satisfying the US Preventive Services Task Force recommendations for preventive services would require 1773 hours of a physician's annual time (which translates into 7.4 hours per working day). Thus, time constraints alone may limit the ability of physicians to comply with preventive services recommendations.

Despite the lack of efficacy, both physicians and the public value the annual physical examination. A survey of primary care physicians found that 65% believed it was necessary and 88% still perform annual physical examinations. Most believed that these were helpful in detecting sub–clinical illnesses (Prochazka et al. 2005). One USA survey found that 66% of people still feel annual physical exams are necessary. What is the "down–side" of these visits? Over 11 million likely unnecessary physician visits hinders ability to provide needed health care; a periodic, more focused health exam would take an estimated 50% less time than an annual physical exam (Gordon et al., 1999). Moreover, outcomes of annual physical exams may be falsely reassuring or create unnecessary anxiety from false–positive results. As well, false–positives generate more expensive diagnostic testing that further increases the costs of healthcare (Kirchner 1999) despite the fact that patients feel better about their health and their care if they receive more tests (Laine 2002). Any efforts to share guidelines with the public have had little effect on patient behaviour (Wool 2002).

What is the "upside" of complete physical examinations? According to some physicians, an annual physical exam is not a needless ritual if it facilitates the formation of physician/patient relationships and the provision of counseling and preventative interventions (Laine 2002). Some argue that while annual physicals may not be cost–effective for the one person where a problem is discovered, it can be a life saving visit (Kowalczyk 1997). Visits during times of acute illness also leave little time for effective preventive care and counseling (Laine 2002), thus these activities would best be served by periodic physical examinations.

As stated in the review of the literature, there are contradictory opinions as to the efficacy of periodic physical examinations, combined with varying beliefs of physicians and patients. These contradictory influences, opinions and beliefs are reflected in our data, where time trends show a slight decline in uptake of the annual complete physical. Yet a persistent one–third to one–half of the population (and slightly increasing) is still receiving this service. With recent emphasis on prevention and screening, it is also not surprising that the trend shows stable rates.

9.4 Recommendations

- Given the current uncertainty in the literature regarding the efficacy of complete physical examinations and the potential benefits or detriments to the health care system overall, a further study of outcomes for those who do and do not receive an annual complete physical could be pursued. This could investigate whether those who have an annual examination actually have better outcomes, both short–term (receipt of appropriate screening or diagnostic services) and long–term (better overall health and reduced use of the health care system for long–term chronic diseases). Only then will there be enough "proof" as to whether an annual complete physical should be supported.
- Many of the indicators in this report (including receiving a mammography test or a cervical cancer screening test) are affected by continuity of physician care—higher continuity (i.e., seeing the same physician for at least half of the visits) means higher likelihood that a person receives these preventive services. Given this fact, the ongoing contact and relationship with a physician may be associated with better outcomes, after controlling for age, gender, socioeconomic status and region of the province.

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CHAPTER 10: MAMMOGRAPHY

10.1 Definition, Graphs and Maps:

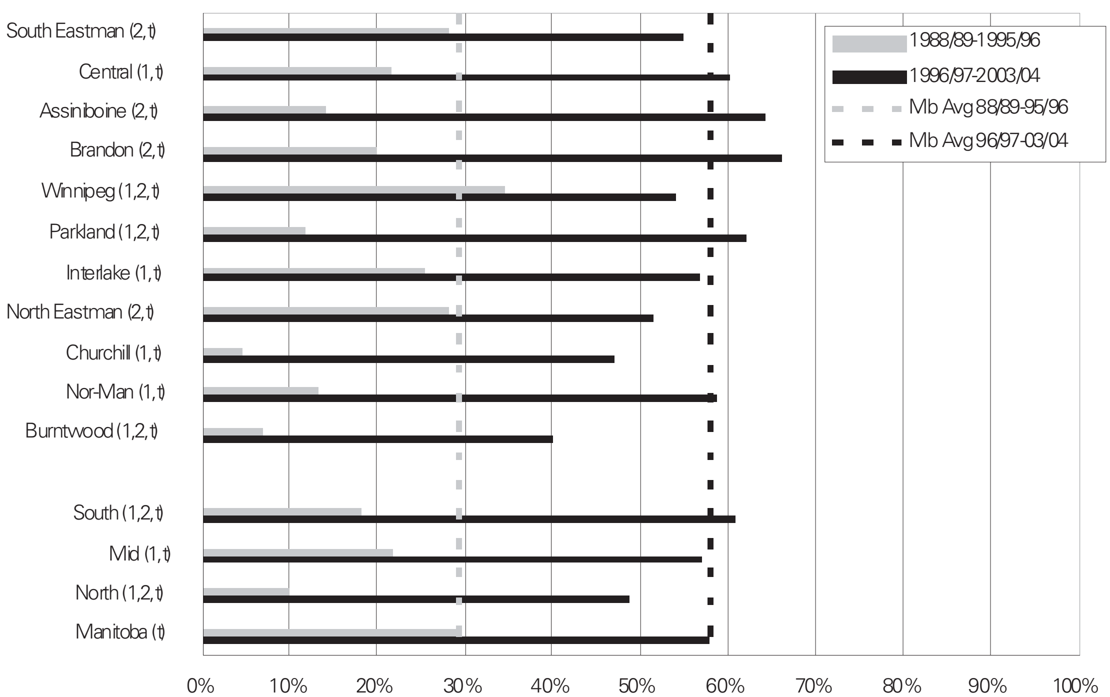
Mammography is a test (x–ray) used to look for breast abnormalities; it is commonly used for breast cancer screening. Manitoba introduced a province–wide breast screening program in 1995 which is operated by the Manitoba Breast Screening Program (MBSP). The percentage of women age 50–69 that have had at least one mammogram screening in a two–year period was calculated over 1984/85–2003/04 fiscal years, with the denominator being the number of women age 50–69 in Manitoba as of December 31 in the second fiscal year of the two–year period. Age is calculated as of the date of the mammogram in the numerator and December 31 of each fiscal year in the denominator. Region of residence is assigned based on the first record in the study period.

We are including mammograms performed through the screening program as well as fee–for–service mammograms. Refer to the Glossary in Appendix 1 for the specific physician tariff codes used to define mammography. It also includes information on how tariff code distribution has changed from 1984/85–2003/04.

Note: further detail as to when mammography was available throughout the province is provided in Appendix 5.

Figure 10.1: Mammography Rates by RHA

Age-adjusted percent of women age 50-69 receiving at least one mammogram in two years

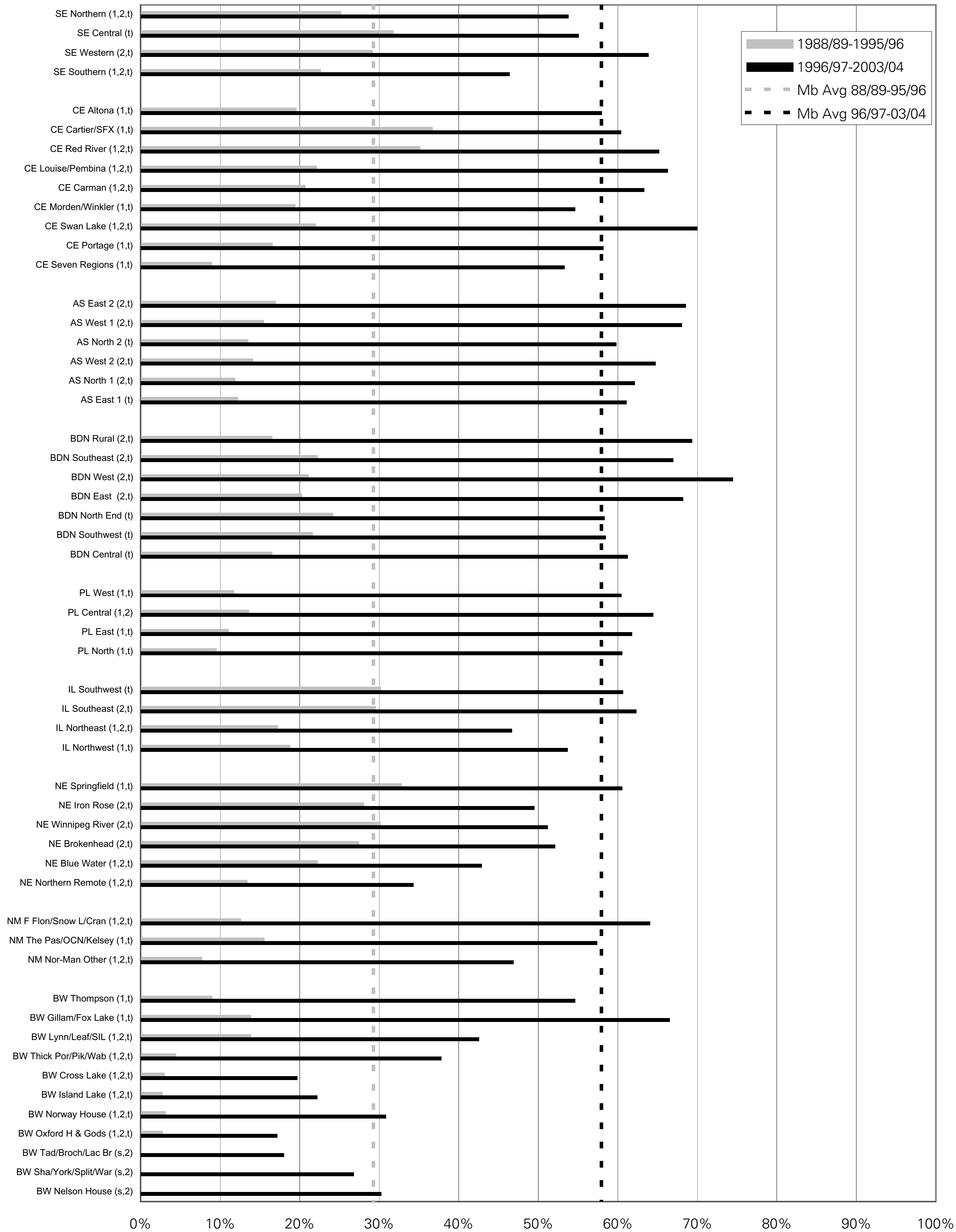


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 10.2: Mammography Rates by District

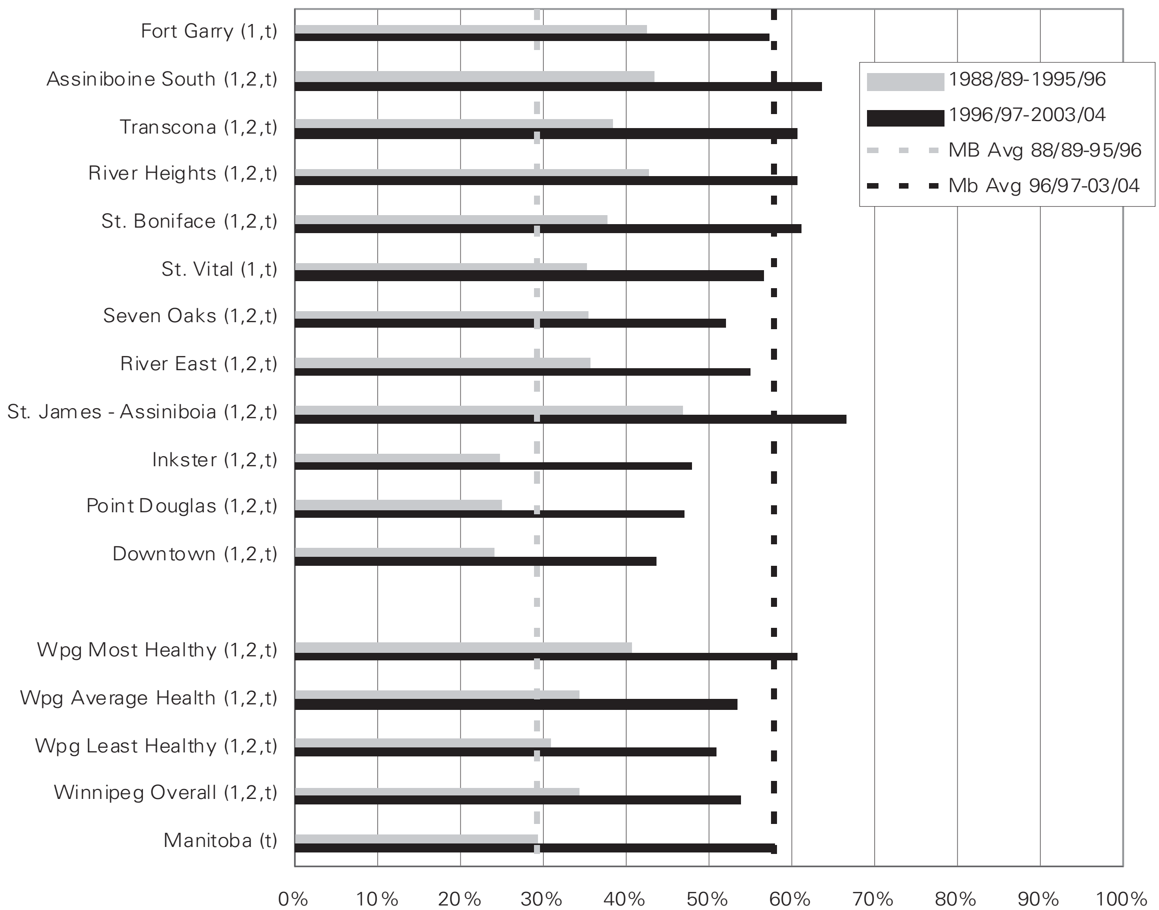
Age-adjusted percent of women age 50-69 receiving at least one mammogram in two years



Source: Manitoba Centre for Health Policy, 2008

Figure 10.3: Mammography Rates by Winnipeg Community Areas

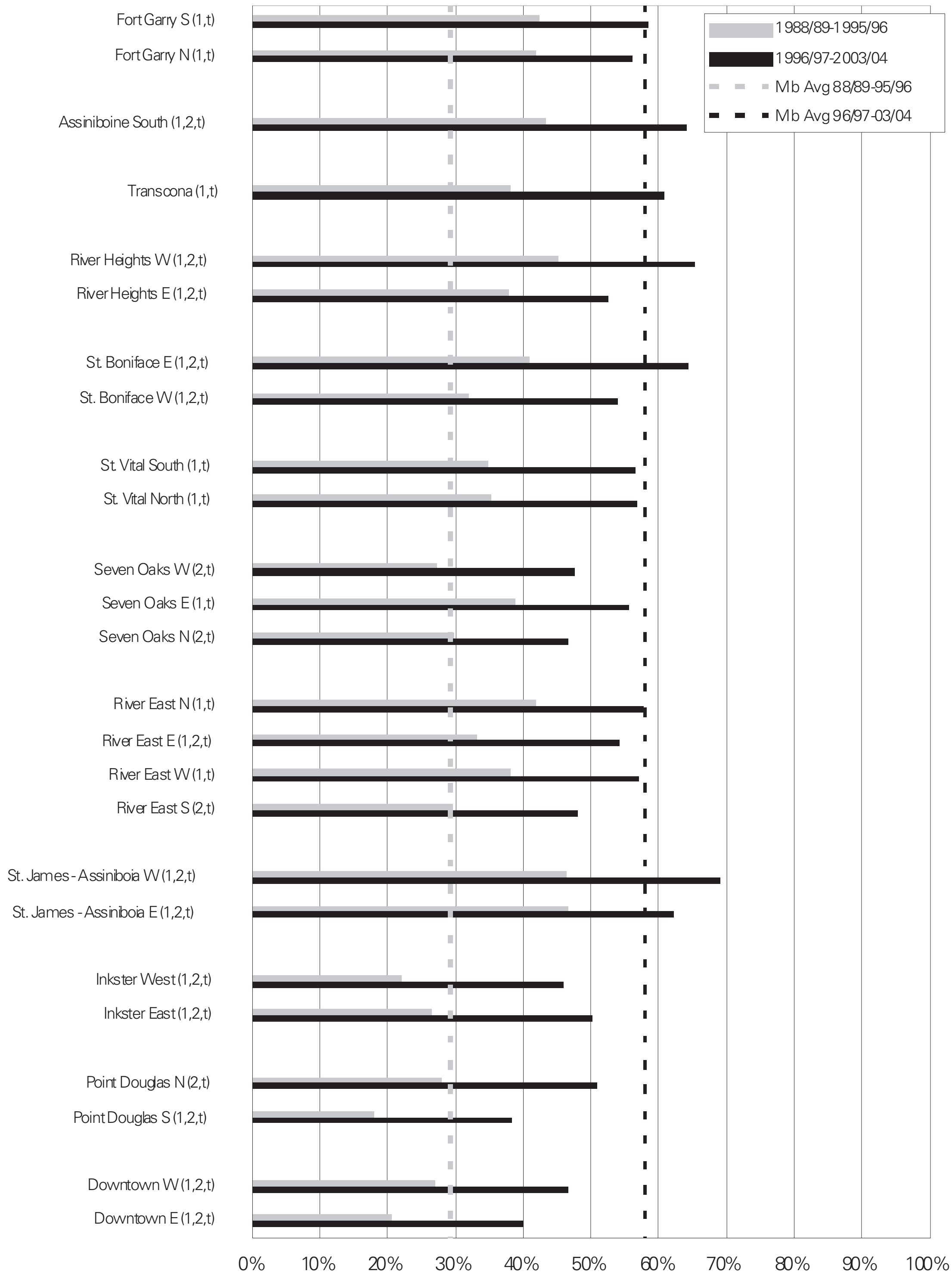
Age-adjusted percent of women age 50-69 receiving at least one mammogram in two years



'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers Source: Manitoba Centre for Health Policy, 2008

Figure 10.4: Mammography Rates by Winnipeg Neighborhood Clusters

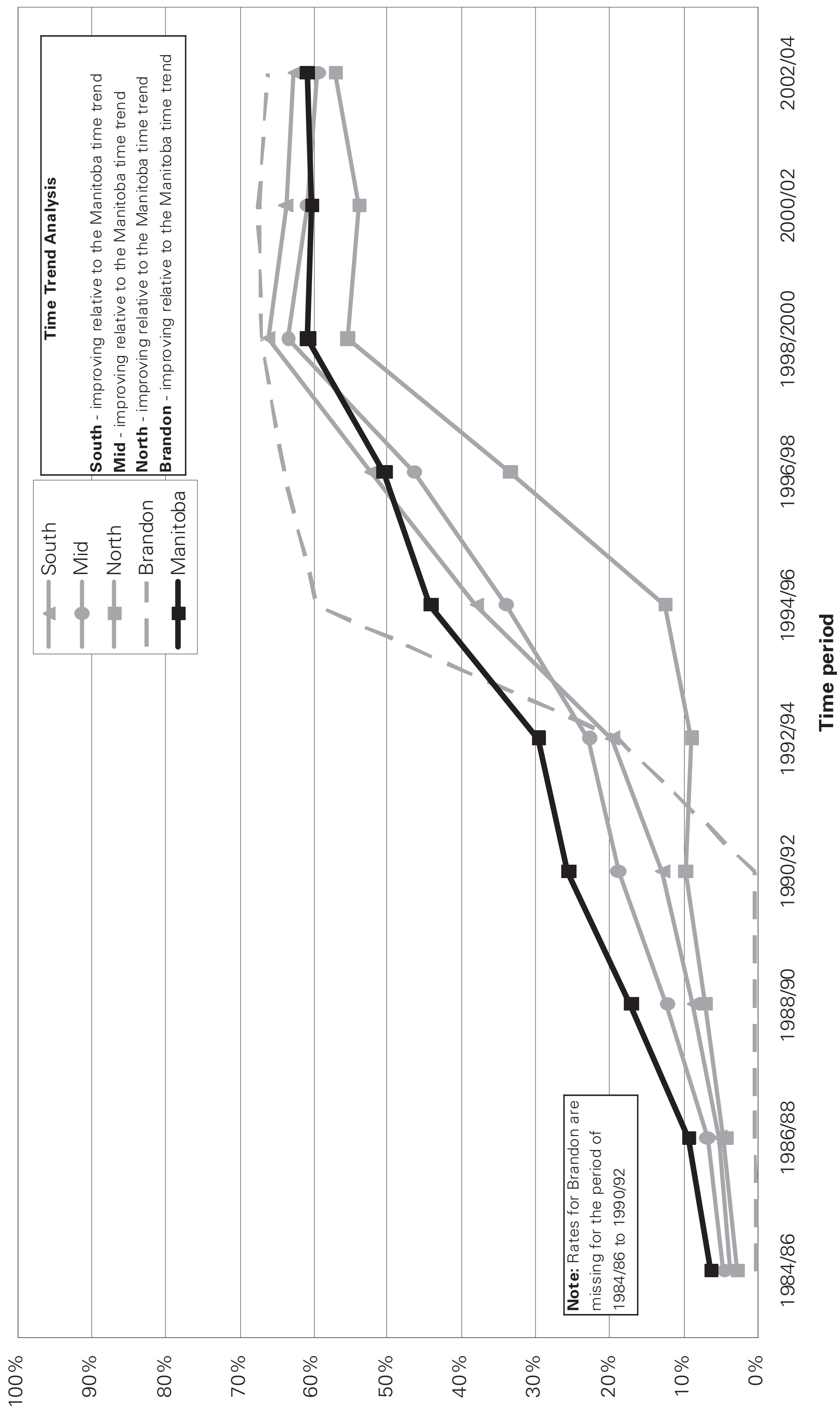
Age-adjusted percent of women age 50-69 receiving at least one mammogram in two years



Source: Manitoba Centre for Health Policy, 2008

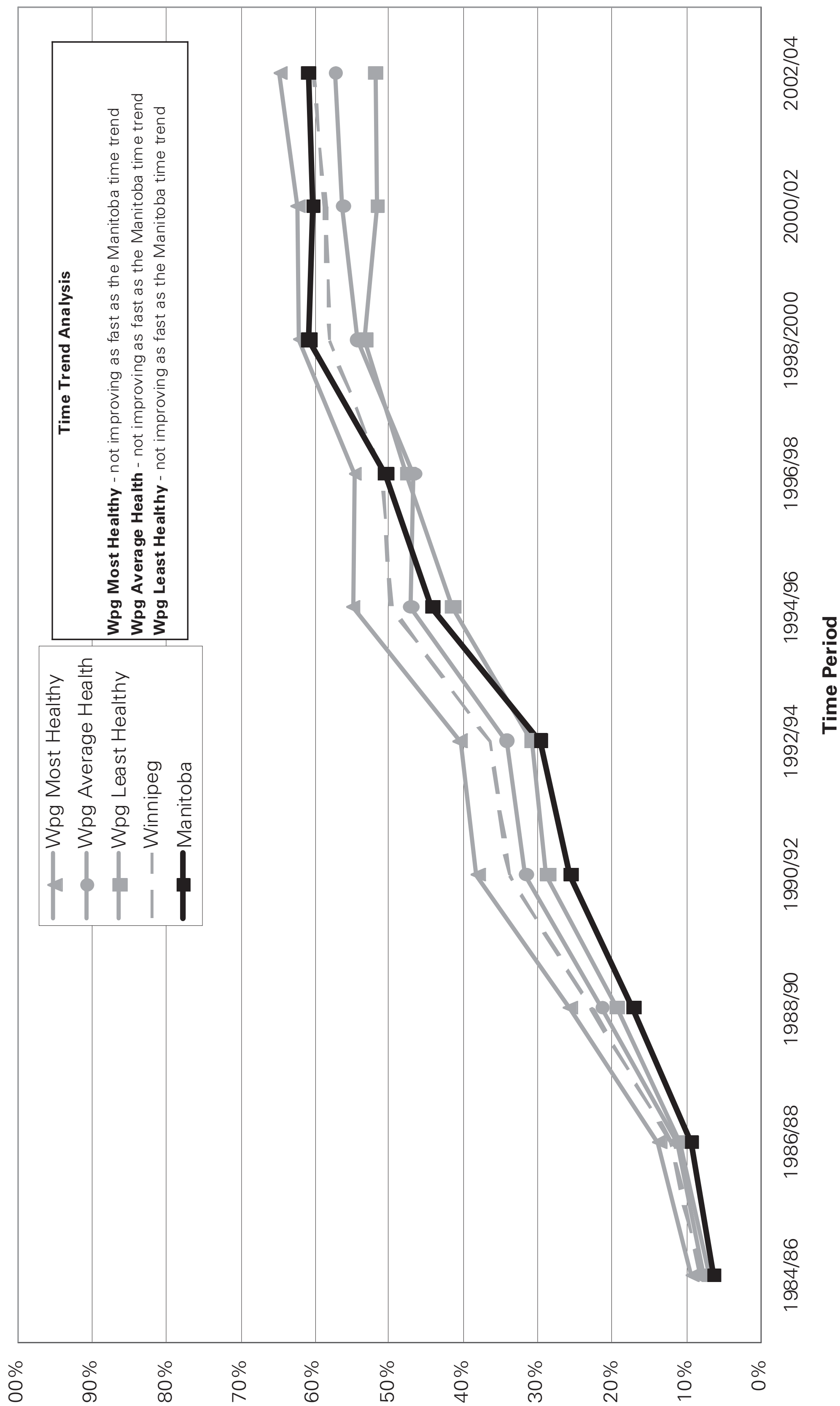
Figure 10.5: Trends in Non-Winnipeg Mammography Rates

Age-adjusted percentage of women age 50-69 receiving at least one mammogram in two years



Source: Manitoba Centre for Health Policy, 2008

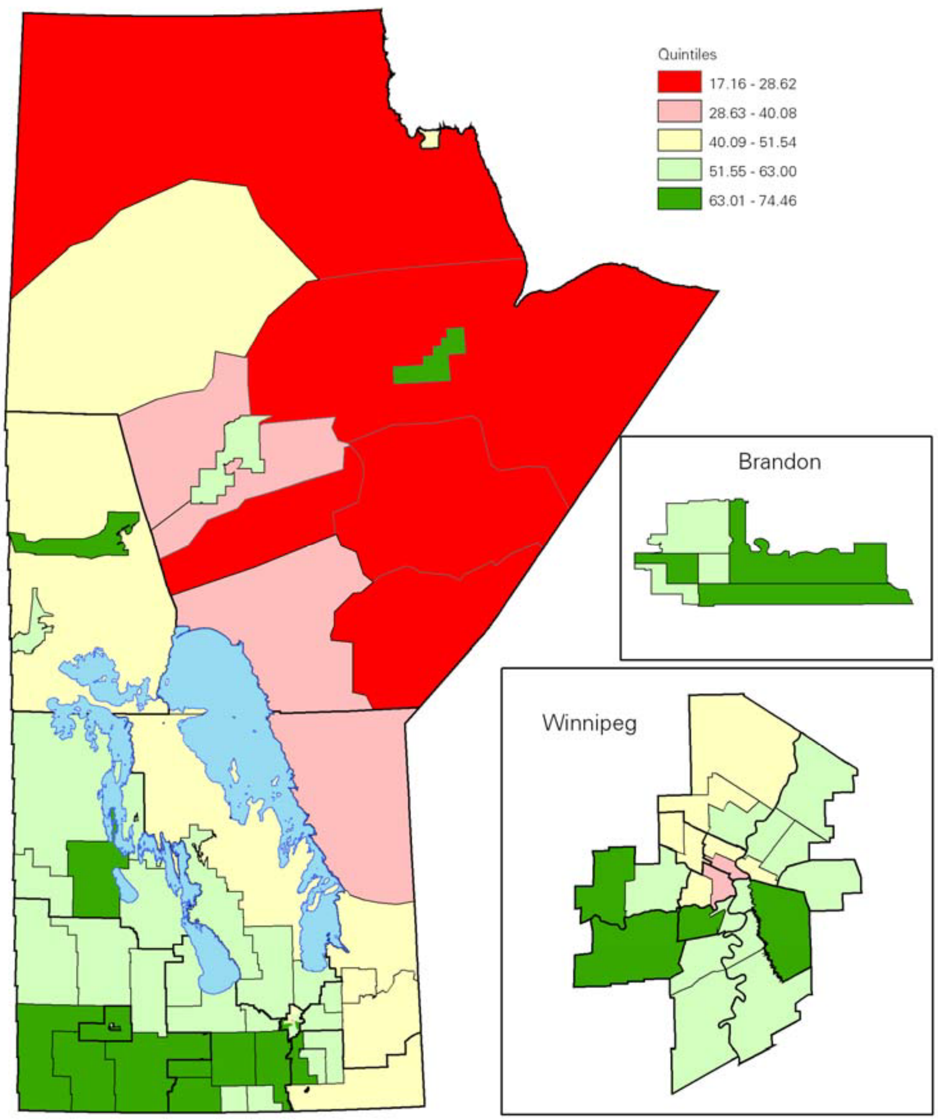
Figure 10.6: Trends in Winnipeg Mammography Rates
Age-adjusted percentage of women age 50-69 receiving at least one mammogram in two years



Source: Manitoba Centre for Health Policy, 2008

Figure 10.7: Mammography Rate Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

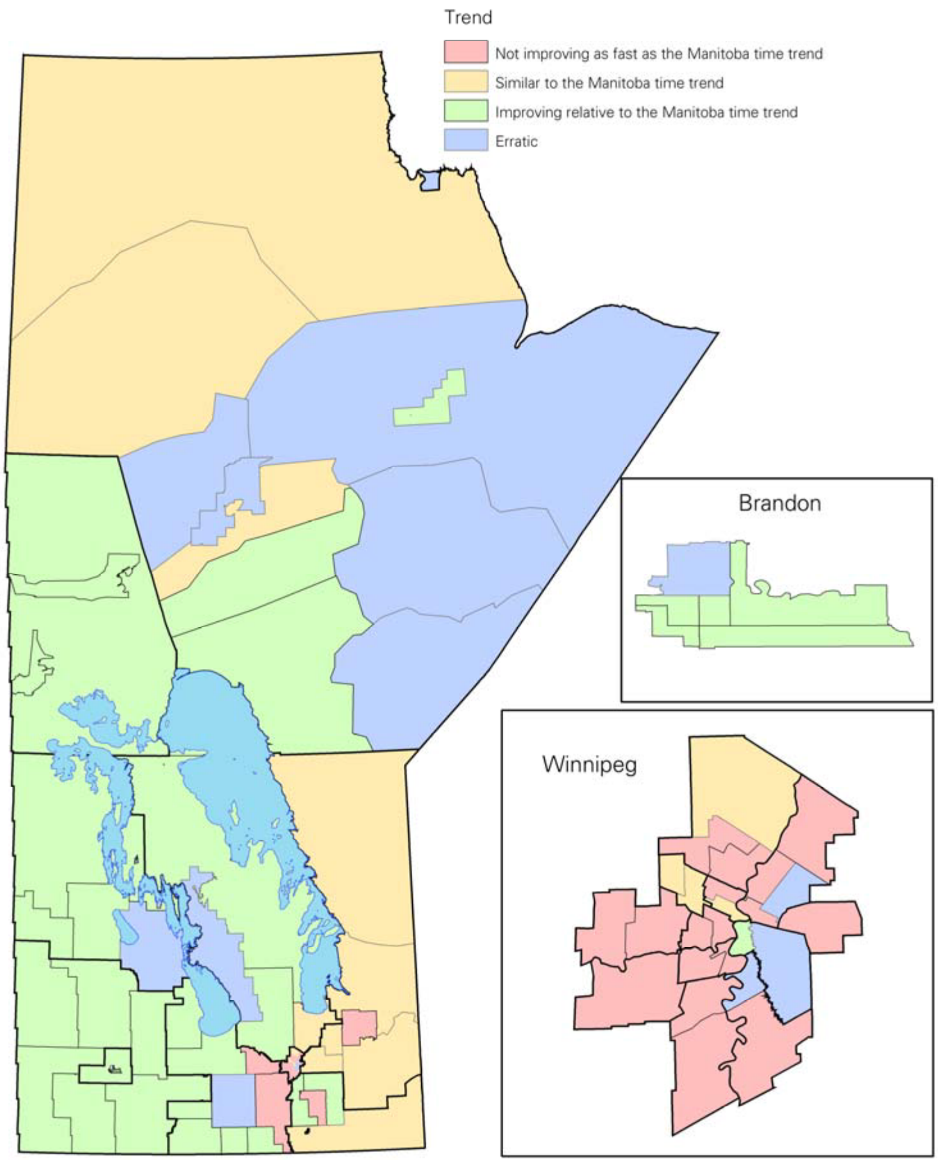
Age-adjusted percentage of women age 50-69 receiving at least one mammogram in two years, 1996/97-2003/04



Source: Manitoba Centre for Health Policy, 2008

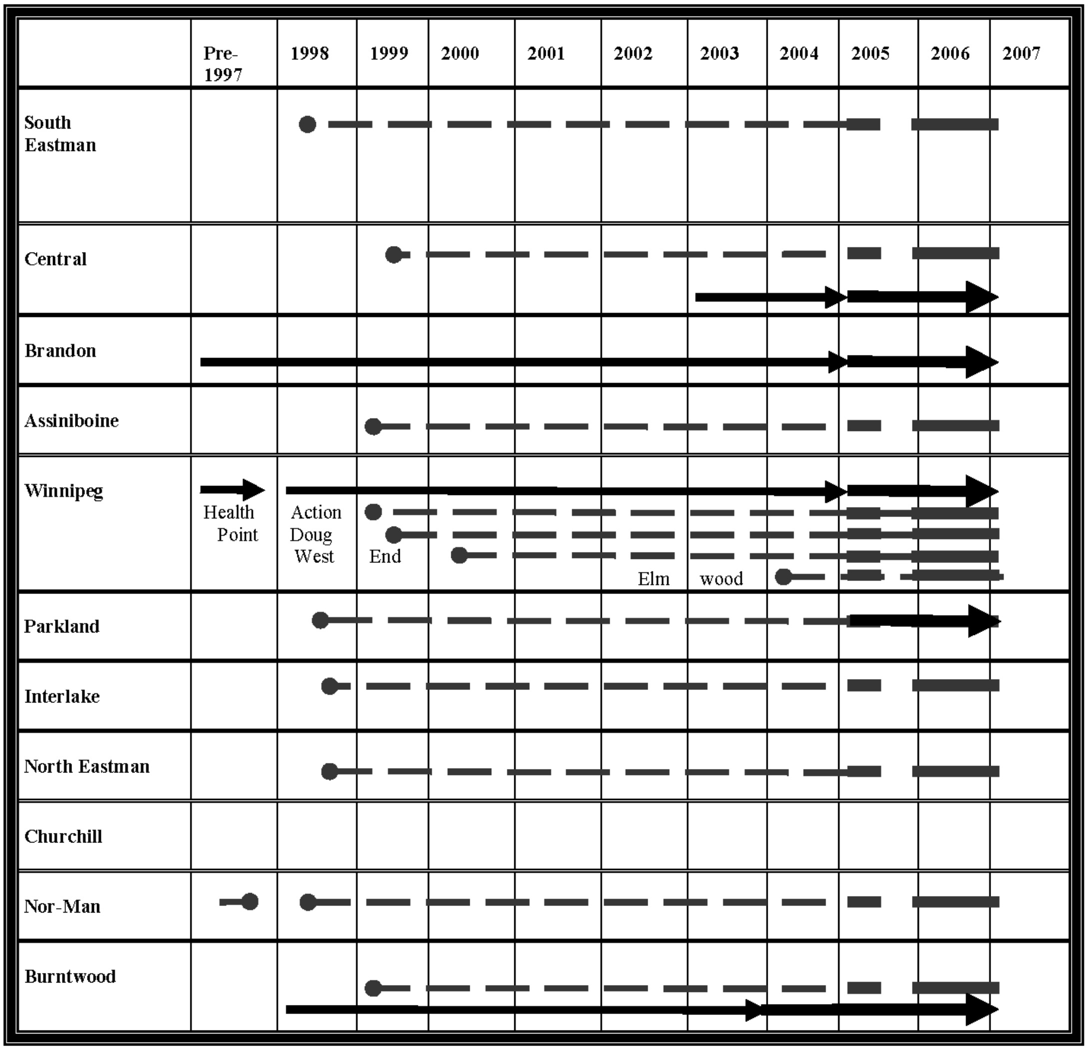
Figure 10.8: Trends in Mammography Rates by RHA Districts and Winnipeg Neighbourhood Clusters

Age-adjusted percentage of women age 50-69 receiving at least one mammogram in two years, 1984/85-2003/04



Source: Manitoba Centre for Health Policy, 2008

Table 10.1: Mammography screening initiatives–policies and programs



Fixed Screening sites opened

Increase in site appointments

Demonstration Project

Mobile Units

Mobile screening program expands

Regions have yearly mobile sites and smaller sites where the mobile comes every 2 years.

The mobile may be in a region from 2 to 6 months.

Note: Further detail as to when mammography screening was available throughout the province is provided in Appendix 5.

10.2 Discussion

What the figures and maps tell us about overall rates and trends in mammography:

- In the first eight years of our study (1988/89–1995/96), mammography rates were generally lower in areas that had the poorest overall health status—with screening rates only half as high in the North (10.0%) as in the Mid (21.8%) and South (18.1%) areas, which in turn were only half as high as in Winnipeg (34.5%). However, the disparity decreased substantially over the next eight years (1996/97–2003/04) with rates in the Mid (57.1%) and South (60.9%) areas higher than those in Winnipeg (53.9%) and rates in the North (48.8%) just slightly lower than Winnipeg. Within Winnipeg RHA, rates over the two time periods show a gradient from highest in the most healthy areas to lowest in the least healthy areas with the "gap" being fairly consistent through the two time periods (40.8% vs. 30.8% in 1988/89–1995/96, 60.7%vs. 51.0% in 1996/97–2003/04).
- Assiniboine, Brandon and Parkland RHAs appear to have the most consistently high rates (i.e., similar or higher than the provincial average) throughout all districts of their regions (see Figure 10.2). As well, the majority of districts in Central, Interlake and South Eastman, as well as the majority of NCs in Winnipeg show higher rates (see Figure 10.7). The RHAs with the most disparity by district are Burntwood and North Eastman. Within Winnipeg, the lowest rates are in Inkster, Point Douglas and Downtown.
- Brandon West district has the highest rate in the province from 1996/97–2003/04, at 74.5%. All other districts (and Winnipeg NCs) have rates below 70%.
- In all aggregate areas of the province (including Winnipeg), there was a rapid increase in mammography rates from the late 1980s up to the late 1990s with most areas leveling off from 2000 onward.
- According to Figure 10.7, Burntwood RHA has the most districts with low rates (but also has high rates in Gillam/Fox Lake district).
- Trends within the province show that the majority of the RHA districts outside of Winnipeg show mammography rates improving faster than the Manitoba time trend (with the exception of most districts in North Eastman and Burntwood). However, the majority of NCs in Winnipeg show time trends that are not improving as fast as the Manitoba time trend.

What the regression modeling[1] tells us about predictors of mammography in 2002/03–2003/04 (for the complete regression model, refer to Appendix 4):

- Individual characteristics that increased the likelihood of mammography for women aged 50 through 69—higher age, higher average household income, better "continuity of care" (i.e., more likely to have seen the same physician for at least 50% of their visits), and women having more mental and physical health problems. The measure for "mental health problems" was the 'mental ADG' group (see Appendix 1 Glossary for a complete description). Although people with at least one mental ADG were more likely to have a mammography,

[1] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

when this was analyzed for the specific condition of schizophrenia the results were reversed. For women being diagnosed with schizophrenia within a 12–year period, their odds of having a mammography in 2002/03–2003/04 was 0.64 (0.58–0.72) after controlling for area, income, age, continuity of care, and physical ADGs. As well, at the provincial level, the age–adjusted rate of mammography was significantly lower for women experiencing schizophrenia compared to those who did not (44.8% versus 58.3%, p<.001).

- Geographical characteristics that increased the likelihood of mammography in 2003/04 after controlling for all other factors—the greatest geographical advantages are seen in Assiniboine, Brandon and Parkland RHAs. There is also an increased likelihood of screening for women living in Central, North Eastman, South Eastman and Interlake. Within Winnipeg, there is a slight increase in mammography for St. Vital, St. Boniface and St. James–Assiniboia community areas. The only geographical areas that have lower likelihood of mammography, after controlling for other individual factors, are all in Winnipeg—River East, Seven Oaks, Inkster, Point Douglas and Downtown.

How the above are associated with descriptive information on policy, program or support initiatives to increase mammography:

- The onset of mobile mammography units throughout Manitoba's rural and northern areas correspond directly with huge increases in screening rates in the South and Mid areas first and a later response in the North. This lag may relate to the delay in the mobile units accessing women living in Burntwood which started after the rest of the rural areas.
- In place since 1995, the fixed screening site in Brandon RHA corresponds with the very rapid increase in mammography rates in Brandon in that same time period.
- The initiatives in Winnipeg have produced a gradual increase in mammography rates over the past two decades with a flattening out since 2000. The Winnipeg least healthy and average healthy areas (see Figure 10.6) were actually below the Manitoba average rate in 2003/04 despite various efforts to ensure accessible screening programs through Health Action Centre and in the Point Douglas, West End and Elmwood areas.
- Two recent initiatives—adding more capacity for screening and flying in northern women to screening sites—may show further increases in screening rates; but further data analysis (past 2003/04) will be required to see the effects. A concern expressed by various RHAs was the "capping" of funding which limits the number of screenings. This may be one reason for the plateau effect since 2000. Since 2003/04, there has been a modest increase; hence we may see another increase in screening rates as a result.

10.3 Comparison of Pertinent Literature Reviews and *Our Study Results*

10.3.1 Mammography Rates:

There have been estimates that screening mammography can reduce mortality from breast cancer by 20–35% for women aged 50–69 years old, and 20% for women age 40–49 years old (Elmore et al. 2005; Fletcher and Elmore 2003). However, there is substantial controversy regarding the appropriate age of screening (De Grasse et al. 1999). The American College of Preventive Medicine Practice

Policy Statement (Ferrini et al. 1996—although still endorsed as of August 2007) states that there is "ample evidence from a variety of well–conducted RCTs that annual or biennial mammography is effective in reducing breast cancer mortality in women 50–69 years". However, the college does not provide recommendations for women under the age of 50 because of the lack of evidence currently. For women aged 50–69, the Canadian Task Force on the Periodic Health Examination (now known as the Canadian Task Force on Preventive Health Care) and the U.S. Preventive Services Task Force recommend mammography every 1–2 years (de Grasse et al. 1999; Ferrini et al. 1996; Canadian Task Force on Preventive Health Care 2007). Manitoba's Breast Screening Program states that the best chances of reducing death from breast cancer arise from screening at least 70% of Manitoba women aged 50–69 every two years (see their website at http://www.cancercare.mb.ca/MBSP/index.shtml).

According to Statistics Canada's Canadian Community Health Survey CCHS 3.1 (Statistics Canada 2005), 70.4% of women aged 50–69 years old reported receiving a mammogram (screening or diagnostic) over a two–year period. Out of all the provinces, PEI had the lowest mammography rate at 64.3%. At 65.6%, Manitoba and BC share the second lowest rate. In Manitoba, 42.6% of women reported that the mammography was routine screening and 23.0% for other reason (presumably diagnostic or follow–up). One caution with using CCHS data is that no "on–reserve" First Nations women are surveyed, a major limitation in the province of Manitoba. The highest mammography rate was in Quebec at 72.8%. Though not entirely comparable, CDC (2007) reports mammography rates for the USA at 74.6% in 2005 for women aged 40 and above, a statistically significant drop from 76.4% in 2000.

In our Manitoba study, the latest data indicate a provincial mammography rate of 61.0% in 2002/2004. Rates vary by aggregate area, with Brandon RHA at a high of 66.3% and the North at a low of 57.2%. Within Winnipeg, the most healthy areas had a rate of 64.8% in 2002/04 and the least healthy 51.9%. Not surprisingly, our provincial rate is lower than that reported in the CCHS 3.1 (Statistics Canada 2005) data, since the national survey excludes those living in First Nations communities (and this population tends to have lower rates). This reinforces the finding of CCHS that Manitoba rates tend to be lower than the Canadian average of 72.6%, and we have one of the lowest provincial rates in Canada. We need to explore "what works"—why does Quebec have such high screening rates? What is Brandon doing in its Brandon West district with a rate of 74.5% overall from 1996/97–2003/04 (whereas all other non–Winnipeg districts and Winnipeg NCs were below 70%)?

10.3.2 Policy and Program Initiatives Pertinent to Increase Mammography Rates:

Population–based screening programs in Canada were started based on the assumption that screening could reduce mortality by 30% in women aged 50–69 if 70% of women in this age range had a mammogram every two years (Gaudette et al. 1996). As of 1995, 22 countries had created national, sub–national or pilot population–based breast cancer screening programs (Bourchard et al. 1999). This includes established programs in Australia, Canada, Finland, Iceland, Israel, Italy, Hungary, Japan, Netherlands, Sweden, UK, USA, and Uruguay; and pilot programs in Belgium, Denmark, France, Greece, Ireland, Luxembourg, Portugal, and Spain. Canadian performance indicators on mammography compare favourably with those of other well–established international screening programs (Wadden and Doyle 2006). Most countries used a personal invitation system to recruit women for screening; some also used media advertising and pamphlets or referral by a primary care physician. Several countries used centres dedicated to mammography; others also had mobile units often used to reach rural, low income or other populations less likely to come to centralized centres (Bourchard et al. 1999).

According to a Cochrane Collaboration review (Bonfill et al. 2001), evidence as to "what works" in increasing participation rates for mammography shows five successful strategies—letters of invitation (OR 1.66, 95% CI 1.43 to 1.92), mailed educational material (OR 2.81, 95% CI 1.96 to 4.02), letters of invitation plus phone calls (OR 2.53, 95% CI 2.02 to 3.18), phone calls (OR 1.94, 95% CI 1.70 to 2.23), and training activities plus direct reminders for the women (OR 2.46, 95% CI 1.72 to 3.50). Home visits were not found to be effective. Personalised risk communication, whether written, spoken or visually presented, was also found to be of limited effect in increasing the uptake of screening tests (OR 1.31, 95% CI 0.98 to 1.77) (Edwards et al. 2006). In a systematic review of interventions designed to increase mammography rates for low–income women (Bailey et al. 2005), interventions that used peer counselors, incorporated multiple intervention strategies, or provided better and easy access (through mobile units, cost vouchers or home visits) were effective. However, contrary to trials involving women of middle or high socio–economic status, mailed or telephone reminders were not effective for low–income women.

In our study, the presence of a rural mobile mammography program was associated with a huge increase in screening rates during the 1990s. These rates even surpassed those in Winnipeg. However, some of the most remote areas of the province still have very low rates and not as rapid improvement as the Manitoba time trend.

According to the literature review, the most effective strategies appear to be a letter of invitation plus a follow–up telephone call (although this may not be effective for vulnerable populations). The Manitoba Breast Screening Program is presently increasing access throughout the province through innovative programs for vulnerable, hard to reach populations. These "easy access" programs include multicultural initiatives, flying northern women in for screening, promoting and organizing group trips, and adding more mobile sites. It has also recently put more effort into increasing the numbers of screens which has limited capacity based on funding, but the effort may translate into another increase in rates following the plateau effect seen in our data after 2000.

10.4 Recommendations

- Given the very positive increases in mammography rates (especially in non–Winnipeg areas of the province), current strategies need to continue. These include notification (mail and telephone), plus mobile screening units that make access easy for rural/remote women. As well, Brandon's fixed screening sites seem to be associated with high rates throughout Brandon's districts.
- Reducing inequity in rates throughout an RHA will take concerted effort—Assiniboine, Parkland and Brandon have all achieved more consistent and high rates throughout their regions. Further study will enable insights into what these regions are doing to reduce inequity.

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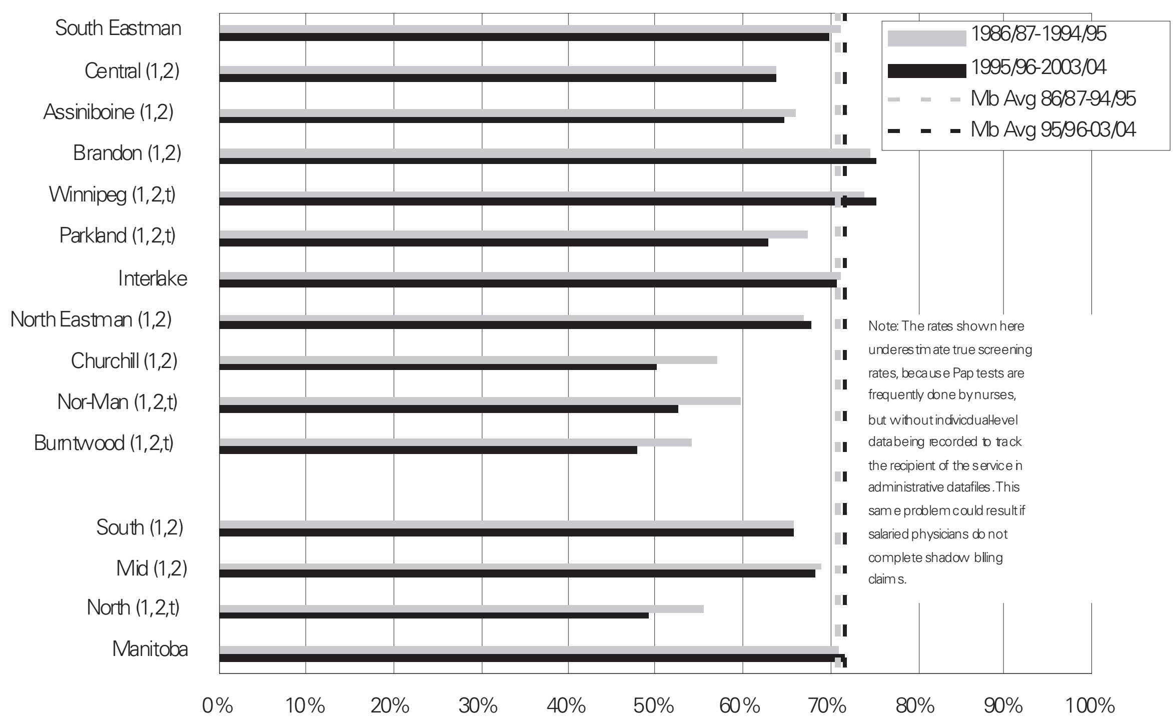
CHAPTER 11: CERVICAL CANCER SCREENING

11.1 Definition, Graphs and Maps

Also called a Pap (Papanicolau) test, cervical cancer screening is based on the examination of cells collected from the cervix to reveal pre–malignant (before cancer) and malignant (cancer) changes as well as changes due to non–cancerous conditions such as inflammation from infections. For this report, the proportion of women age 18–69 who received at least one Pap test in a three–year period was calculated for fiscal years 1986/87–2003/04. Women who have had a total hysterectomy (ICD–9–CM codes 68.4–68.9) were excluded from both the numerator and denominator. Cervical cancer screening was defined by a physician visit with a tariff code for a Pap test: 8470, 8495, 8496, 8498 or 9795, or a laboratory tariff code of 9470. Age is calculated as the physician visit date in numerator and December 31 in the denominator. Region of residence is assigned based on the first record for each three–year period. For further information, refer to "Cervical Cancer Screening" in the Glossary, Appendix 1.

Figure 11.1: Cervical Cancer Screening Rates by RHA

Age-adjusted percent of women age 18-69 with one or more Pap smears in a three-year period, excluding those who have had a hysterectomy

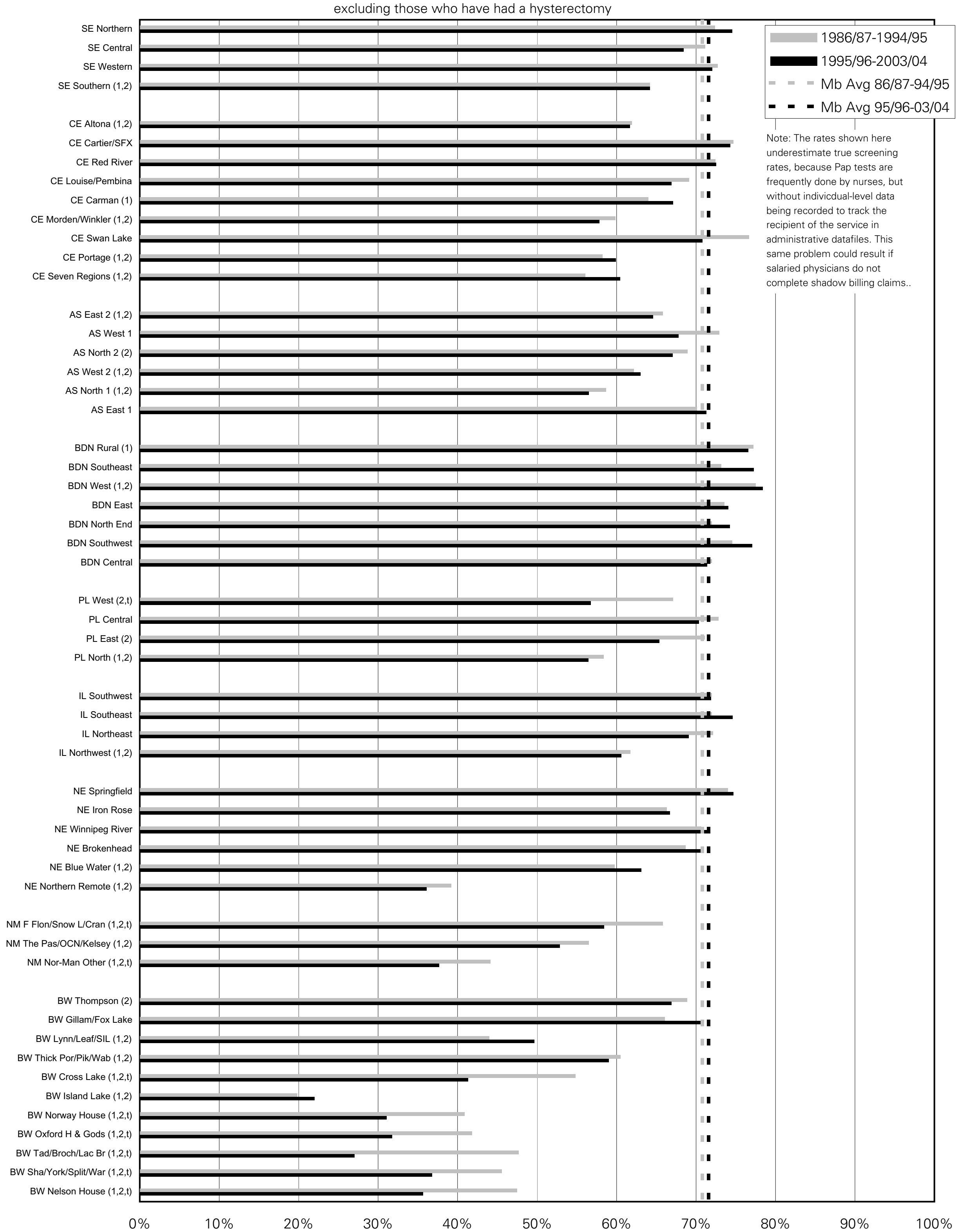


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 11.2: Cervical Cancer Screening Rates by District

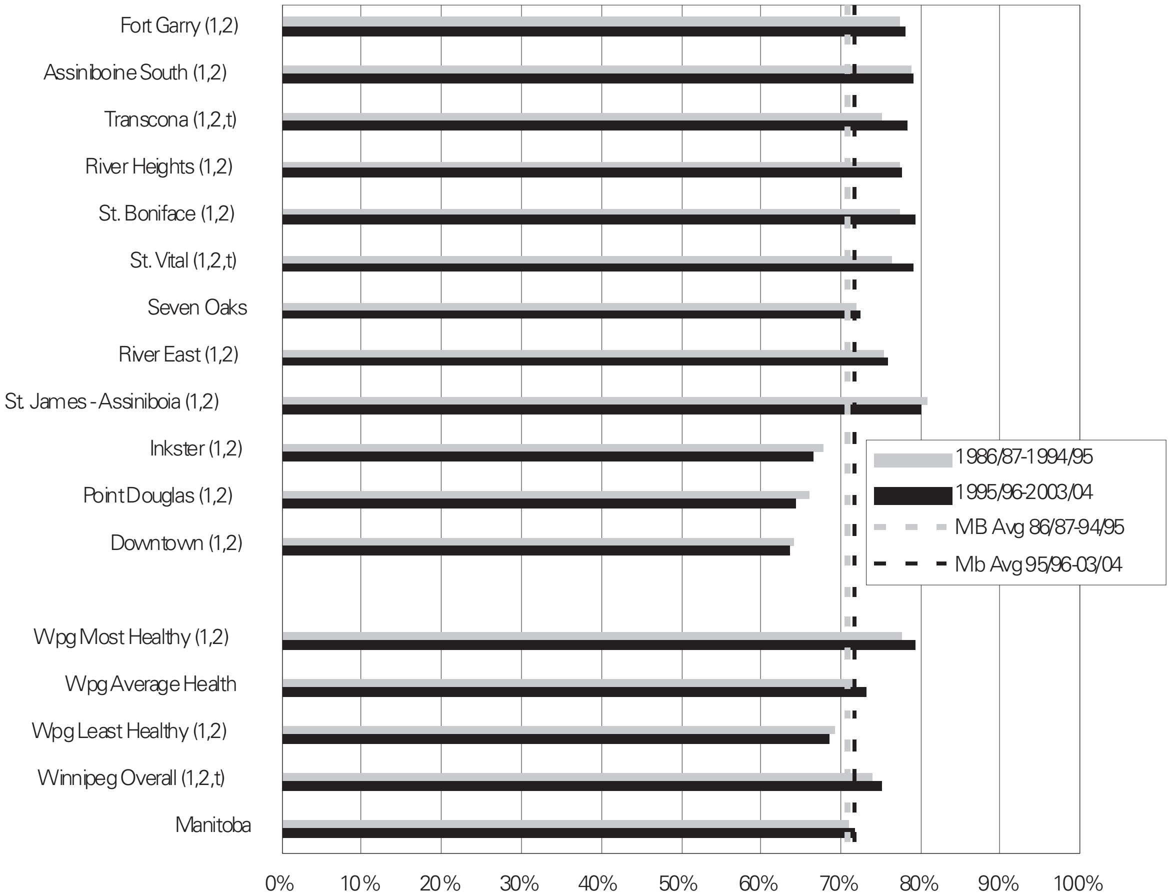
Age-adjusted percent of women age 18-69 with one or more PAP smears in a three-year period, excluding those who have had a hysterectomy



Source: Manitoba Centre for Health Policy, 2008

Figure 11.3: Cervical Cancer Screening Rates by Winnipeg Community Areas

Age-adjusted percent of women age 18-69 with one or more Pap smears in a three-year period, excluding those who have had a hysterectomy

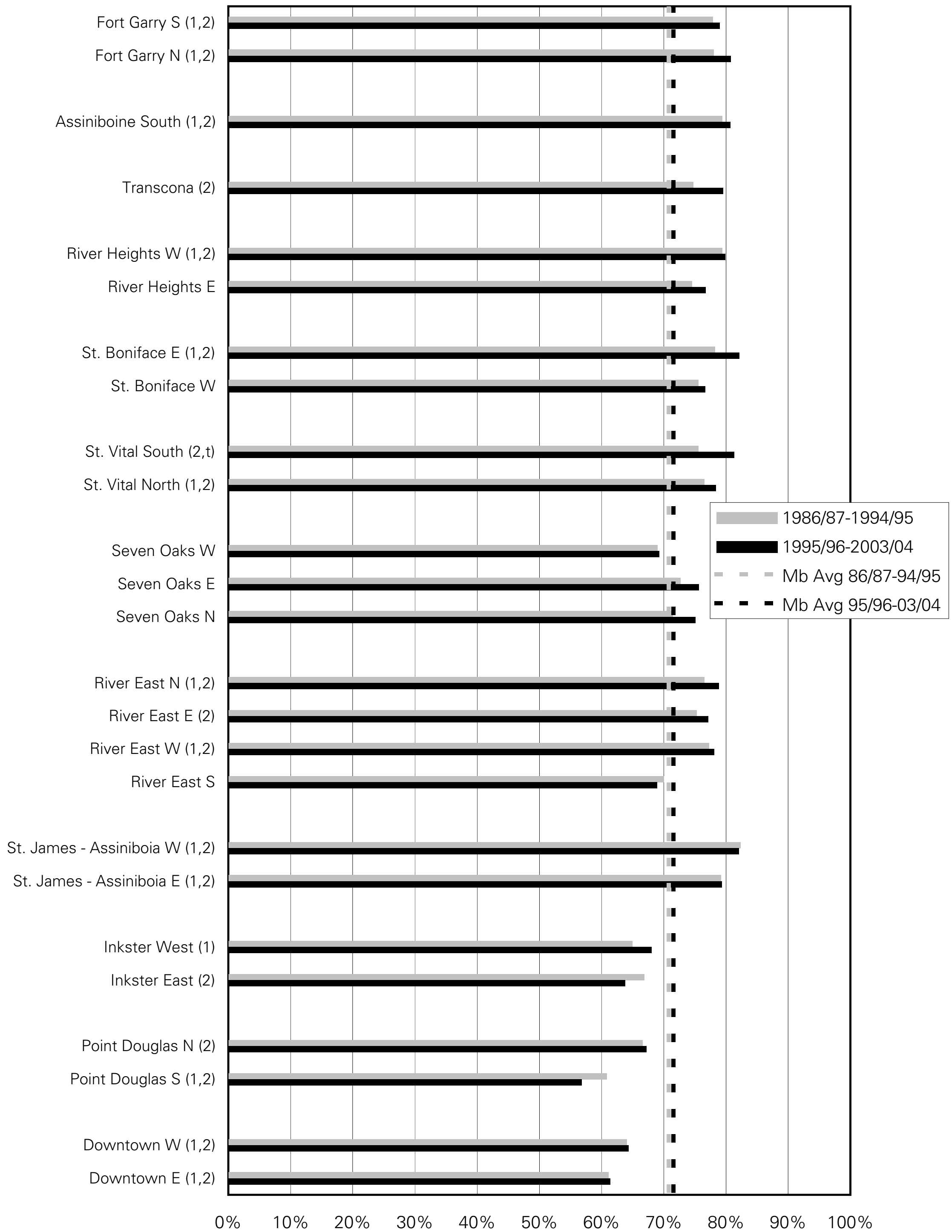


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 11.4: Cervical Cancer Screening Rates by Winnipeg Neighbourhood Clusters

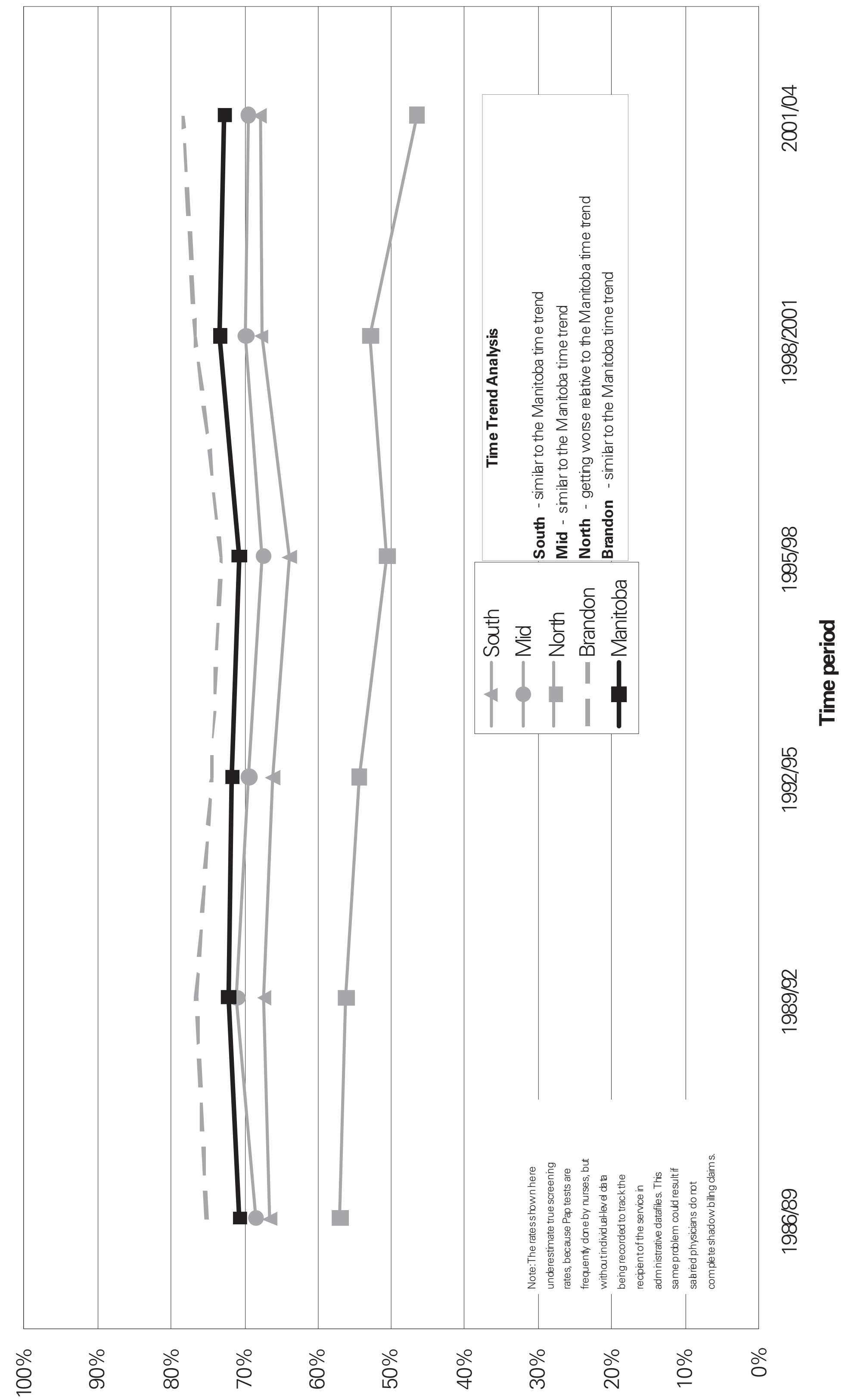
Age-adjusted percent of women age 18-69 with one or more Pap smears in a three-year period, excluding those who have had a hysterectomy



Source: Manitoba Centre for Health Policy, 2008

Figure 11.5: Trends in Non-Winnipeg Cervical Cancer Screening Rates

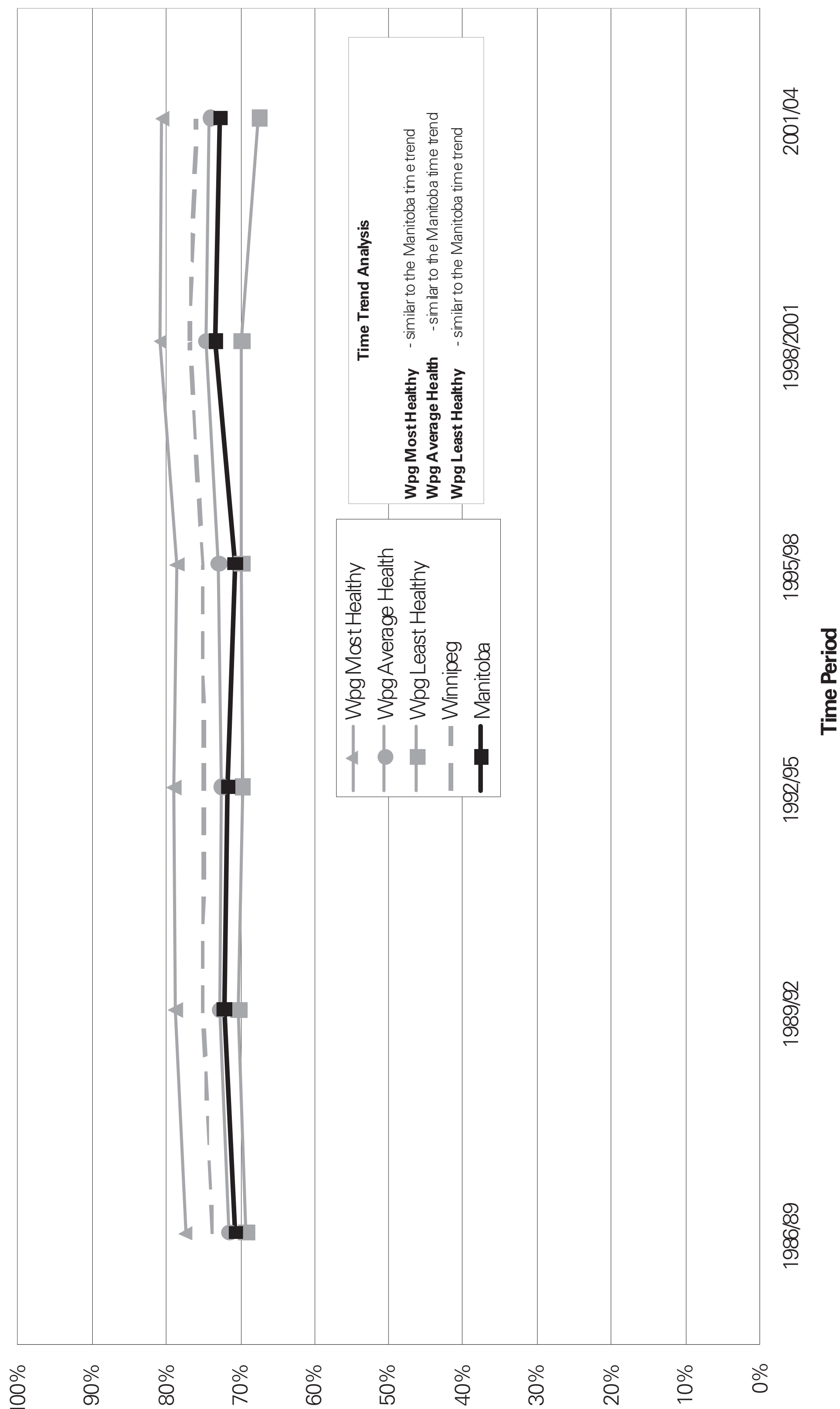
Age-adjusted percent of women age 18-69 with one or more Pap smears in a three-year period, excluding those who have had a hysterectomy



Source: Manitoba Centre for Health Policy, 2008

Figure 11.6: Trends in Winnipeg Cervical Cancer Screening Rates

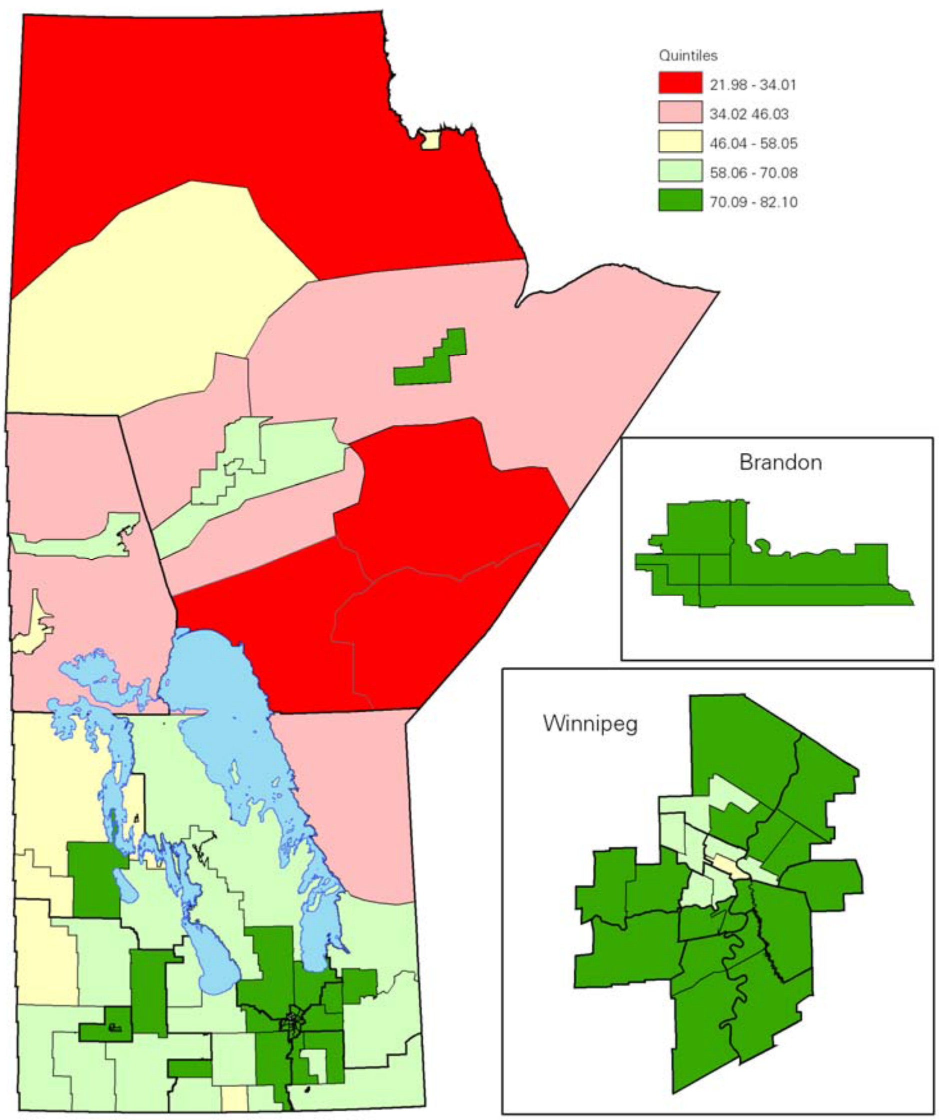
Age-adjusted percent of women age 18-69 with one or more Pap smears in a three-year period, excluding those who have had a hysterectomy



source: Manitoba Centre for Health Policy, 2008

Figure 11.7: Cervical Cancer Screening Rate Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

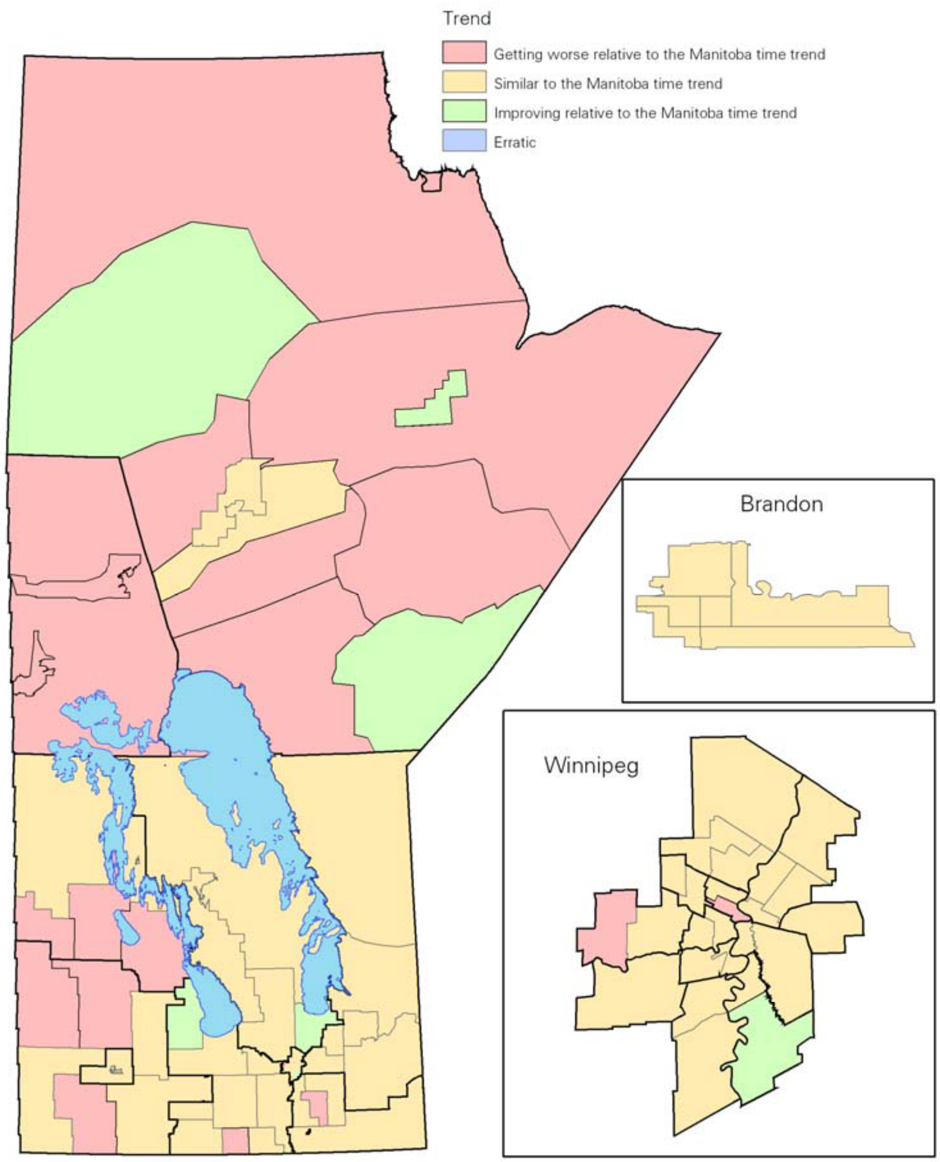
Age-adjusted percent of women age 18-69 with one or more Pap smears in a three-year period, excluding those who have had a hysterectomy, 1995/96-2003/04



Source: Manitoba Centre for Health Policy, 2008

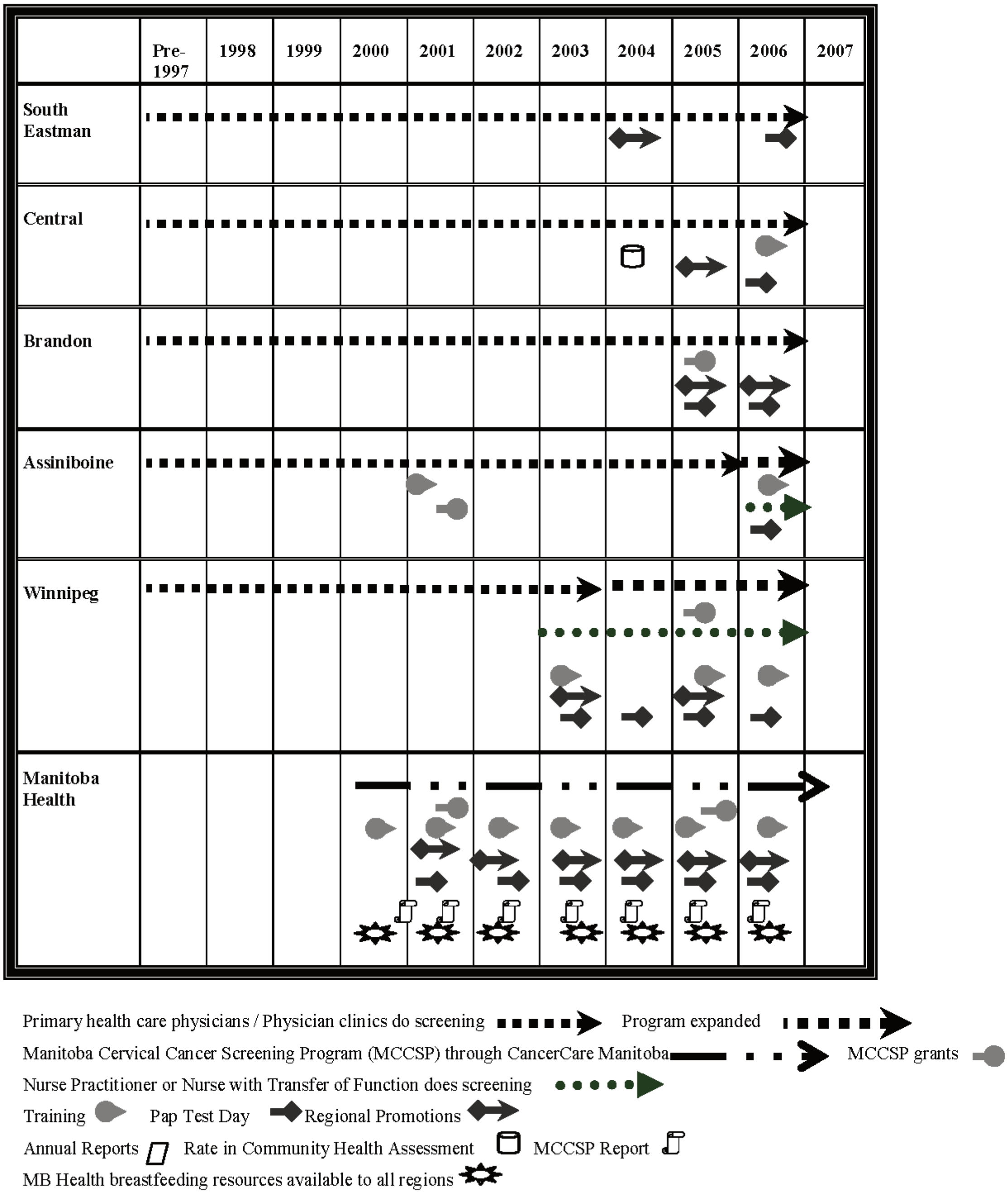
Figure 11.8: Trends in Cervical Cancer Screening Rates by RHA Districts and Winnipeg Neighbourhood Clusters

Age-adjusted percent of women age 18-69 with one ore more Pap smears in a three-year period, excluding those who have had a hysterectomy,1986/87-2003/04



Source: Manitoba Centre for Health Policy, 2008

Table 11.1: Cervical cancer screening initiatives



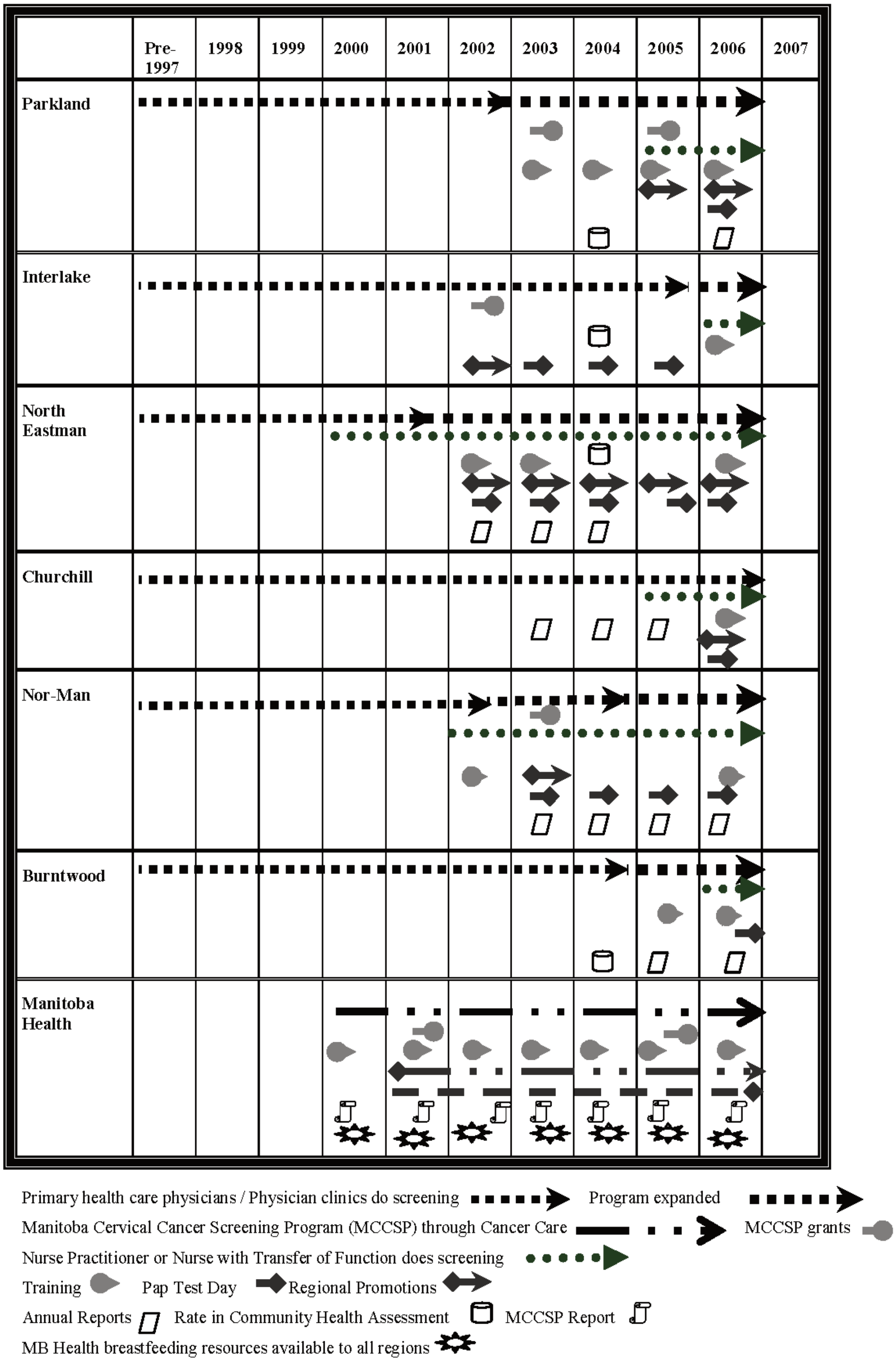

Pre-1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Parkland
Interlake
North Eastman
Churchill
Nor-Man
Burntwood
Manitoba Health
Primary health care physicians / Physician clinics do screening
Program expanded
Manitoba Cervical Cancer Screening Program (MCCSP) through Cancer Care
MCCSP grants
Nurse Practitioner or Nurse with Transfer of Function does screening
Training
Pap Test Day
Regional Promotions
Annual Reports
Rate in Community Health Assessment
MCCSP Report
MB Health breastfeeding resources available to all regions

Table 11.2: Comparisons of cervical cancer screening rates if women with total hysterectomies are included or excluded

	Cervical Cancer Screening Rates (adjusted)			
region	excluding women who have had a hysterectomy (%)		including women who have had a hysterectomy (%)	
	1986/87-1994/95	1995/96-2003/04	1986/87-1994/95	1995/96-2003/04
RHAs				
South Eastman	71.06	69.82	70.79	68.67
Central	63.80	63.74	63.48	62.66
Brandon	74.71	75.29	74.32	74.04
Assiniboine	66.09	64.54	65.73	63.42
Winnipeg	73.88	75.22	73.88	74.64
Parkland	67.36	62.92	67.26	62.25
Interlake	71.09	70.76	70.99	69.94
North Eastman	66.97	67.93	66.76	67.32
Churchill	57.05	50.19	56.88	49.52
Nor-Man	59.69	52.66	59.44	52.30
Burntwood	54.17	47.88	54.17	47.82
South	65.91	65.79	65.63	64.57
Mid	68.99	68.29	68.90	67.48
North	55.35	49.41	55.46	49.34
Manitoba	70.79	71.58	70.73	70.78
Winnipeg Community Areas				
Fort Garry	77.33	78.03	77.17	77.73
Assiniboine South	78.76	78.85	78.63	78.19
River Heights	77.35	77.59	77.21	77.16
St. Vital	76.37	78.86	76.21	78.20
River East	75.34	75.76	75.25	75.06
St. Boniface	77.33	79.23	77.23	78.66
Transcona	75.19	78.19	75.00	77.37
Seven Oaks	71.86	72.60	71.84	72.19
St. James - Assiniboia	80.69	79.82	80.53	79.23
Inkster	67.77	66.55	67.89	66.48
Downtown	64.25	63.61	64.31	63.35
Point Douglas	66.08	64.31	66.22	64.10
Wpg Most Healthy	77.59	79.16	77.49	78.42
Wpg Avg Health	71.51	73.18	71.55	72.63
Wpg Least Healthy	69.07	68.42	69.21	68.14

11.2 Discussion

What the figures and maps tell us about overall rates and trends in cervical cancer screening:

- Generally, cervical cancer screening rates are higher in areas that have the best overall health status both in non–Winnipeg RHAs/districts and in Winnipeg CAs/NCs. Caution must be exercised in the interpretation, however, since northern regional health services (where many nurses or nurse practitioners could do Pap tests) may not be captured in the data. However, even in RHAs where data are presumably available and within Winnipeg, the gradient with health status is present.
- Cervical cancer screening rates have changed very little since the mid–1980s, with no statistically significant difference between time periods even at the provincial level (70.8% versus 71.6%, 1986/87–1994/95 compared to 1995/96–2003/04). This is also true in most RHAs where rates have remained stable or, in some, even declined (statistically significant declines are apparent in Parkland, Nor–Man and Burntwood although caution must be exerted since Pap tests done by nurses and nurse practitioners may not be captured in certain regions). Only the Winnipeg RHA shows a statistically significant though slight increase over time, from 73.9% to 75.2% (see Figures 11.1 through 11.4).
- Brandon RHA has remarkably high rates (70 % and over) throughout all the districts of its region with very little disparity within–region. Most other regions show disparity within–region with the least healthy districts having the lowest cervical cancer screening rates.
- Winnipeg rates at the NC level are mostly above the provincial average with the exception of the NCs within Inkster, Point Douglas and Downtown (Figures 11.3 and 11.4). Two Winnipeg CAs have seen statistically significant increases from 1986/87–1994/95 to 1995/96–2003/04—the CAs of Transcona (75.2% to 78.2%) and St. Vital (76.3% to 78.9%).
- Trends over time (see Figures 11.5 and 11.6) show little change over the last twenty years from 1986/89 to 2001/04 at the provincial level (70.7% to 72.8%) and most aggregate areas. The possible exception is the particularly large declines for the North (57.1% versus 46.6%). However, this may be an artifact of missing data in the North.
- There appears to be a slight increase in disparities over time both within Winnipeg and in non–Winnipeg aggregate areas. If North rates are truly captured, then the biggest contribution to disparity is the decline in northern rates compared to the relative stability of rates in the rest of the province. Within Winnipeg, a slight increase in disparity is also seen over time due primarily to slightly higher rates in the most healthy and slightly lower rates in the least healthy regions over a twenty year period (see Figures 11.5 and 11.6).
- The maps (Figures 11.7 and 11.8) indicate that, in general, southern and urban areas of Manitoba have the highest rates. Trends indicate that these rates are also relatively stable in the urban areas of Winnipeg and Brandon. There appears to be many districts (some in the south, more in the Mid, and many in the North) that are not improving as fast or are getting worse compared to the Manitoba time trend. One notable exception is Gillam/Fox Lake district in Burntwood RHA which has both high rates and faster increases over time.

What the regression modeling[1] tells us about predictors of cervical cancer screening in the year 2003/04 (for the complete regression model, refer to Appendix 4):

- Individual characteristics that increased the likelihood of cervical cancer screening—living in a neighbourhood of higher average household income, having either mental or physical illnesses, and having good continuity of physician care (i.e., 50% or more of the visits from the same physician in the year). Compared to women aged 40–49 years old, women aged 18–29, 50–59 and 60–69 are all less likely to have a Pap test; but women aged 30–39 are more likely. The measure for "mental health problems" was the 'mental ADG' group (see Appendix 1 Glossary for a complete description). Although people with at least one mental ADG were more likely to have cervical cancer screening, when this was analyzed for the specific condition of schizophrenia the results were reversed. For women being diagnosed with schizophrenia within a 12-year period, their odds of having a Pap test in 2001/02-2003/04 was 0.71 (0.66-0.76) after controlling for area, income, age, continuity of care, and physical ADGs. As well, at the provincial level, the age-adjusted rate of receiving a Pap test was significantly lower for women experiencing schizophrenia compared to those who did not (58.8% versus 67.8%, $p<.001$).
- Geographical characteristics that increased the likelihood of cervical cancer screening after controlling for individual factors—living in Brandon (the greatest likelihood in the province), South Eastman, Interlake, and all CAs of Winnipeg except Inkster, Point Douglas or Downtown.

How the above are associated with descriptive information on policy, program or support initiatives to increase cervical cancer screening:

- Many of the provincial initiatives to have a provincial cervical cancer screening program have only begun recently (2005 onward), so these are not captured in the data available within this report up to 2003/04.
- Three areas of the province outside Winnipeg showed high rates in 2001/02–2003/04 (regression modeling) after controlling for individual factors—Brandon, South Eastman, and Interlake. Brandon RHA, with its high screening rates within all districts of the RHA, mainly worked through physician clinics. Brandon RHA has had Sexual Health Clinics for over 20 years. This clinic has been aimed at the "at risk" population, with physicians performing the Pap tests. Brandon also received a grant in 2005 to provide educational sessions. South Eastman RHA has utilized midwives to do testing since 2002, although many women in this region still receive Pap tests from physicians. Interlake, along with Nor–Man, received a grant in 2002 to increase Pap test participation rates through the Manitoba Cervical Cancer Screening Program (MCCSP). Our data show a 2003/04 screening rate in Interlake that is significantly higher than expected after controlling for individual factors. However, the Nor–Man rate appears to be low—this may be, in part, due to the lack of data in the system from the nurses giving Pap tests in Nor–Man RHA.

[1] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

- Within the time range of our data, the province did not have a universal screening program for cervical cancer (in contrast to mammography with its rural mobile units). This has resulted in very different trending over time. Comparing Figures 11.8 and 10.8, the cervical cancer screening trends in most of the non–urban districts of the province indicate that the rates have not improved as fast as the Manitoba time trend (i.e., pink–coloured); whereas many districts outside the urban areas show improvement faster than the provincial average for mammography (green–coloured). Cervical cancer screening rates have also shown remarkably little change over time (see Figures 11.5 and 11.6), unlike the dramatic changes in mammography rates (Figures 10.5 and 10.6).

11.3 Comparison of Pertinent Literature Reviews and *Our Study Results*

According to the Health Canada Programmatic Guidelines for Screening for Cancer of the Cervix in Canada (a consensus document), women 18 years or older should be screened initially with two smears one year apart; if these are satisfactory, re–screening should be done every three years thereafter until age 69 years (Alberta Medical Association 2006; Lofters et al. 2007). Screening through an organized program can reduce cervical cancer incidence and death (Canadian Cancer Society 2006), and even with ad–hoc (non–organized) screening, incidence has decreased by 50% and death rates by 60% since 1977.

11.3.1 Cervical Cancer Screening Rates:

Self–reported rates of cervical cancer screening in Canada are available through several national surveys over the past decade. According to the National Population Health Survey in 1994/95 (Lee et al. 1998; Snider and Beauvais 2000; Lotocki 2000), 82% of Canadian women reported having a Pap test at least once in their lives and around 68% reported a test within the past three years. Predictors of not having a Pap test were: being older, being single, being a resident of Quebec, being an immigrant to Canada, and being of lower educational and income levels. The 1998/99 NPHS self–reported rate was 79% having been screened within the past three years (Public Health Agency of Canada 1998), ranging from 77% in BC to 85% in Manitoba.

The most recent 2005 Canadian Community Health Survey (Statistics Canada 2005 CANSIM Table 105–0442) showed a screening rate of 72.8% for Canadian women aged 18–69 years with a low of 68.5% in Quebec to highs of 81.0% in Nova Scotia and 83.5% in the Northwest Territories (Manitoba was at 75.1%). However, none of these national surveys includes women living in First Nations communities. The other problem is in the bias of self–reporting. Women may not remember accurately over a three–year time period and may be influenced to report positive behaviour (having a Pap test) when surveyed. According to the Public Health Agency of Canada (1998), cervical cancer screening rates estimated through physician billing data from 1996–1998 show that self–reported data are overestimates. Administrative data show rates of 74% for Nova Scotia, 69% for Manitoba, and 67% for BC. This effect was also found in Ontario where self–reported rates were 80% in 2001 for women aged 20–69, but the Ontario Pap Test Registry data estimates the overall provincial rate to be 40.7% (Fehringer et al. 2005). However, this low rate of 40.7% was the one–

year prevalence only. This study also detected huge variability across health regions of the province, 11.6% to 73.9%, with higher prevalence in areas serviced by teaching hospitals.

Comparing Canada to other countries in the 1990s (Public Health Agency of Canada 1998), the cervical cancer screening rate for UK was 70% (three years, ages 25–64), and Australia was 63.9% (two years, ages 20–69). Based on the 2003 National Health Interview Study for the USA, the self–reported rate of Pap tests within three years was 85% (Solomon et al. 2007).

An important point was made by Snider and Beauvais (1998) when they re–analyzed the NPHS 1994 three–year cervical cancer screening rate estimates to exclude those women with a hysterectomy (since Pap tests are not required for those having a hysterectomy). In doing so, their estimates for the Prairie region increased from 74.1% to 86.0%. They state that in adjusting for hysterectomy, calculated Pap test rates may increase from 7% to 25%, depending upon the underlying hysterectomy rates in the various regions of Canada.

Comparing this report's rate for cervical cancer screening which is based on administrative data, the overall provincial average for 2001/04 was 72.8%. This is very close to the self–reported data of 75% in the 2005 CCHS. Knowing that women living in First Nations communities were excluded in the CCHS survey and knowing that the North rates tend to be lower than the provincial average, our lower administrative database estimate, which includes all Manitoba women, "makes sense" when comparing to the CCHS data. Risk factors for not being screened in Manitoba in the year 2003/04: lower neighborhood income, less likely a woman will be screened (similar to other findings) and the less the continuity of care, the less likely the woman will be screened. Regarding age, NPHS found declining Pap test rates with age. Our study showed that the very youngest group (18–29) as well as those women over 49 were both less likely than the 40–49 year olds to be screened, and the women aged 30–39 were more likely.

Contrary to the findings of NPHS, there was very little difference in screening rates when we included or excluded those women with a total hysterectomy (see Table 11.2 comparison). At most, the difference was around 1%, and most of the time was less than that.

11.3.2 Policy and Program Initiatives Pertinent to Increasing Cervical Cancer Screening Rates:

Evidence from a systematic review of the literature shows that outreach methods tend to be more successful than physician reminders in increasing cervical cancer screening rates (Black et al., 2000). Subsequent literature reviews have shown that strategies most successful in increasing Pap test rates include: (i) mass media campaigns in combination with other strategies (e.g., group education, free screening, physician education, letters of invitation)—increases ranged from 26% to 52% compared to no intervention; (ii) language–specific mass media campaigns only—a 6% additional increase in non–English speaking women; (iii) letters of invitation—a 40% increase compared to control group (Black et al. 2002). In a Cochrane Systematic Review, Forbes et al. (2002) found that intervening through invitation letters continues to show the largest effect in increasing screening rates. Only limited effects are shown for educational interventions.

As far back as 1973, the limitations of opportunistic screening for cervical cancer were acknowledged by the Conference of Deputy Ministers of Health (Lotocki 2000). A task force produced a report outlining the necessary components for an organized screening program including: (i) a population–based information system that can link to cancer registries and to laboratory data; (ii) a method of recruitment and retention, especially ensuring that groups who have low screening rates be targeted (aged 65 or older, Aboriginal, of lower SES, less educated, members of minority groups, rural residents from areas with high physician turnover, recent immigrants whose mother tongue is neither English or French). The report also recommended that to improve screening universally and in high–risk groups, we needed to determine and address reasons for non–participation, provide educational information, use community–based approaches involving local leaders, and provide culturally sensitive and linguistically compatible testing and staffing. As well, there needed to be professional education to increase awareness for screening guidelines, frequency and management of abnormal smears. This report has been generally accepted nationally and internationally. Several countries have developed national organized screening programs—the Scandinavian countries, Australia, and Great Britain. However, in Canada the program implementation has been at the regional or provincial level rather than the national level, resulting in slow progress. This may, in part, be due to the lack of universal approaches to participation—letters of invitation (which show the greatest effects) and truly accessible services for lower income people and people living in remote areas of the country.

Our study showed a definite "plateauing" effect of Pap tests over the past twenty years. The two urban areas of Brandon and Winnipeg show the highest rates. In addition, women living in higher income neighbourhoods have an increased likelihood of receiving a Pap test. The fact that women living rural areas and low–income areas have lower likelihood of having a Pap test points out access issues. Given the literature review above, it points out that letters of invitation combined with easily accessible and culturally appropriate health care provision is the most effective. This has proven to be effective in reducing inequities in mammography within the province. Recent initiatives after the time period of this study, including a move to a provincial screening approach, may very likely increase both the Pap test rates and decrease inequities rurally and in low income areas.

The Manitoba Cervical Cancer Screening Program has supported a variety of education and access–to–screening service initiatives throughout the province. These initiatives have been directed at hard to reach, under screened women. Projects in Nor–Man, Interlake, and Parkland RHAs have successfully increased the role of nurses in providing cervical cancer screening services to women within their home communities. Brandon RHA has had Sexual Health Clinics for over 20 years. This clinic has been aimed at the "at risk" population, with physicians performing the Pap tests. A Poplar River Aboriginal initiative demonstrated that strong interpersonal relationships with community women ensured that women attend screening services. Annually, the program with community health care providers, community clinics, and nursing stations offer walk–in, no appointment Pap clinics during the last week of October. The program started with seven inner city clinics in 2003 and expanded to 104 clinics throughout Manitoba in 2007. Findings from this walk–in Pap clinic initiative support research findings where educational campaigns combined with service delivery have the greatest impact in recruiting women for screening participation. Consistently, *under screened women attend a walk–in Pap clinic because they saw an advertisement, the clinic was easy to get to, and they had support from family members and friends. Most recent initiatives have included training of nurses to perform Pap tests in their communities. This project has been successful when delegation of function from physicians can be secured and recruitment and retention of nursing personnel is sustainable (Communication with Kathleen Decker, MCCSP, January 14, 2008.).*

11.4 Recommendations

- We need to be creative to increase Manitoba's rates. The start of a universal screening program in Manitoba within the past few years may begin an upward trend, but future reports will be needed to investigate the effects of new programs. An emphasis in the literature on the importance of letters of invitation, along with accessible testing, reflects recent initiatives within Manitoba.
- Data collection must be a high priority so programs and intervention effects can be measured. Any Pap test given in Manitoba whether performed by a physician or other professional should have a way to be recorded at the person–level (i.e., in the administrative database with a personal health number attached to the record).
- Standardized ways of reporting cervical cancer screening rates must be developed in order to exclude those women with hysterectomies that are no longer in the target group for Pap testing.
- Continuity of care is associated with better screening rates—both for cervical cancer and for breast cancer (see Chapter 10). The use of primary care models that encourage continuity of care could be important in any prevention and screening strategy throughout the province.
- Ensure monitoring of how changes in the field of immunization (i.e., liquid–based cytology and the implementation of the HPV vaccine) impact the screening recommendations and guidelines.

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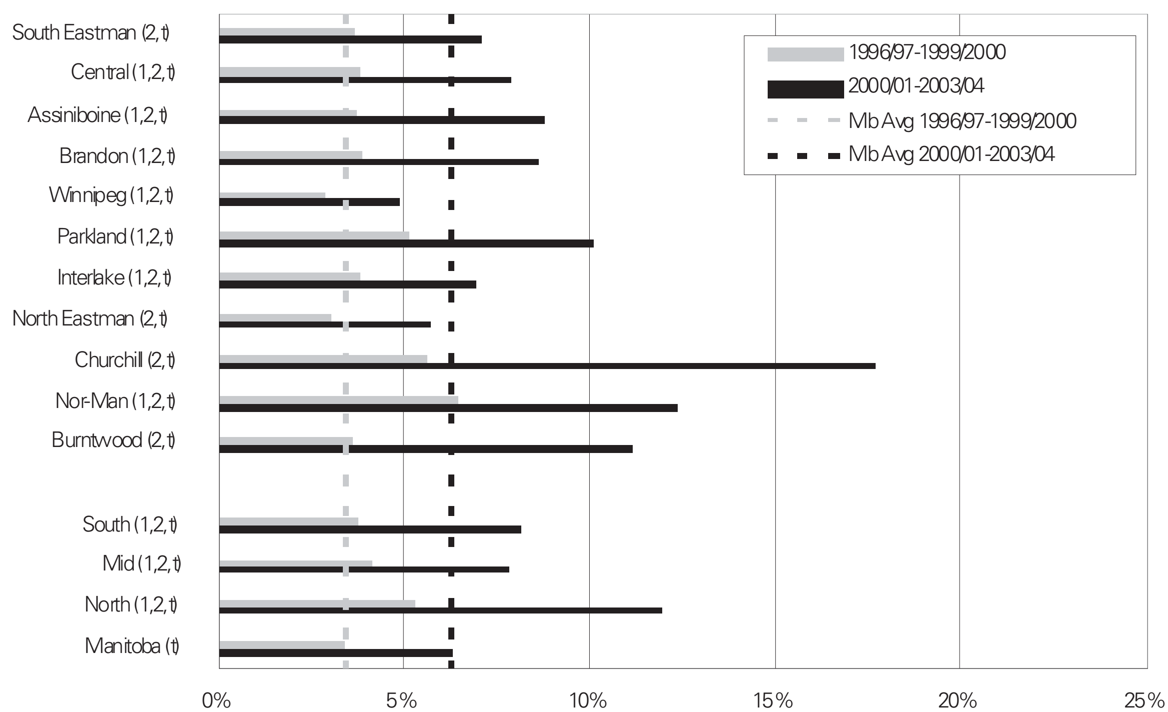
CHAPTER 12: POLYPHARMACY

12.1 Definition, Graphs and Maps

Polypharmacy was defined as the proportion of community–dwelling Manitoba residents age 65 or older taking six or more different drugs in a 121–day period in fiscal years 1996/97–2003/04. The number of drugs in each third of the year (121 days) is averaged over the fiscal year for each person, to obtain an average annual number of drugs per person. Individuals had to be living in Manitoba for the entire 121–day period to be included in analyses for that time period. Individuals residing in a nursing home or personal care home at any time during the 121–day period, or in a hospital for more than 60 days during the 121–day period were excluded from analyses for that time period. The count of different drugs is determined by classifying each drug into its appropriate Anatomical Therapeutic Chemical (ATC) code and counting the number of different drugs at the 4th level of ATC or the number of drugs with a different chemical, therapeutic or pharmacological subgroup. For a drug to be included in the count of different drugs over 121 days, an individual had to have at least 2 prescriptions in the 121–day period with a greater than 30 day supply for each prescription. Over–the–counter drugs, such as acetaminophen, are excluded from the count of different drugs. See the Glossary entry for "Polypharmacy", Appendix 1, for more details.

Figure 12.1: Polypharmacy Rates for Community-Dwelling Seniors by RHA

Average annual proportion of community-dwelling seniors age 65+
taking 6 or more different drugs in 121 days (people with 60+ days in hospital excluded)

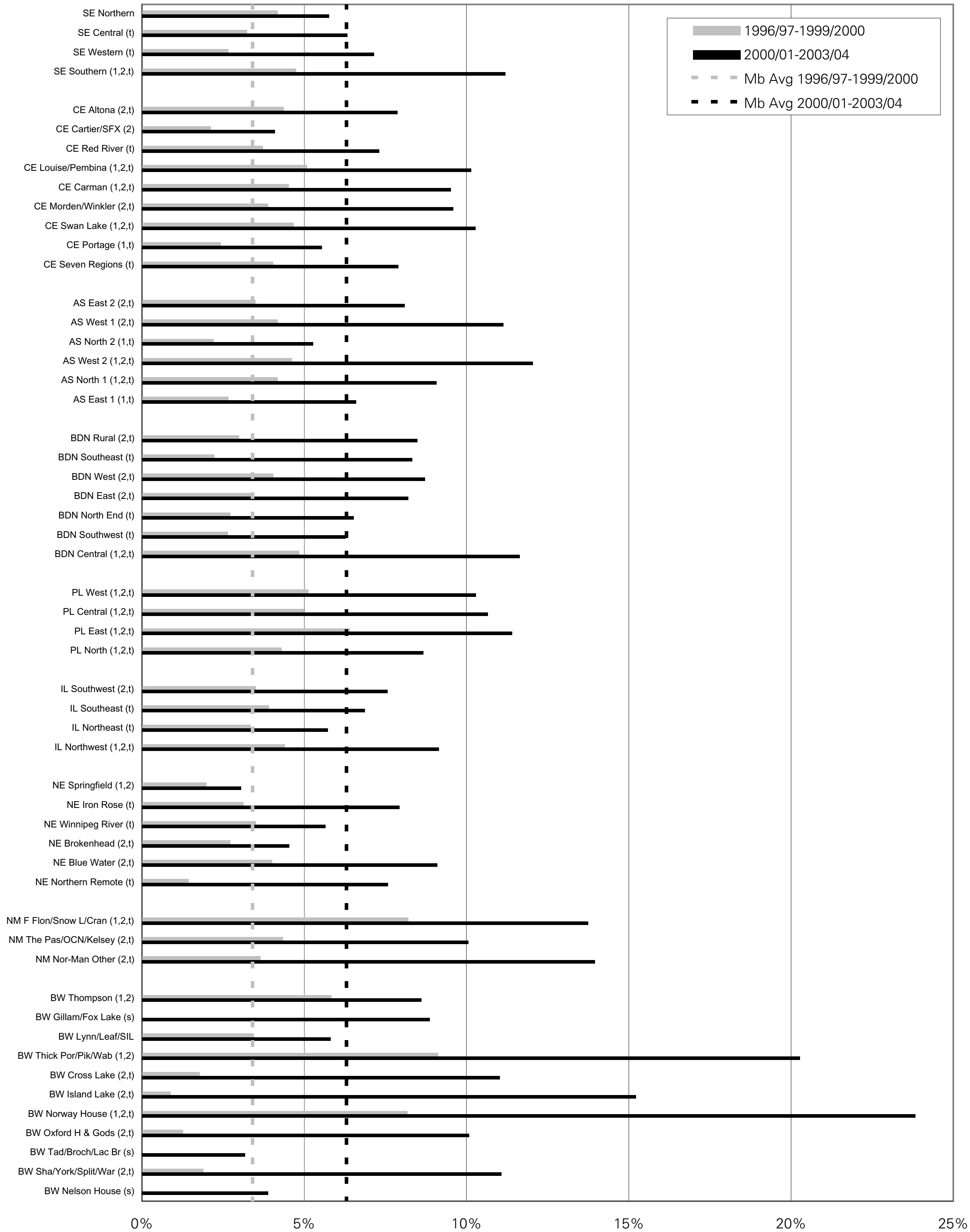


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 12.2: Polypharmacy Rates for Community-Dwelling Seniors by District

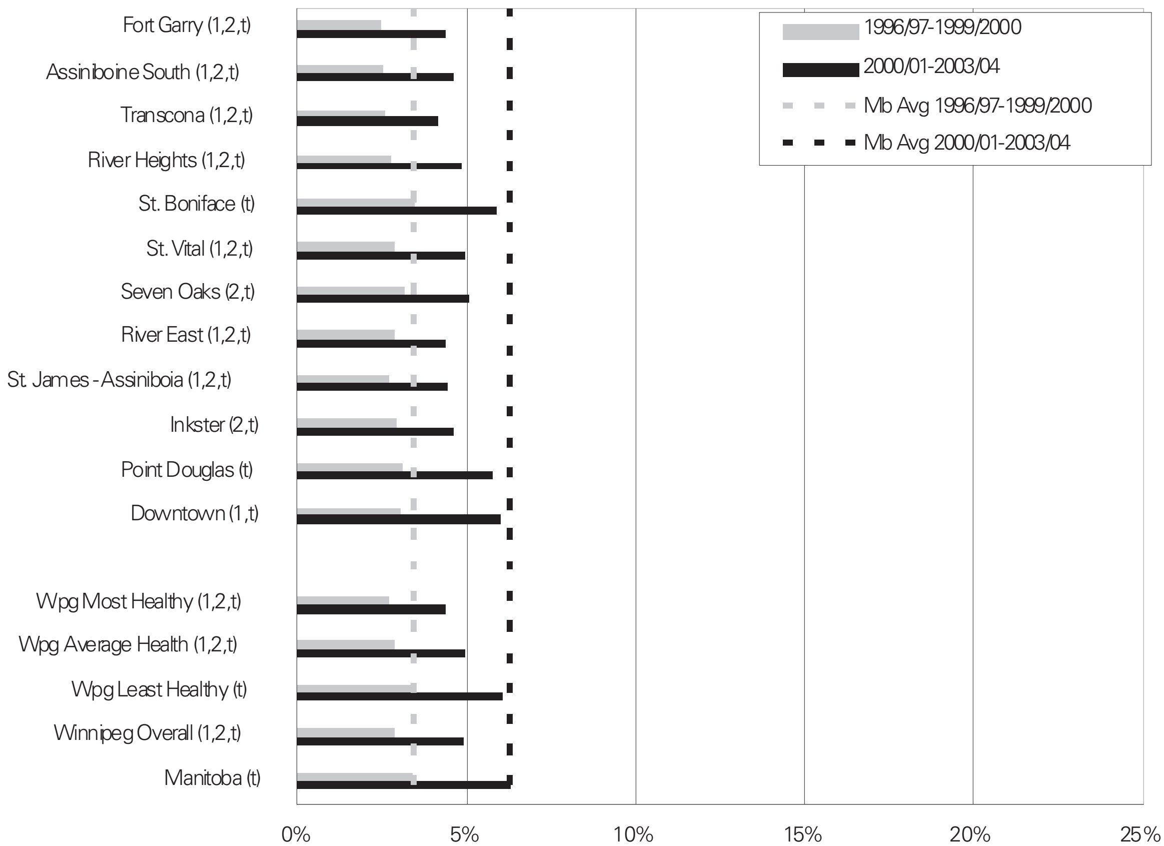
Average annual proportion of community-dwelling seniors age 65+
taking 6 or more different drugs in 121 days (people with 60+ days in hospital excluded)



Source: Manitoba Centre for Health Policy, 2008

Figure 12.3: Polypharmacy Rates for Community-Dwelling Seniors by Winnipeg Community Areas

Average annual proportion of community-dwelling seniors age 65+
taking 6 or more different drugs in 121 days (people with 60+ days in hospital excluded)

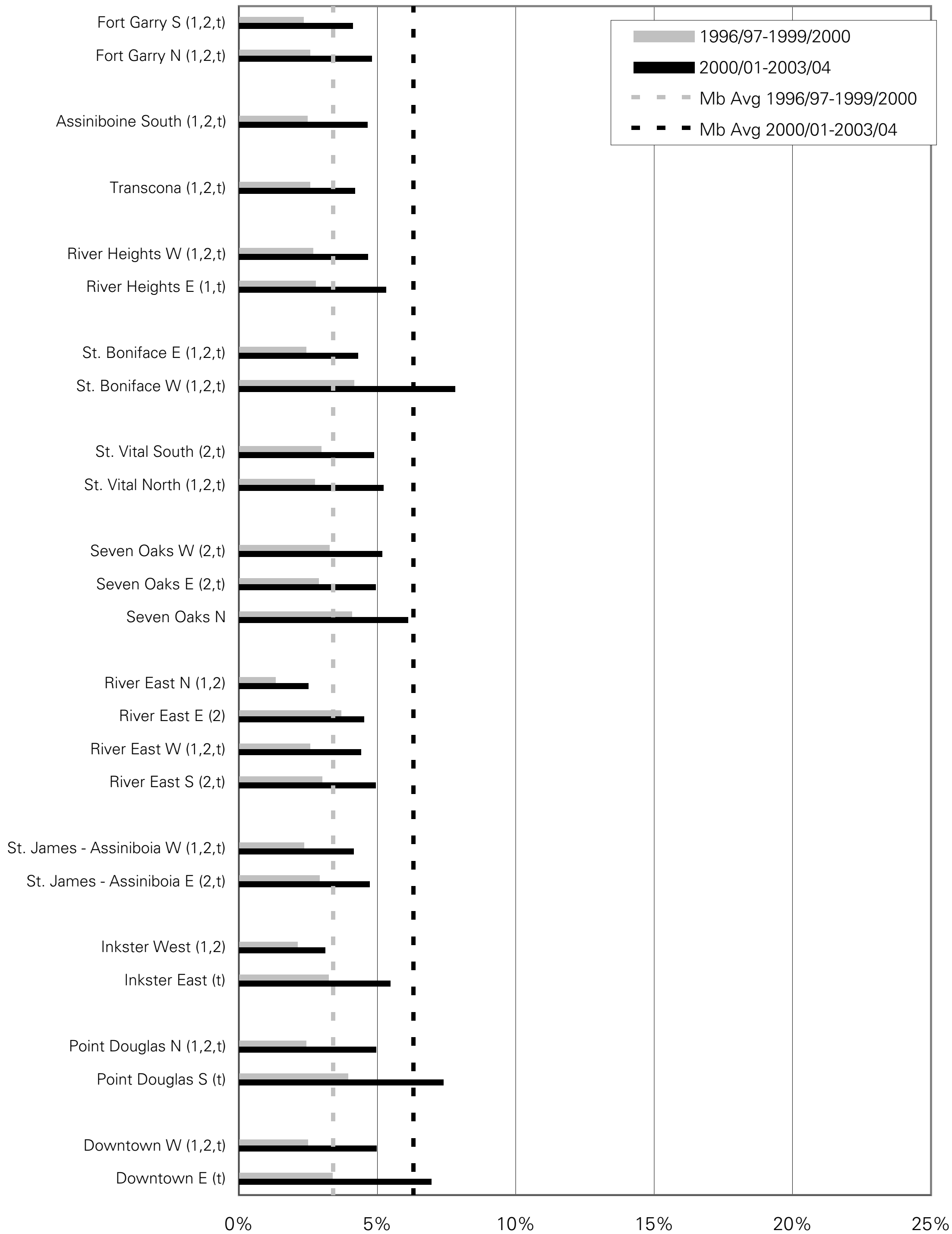


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 12.4: Polypharmacy Rates for Community-Dwelling Seniors by Winnipeg Neighbourhood Clusters

Average annual proportion of community-dwelling seniors age 65+
taking 6 or more different drugs in 121 days (people with 60+ days in hospital excluded)



Source: Manitoba Centre for Health Policy, 2008

Figure 12.5: Trends in Non-Winnipeg Polypharmacy Rates for Community-Dwelling Seniors

Average annual proportion of community-dwelling seniors age 65+
taking 6 or more different drugs in 121 days (people with 60+ days in hospital excluded)

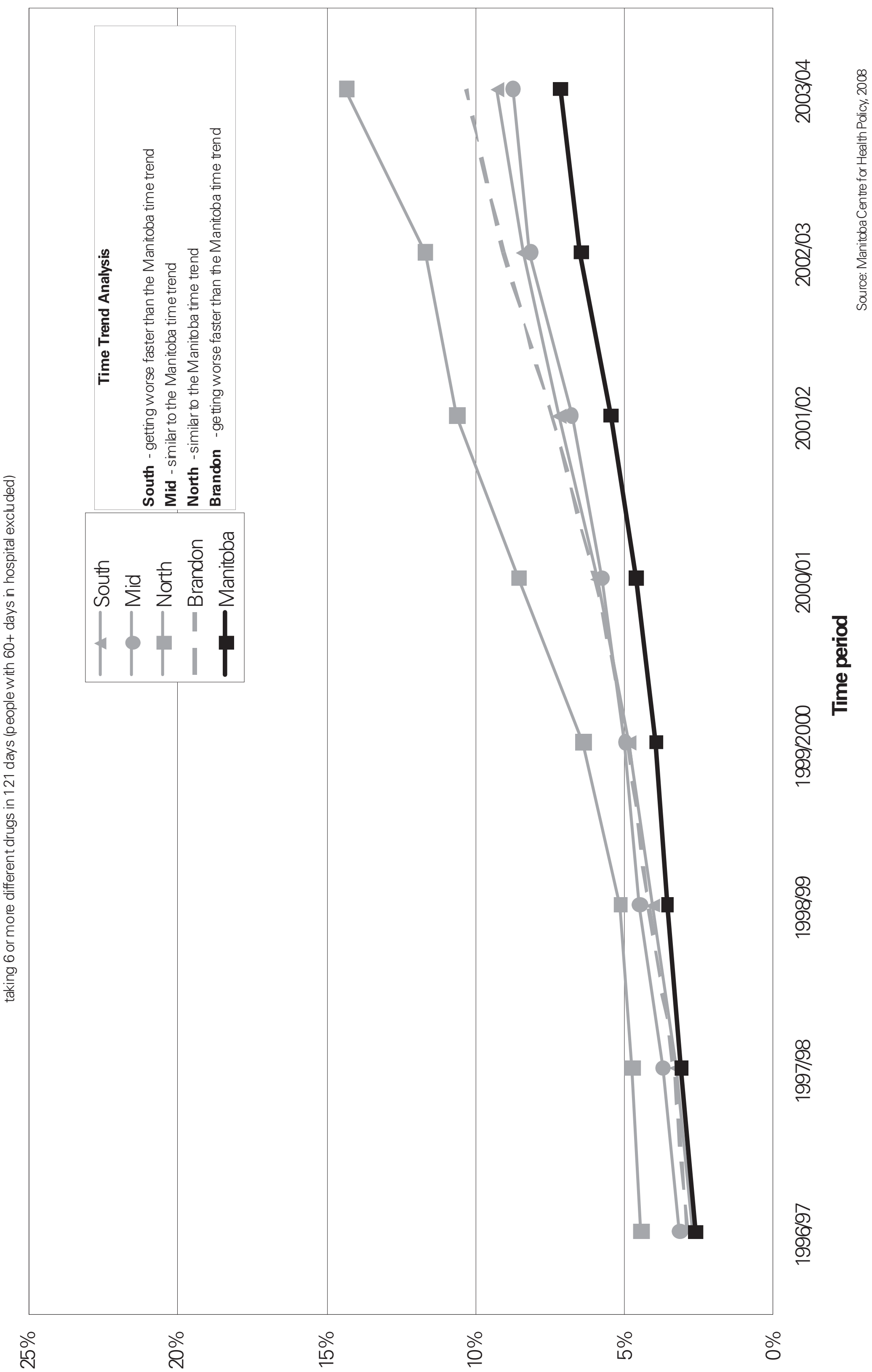


Figure 12.6: Trends in Winnipeg Polypharmacy Rates for Community-Dwelling Seniors

Average annual proportion of community-dwelling seniors age 65+
taking 6 or more different drugs in 121 days (people with 60+ days in hospital excluded)

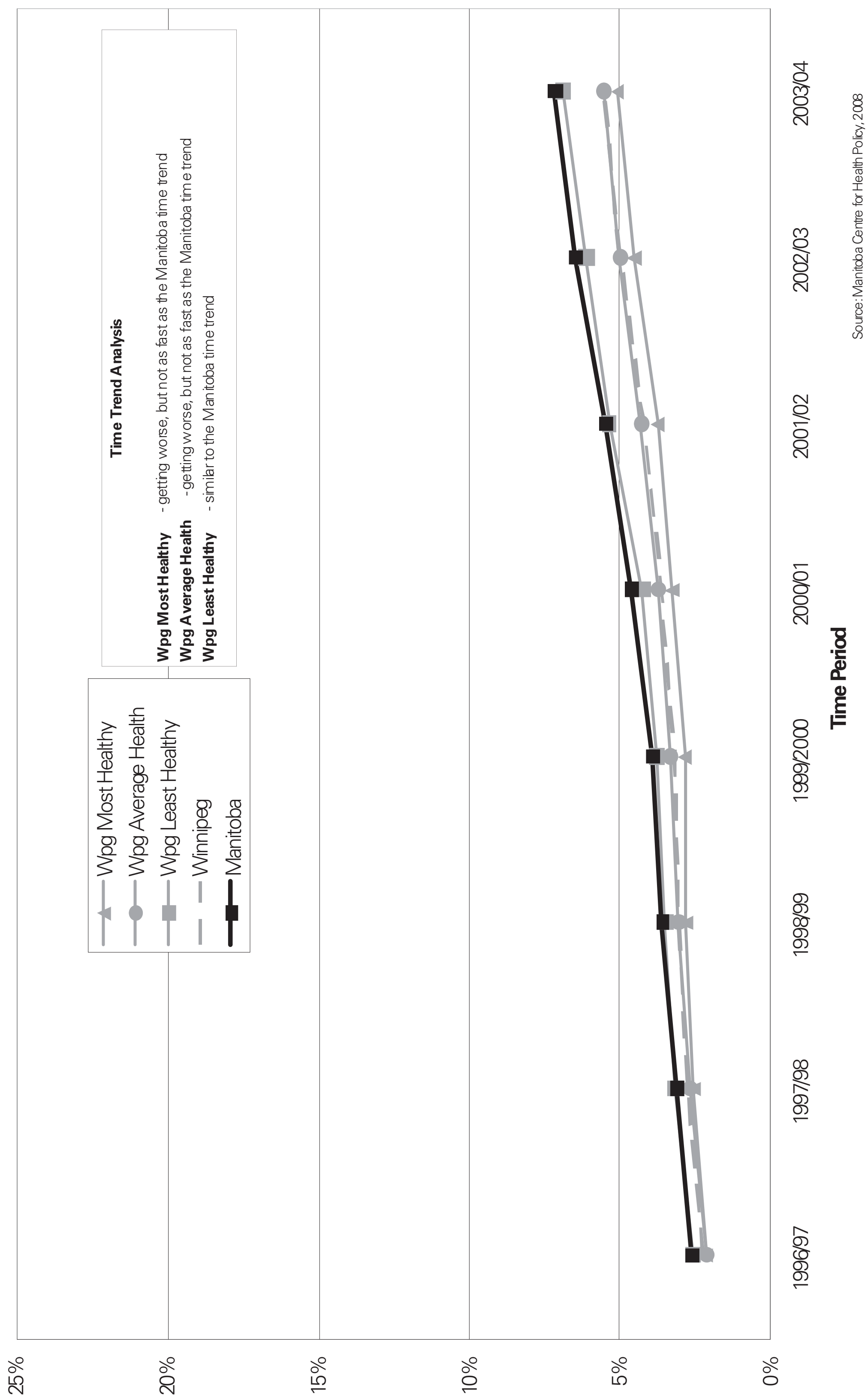
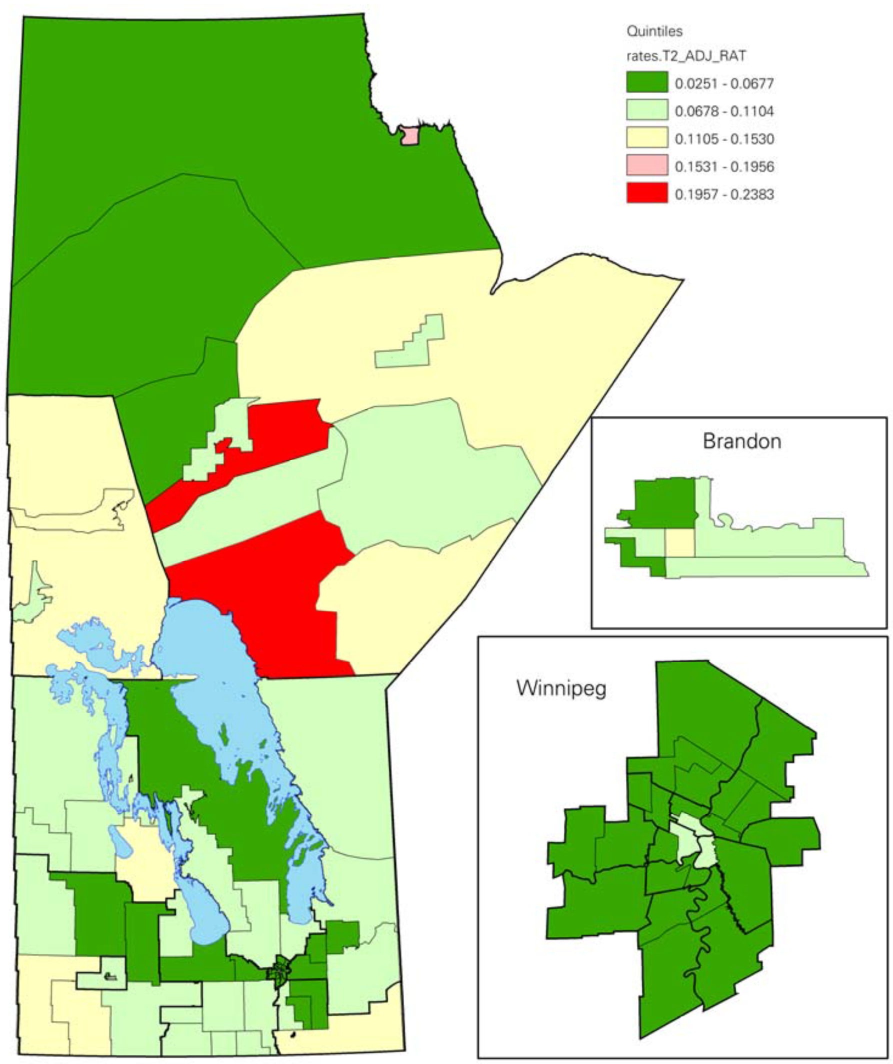


Figure 12.7: Polypharmacy Rates for Community-Dwelling Seniors Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

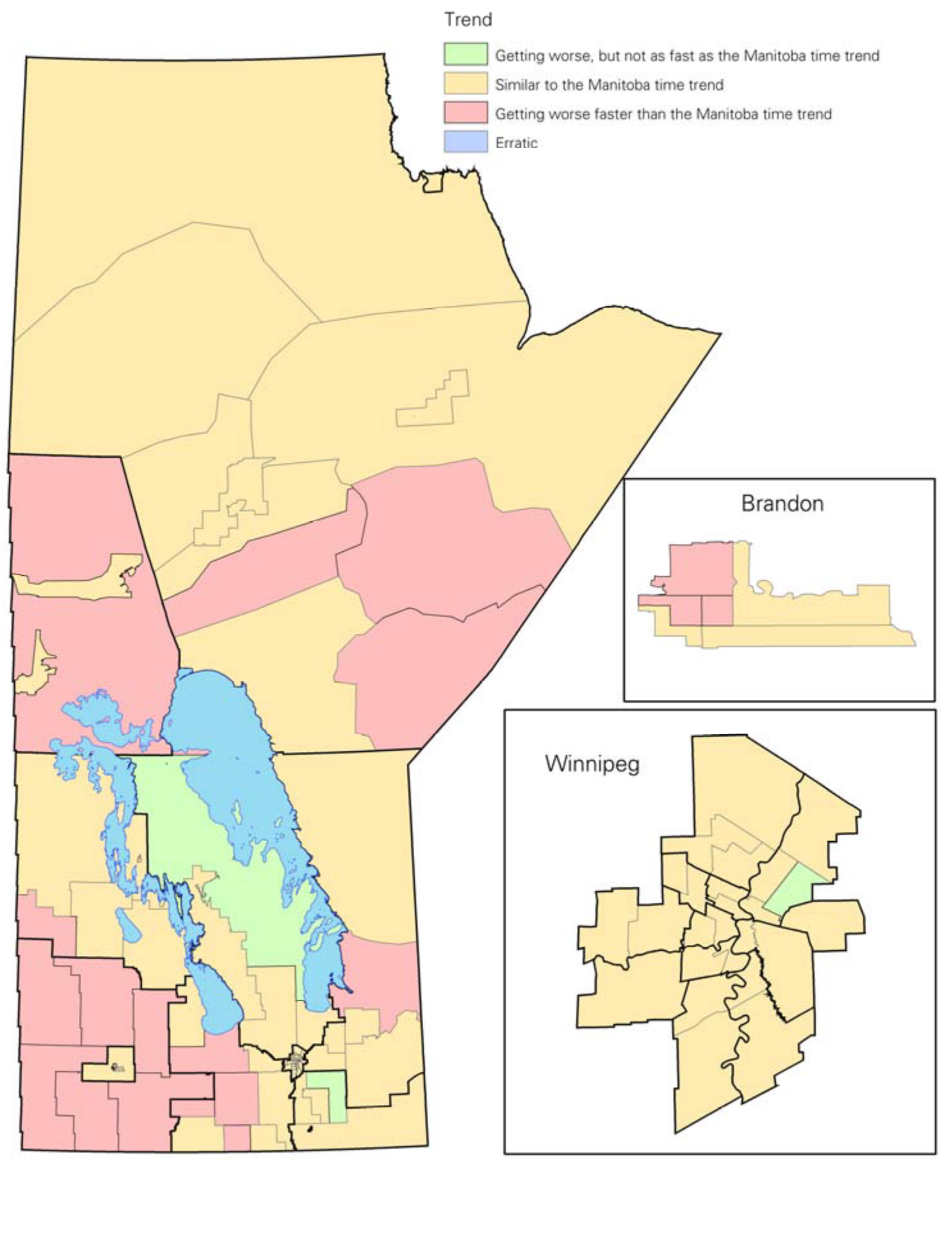
Average annual proportion of community-dwelling seniors age 65+
taking 6 or more different drugs in 121 days (people with 60+ days in hospital excluded), 2000/01-2003/04



Source: Manitoba Centre for Health Policy, 2008

Figure 12.8: Trends in Polypharmacy Rates for Community-Dwelling Seniors by RHA Districts and Winnipeg Neighbourhood Clusters

Average annual proportion of community-dwelling seniors age 65+
taking 6 or more different drugs in 121 days (people with 60+ days in hospital excluded), 1996/97-2003/04



Source: Manitoba Centre for Health Policy, 2008

Table 12.1 Polypharmacy medication reduction for community dwelling seniors age 65+

Program	Policy / Program details	Timeline
Community counselling / outreach programs	**ASSINIBOINE** - MILE - Medication Information Line for the Elderly is available through a Winnipeg toll free number to Seniors within the province - Medication Reconciliation Assimilation – pilot in Russell Will roll it out to rest of region in coming year	 2005 2006
Use of screening tools on a regional level Home Care **Comments:** Safer Health Care Now – National campaign to increase safety - One of the goals was to	**BRANDON** - No regional programs, some community pharmacists working on this - Home Care reviews meds on entry to program Currently reviews held every six months thereafter - Pharmacists involved in Community Mental Health Program - Pharmacies using DPIN (computerized drug interaction) system to reduce multiple meds from multiple sources - Seniors organizations in certain communities offer talks by pharmacists - Referrals received from Outpatient Palliative Care program for med reviews Pharmacist sits on review board - Ambulatory Care pharmacist involved in Pre-Hab, Pain Clinic, Heart Clinic, Respiratory Clinic and Falls Initiative (2005 initiitive?) - MILE – Medication Information Line for the Elderly is available through a Winnipeg toll free number to Seniors within the province	 Pre-1997 - current Pre-1997 - current Pre-1997 - current Pre-1997 - current Pre-1997 - current 2004 - current 2005
Prevent Adverse Drug Events (ADEs) - by implementing medication	**BURNTWOOD** - No policies, no planned programs, Home Care Program covers quite a few communities but +65 is a small % of population - MILE – Medication Information Line for the Elderly is available through a Winnipeg toll free number to Seniors within the province	 2005
reconciliation - April, 2005 - December, 2006 http://www.saferhealthcarenow.ca/Default.aspx?folderId=82&contentId=124	**CENTRAL** - Home Care Coordinator's role to track meds - Med Reconciliation Pilot Project Three month project part of RHA's Safer Healthcare Now Initiative Medications reviewed upon admission (difference between client info & what's on their chart) Will roll out across the region after pilot is done. Critical care maps –standard of care for right kind & amt of medication Surgical Medical Acute Coronary Syndrome – Two years Stroke - No regular community teaching on polypharmacy Only sporadic presentations by pharmacists at the request of a Seniors Center - MILE – Medication Information Line for the Elderly is available through a Winnipeg toll free number to Seniors within the province - Falls Prevention Best Practice Guidelines from Australia document medications Four or more, One or more psychotropic meds Also track how often meds are taken in a day	 1997 - current Spring 2006 1998 2001 2004 2005 2005 Draft 2006
	CHURCHILL - No programs - MILE – Medication Information Line for the Elderly is available through a Winnipeg toll free number to Seniors within the province	 2005

Program	Policy / Program details	Timeline
Community counselling / outreach programs	**INTERLAKE** - MILE – Medication Information Line for the Elderly is available through a Winnipeg toll free number to Seniors within the province - Medication Reconciliation – (not just 65+) in Gimli only as a pilot	2005 2006?
Use of screening tools on a regional level Home Care	**NOR-MAN** - Monthly blood pressure clinics include general health concerns Appropriate referrals are made - Medication is charted and checked during the first home care assessment It is also checked on an ongoing basis, if client is on more meds than when first assessed, they suggest a physician consult - Seniors Wellness Fairs held each year in conjunction with Influenza campaign Displays target issues of interest to seniors including medication use University College of The North Bachelor of Nursing program are partners - University College of the North & Assiniboine Community College Nursing students (as well as LPNs, Health Care Aides) partnership with the Home Care / Seniors program to provide practical experience - Case coordinators do mini mental exams with all clients Dehydration is related to elder confusion - MILE – Medication Information Line for the Elderly is available through a Winnipeg toll free number to Seniors within the province - Home Care staff sit on the Health Care Aid diploma program Advisory Committee for the University College of The North in The Pas - Well Seniors clinics with seniors clubs and in block housing. (includes blood pressure, education)	Pre 1996 Pre 1996 - current Pre 1996 - current 1999 - present 1999 - current ongoing 2005 Oct 2005 - present 2006
	North Eastman - No regional programs - MILE – Medication Information Line for the Elderly is available through a Winnipeg toll free number to Seniors within the province	2005
	PARKLAND - Through Home Care - MILE – Medication Information Line for the Elderly is available through a Winnipeg toll free number to Seniors within the province	1980's 2005
	SOUTH EASTMAN - Tracking number of meds per resident of Personal Care Homes - MILE – Medication Information Line for the Elderly is available through a Winnipeg toll free number to Seniors within the province Handed out at trade shows, & to various seniors - Medication Reconciliation Program	Pre 1996 - current 2005 April 2006
	WRHA - MB Health programs through Geriatric Health Care - Geriatric Program Assessment Team (GPAT) Targets the frail elderly over 65 years of age, living in Winnipeg Clients seen by a Geriatric Clinician in their home to asses mobility, impaired function / activities of daily living, confusion/dementia, incontinence (toiletting) depression, inadequate social supports, medication issues (polypharmacy) - MILE – Medication Information Line for the Elderly is available through a Winnipeg toll free number to Seniors within the province	1982 1999 - current 2005

12.2 Discussion

Polypharmacy (i.e., taking many prescription drugs) is a growing problem, particularly among older adults. The more drugs people take, the greater the chance of drug interactions and admission to hospital as a result of bad side effects, and the less likely they are taking any one particular medication properly. Seniors living in the community may be at particularly high risk because their drug intake is not monitored in the same way that it is for seniors living in long–term care. It is important to note that there will most likely be situations where "polypharmacy", i.e., being prescribed 6 or more different drugs in a 121–day period may be appropriate care. However, this should presumably be a rare event. So a rate of 0% polypharmacy would be unrealistic. Variation in rates throughout the province, if they reflect underlying health status, should show a pattern of increasing rates for populations of poorer health status. However, the much lower rates in the Winnipeg RHA may be closer to giving an idea of the "right rate" given the degree of variation which is not necessarily explainable by health status alone.

What the figures and maps tell us about overall rates and trends in polypharmacy:

- Overall, 6.3% of community–dwelling seniors aged 65+ were prescribed 6 or more different drugs over a 121–day period in the years 2000/01–2003/04. The most striking finding is the dramatic rise in polypharmacy provincially from 3.4% in 1996/97–1999/2000 to 6.3% in 2000/01–2003/04 (see Figure 12.1). This is a continual upward trending over the time period, almost tripling from a low of 2.6% in 1996/97 to a high of 7.2% in 2003/04.
- Generally, polypharmacy rates are higher in areas that have the lowest overall health status in non–Winnipeg RHAs/districts. The range by aggregate areas (see Figure 12.1) is from 7.8% in the Mid to 12.0% in the North in the latest time period of 2000/01–2003/04. Exceptionally high rates are seen in Churchill (17.7%), in many northern districts such as Burntwood RHA's districts of Thicket Portage/Pikwitonei/Wabowden (20.3%), Island Lake (15.2%), and Norway House (23.8%) and Nor–Man RHA's districts of Flin Flon/Snow Lake/Cranberry Portage (13.7%) and Nor–Man "other" (14.0%).
- Winnipeg RHA (at 4.9% overall) has substantially lower polypharmacy rates compared with other RHAs. Although there is a slight gradient with less healthy sub–regions showing higher rates, the differences are marginal compared to outside Winnipeg, and all rates are below or similar to the Manitoba average. The exception is St. Boniface West NC at 7.8% (see Figure 12.4). The range by aggregate area in Winnipeg for 2000/01–2003/04 is from 4.4% for the most healthy area to 6.0% for the least healthy area of Winnipeg.
- The gradient is increasing over time (see Figures 12.5 and 12.6) with a wide variation in polypharmacy rates outside Winnipeg. In the year 2003/04, there was a low of 8.8% in the Mid region and a high of 14.3% in the North. This spread is much larger than in 1996/97 when the range was from around 2.6% to 4.4%. In part, there may have been some missing pharmaceutical data for northern regions before November 2004 (particularly in First Nations communities); but recent changes in how drugs are dispensed has rectified the missing data situation. Within Winnipeg, the gradient is also apparent, but all rates are relatively low. The higher rates in the least healthy areas may reflect a need for more drugs in these residents.

- Looking at the maps (Figures 12.7 and 12.8), Winnipeg RHA stands out as having low rates and trends that are mostly similar to the Manitoba time trend. In Burntwood RHA, the districts of Tadoule Lake/Brochet/Lac Brochet, Lynn Lake/Leaf Rapids/South Indian Lake, and Nelson House also appear to have low rates and trending similar to the province. However, caution must be exerted in looking at northern rates because of concerns about completeness of data collection before November 2004.
- Interlake and South Eastman RHAs have all districts showing both lower rates and trends that are similar to or increasing less rapidly than the province.

What the regression modeling[1] tells us about polypharmacy rates for community–dwelling people aged 65+ in the year 2003/04 (for the complete regression model, refer to Appendix 4):

- Individual characteristics that increased the likelihood of polypharmacy—being female, having a lower income, being older, being enrolled in the provincial homecare program, and having either mental or physical illnesses.
- Individual characteristics that did not influence the likelihood of polypharmacy—having good continuity of care (there was a trend toward lower likelihood, but it was not statistically significant).
- Geographical characteristics that decreased the likelihood of polypharmacy, after controlling for individual factors—residing in any of the CAs of Winnipeg. After controlling for individual factors, residing in South Eastman, Interlake and North Eastman were associated with being similar to the overall Manitoba rate. Living in any other RHA outside Winnipeg was associated with an increased likelihood of polypharmacy.

How the above are associated with descriptive information on policy, program or support initiatives to decrease polypharmacy:

- Since 1999, Winnipeg RHA has had a Geriatric Program Assessment Team which assesses new home care clients to examine mobility, impaired function, dementia, depression, social support, and medication issues. The effect of this program may help explain in the quantitative analysis where all sub–regions of Winnipeg have much lower polypharmacy rates than the province as a whole, and the trend upwards is similar to the Manitoba time trend.
- Several RHAs (South Eastman, Interlake, Assiniboine, and Brandon) have begun programs of medication reconciliation recently (2006 and forward), so it will be important to track this indicator to see evidence of more proactive attempts to ensure appropriate pharmaceutical usage by community–dwelling seniors.

[1] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

12.3 Comparison of Pertinent Literature Reviews and *Our Study Results*

Polypharmacy is definitely a concern in the older adult population of Canada. The more drugs that people are taking, the greater is the risk of drug interaction and hospitalization due to adverse effects and the less likely is the compliance with any given medication (Frank 2002). One study (Frank et al. 2001) found that a group of frail elderly attending a geriatric day hospital were taking, on average, 10.5 drugs (including over–the–counter medications) within the month previous.

According to the literature, the risk of polypharmacy is considered to be greatest amongst community–dwelling seniors (versus institutionalized seniors) mainly because they are responsible for their own drug administration (Jones 1997). As well, the medication error rate for people taking 6 or more drugs was estimated to be at 70%. The risk of potentially inappropriate prescribing (PIP) increases exponentially as the number of drugs increases—those taking up to four drugs have a PIP risk of 12% and those taking 5 or more drugs a risk of 40% (Allard et al. 2001).

12.3.1 Polypharmacy Rates for Community–Dwelling Seniors (Aged 65+):

The rates of polypharmacy reported in the literature are variable given the fact that there are many different definitions of polypharmacy including the number of drugs taken and the number of days of concurrent use in the definition (Fulton and Allen 2005). One USA telephone survey (Kaufman et al. 2002) in 1998/1999 found the highest overall prevalence of medication use in women aged 65+. Overall, 12% of males and females were taking 10 or more medications (prescriptions and over–the–counter), 23% of females and 19% of males were taking at least 5 prescription drugs, 57% of females and 44% of males were taking 5 or more medications in the week previous to the telephone call. The review by Fulton and Allen (2005) notes that 39% of Swedish seniors used five or more prescription drugs in 1994, much higher than that reported by the Netherlands at 4%. A study in Finland found a significant increase in the use of over 5 prescriptions by community dwelling seniors, from 19% in 1990/91 to 25% in 1998/99 (Linjakumpu et al. 2002). A 1994 administrative database study in Denmark showed that the rate of "major" polypharmacy (i.e., 5 or more drugs) was 1.2% over a three–month period (Bjerrum et al. 1997).

It is very difficult to compare our results to those mentioned in the literature. First, our definition tried to exclude short–term prescriptions and, rather, focused on long–term prescription use (at least 2 prescriptions of at least 30 days each and excluded over–the–counter medications). Our provincial rate of 3.4% in the 1990s which jumped to 6.3% in the 2000s, approximates some of the literature which shows general increases in pharmaceutical use in the general population. The Danish study using administrative data to estimate rates of 5 or more medications over 90 days in the year 1994 probably most closely matches our provincial rate of 2.6% in 1996/97. Assuming a similar linear trend that had occurred in the two years after 1996/97, we can extrapolate the trend graph back in time and yield an estimate of around 1.6% for Manitoba in 1994.

12.3.2 Policies and Programs to Reduce Polypharmacy Rates:

The USA has identified polypharmacy as a medication safety issue. Therefore, one of the goals of the USA's Healthy People 2000 initiative was to reduce the rate of polypharmacy (Jones 1997; Fulton et al. 2005).

The council on Gerontological Nursing of the American Nurses Association recommended the following for reducing the polypharmacy incidence (Jones, 1997): (i) start a drug profile on clients upon admission to a health care facility; (ii) monitor and evaluate the drug regimen, ideally by an expert team of professionals including a pharmacist, to eliminate unnecessary drugs; (iii) support nurses who withhold drugs they have judged to have an adverse effect on clients; (iv) advocate for increased research on pharmacodynamics; and (v) promote safe self–administration of drugs in seniors.

A literature review showed that sending written education material on its own was ineffective in changing physician–prescribing practices; successful education involved face–to–face interaction between an expert and the physician. Feedback that included a description of a physician's current practice and specific recommendations for modifications was also found to improve prescribing (Allard et al. 2001).

Through screening and patient profiles, pharmacists could potentially play a role in reducing polypharmacy by assessing the effects of comorbid conditions and reviewing potential drug interactions (Terrie 2004). However, polypharmacy in the senior population is complex and requires a multi–faceted response (Stewart et al. 1994) including patient education, physician education and improving physician prescribing habits. According to Stewart et al. (1994), the most promising approaches have been:

- One–to–one physician education outreach visits by clinical pharmacists or physician counselors
- Provision of regular feedback regarding prescribing performance
- Educational programs focused on specific therapy problems or specific drug classes
- Geriatric assessment units, which have been found to reduce polypharmacy

However, another literature review by Rollason and Vogt (2003) found the studies on pharmacist interventions to be of poor quality. None have a reduction of polypharmacy as an outcome measure for the effectiveness of an intervention. One more recent research paper detailed an intervention program in a managed care setting in the USA. This consisted of clinical pharmacists performing drug therapy reviews, educating physicians and patients about drug safety and polypharmacy, and working with physicians and patients to correct polypharmacy problems (Zarowitz et al. 2005). The pre–post comparisons indicated a significant drop in polypharmacy for the members (from 2.9% to 0.9% in the first intervention and from 2.8% to 1.7% in the second intervention time period). Overall drug costs were substantially reduced and sustained effects were seen after adoption of the intervention on a permanent basis.

There have been USA regulatory methods used to decrease polypharmacy which includes a mandate in 1974 for pharmacists to do monthly drug regimen reviews, a 1987 Omnibus Reconciliation Act to regulate the use of psychoactive drugs for Medicare and Medicaid nursing homes, a 1990 national drug utilization review (DUR) programme for all Medicaid patients and DUR Boards in states to conduct retroactive and prospective reviews.

In our current study, Winnipeg RHA had the most "success" in the province in controlling polypharmacy rates for community–dwelling seniors; these low rates are seen throughout the entire region. Although our study design cannot claim causation, this region has also had the longest history in medication reviews of the elderly by a designated geriatric program assessment team. Although other regions are beginning to implement specific reviews, most other RHAs have "patchwork" programs or educational strategies only. The literature has shown these to be less effective.

Further study could also be done as to the role of urban versus rural physician/pharmacist communication and how that relates to rates of polypharmacy.

12.4 Recommendations

- Given the success of the Winnipeg RHA in controlling polypharmacy through health care provider team approaches, this region needs further study into what makes it a promising practice area. Universal efforts to review medications (especially in the elderly) would presumably have positive effects throughout the province.
- An evaluation of the success in controlling polypharmacy in various regions of the province where more region–wide pharmaceutical reviews are being introduced will enable Manitoba to track what programs work and what programs do not. As well, differences in levels of communication between physicians and pharmacists in urban and rural settings could also be studied.
- Given the fact that the risk of polypharmacy is greatly increased when people are on homecare (short–term, but especially long–term), medication reviews at the onset and throughout homecare use are critical.

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CHAPTER 13: CAESARIAN SECTIONS (C–SECTIONS)

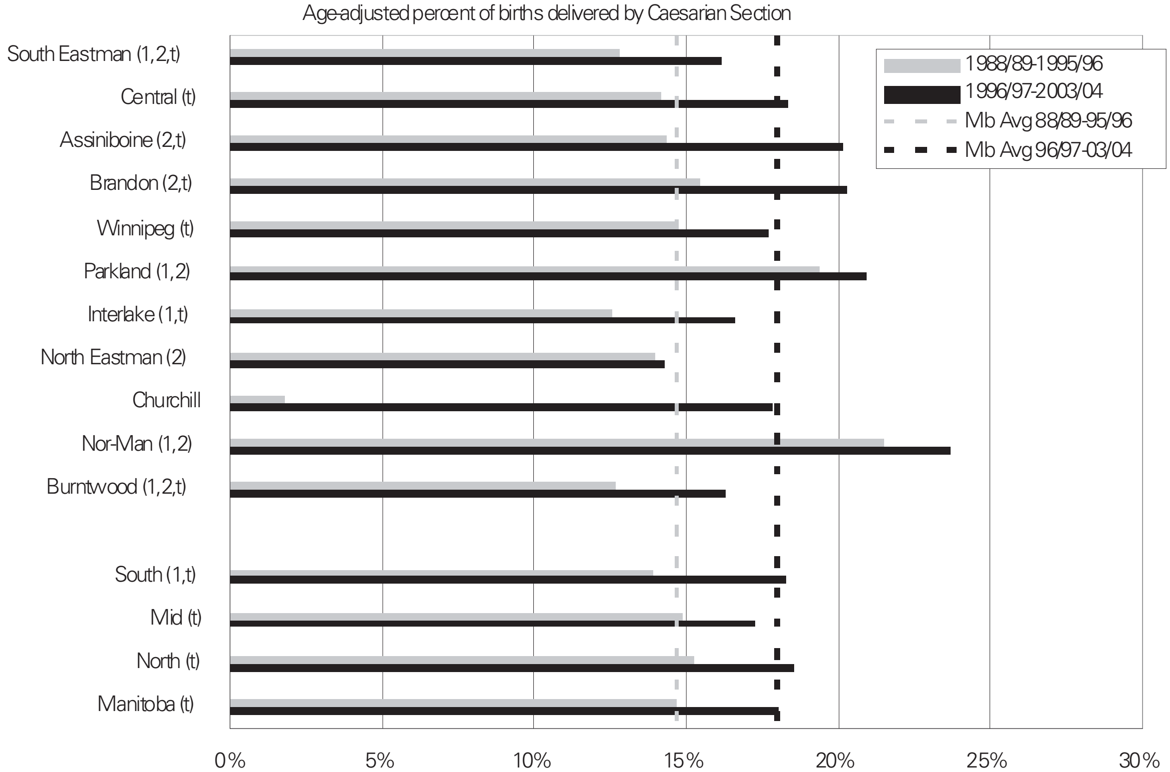
13.1 Definition, Graphs and Maps

A Caesarian section is a procedure in which a baby, rather than being born vaginally, is surgically extracted (removed) from the uterus.

Rates of C–Sections were calculated over 20 fiscal years of hospitalizations, 1984/85–2003/04. C–Sections were defined by ICD–9–CM procedure codes of 74.0 (classical Caesarian section), 74.1 (low cervical Caesarian section), 74.2 (extraperitoneal Caesarian section), 74.4 (Caesarian section of other specified type), or 74.9 (Caesarian section of unspecified type). The denominator is all maternal birth hospitalizations in the time period, defined by ICD–9 CM diagnosis code V27 (Outcome of Delivery). The mother's age is calculated as of date of admission to hospital. Region of residence is assigned based on hospital record.

Figure 13.1: C-Section Rates by RHA

Age-adjusted percent of births delivered by Caesarian Section

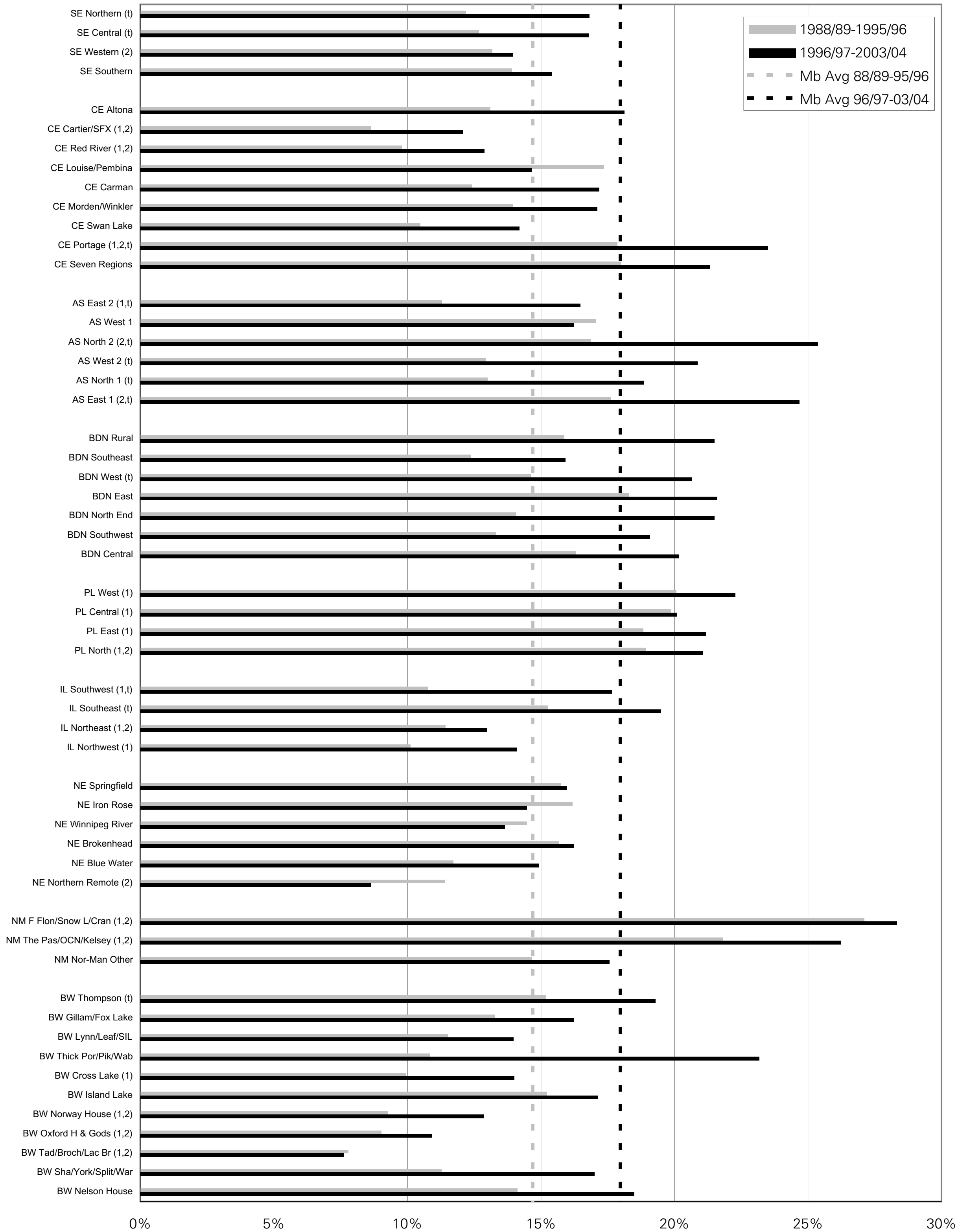


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 13.2: C-Section Rates by District

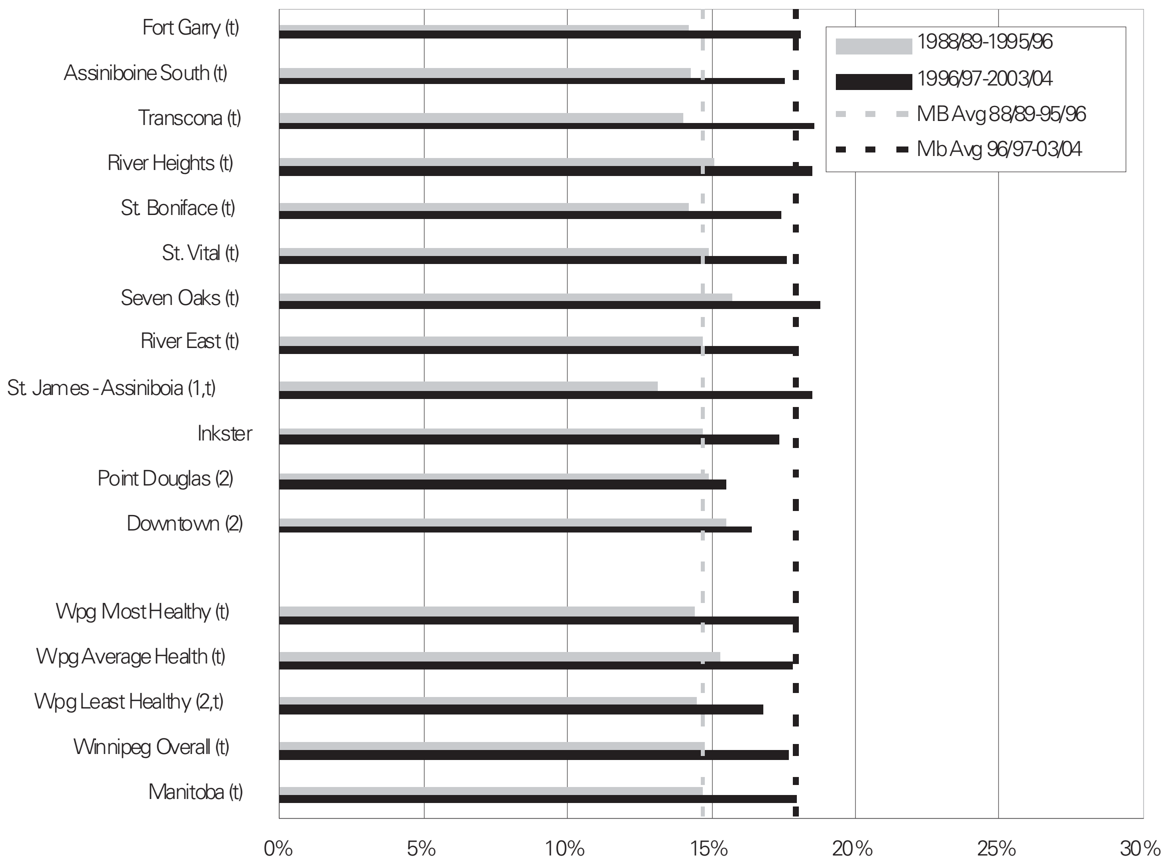
Age-adjusted percent of births delivered by Caesarian Section



Source: Manitoba Centre for Health Policy, 2008

Figure 13.3: C-Section Rates by Winnipeg Community Areas

Age-adjusted percent of births delivered by Caesarian Section

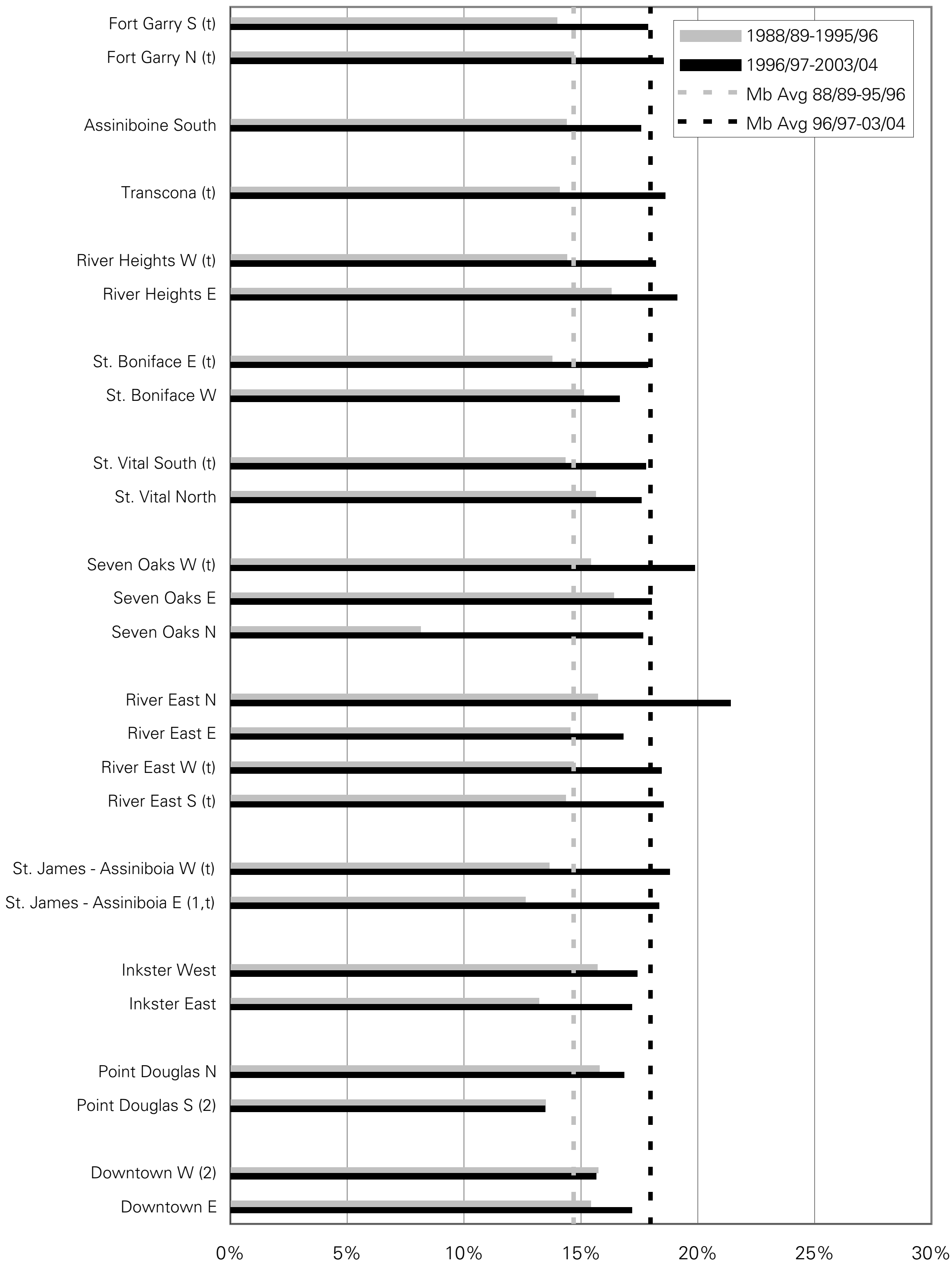


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 13.4: C-Section Rates by Winnipeg Neighbourhood Clusters

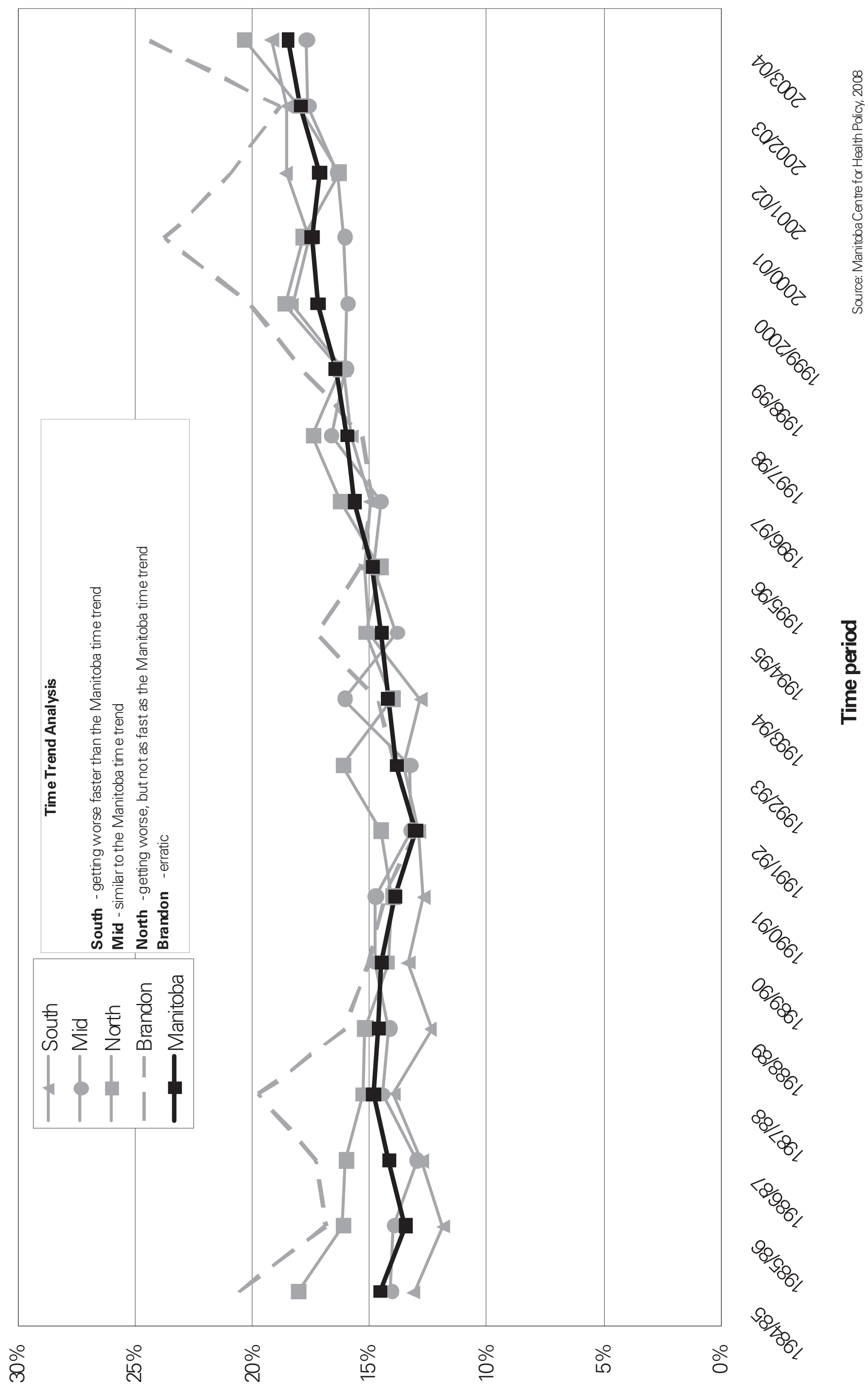
Age-adjusted percent of births delivered by Caesarian Section



Source: Manitoba Centre for Health Policy, 2008

Figure 13.5: Trends in Non-Winnipeg C-Section Rates

Age-adjusted percent of births delivered by Caesarian Section



Source: Manitoba Centre for Health Policy, 2008

Figure 13.6: Trends in Winnipeg C-Section Rates

Age-adjusted percent of births delivered by Caesarian Section

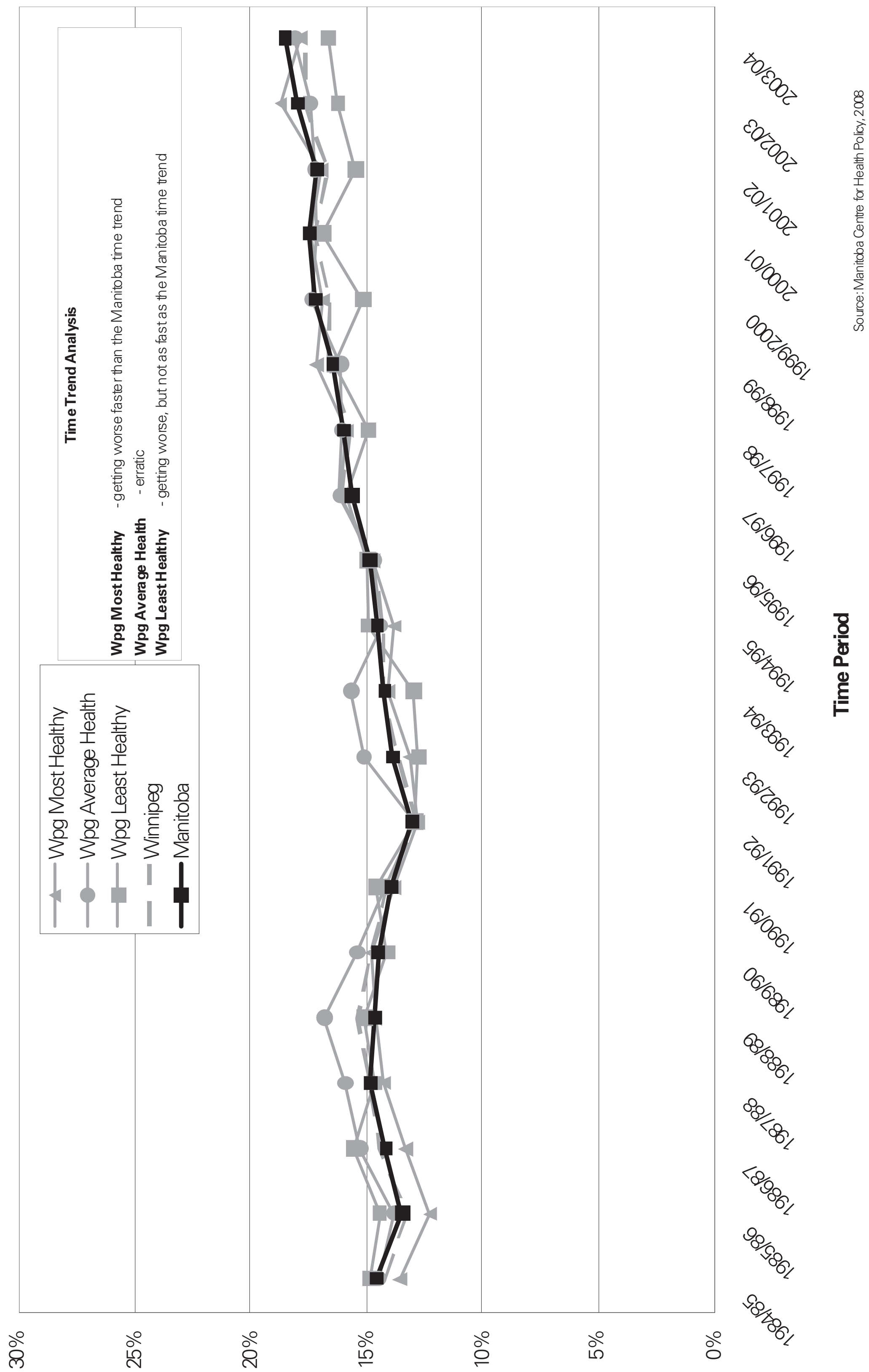
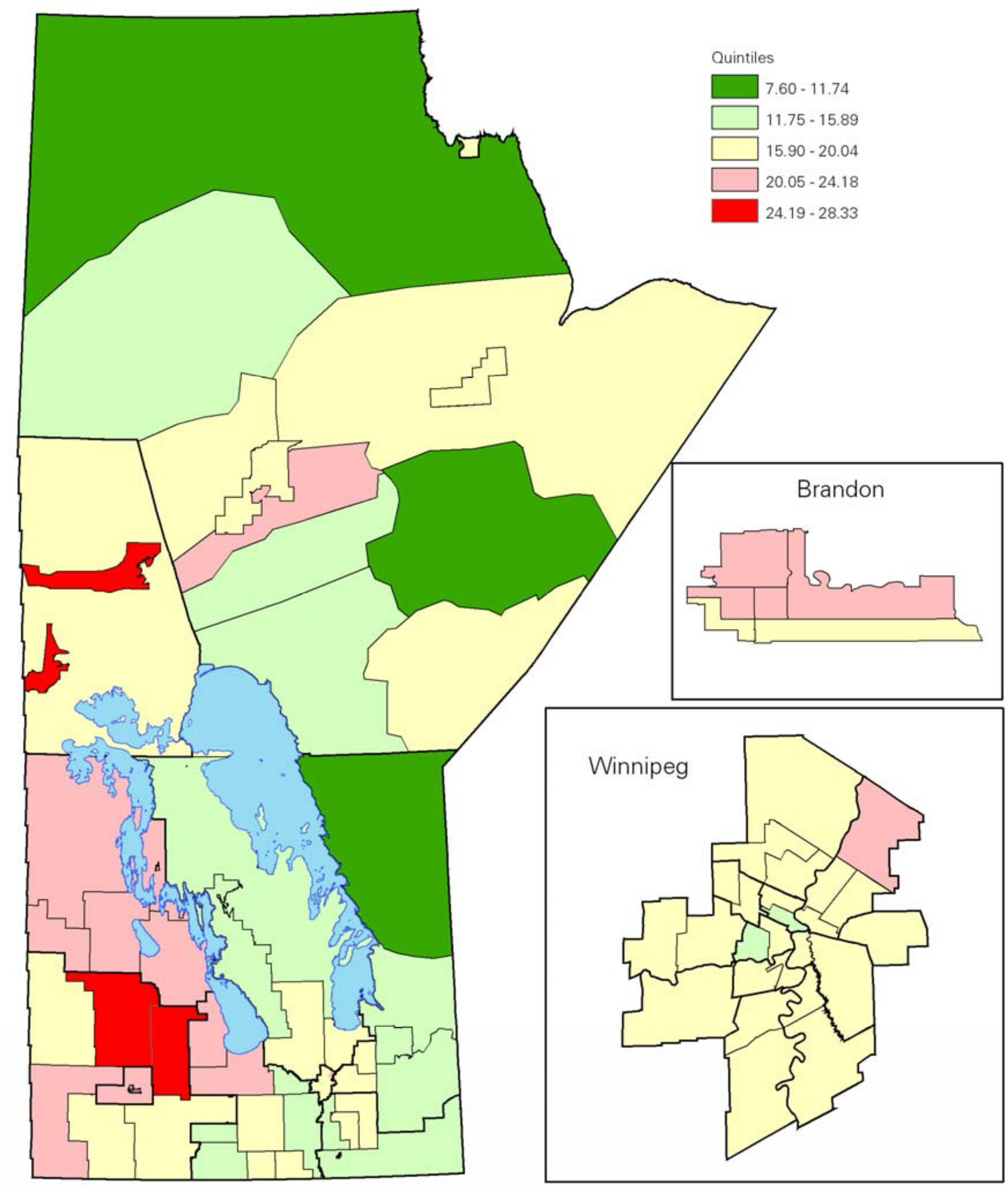


Figure 13.7: C-Section Rate Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

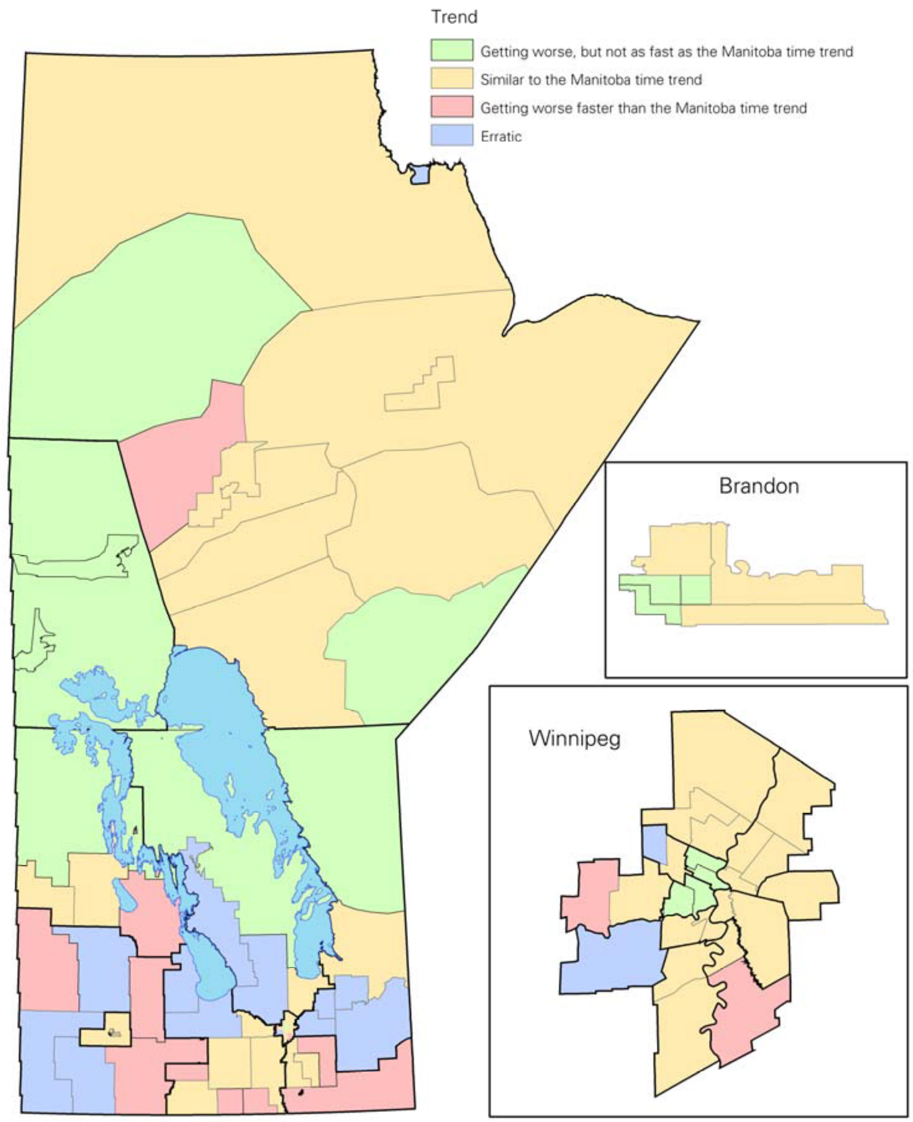
Age-adjusted percent of births delivered by Caesarian Section 1996/97-2003/04



Source: Manitoba Centre for Health Policy, 2008

Figure 13.8: Trends in C-Section Rates by RHA Districts and Winnipeg Neighbourhood Clusters

Age-adjusted percent of births delivered by Caesarian Section 1984/85-2003/04



Source: Manitoba Centre for Health Policy, 2008

Table 13.1 Caesarian Section prevention strategies by RHA

Program	Policy / Program details	Timeline
C-Sections performed in RHA Facilities Policies Guidelines Reviews Rate collection Rate reporting: To physicians In Community Assessments	**ASSINIBOINE** **Facilities:** Two sites can do C-Sections - Neepawa, Minnedosa Mothers also go to Brandon, a few go to Yorkton or Dauphin **Policies:** No regional policies / programs **Rate Reviews:** reported in community health assessments In 1992- 96 C-Section rate was 14.5% in RHA, 15% MB overall In 1997 – 01 C-Section rate was 19% in RHA, 17% MB overall Source: Manitoba Centre for Health Policy, RHA Atlas, 2003 Rates influenced by Brandon practice Informal process by four physicians in the region to determine rates **Reports: Community health assessment report** Physicians had access to the report which was distributed widely	 Pre-1997 - current 2004
	BRANDON **Facilities:** Brandon Hospital (1200 births/yr) C-Section rate 20-25% **Policies:** No regional initiatives to decrease C-Section rate **Rate Reviews :** Dept of Ob/Gyn to begin discussing monitoring rates Ob/Gyn also interested in Epidural rates **Reports:** Local data provided to physicians re rates Data not provided on a systematic basis Reported in community health assessments Midwives available	 Pre -1997 - current 2006 2007 2004 2002 - current
CQI Continuous Quality Improvement	**BURNTWOOD** **Facilities:** Thompson Hospital **Policy / Rate Review:** 113 C-Sections / 724 births, rate is 15% Rates discussed at Maternal Child CQI and Perinatal meetings A second opinion/consult is not required unless requested by a patient **Reports:** Rates are not communicated in Community Health Assessment One Midwife available	 2006 2002 - current
	CENTRAL **Facilities:** Four sites - Altona, Carmen, Boundary Trails and Portage Last three sites have 24-hour call and surgeries **Policies:** Surgical / Women's teams review clinical guidelines **Rate Review:** Site by site review - Collected data communicated to each site Physicians asked about common practices, gaps and needed changes Scheduling meetings with surgeons difficult due to time schedules, etc Discuss number of procedures and length of stay **Reports:** Surgical Team vision report based on review Community health assessment did not include acute care program C-Section rate 29% based on last year's deliveries Midwives available	 1996 - current 2003 - current 2003 - current 2005/06 2002 - current
	CHURCHILL This surgery not provided in region	

Program	Policy / Program details	Timeline
	INTERLAKE	
C-Sections	**Facilities:** Scheduled C-Sections at Selkirk	Pre-1997 - current
performed in RHA	Two General surgeons handling Emergency C-Sections	Pre-1997 - 2005
	Surgeons withdrew services due to time commitments	
Facilities	Most emergencies sent to Winnipeg	
Policies	OB program stopped in Ashern	
Guidelines	**Policies:** No regional policies / programs	Pre-1997 - 2002
Reviews	**Rate Reviews:** C-Section rates (utilization rates) are reported back to surgeon	
Rate collection	**Reports:** Not reported in community health assessments	
Rate reporting:		
To physicians	**NOR-MAN**	
In Community	**Facilities:** Two sites in Flin Flon, The Pas	Pre-1997 - current
Assessments	RHA has high diabetes rates resulting in bigger babies	
	70% of births are from North Eastern Saskatchewan 05/06	
	Policies:	
	Flin Flon General Hospital is a Level One OBS facility	2002 - current
	Policies are in the OBS Unit procedure manual	
	Consultation policy was updated	October 2006
	OBS Chief of Service completes an audit form on each C-Section	
	Audit forwarded to the College of Physicians and Surgeons of Manitoba	
	The Pas Health Complex is a Level Two OSB facility	2002 - current
	Rate Reviews:	
	Flin Flon General Hospital	Pre-1997 - current
	OBS Nurse Manager keeps manual records of all births	
	The Pas Health Complex	Pre-1997 - current
	OBS Head Nurse keeps manual records of all births at	
	Reports:	
	C-section data collected for Monthly hospital utilization reports	2004
	C-section rates reported in NRHA Quality Scorecard annually	2004
	Community health assessments	2004
	% of del by C-Section 1991/92 to 19965/96 and 1996/97 to 2000/01,	
	In 1992- 96 C-Section rate was 20.2% in RHA, 14.6% MB overall	
	In 1997 – 01 C-Section rate was 21.5% in RHA, 17.4% MB overall	
	Source: Manitoba Centre for Health Policy, RHA Atlas, 2003	
	Flin Flon Hospital C-Section rates, 2004 - 17% , 2005 - 15.8%, 2006 - 14.1%	
	C-section rates are reported in the on an annual basis	
	Midwives available	2001 - current
	North Eastman	
	No deliveries in region	
	PARKLAND	
	Facilities: C-sections in Dauphin, Swan River	Pre-1997 - current
	Policies: No regional policies or guidelines	
	Rate Reviews: Monitored every year	2003 - current
	Sent intermittently to the (two) surgeons	
	Reports: In Community health assessment report as a high rate	2004

Caesarean Section prevention strategies by RHA

Program	Policy / Program details	Timeline
	SOUTH EASTMAN	
C-Sections	**Facilities:** Bethesda Hospital does elective and emergency C-Sections	Pre-1997 - current
performed in RHA	St. Anne's does elective C-Sections on days when surgeries are scheduled	Pre-1997 - current
	Policies / Rate Reviews:	
Facilities	HIS stats have always reflected C-Section numbers, monthly & annually.	Pre-1997 - current
Policies	Guidelines / Indicator trends monitored by mat/child team, medical advisory	2003/4 - current
Guidelines	team including surgeons	
Reviews	CIHI report data is also used to see RHA , provincial and national rates	
Rate collection	**Reports**: C-Section stats in CEO scorecard	2005
Rate reporting:	Moved to the System Competency scorecard	2006
To physicians	Not reported in Community Health assessments	
In Community	Midwives available	2002 - current
Assessments		
	WRHA	
	Facilities: Hospitals providing maternity care as of 1997:	
	Grace Hospital (Obstetrical unit closed)	Pre-1997 - Oct 1998
	Victoria Hospital (Obstetrical unit closed)	Pre-1997 - 2004
	St. Boniface Hospital	Pre-1997 - current
	Health Science Centre Women's Hospital	Pre-1997 - current
	Policies/ Rate Reviews: No policies – peer review for justifiable care.	
	Regional audits have been done within WRHA annually	
	Audits were shared internally to OBs, administrators.	2004 - current
	Rates for 2005/6 will be published in the journal of SOGC	Future
	Not using crude rates	
	Looking at rates using Robson's criteria (10 different sub-groups of the populations - mutually exclusive clinical categories of patients comparing like with like, across institutions, care givers, regions)	
	Reports: Not reported in Community Health assessments	2004 Report
	Rates reported in Winnipeg Health Region Overview	2002 - current
	Midwives available	
	Comments:	
	Clinical guidelines:	
	A C-section for a first time mom requires a consult	
	Vaginal Birth After Caesarean (VBAC) requires a second consultation	
Comments are not in	C-section on demand requires 2 supportive opinions	
order of RHA, but	All RHAs have Clinical guidelines and protocols based on Ob/Gyn national	2003 – 2006
are randomly placed	standards	
	Most RHAs have care maps based on best practice	
Comments may	Society of OB GYN has a statement on elective c-sections	
have been voiced	College of Physicians and Surgeons did a report in 2005 on C-Sections that	
more than once	were performed in 2004	
	Too many factors to create a policy around caesarean section reduction.	
	Midwifery was introduced which should decrease rates	
	Midwifery rates for transfer are similar to some physician C-Section rates.	
	Health provider C-Section rates vary for Prime-ips that arrive at the hospital in spontaneous labour, with no other complications	

Table 13.2: C-Section Rates by Robson Index and by Aggregate Area, 2002/03-2003/04

Robson Index	Winnipeg	Brandon	South	Mid	North	Manitoba
All women	19.54%	22.23%	20.14%	18.63%	19.14%	19.64%
All singleton cephalic term	14.96%	17.96%	13.21%	12.65%	6.66%	13.69%
All breeches and abnormal lies	82.43%	80.00%	59.71%	58.95%	85.47%	72.36%
Premature (<37 weeks): singleton cephalic only	26.00%	30.00%	23.94%	26.62%	19.44%	25.23%
All multiple births	56.41%	36.84%	48.44%	45.71%	50.00%	52.17%
Nulliparous women with singleton, cephalic term pregnancy, spontaneous labour	10.99%	14.93%	12.81%	9.34%	6.91%	11.02%
Nulliparous women with singleton, cephalic term pregnancy, induced	24.17%	24.42%	22.30%	22.62%	12.00%	22.87%
Nulliparous women with breech presentation, abnormal lie, multiple pregnancy, or preterm	54.60%	54.55%	48.08%	50.51%	77.33%	55.18%
Multiparous women with singleton, cephalic term pregnancy, without scarred uterus	5.85%	6.59%	5.13%	4.97%	2.87%	5.28%
Multiparous women with singleton, cephalic term pregnancy, with scarred uterus	70.16%	77.01%	67.36%	64.54%	38.79%	66.87%
Multiparous women with breech presentation, abnormal lie, multiple pregnancy, or preterm	52.30%	52.63%	53.39%	46.21%	61.83%	53.46%

13.2 Discussion

What the figures and maps tell us about overall rates and trends in C–Sections:

- C–Section rates have increased substantially over time across most RHAs and districts and most Winnipeg CAs and NCs. Provincially, the rate has increased from 14.7% to 18.0% of births in the time period from 1988/89–1995/96 to 1996/97–2003/04.
- There is not a clear association between overall health status of a non–Winnipeg region and C–Section rates. For example, some northern RHAs have high rates (Nor–Man RHA) and others low rates (Burntwood RHA). Using aggregate areas, South, Mid and North have rates similar to the provincial average.
- Within Winnipeg RHA, all CAs, except Point Douglas and Downtown, have rates similar to the provincial average. Point Douglas and Downtown CAs have C–Section rates that did not increase over time and, therefore, are lower than the provincial average in the time period from 1996/97–2003/04. This is surprising, given the fact that women residing in these two areas may be at particularly high risk of poorer health resulting in birth complications.
- South Eastman, North Eastman and Burntwood RHAs show rates in the latest time period (1996/97–2003/04) that are lower than the provincial average. Assiniboine, Brandon, Parkland and Nor–Man RHAs show rates in the latest time period that are higher than the provincial average. Within Winnipeg, all NC rates are similar to the provincial average with the exception of the lower rates in Point Douglas South and Downtown West.
- Prior to 1995/96, the trends in C–Section rates were erratic, hovering around 15% or lower provincially. After 1995/96, the rates continually increased up to 2003/04 when the provincial rate was 18.5% (see Figures 13.5 and 13.6). In non–Winnipeg areas, there has been a decrease in the difference between aggregate areas over the past 20 years. There was little variation in rates in 2003/04 when comparing to 1984/85. In Winnipeg, rates have been very similar throughout the sub–regions and have remained so throughout the past twenty years.
- Looking at the maps (Figures 13.7 and 13.8), higher C–Section rates tend to cluster in the western part of the province (Assiniboine, Parkland, Brandon, Nor–Man RHAs). RHAs with the lowest C–Section rates throughout their regions tend to be in the mid and eastern parts of the province (South Eastman, North Eastman, and Interlake). South Eastman and North Eastman show the most consistently low rates throughout their regions. Burntwood RHA and Central RHA have quite diverse rates among their districts.
- Despite relatively high rates, the RHAs of Nor–Man and Parkland appear to be not increasing as rapidly as the provincial average (green on Figure 13.8) or they stayed similar to the Manitoba time trend. Districts of concern are those in the southwest corner of the province (particularly in Assiniboine RHA) which tend to have higher rates in 2003/04 and have rates going up faster than the Manitoba time trend.

Because there are distinct predictors of emergency versus scheduled C–Sections, two different models were analyzed.

What the regression modeling[1] tells us about **EMERGENCY** C–Section rates in the years 2002/03 to 2003/04 (for the complete regression model, refer to Appendix 4):

- Individual characteristics that increased the likelihood of having an emergency C–Section—being older, residing in a neighbourhood of lower average household income, having had a previous C–Section, being nulliparous (no previous deliveries), having augmentation or induction during the birth[2], having a breech presentation, having diabetes (both diabetes and gestational diabetes), and the baby being a male. The relationship between gestational age, weight, and the probability of an emergency C–Section is complex. This is illustrated in Figure 13.9. The likelihood of C–Section is increased when a baby is either low birthweight and lower gestational age or high birthweight and higher gestational age.
- Individual characteristics that did not influence the likelihood of having an emergency C–Section—having multiple births and having other physical or mental health diagnoses.
- After controlling for individual effects and hospital effects, there were no geographical characteristics that affected the likelihood of having an emergency C–Section.
- Hospital characteristics that decreased the likelihood of having an emergency C–Section, after controlling for individual factors—giving birth in The Pas, Selkirk and Intermediate/Small Rural hospitals. For Selkirk and the Intermediate/Small Rural hospitals, this may be an artifact in that most women requiring an emergency C–Section would be transferred to a nearby tertiary care centre.
- Hospital characteristics that increased the likelihood of having an emergency C–Section, after controlling for individual factors—giving birth in Brandon Hospital.

What the regression modeling[3] tells us about **SCHEDULED** C–Section rates in the years 2002/03–2003/04 (for the complete regression model, refer to Appendix 4):

- Individual characteristics that increased the likelihood of having a scheduled C–Section—being older, having a previous C–Section, having multiple births, being a multiparous mother (i.e., having had one baby already), and having a breech presentation. The relationship between having a scheduled C–Section, gestational age, and birthweight is rather complex and is illustrated in Figure 13.10. Basically, the highest probability of scheduled C–Section is within the 37 to 38 week gestational period. This requires an understanding of how elective C–Sections are booked, with planned elective sections routinely booked to occur after 39 weeks to reduce the chance of transient tachypnea of the newborn (TTN). But according to Dr. Maggie Morris (personal communication, January 2008), at least ¼ of those

[1] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

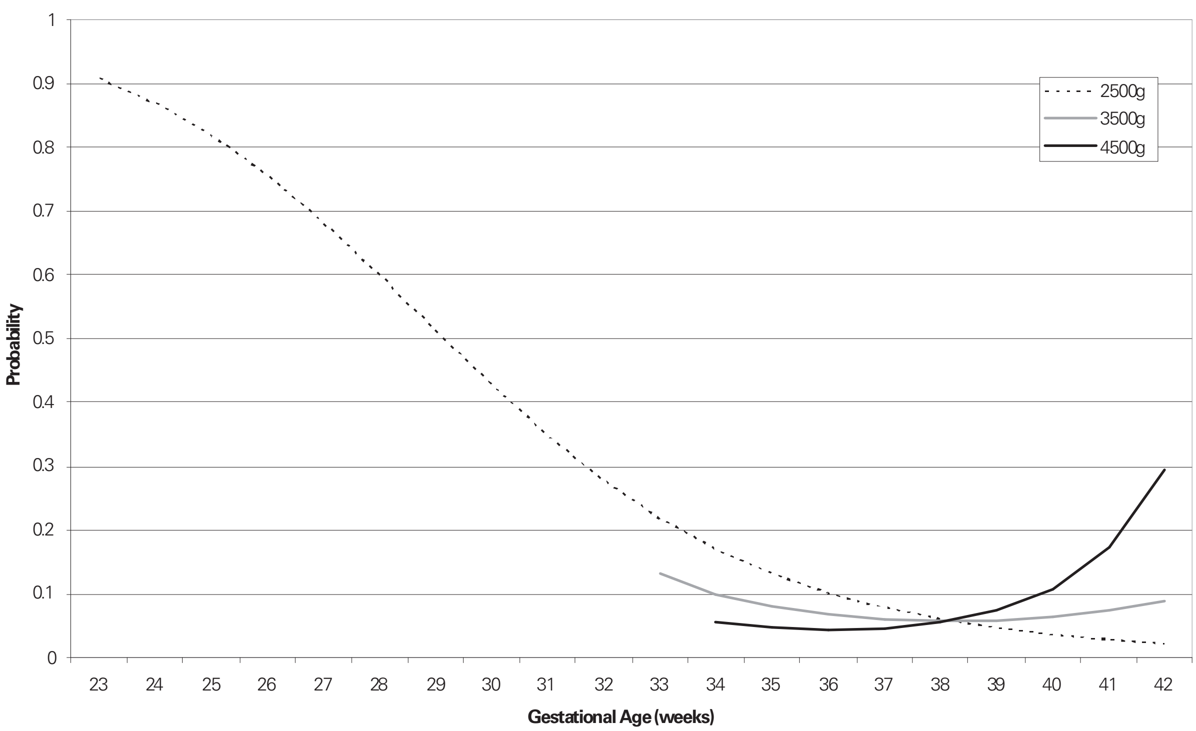
[2] An induction refers to a medical induction when labour had not yet started, and an augmentation refers to a medically stimulated labour when labour had already started. Augmentation may occur by having the waters artificially ruptured or through medication.

[3] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

women go into labour before that date. When a baby needs to be delivered due to complications of the pregnancy, the timing of the C–Section will be related to the stage of the disease and the need to deliver the baby, hence gestational age is not a factor.

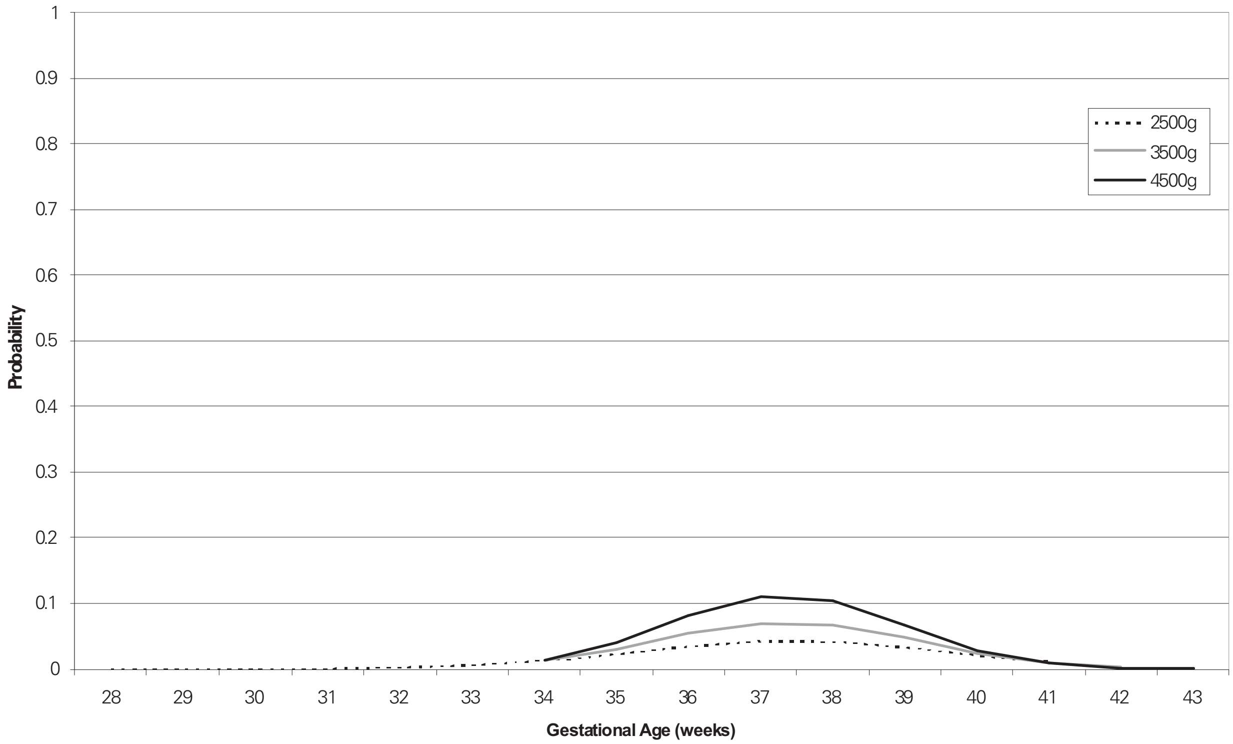
- Individual characteristics that did not influence the likelihood of having a scheduled C–Section—residing in a neighbourhood of lower average household income, having either diabetes or gestational diabetes, having other mental or physical health problems, the sex of the baby. (Note: According to clinical experts, diabetes is associated with an increased likelihood, but given the individual–level characteristics measurable in the Repository housed at MCHP, our analyses showed no effect after controlling for the comorbidities, age and regional factors available to us. Further study using more definitive clinical databases may be warranted).
- Geographical characteristics that decreased the likelihood of having a scheduled C–Section, after controlling for individual factors—living in Burntwood RHA or in the Winnipeg CA of Point Douglas.
- Geographical characteristics that increased the likelihood of having a scheduled C–Section, after controlling for individual factors—living in Assiniboine RHA.
- Hospital characteristics that decreased the likelihood of having a scheduled C–Section (compared to Health Sciences Centre), after controlling for individual factors—giving birth in the hospitals of Brandon, Victoria, Boundary Trails (Winkler/Morden), Flin Flon, Portage, The Pas, Selkirk, Swan River, Thompson, and Intermediate/Small Rural hospitals. This may be an artifact that any presumed high risk scheduled C–Section birth would probably not occur in smaller hospitals, but rather be referred to a larger centre.

Figure 13.9: Probability of Emergency C-Section by gestational age and weight, 2002/03-2003/04 after controlling for other factors in the regression model



Source: Manitoba Centre for Health Policy, 2008

Figure 13.10: Probability of Scheduled C-section by gestational age and weight, 2002/03-2003/04, after controlling for other factors in the regression model



Source: Manitoba Centre for Health Policy, 2008

How the above are associated with descriptive information on policy, program or support initiatives to decrease C–Section rates:

- By geographical region (after controlling for both individual and hospital of birth characteristics in the regression modelling), there were no geographical effects for emergency C–Sections. However, a woman was less likely to have a scheduled C–Section if she resided in Burntwood RHA and more likely if she resided in Assiniboine RHA. Burntwood RHA discusses C–Section rates at the Maternal Child Continuous Quality Improvement meetings and in Perinatal meetings.
- The two RHAs that reported having C–Section rates as part of their quality Scorecard for the CEO and Board members are Nor–Man and South Eastman. Nor–Man has high rates, but these rates are explainable by individual risk factors within the population. Nor–Man also shows trends that are not increasing as fast as the Manitoba time trend which may indicate monitoring to avoid upward drift. The two hospitals in Nor–Man (Flin Flon and The Pas) are both associated with lower C–Section rates after controlling for other individual and geographical factors which, again, may indicate monitoring by the RHA. South Eastman shows low rates, but these too are explainable by individual risk factors within the population.
- Women giving birth in Brandon Hospital show a greater likelihood of emergency C–Section birth, but lower likelihood of scheduled C–Sections. This may, in part, be explained by transfers to Brandon Hospital from surrounding smaller hospitals in the area. However, C–Section rates tend to be higher than expected in the southwest corner of the province.

Assiniboine RHA shows higher than expected scheduled C–Section rates even after controlling for individual factors and hospital factors.

Studying C–Section rates to analyze where rates may be higher than expected is a difficult task unless one "breaks down" the types of births through such information as the Robson Index (see Table 13.2). Reducing C–Section rates in an RHA may be aimed at different strategic education depending upon the birthing situations in the Robson Index where C–Sections are higher than expected. Given various classifications of birthing situations, rates vary throughout different parts of the province. For example:

- Women living in the South (60%) and Mid (59%) areas of the province and having a breech presentation are less likely to have a C–Section than their counterparts in Winnipeg (82%), Brandon (80%) and North (85%) areas. However, this must be interpreted with caution due to the potential of small numbers in non–Winnipeg areas.
- For situations of multiple births, women living in Brandon are less likely to have a C–Section (37%) compared to their counterparts in the rest of the province—Winnipeg (56%), South (48%), Mid (46%) and North (50%) areas.
- On the other hand, Brandon tends to have higher C–Section rates (15%) for women giving birth to their firstborn, singleton birth, term pregnancy and spontaneous labour compared to women living in Winnipeg (11%), South (13%), Mid (9%) and North (7%) areas.
- In the North, multiparous women with normal term pregnancy, but previous C–Sections, are much less likely to have a C–Section (39%) than their counterparts in Winnipeg (70%), Brandon (77%), South (67%), or Mid (65%) areas.

13.3 Comparison of Pertinent Literature Reviews and *Our Study Results*

13.3.1 C–Section Rate Comparisons:

According to the Canadian Institute for Health Information, Canadian C–Section rates have increased from 18.0% in 1994/95 to 22.1% in 2000/01 (Liu et al. 2004), and the most recent data from 2005/06 showed another increase to 26.3% (CIHI 2007). Liu et al. (2004) attribute only a small proportion of the increase (15%) to increasing maternal age at birth. Separating this into primary C–Section only (i.e., excluding repeat C–Section situations), this also increased from 12.7% in 1994/95 to 16.3% in 2000/01, and 18.6% in 2005/06 mostly due to an increase in C–Sections for dystocia (slow or difficult delivery). In 2005/06, the two provinces reporting the lowest rates (21.1% and 21.3% respectively) were Saskatchewan and Manitoba, although the Manitoba CIHI data only represent three RHAs (Interlake, Winnipeg and Central).

The increase in rates is also seen in the USA with an overall C–Section rate of 26.1% in 2002 and 27.6% in 2003 (Korst et al. 2005), and up to 29% in 2004 (CIHI 2007). Declines in the C–Section rates were seen from 1989 to 1996; but since then, there have been steady increases up to 2005.

According to Walker et al. (2002), the USA and Australia have the highest C–Section rates in the developed world, at 22% and 21% respectively. However, developing countries such as India, South

America and South Korea have rates between 25% and 45%. Rates in the Netherlands and Sweden have stayed at approximately 10% since the 1980s (Walker et al. 2002; Lee et al. 2004).

The World Health Organization (Chalmers et al. 2001) has stated that "Cesarean section rates should range from about 5% to 15% in any facility, depending on its level. Use the simplest technology available rather than more sophisticated techniques provided this is supported by sound evidence." On the other hand, there is debate in the literature regarding the WHO rate and whether this is realistic given current medical opinion (Dosa 2001). However, the USA "Healthy People 2010" guidelines still recommend a 15% C–Section rate for nulliparous women in low risk situations of giving birth to a singleton, full–term, normal presentation (Declercz et al. 2006).

Until 1996, our Manitoba study shows similar trends of steady rates just below 15% throughout the province. After 1996, the rates began to increase steadily up to a high of 18.5% in 2003/04. Our rates are still below the Canadian average, but can vary by district of the province—from lows in the Northern Remote district of North Eastman RHA (8.6%) and Tadoule/Brochet/Lac Brochet district of Burntwood RHA (7.6%) to highs in the two Nor–Man districts of Flin Flon/Snow Lake/Cranberry Portage (28.3%) and The Pas/OCN/Kelsey (26.2%). Since Nor–Man RHA does not have an elevated risk when the individual factors are taken into account, the two high rates appear to be influenced mostly by individual risk factors. However, even after controlling for individual factors and hospital effects, Burntwood RHA appears to have a lower likelihood of scheduled C–Sections (but a similar likelihood to the province for emergency C–Sections).

13.3.2 Policies and Programs to Reduce C–Section Rates:

Caesarian Section rates have been noted to vary substantially, even within a relatively homogeneous population practicing in a single hospital setting. A Winnipeg study in the 1990s (Menticoglou 1997) found that amongst 15 obstetricians, C–Section rates varied widely from 5.5% to 20.1% for primiparous women with normal birth presentations and birth weights above 2500 g. These differing rates could not be explained by institutional factors, patient differences or physician convenience factors. As well, there appeared to be little relationship between the C–Section rate and the perinatal outcomes. However, more recent studies have looked at the effect of increasing rates of obesity on pregnancy outcomes (Bhattacharya et al. 2007). These studies observed that obesity potentially increases the risk of emergency C–Sections. Although some have suggested that increasing C–Section rates are a result of 'patient choice', this is not based on evidence in surveys of mothers. Declercq et al. (2006) have suggested that neither the prevalence of medical risk factors nor labour or delivery complications correspond to the increasing C–Section rates. Rather, changes in obstetrical practices were the major influence in the 1990s and 2000s.

Planners must consider the cost of having a C–Section especially if it could be avoided. According to CIHI (2006), hospitals spend over 60% more to care for a mother having a C–Section compared to a vaginal delivery ($4,600 versus $2,800). There is a growing concern over the possible health consequences of increasing C–Section rates as well (Belizan et al. 2007; Martens et al. 2004; Ontario Women's Health Council 2000; Walker et al. 2002). These consequences may include increased re-hospitalization rates of the newborn, increased infant and maternal morbidity and mortality, decreased satisfaction with the birth, and increased maternal psychosocial problems. Further study needs to be done to evaluate the outcomes of increased rates.

Debates over the safety of vaginal birth after a C–Section delivery (VBAC) have been in the literature for many years. In Canada, the 1986 National Consensus Conference on Aspects of Caesarean Birth developed guidelines for reducing unnecessary surgical intervention at birth and promoting the safety of VBAC (Liu et al. 2004). After 1986, the C–Section rate steadily decreased to 17.6% in 1993, but increased again after 1993. There is speculation that a landmark study in 1996 was the reason behind a decline in VBACs. The study looked at the rate of serious maternal complications (e.g., need for hysterectomy, uterine rupture) and found that complications occur during vaginal birth at almost twice the rate of complications during C–Sections. Thus there was a shifting pattern back to C–Section rather than VBAC (Liu et al. 2004; Declercq et al. 2006).

Research on strategies to reduce C–Section rates:

- A meta–analysis (Chaillet and Dumont 2007), which included RCTs, controlled before/after studies and interrupted time series studies, were evaluated using the Effective Practice and Organization of Care Group criteria. The analysis showed a reduced risk (RR=.81, 95% CI 0.75–0.87) in several scenarios. Significant reductions occurred for those interventions that involved health workers analyzing and modifying their practices, including changes such as audit and feedback, quality improvement initiatives, and multi–faceted strategies.
- One medical audit process in the UK (Robson et al. 1996) found that if interventions were aimed at management of dystocia (slow or difficult delivery), then C–Section rates were reduced. This was implemented through monthly chart audits, increased early augmentation of dysfunctional labour, greater cooperation between midwives and physicians, and applying management guidelines for dystocia more rigorously.

At the request of the Minister of Health and Long–Term Care, the Ontario Women's Health Council (2000) established a Caesarean Section Working Group, which identified 12 critical success factors for best practices:

- Pride in a low c–section rate
- A philosophy of birth as a normal physiological process
- A commitment to one–to–one supportive nursing care during active labour
- Strong team leadership
- Effective multi–disciplinary teams
- Timely access to skilled professionals
- A strong commitment to evidence–based practice
- Programs to ensure continuous quality improvement
- An accessible and interactive database
- Coordinated maternal/newborn services
- Networking

- The hospital's ability to manage change (i.e., by monitoring performance and adjusting strategies, hospitals can be resilient enough to continue to attain and maintain goals such as a low C–Section rate)

13.4 Recommendations

- Despite Canadian and world–wide increases in C–Section rates, Manitoba continues to be in the range of the lowest rates in Canada. This should be recognized as an achievement for the province as a whole.
- Use the Robson Index tool when reporting C–Section statistics to regions. In planning a strategy to reduce C–Section rates, different educational interventions may be required in different areas of the province. Studying the "best practices" for such situations as breech presentation, multiple birthing, and previous C–Section birth may assist the RHAs in determining the appropriate area in which to focus further education, thereby potentially reducing C–Section rates.
- C–Section rates at major rural hospitals will vary according to referral patterns from smaller birthing centres. However, rates by women residing in various RHAs should be analyzed to determine higher than expected rates (such as the higher scheduled C–Section rates in Assiniboine).
- Mothers with diabetes and gestational diabetes are at particular risk of C–Sections even after controlling for gestational age and birth weight of the infant. This may need further study given the fact that women with comorbid physical or mental illnesses do not show any increased likelihood of scheduled or emergency C–Section.

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CHAPTER 14: HYSTERECTOMY

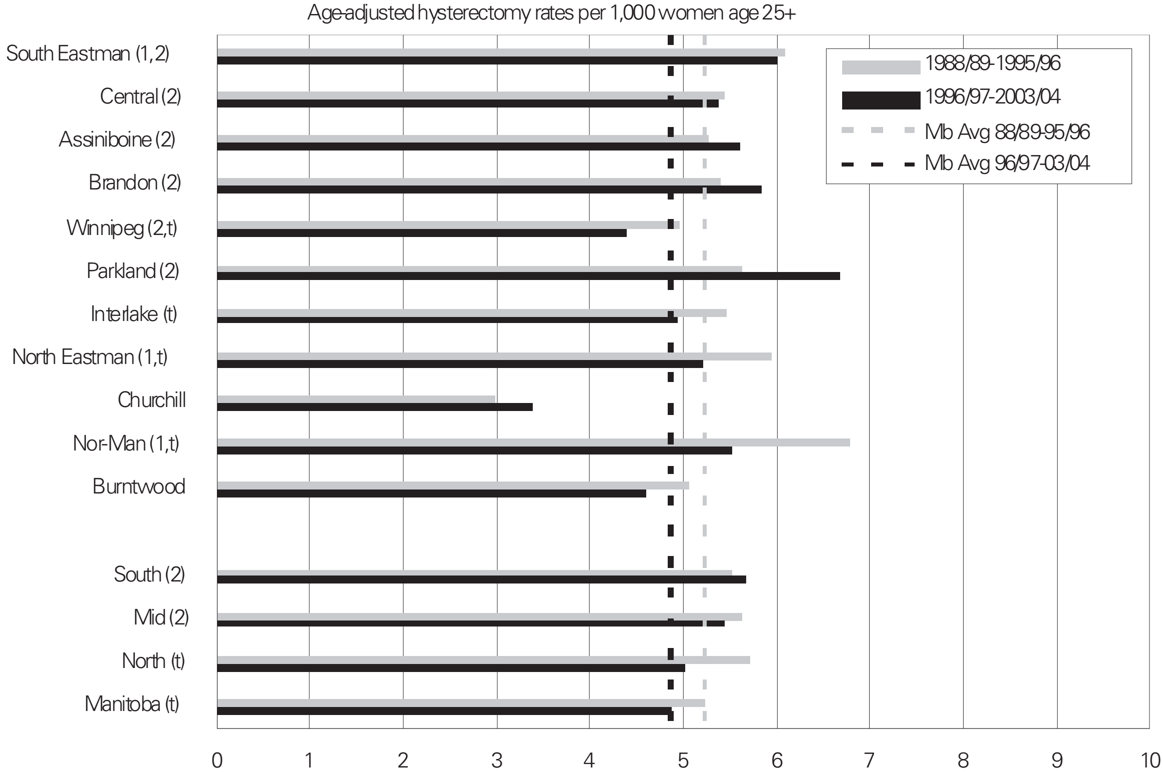
14.1 Definition, Graphs and Maps

A hysterectomy is a surgical operation to remove the uterus and, sometimes, the cervix. Removal of the body of the uterus without removing the cervix is referred to as a subtotal (or partial) hysterectomy. Removal of the entire uterus and the cervix is referred to as a total hysterectomy.

In this report, hysterectomy rates were calculated for woman age 25 or older for fiscal years 1984/85–2003/04. Hysterectomy was defined as any hospitalization for a hysterectomy surgery. These were identified by ICD–9–CM procedure codes of 68.4, 68.5 or 68.9 in any procedure field. (Note: this excludes procedure codes for radical hysterectomies typically associated with cancer cases, i.e., codes 68.6 and 68.7). Age and region of residence is determined as of date of admission to hospital in numerator and December 31 of each fiscal year in the denominator.

Figure 14.1: Hysterectomy Rates by RHA

Age-adjusted hysterectomy rates per 1,000 women age 25+

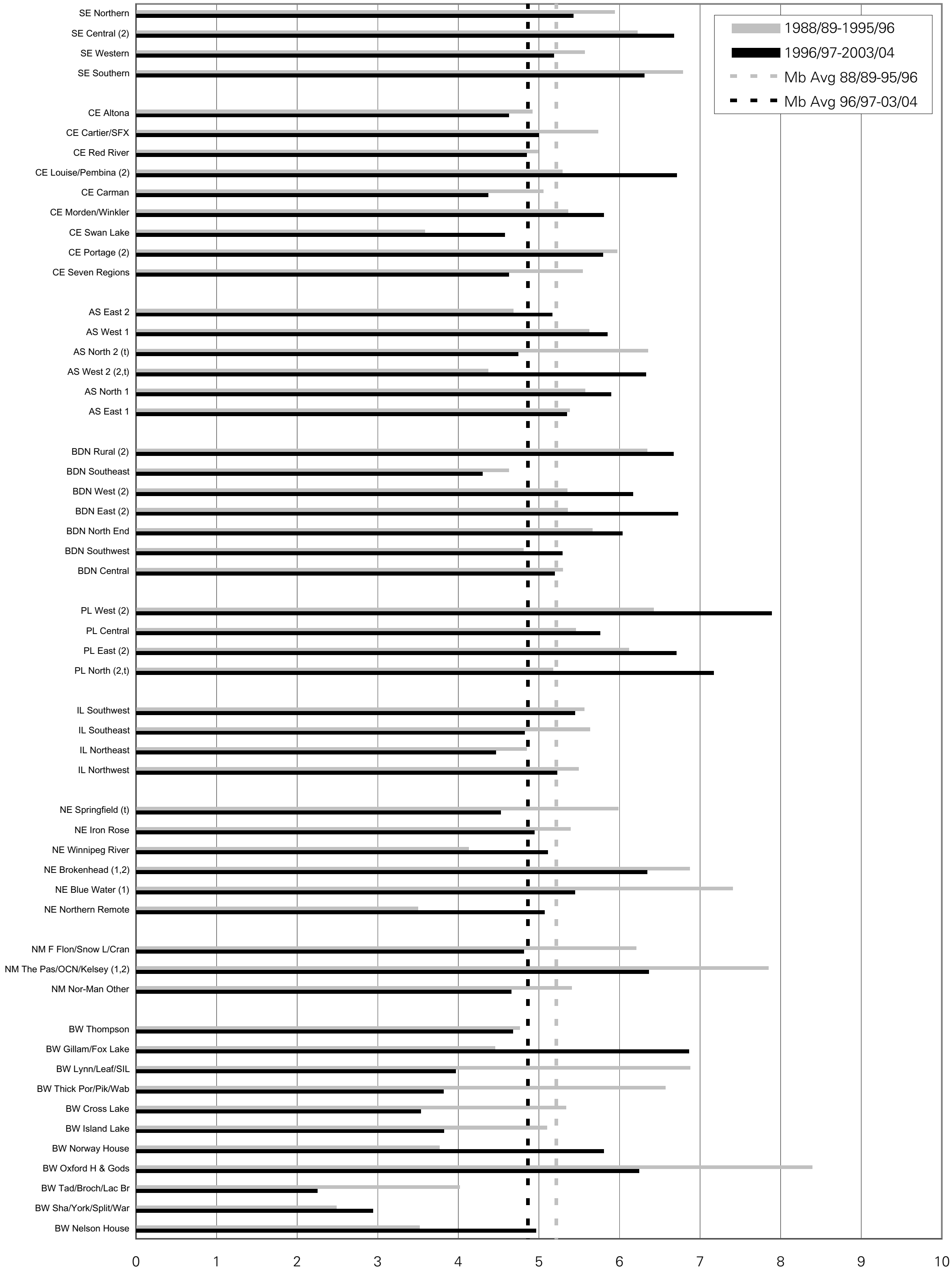


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 14.2: Hysterectomy Rates by District

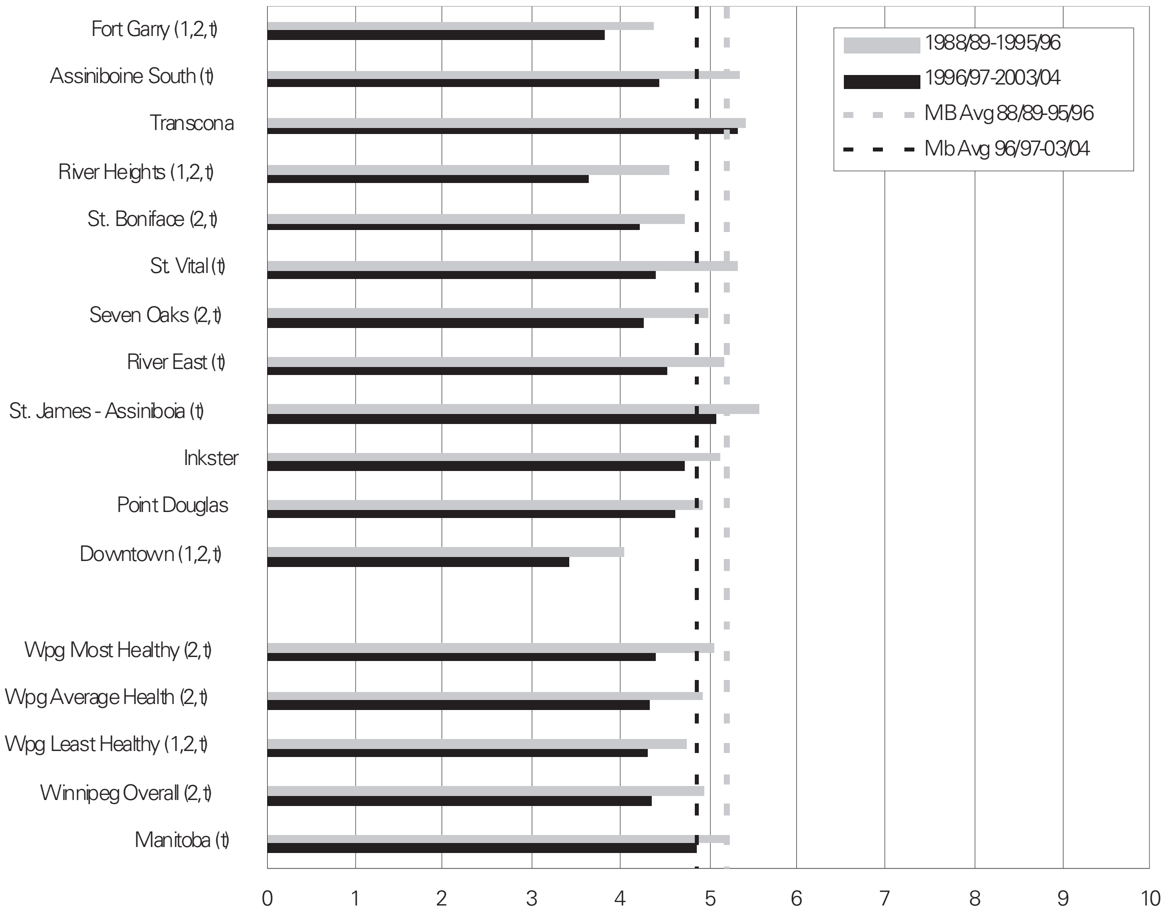
Age-adjusted hysterectomy rates per 1,000 women age 25+



Source: Manitoba Centre for Health Policy, 2008

Figure 14.3: Hysterectomy Rates by Winnipeg Community Areas

Age-adjusted hysterectomy rates per 1,000 women age 25+



'1' indicates area's rate was statistically different from Manitoba average in first time period

'2' indicates area's rate was statistically different from Manitoba average in second time period

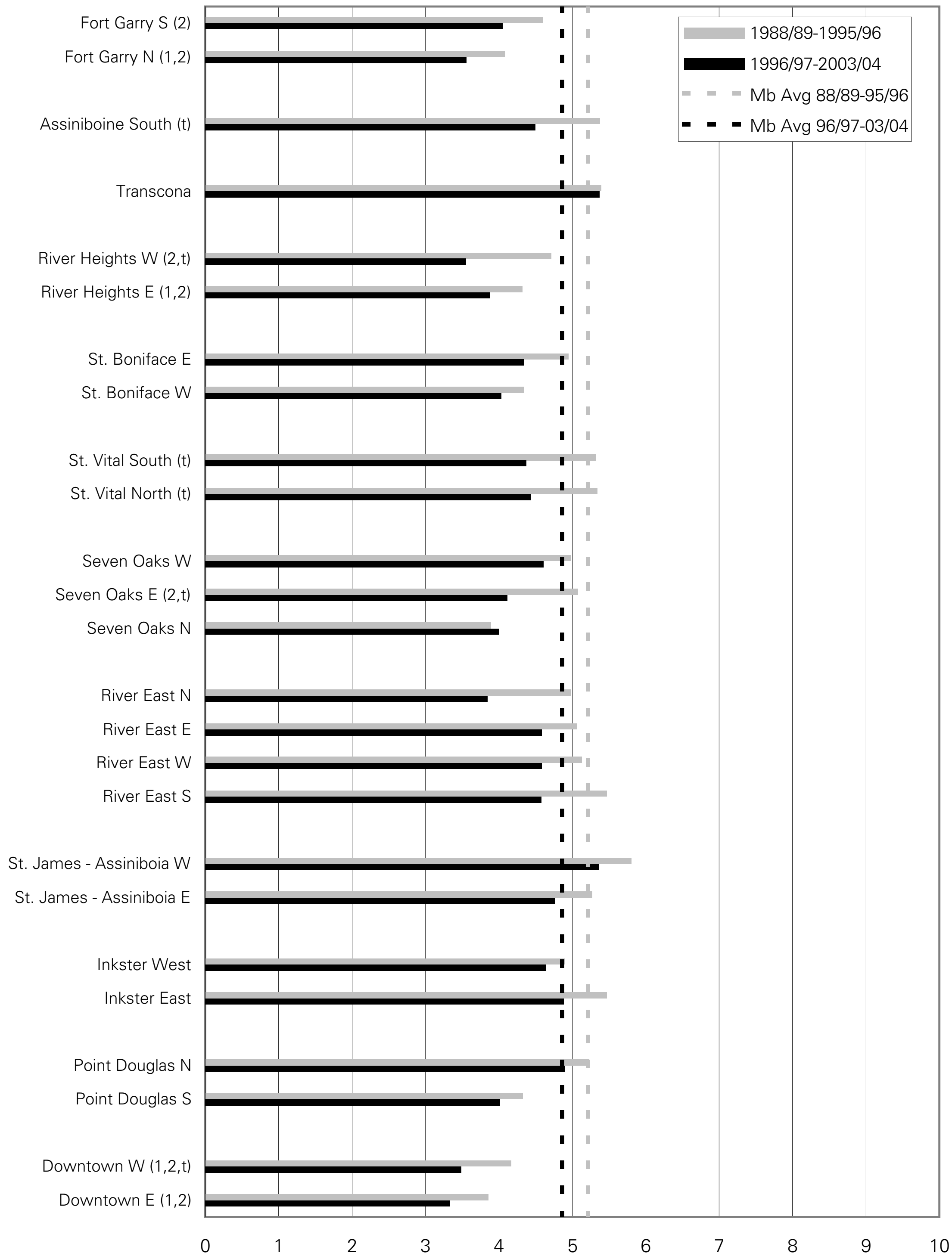
't' indicates change over time was statistically significant for that area

's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 14.4: Hysterectomy Rates by Winnipeg Neighbourhood Clusters

Age-adjusted hysterectomy rates per 1,000 women age 25+



Source: Manitoba Centre for Health Policy, 2008

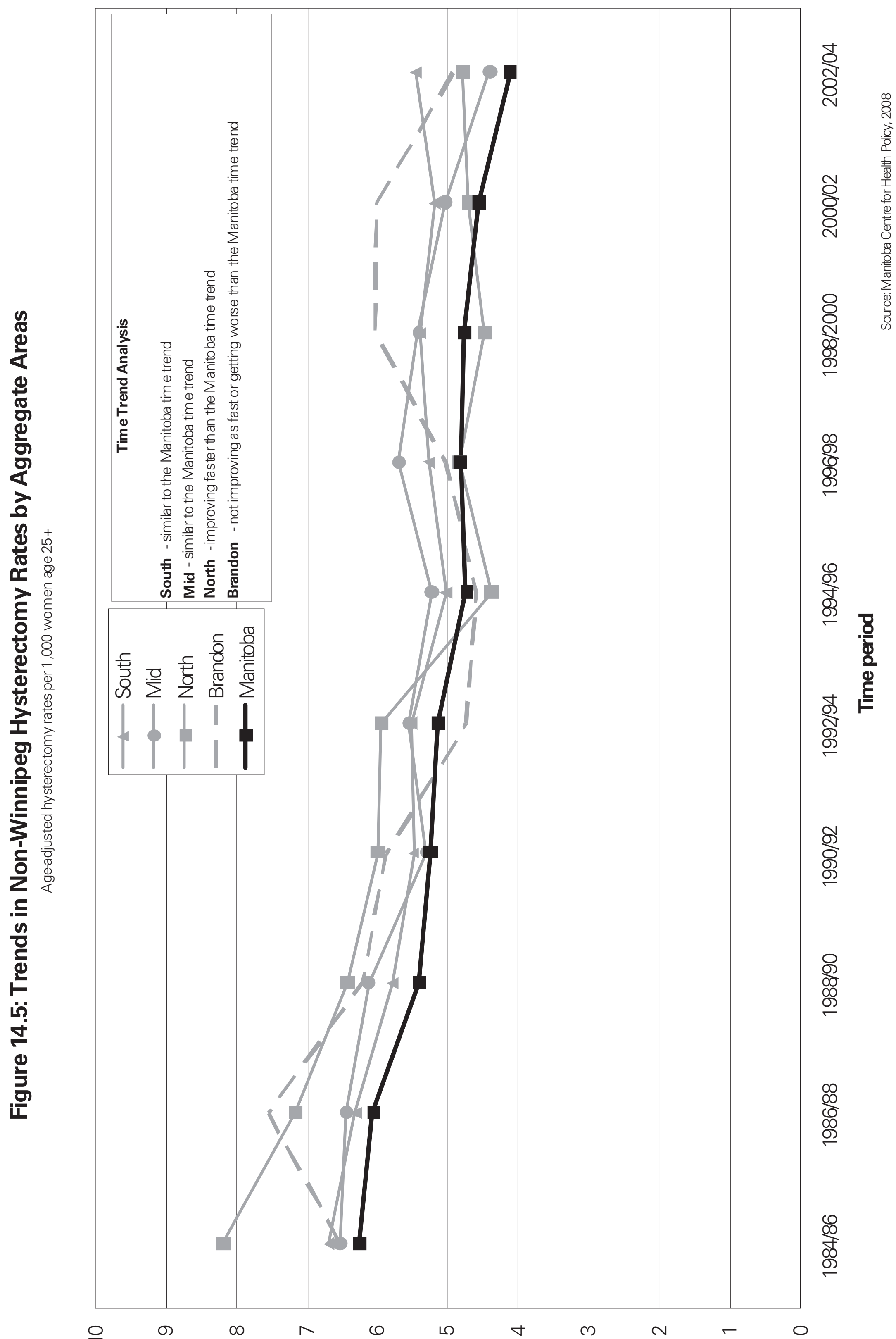
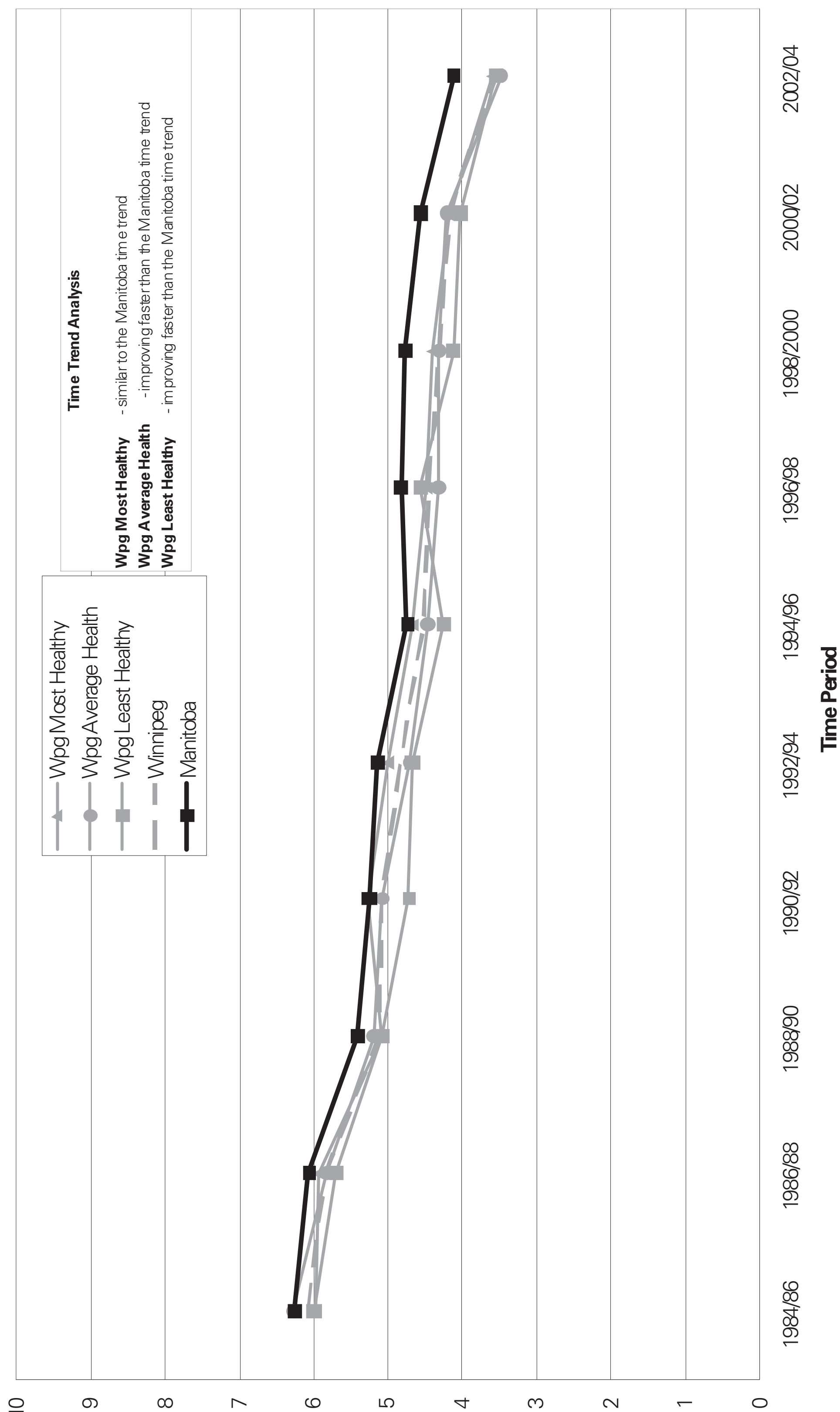


Figure 14.5: Trends in Non-Winnipeg Hysterectomy Rates by Aggregate Areas

Figure 14.6: Trends in Winnipeg Hysterectomy Rates by Aggregate Areas

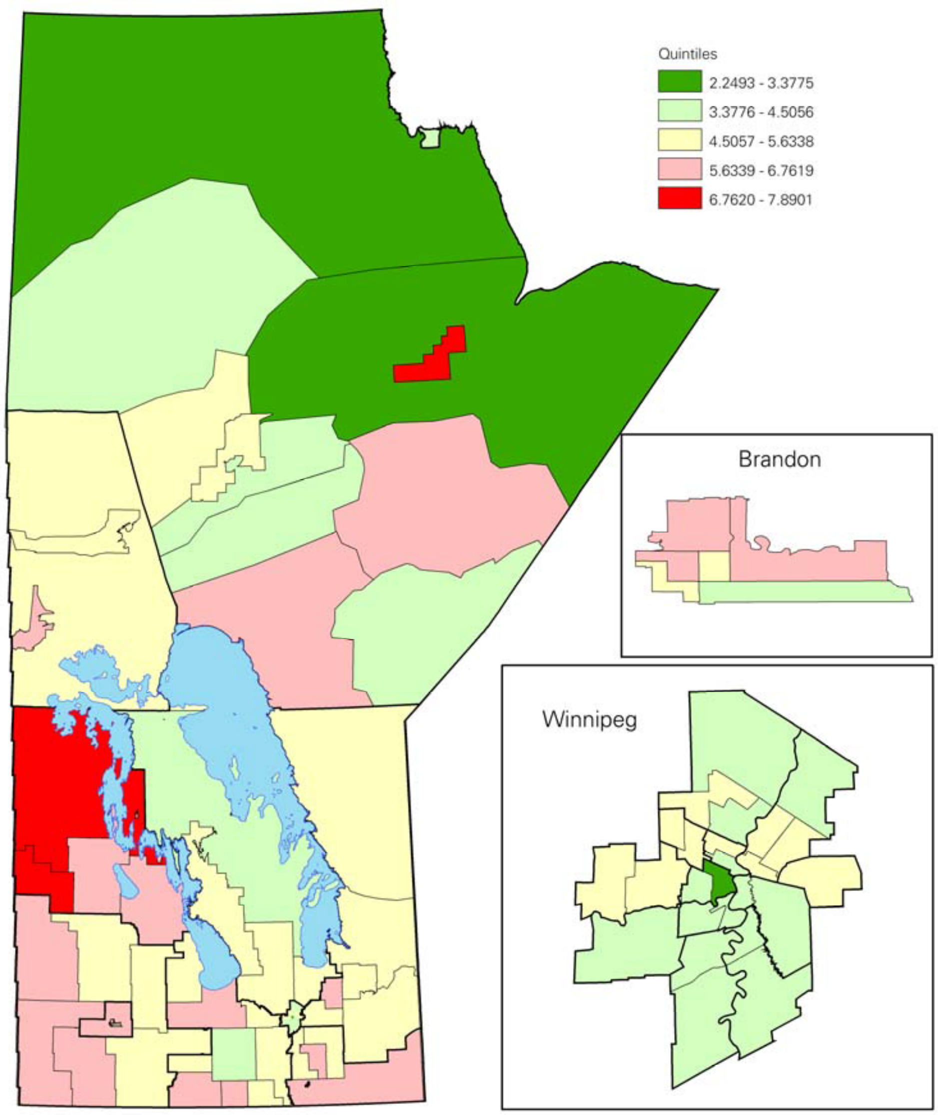
Age adjusted hysterectomy rates per 1,000 women age 25+



Source: Manitoba Centre for Health Policy, 2008

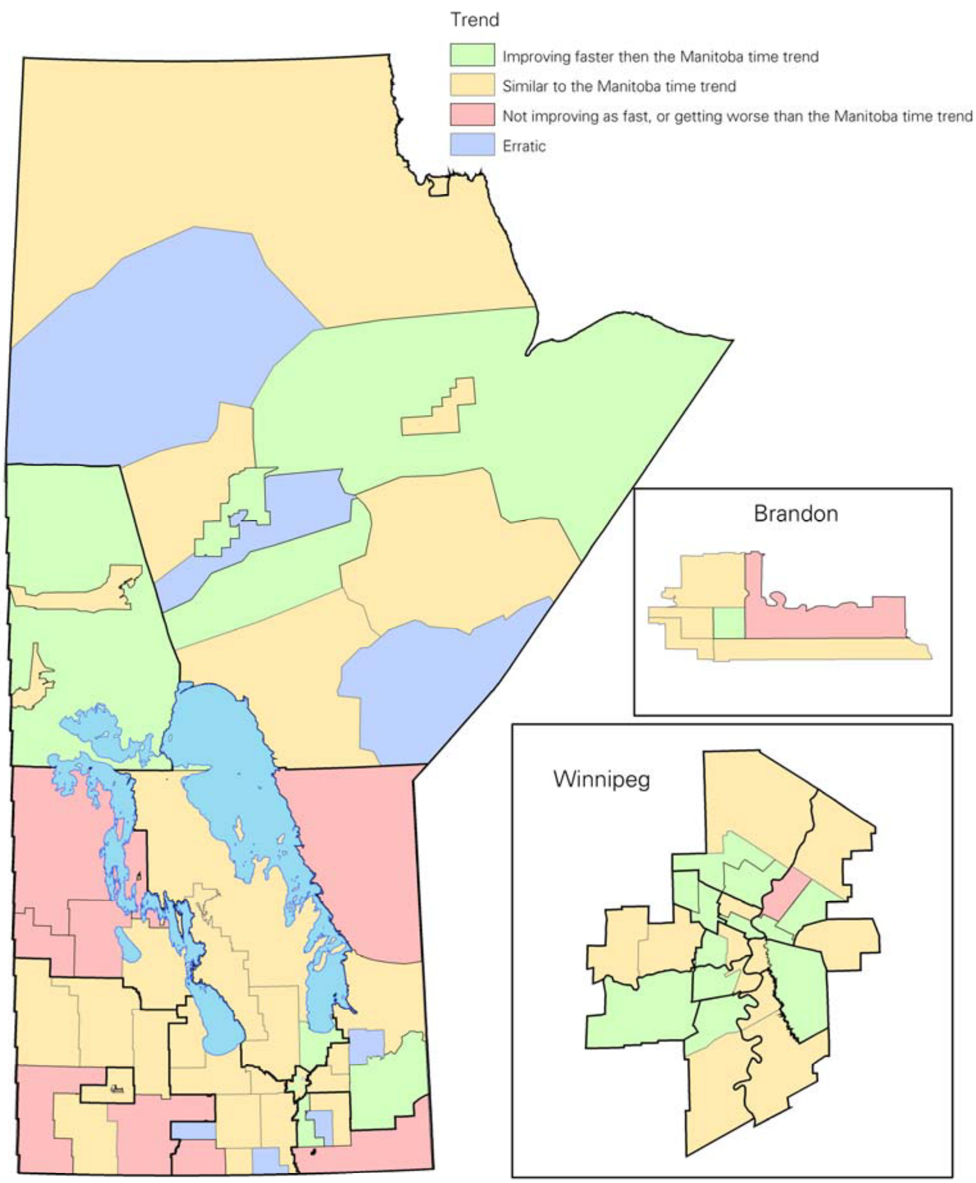
Figure 14.7: Hysterectomy Rate Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

Age-adjusted hysterectomy rates per 1,000 women age 25+, 1996/97-2003/04



Source: Manitoba Centre for Health Policy, 2008

Figure 14.8: Trends in Hysterectomy Rates by RHA Districts and Winnipeg Neighbourhood Clusters
Age-adjusted hysterectomy rates per 1,000 women age 25+, 1984/85-2003/04



Source: Manitoba Centre for Health Policy, 2008

Table 14.1 Initiatives to ensure appropriate hysterectomy rates, by RHA

Program	Policy / Program details	Timeline
Hysterectomies **Total** **Sub-total** Facilities Policies / Guidelines Rate collection Rate reporting: To physicians In Community Assessments Policy refers to regional strategies, adapted guidelines or programs to examine rates.	**ASSINIBOINE**	
	Facilities: Most surgeries done in Brandon	Pre-1997 - current
	Two sites do major surgery	
	Minnedosa (2-3 year)	Pre-1997 - current
	Neepawa	Pre-1997 - current
	Two surgeons did do hysterectomies	Pre-1997 - 06
	OB/GYN out of Brandon that comes one day a month, most surgeries are endometrial ablation (day surgery) or abdominal hysterectomy	July 06 - current
	Local surgeon takes on responsibility after OB/GYN goes back	
	Few surgeries are done in Yorkton, Dauphin	
	Policy: No regional guidelines	
	Rate Reviews: Are collected	
	Reports: Are reported widely in the region in Community Assessment Report	2004
	BRANDON	
	Facilities: Surgeries done in Brandon Hospital	Pre-1997 - current
	Policies: No utilization programs requiring second opinion.	
	Med/Surg team reviews indicators	
	The surgeons do not sit on any team including Med/Surg team	
	The surgeons "visit" with the surveyors during accreditation	
	Surgeons who do complete hysterectomies are retiring, newer surgeons do complete Hysterectomies & alternatives	
	New surgical suite with equipment to do laparoscopies	
	Rate Reviews: Not monitoring rates	2002/03
	Reports: In Community health assessment report	2004
	In annual Board reports	
	BURNTWOOD	
	Facilities: Total Abdominal Hysterectomies and Vaginal Hysterectomies	Pre-1997 - current
	Done in Thompson by one private and two BRHA OB/GYNs	
	Procedures are performed when visiting locum is able to assist and mentor.	
	Mentoring for new surgical procedures is provided by a locum OB/GYN from St Boniface hospital	
	Policy: no regional - clinical guidelines are available through SOGC	
	Through accreditation, standards are reviewed, however	
	Operating Room time utilization reviewed by manager regularly and discussed at surgical utilization meetings	
	A second opinion/consult is not required unless patient requests this	
	Rate Reviews: If needed, the numbers are available thru Medical records	
	Reports: Not in Community Health Assessment	

Program	Policy / Program details	Timeline
Hysterectomies: **Total** **Sub-total** Facilities Policies / Guidelines Rate collection Rate reporting: To physicians In Community Assessments Policy refers to regional strategies, adapted guidelines or programs to examine rates.	**CENTRAL**	
	Facilities: Boundary Trails Hospital, Portage Hospital, Carman	Pre-1997 - current
	Procedures: Partial and complete hysterectomies	
	BTHC and Portage can do laparoscopies (not Carman), neither facility does laparoscopic hysterectomies (these are referred to Winnipeg)	
	OB/GYN specialist routinely available in BTHC to help with a second opinion	2007
	Itinerant OB/GYN specialist services are available at Portage	
	No 2nd consults yet. Hope to include second consults in guidelines	
	Policies: Accreditation teams looked at standards, but not guidelines or policies	
	Accreditation team changed with organization shift to program teams	Pre 1997 - 2004
	Surgical Vision Team established	Jan 2004 - current
	Discussions with Surgical Vision Team to review where service needed.	
	Team started with a review of the use of blood order for every patient	
	Half of it was being thrown out	
	After review and physician discussion, practice changed	
	Review of Average Length of Stay	1998 – Dec 2006
	The surgical programs along with ALS were reviewed on an ad hoc basis	
	Surgical Vision Team develops routine report and shares it with surgeons	Dec 2006
	Meeting so that OR equipment will be standardized within the region	2007
	Rate Reviews: Physicians see rate information as part of regular reporting	Dec 2006 - current
	The meetings of the Surgical Vision Team allow providers to discuss these rates	
	Reports: Have not done reports routinely in the past	
	One ad hoc report in 1998	1998
	First Surgical Vision Summary report due June 2007	2007
	CHURCHILL	
	Not done in region	
	INTERLAKE	
	Facilities: Hysterectomies performed in Selkirk	Pre-1997 - current
	One local general surgeon & an itinerant OB/GYN that visits monthly	
	Procedures: Abdominal and vaginal procedures; mainly sub-total (ovaries left)	
	No laparoscopic hysterectomies are preformed at present	
	Policies: No regional guidelines	
	Rate Reviews: Stats are rolled in with other stats on OB/GYN	
	Reports: No reports are done	
	NOR-MAN	
	Facilities: Very few "open" hysterectomies done in Flin Flon	Pre-1997 - 2004
	Flin Flon General has not done any in past three years	2003 - 2006
	The Pas Health Complex performs both Abdominal and Vaginal procedures	Pre-1997 - current
	Currently only one physician performing hysterectomies	
	Procedures: Has equipment for laparoscopies	
	Policies: No regional guidelines	
	Rate Reviews: Do not track hysterectomy as part of hospital utilization	
	In 1991 - 96 hysterectomy rate was 6.8/1000 in RHA, 5.2/1000 in MB	2004 - current
	In 1997 – 01 hysterectomy rate was 6.3/1000 in RHA and 5.0/1000 in MB	
	Reports: Community health assessment report under high profile procedures	
	Not reported in quality score cards	
	NORTH EASTMAN	
	Not done in region	

Program	Policy / Program details	Timeline
Hysterectomies: **Total** **Sub-total** Facilities Policies / Guidelines Rate collection Rate reporting: To physicians In Community Assessments Policy refers to regional strategies, adapted guidelines or programs to examine rates.	**PARKLAND**	
	Facilities: Dauphin, Swan River	Pre-1997 - current
	Procedures: New equipment to allow for less radical surgery has reduced rates	2003/4 - current
	Policies: No regional guidelines	
	Rate Reviews: Consistently shared with surgeons	
	Reports: Community Health Assessment	2004
	SOUTH EASTMAN	
	Facilities: Bethesda, not Ste. Anne?	Pre-1997 - current
	Procedures: Vaginal hysterectomies have been available for years	Pre-1997-current?
	Hysterectomy Client postoperative pain management led to use of alternative options:	
	Laparoscopic assisted vaginal hysterectomies	Sept 2005
	Supracervical hysterectomies	Dec 2006
	Other postop analgesia protocols have been implemented to address the post op pain management for abdominal hysterectomies, for those clients that do not meet the criteria for a vaginal or laparoscopic hysterectomy	2005 - current?
	Policies: No regional guidelines	
	Rate Reviews: HIS stats reflect Hysterectomy #s, monthly & yearly	
	Accreditation process reviews hysterectomy standards, guidelines or policies	Pre-1997 - current
	The surgical team has not specifically reviewed standards, guidelines or policies specific to hysterectomies except in relationship to HIS stats	
	Hysterectomy stats looked at by Quality Improvement / Maternal Child Team	
	CIHI report data is also used to see RHA, provincial and national rates	
	Reports: Hysterectomy stats in CEO scorecard	
	moved to the System Competency scorecard	2005
	Not reported in Community Health Assessments	
	WRHA	
	Facilities: Victoria Hospital, St. Boniface Hospital, Health Sciences Centre, Grace General Hospital, Seven Oaks General Hospital, Concordia Hospital	Pre-1997 - current
	Some WRHA Gynecologists travel to Thompson, Brandon, Selkirk, Carmen	
	Procedures: Grace Hospital Surgery Program conducted the first laparoscopic supracervical hysterectomy in Winnipeg	2004/5 - current
	Halt program (Hysterectomy Alternative Program) at Mature Women's Centre Victoria Hospital	2007 - current
	HALT for Benign problems – dysfunctional uterine bleeding, fibroids	
	Use of hysterectomies Individualized among WRHA	
	Embolization of fibroids started as a pilot research protocol	2006 – current
	Developing future protocol re criteria to be considered a candidate	2010
	Policies/ Rate Reviews:	
	Quality and Standards program team have not looked at the stats	2005 – current
	Reports: Projects were picked to report on	
	Hysterectomy was not one of them	

Program		
	Explanation of possible procedures: **Abdominal: total** abdominal (open) hysterectomy may involve the removal of the uterus and cervix – with or without the removal of the **ovaries** or fallopian tubes -- through a large abdominal incision. **Sub-total** hysterectomy involves leaving the cervix, with or without the removal of the ovaries or fallopian tubes **Vaginal hysterectomy** (VH) - an incision deep in the vagina **Laparoscopically Assisted Vaginal Hysterectomy** (LAVH) - an incision at the bellybutton and vagina **Laparoscopic supracervical hysterectomy** (LSH) - laparoscopic procedure alone is used to remove a woman's uterus without removing her cervix. **Oophorectomy**: removal of the ovaries	
	Comments may have been voiced more than once: Use of hysterectomies should be on the wane. Rates seem to relate to practice (old surgeons leaving, new surgeons arriving) Participant would like to see National averages and a literature review reflected in MCHP report Need to be clear in report whether rate is based on all women or based on a diagnosis. Laparoscopically Assisted Vaginal Hysterectomy and Laparoscopic supra hysterectomy procedures address the post op pain management concerns (less invasive = less postoperative pain).	

14.2 Discussion

What the figures and maps tell us about overall rates and trends in hysterectomies:

- Hysterectomy rates have decreased over time provincially (from 5.2 to 4.9 per thousand women from 1988/89–1995/96 to 1996/97–2003/04). This trend varies by RHA. Winnipeg, Interlake, North Eastman and Nor–Man RHAs have seen statistically significant drops over time; whereas the other RHAs have seen very little change over time. Interlake's districts have consistent rates that are lower than most of the other non–Winnipeg areas; whereas most other non–Winnipeg RHAs have substantial variation by district. Within Winnipeg, all CAs and NCs have rates either lower than or similar to the provincial average.
- There is no association between overall health status and hysterectomy rates—mostly, it appears to be random variation with some of the most/least healthy areas having both high and low rates. The aggregate areas of South and Mid have elevated rates in the most recent time period (1996/97–2003/04); the North is similar to the Manitoba time trend. Looking at the Winnipeg aggregate areas, all three (most healthy, average, least healthy) have hysterectomy rates lower than the provincial average in the latest time period of 1996/97–2003/04 (see Figures 14.1 and14.3).
- In general, hysterectomy rates from 1984/86–2002/04 (see Figures 14.5 and 14.6) show a downward trend. Provincially, rates dropped from 6.3 to 4.1 per 1000. The largest drop during this 18 year time period was in the North with a change from 8.2 to 4.8 per thousand. The gradient in hysterectomy rates outside Winnipeg became smaller over time; whereas within Winnipeg, the gradient remained small. Most Winnipeg CA and NC rates are slightly below the provincial average and dropping as fast as or faster than the provincial average. Only Brandon showed a pattern of not improving as fast or getting worse compared to the Manitoba time trend.
- Looking at the maps (Figures 14.7 and 14.8), the hysterectomy rates appear to be lowest in Winnipeg and most of Burntwood and Interlake RHAs (green on Figure 14.7). Downward trends either similar to or faster than the Manitoba time trend appear in Winnipeg, districts in other RHAs that are close to Winnipeg, Nor–Man RHA, and many of Burntwood RHA's districts. The particular "hotspots" of high rates (pink/red in Figure 14.7) and trends not declining as rapidly as the provincial average (pink in Figure 14.8) are seen in many of the western areas (districts within Parkland, Assiniboine, and Brandon RHAs).

What the regression modeling[1] tells us about hysterectomy rates in the years 2002/03 to 2003/04 (for the complete regression model, refer to Appendix 4):

- Individual characteristics that increased the likelihood of having a hysterectomy—being older and having physical or mental health problems.

[1] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

- Individual characteristics that did not influence the likelihood of having a hysterectomy—the average household income of the neighbourhood.
- Geographical characteristics that increased the likelihood of a hysterectomy, after controlling for individual effects—living in Central, South Eastman, Parkland, Burntwood, Brandon and Assiniboine RHAs. All other non–Winnipeg RHAs (North Eastman, Interlake, Nor–Man, Churchill) were similar to the provincial average.
- Geographical characteristics that decreased the likelihood of a hysterectomy, after controlling for individual effects—living in the Winnipeg CAs of Assiniboine South, Fort Garry, St. Boniface, Downtown and River Heights. All other Winnipeg CAs were similar to the provincial average.

How the above are associated with descriptive information on policy, program or support initiatives to decrease C–Section rates:

- By geographical region, the most consistently low hysterectomy rates are within the Winnipeg RHA. As well, some Winnipeg gynaecologists travel to Selkirk which may influence the lower rates for both Interlake and North Eastman RHAs.
- Many programs to reduce hysterectomies and explore alternatives (such as the HALT program in Winnipeg—see Table 14.1) have only begun in the time period after the 2003/04 data, so the results of these will need to be explored over the next few years.

14.3 Comparison of Pertinent Literature Reviews and *Our Study Results*

14.3.1 Hysterectomy Rate Comparisons:

According to the Canadian Institute for Health Information (2006), the Canadian hysterectomy rate for women aged 20+ was 3.73 per thousand in 2003/2004. In both 2003/2004 and 2004/2005, rates were high (i.e., above 4 per thousand) in all the Atlantic provinces and in Saskatchewan. Manitoba was in the "low" group (less than 4 per thousand—3.76 in 2003/2004 and 3.43 in 2004/2005) for both time periods. Quebec, Ontario, Alberta and BC were also in the "low" group. Within Manitoba, Winnipeg rates were lower than either Interlake or Central RHA (CIHI 2006). In Canada, the overall hysterectomy rates have declined sharply since the early 1980s, from 9.37 per thousand in 1981/82 to 6.28 per thousand in 1996/97 (Statistics Canada 2001). In the latter year, hysterectomy rates were lowest in British Columbia (5.79 per thousand women aged 35+) and highest in Newfoundland (9.17 per thousand). According to a study using Canadian data in 1994 (Snider and Beauvais 1998), the overall prevalence was 16.3% of women, with higher rates for women of lower income and education and the highest rates for women aged 40–44 years.

The overall hysterectomy rate in the United States in 1994–1999 was 5.5/1000 women (CDC Reproductive Health 2006). The highest rates were in women aged 40–44 years. Three conditions most commonly associated with hysterectomy are: (i) leiomyoma (fibroid tumors); (ii) endometriosis; and (iii) uterine prolapse. As in Canada, USA rates of hysterectomy have shown declines over the past 20 years (Irwin et al. 1986; Kerr 2007; Jacobson et al. 2006). In comparison to the USA, Manitoba has been shown to have lower hysterectomy rates in the 1970s (4.4 per 1,000 females vs. 6.7 per 1,000) but the type of hysterectomy, indications for surgery and size of hospital where performed were similar (Roos 1984). The most recent data from Kaiser Permanente in northern California showed declines from 4.01 per thousand in 1994 to 3.41 per thousand in 2003 (Jacobson et al. 2006). In one study which compared USA and Scandinavian countries (Cutler 1988), the chance of having a hysterectomy during a woman's lifetime was much higher in the USA (50% USA versus 10% Sweden) and the average age for premenopausal hysterectomy was much lower (35 years in USA versus 46 years in Scandinavia).

Similar to the trends throughout Canada and the world, our study found that Manitoba's hysterectomy rates have declined substantially from 1984/86 to 2002/04, from 6.3 to 4.1 per 1,000 women aged 25+. Manitoba's rates tend to be similar to other studies in the most recent years, in the lower range. Similar to other studies, our study found that being older increased the likelihood of having had a hysterectomy (using 2003/04 data). However, income (average household income of the neighbourhood) did not influence the likelihood of hysterectomy after controlling for other individual characteristics such as having physical or mental health problems.

14.3.2 Policies and Programs to Reduce Hysterectomy Rates:

The Ontario Women's Health Council (2002) voiced concerns that hysterectomy is used too often as a first line of treatment and is not necessarily always appropriate. The Council recommends the following as best practice regarding the use of hysterectomies:

- Provide women with needed information that will allow them to become more involved in making decisions about their own health
- Improve the management of discretionary indications for hysterectomy, especially the newer, less invasive methods (e.g., ablation therapies, myomectomy, embolization)
- Improve access to alternate forms of treatment for discretionary indications for hysterectomy

According to a Cochrane Database Systematic Review published in 2006 (Marjoribanks et al. 2006), a comparison was made between oral medication treatment, hormone–releasing intrauterine system, and surgical options (including hysterectomy) to address heavy menstrual bleeding. Surgery, especially hysterectomy, reduced menstrual bleeding at one year more than did other medical treatments. However, hysterectomy also caused serious complications for some women. There were no statistical differences at one year between the hormone–releasing intrauterine system and hysterectomy in the satisfaction ratings or quality of life ratings. Furthermore, considerations such as the cost of certain procedures (such as the more expensive laparoscopic methods) balanced with the savings to the individual in a quicker return to regular activity must be taken into account.

Manitoba's RHAs have only recently begun to examine the hysterectomy rates as part of their quality improvement initiatives. Very few have guidelines or protocols in place. Winnipeg is the most proactive in terms of providing clinical discussions for alternatives to hysterectomies through their HALT program and their clinicians. Although the HALT program may only see relatively few patients, the clinical environment of Winnipeg to explore minimally invasive procedures may account for the relatively low hysterectomy rates.

14.4 Recommendations

- Continue to monitor hysterectomy rates with new RHA tracking systems, including these in reports to the CEO and Board.
- The programs or policies of "Winnipeg RHA" in maintaining the lowest hysterectomy rates, consistently across its sub–regions, needs to be shared throughout the province. Guidelines and protocols for indications of hysterectomy, treatment options to avoid surgery, current limitations in funding available for minimally invasive technology (such as endometrial ablation kits), and sharing of knowledge by the gynaecologists/surgeons across the province will be necessary to make rates more consistent across RHAs and probably lower in most non–Winnipeg RHAs.
- The trend to lower hysterectomy rates in most areas of the province and the lack of difference in rates by income are both promising trends.
- The areas of most concern are southern and western districts outside of Winnipeg, where rates appear to be high and are not trending down as fast as the rest of the province. A review of practices may be indicated.

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CHAPTER 15: SPECIALIST VISITS

15.1 Definition, Graphs and Maps for Specialist Visits:

This chapter focuses on total visit ambulatory rates to specialists, and that portion of specialist visits which require the patient to travel outside their RHA of residence. It also includes a discussion of specialist use through the provincial Telehealth system (referred to as "MBTelehealth").

15.1.1 Total Ambulatory Visit Rates to Specialists:

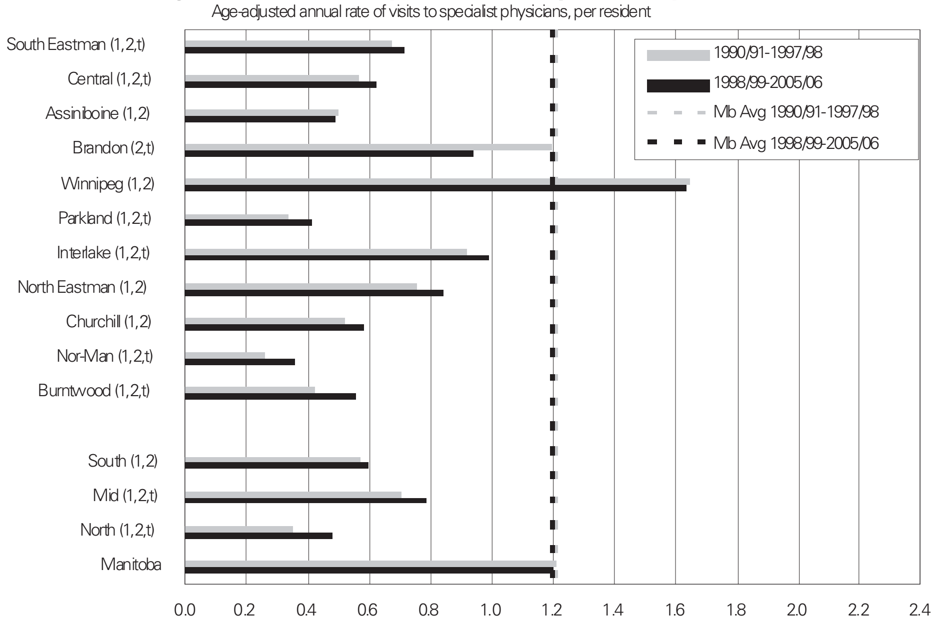
The specialist visit rate is defined as the average annual number of ambulatory visits to specialist physicians per resident for fiscal years 1990/91 to 2005/06. This excludes visits to patients while in hospital. All visits to medical specialists (e.g. paediatricians, internists, and psychiatrists) and surgeons (e.g. general and sub–specialty surgeons, obstetricians, and gynaecologists) who bill Manitoba Health as specialists are included. Rates are age– and sex–adjusted to reflect the population distribution of Manitoba.

Some specialists do not bill through the fee–for–service system (e.g. contract or salaried physicians), but rather file "shadow billing claims". However, where salaried physicians do not submit these shadow billing claims, there could be under–reporting of visit rates. This may be particularly a problem for visits to psychiatrists, many of whom are salaried and do not submit claims.

Figures 15.1 through 15.8 show total visit rates to specialist physicians. Figure 15.9 shows the distribution of where residents received their specialist's visits—which is further analyzed in the following section.

Figure 15.1: Ambulatory Visit Rates to Specialists by RHA

Age-adjusted annual rate of visits to specialist physicians, per resident

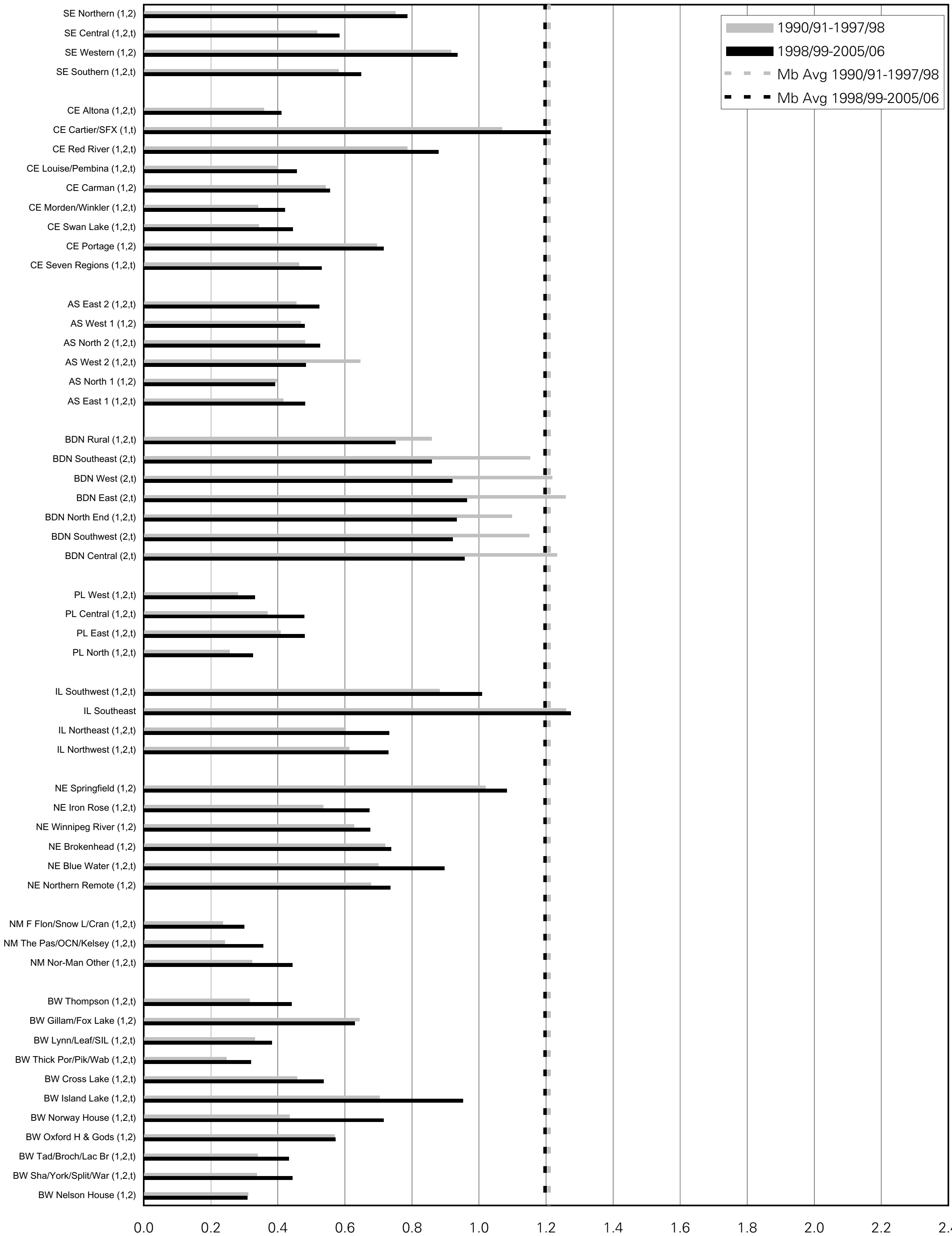


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 15.2: Ambulatory Visit Rates to Specialists by District

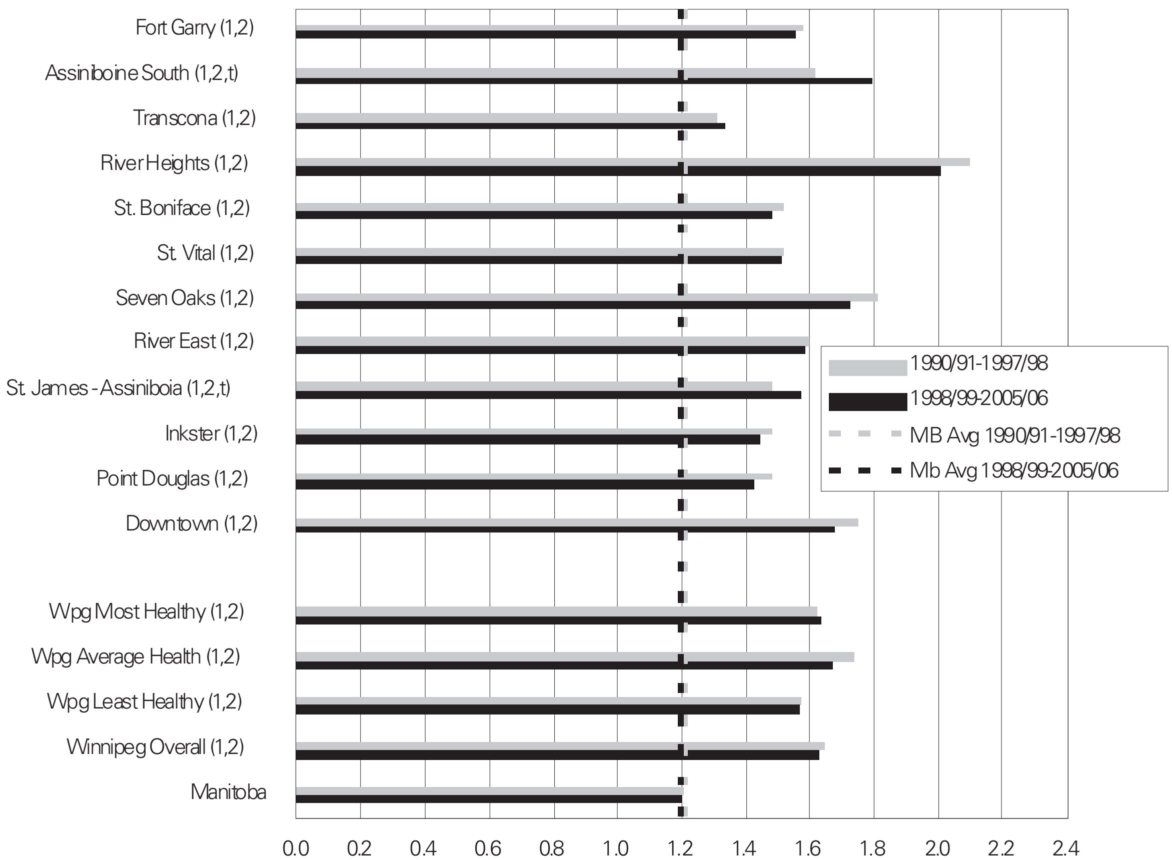
Age-adjusted annual rate of visits to specialist physicians, per resident



Source: Manitoba Centre for Health Policy, 2008

Figure 15.3: Ambulatory Visit Rates to Specialists by Winnipeg Community Areas

Age-adjusted annual rate of visits to specialist physicians, per resident

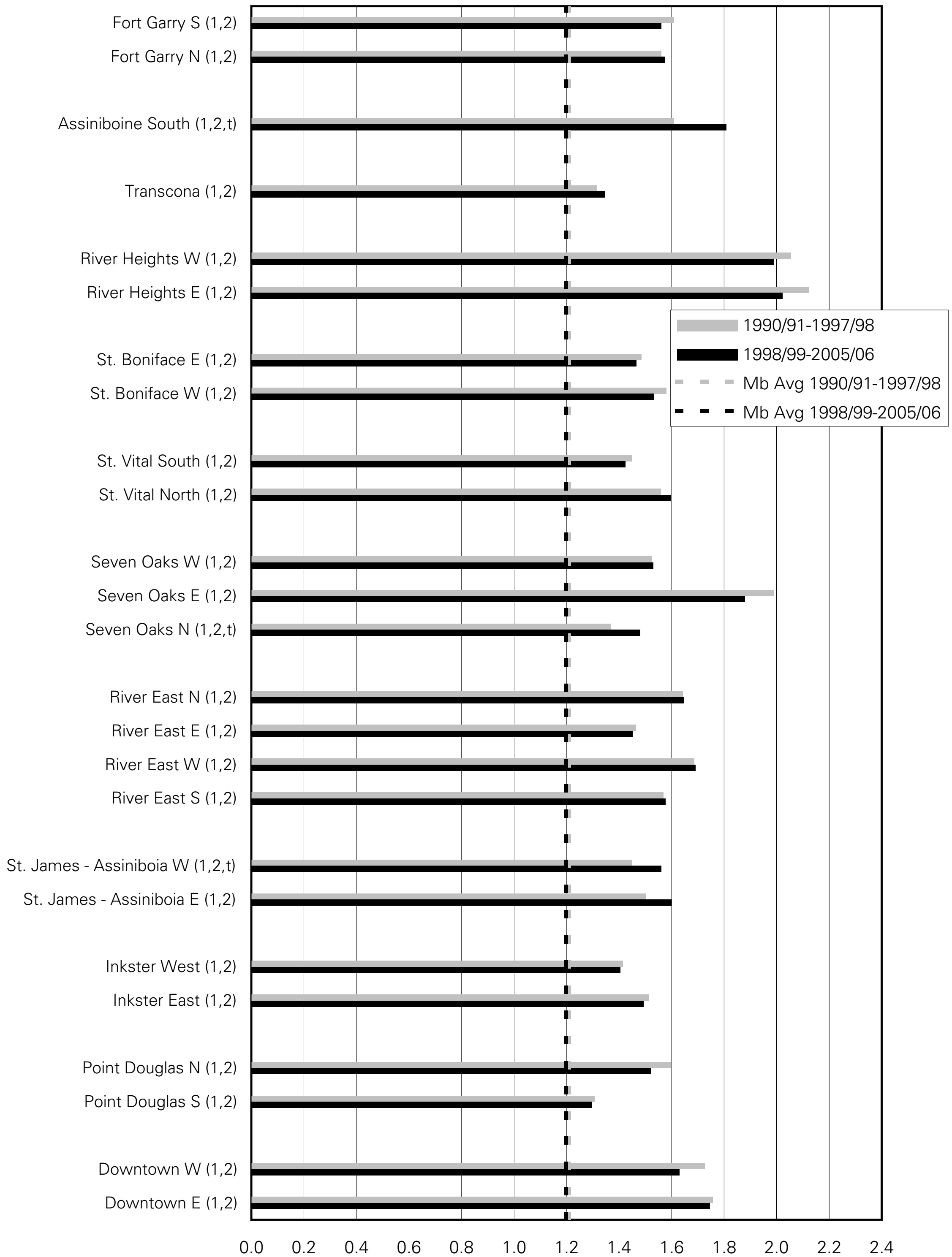


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 15.4: Ambulatory Visit Rates to Specialists by Winnipeg Neighbourhood Clusters

Age-adjusted annual rate of visits to specialist physicians, per resident



Source: Manitoba Centre for Health Policy, 2008

Figure 15.5: Trends in Non-Winnipeg Ambulatory Visit Rates to Specialists

Age-adjusted annual rate of visits to specialist physicians, per resident

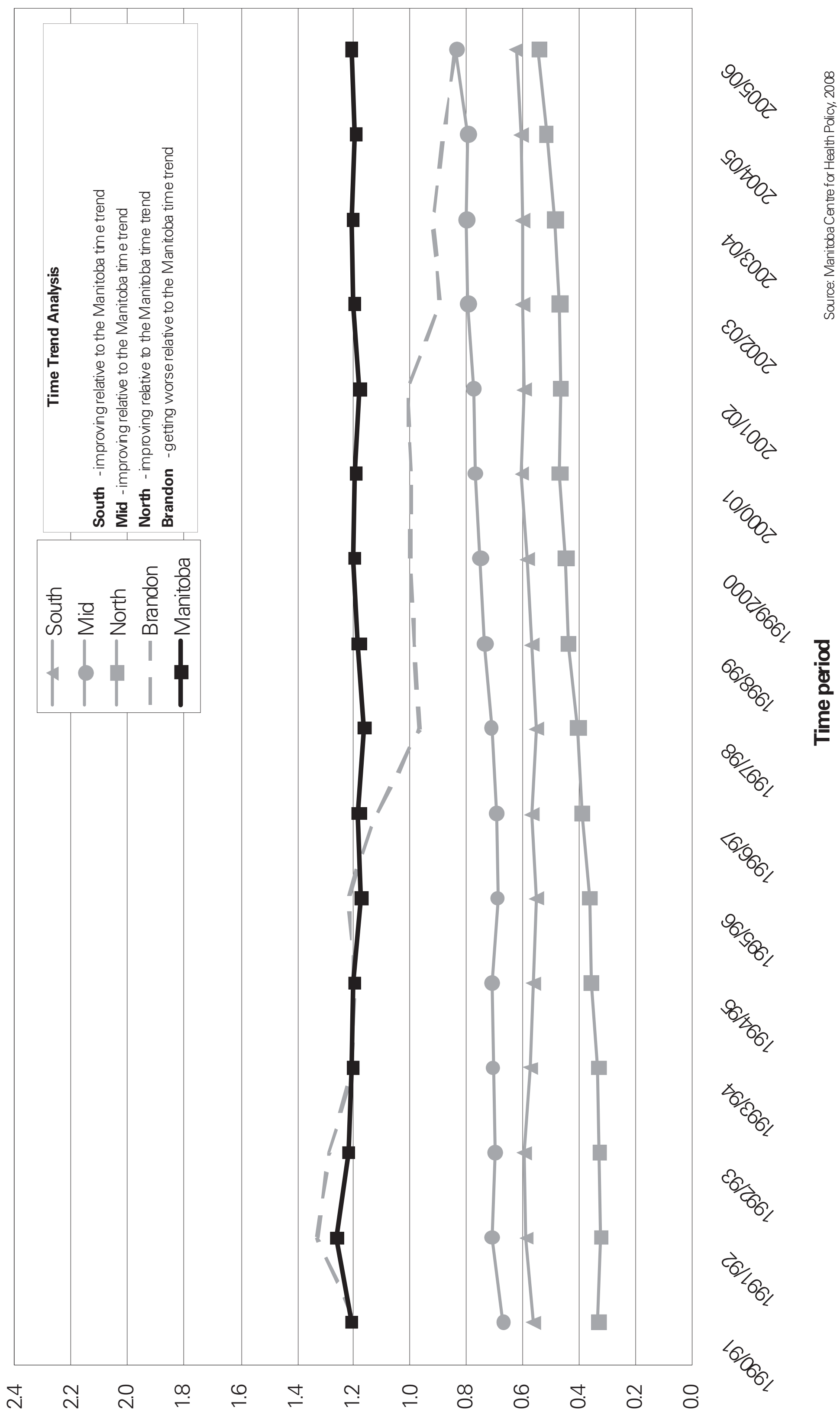


Figure 15.6: Trends in Winnipeg Ambulatory Visit Rates to Specialists

Age-adjusted annual rate of visits to specialist physicians, per resident

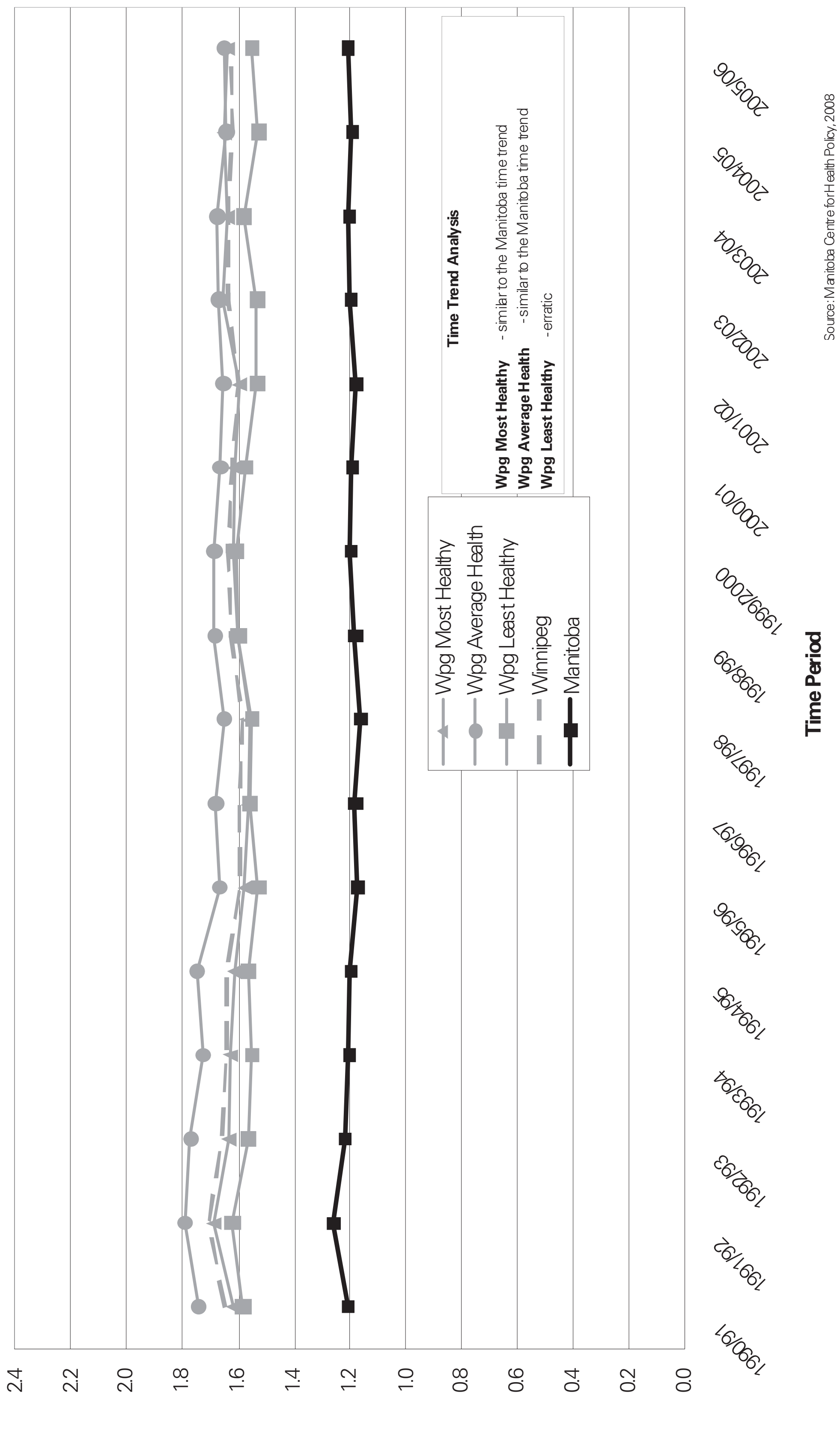
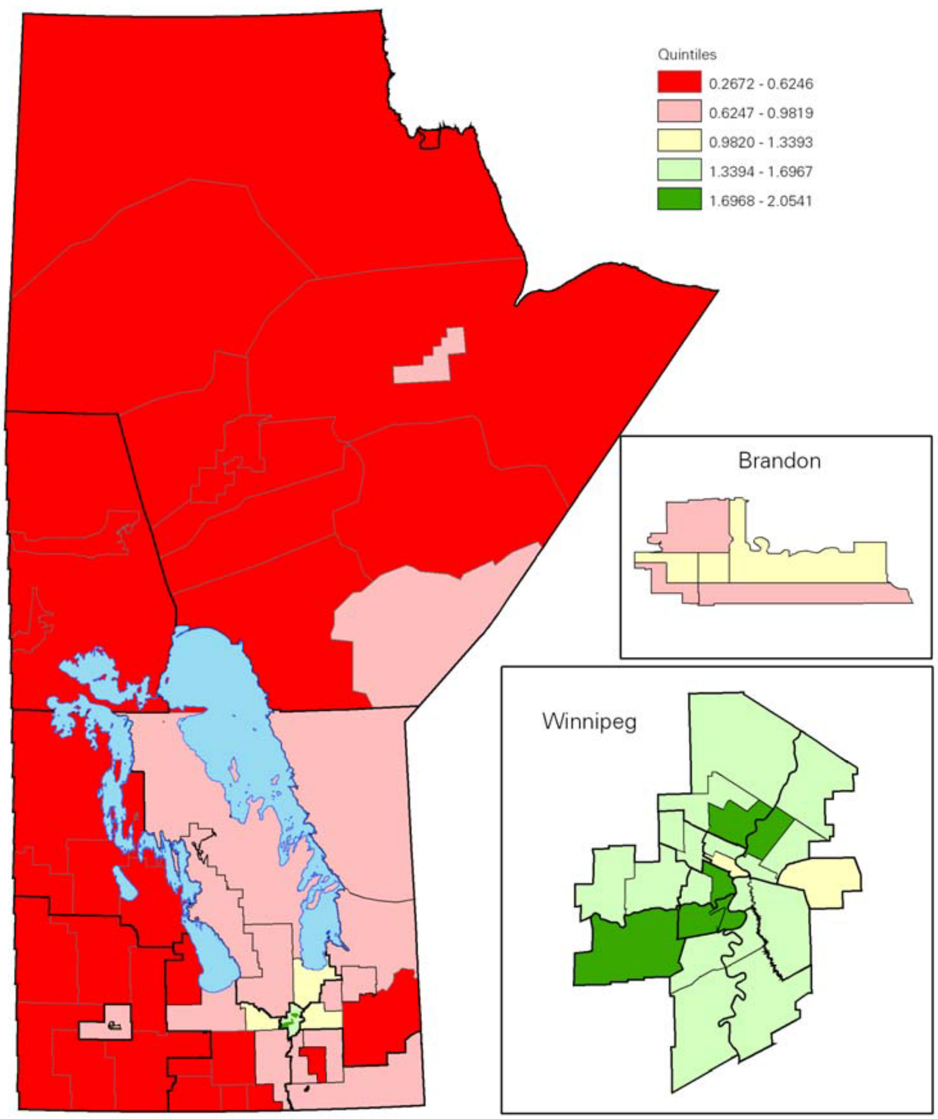


Figure 15.7: Ambulatory Visits to Specialists Rate Quintiles by RHA Districts and Winnipeg Neighbourhood Clusters

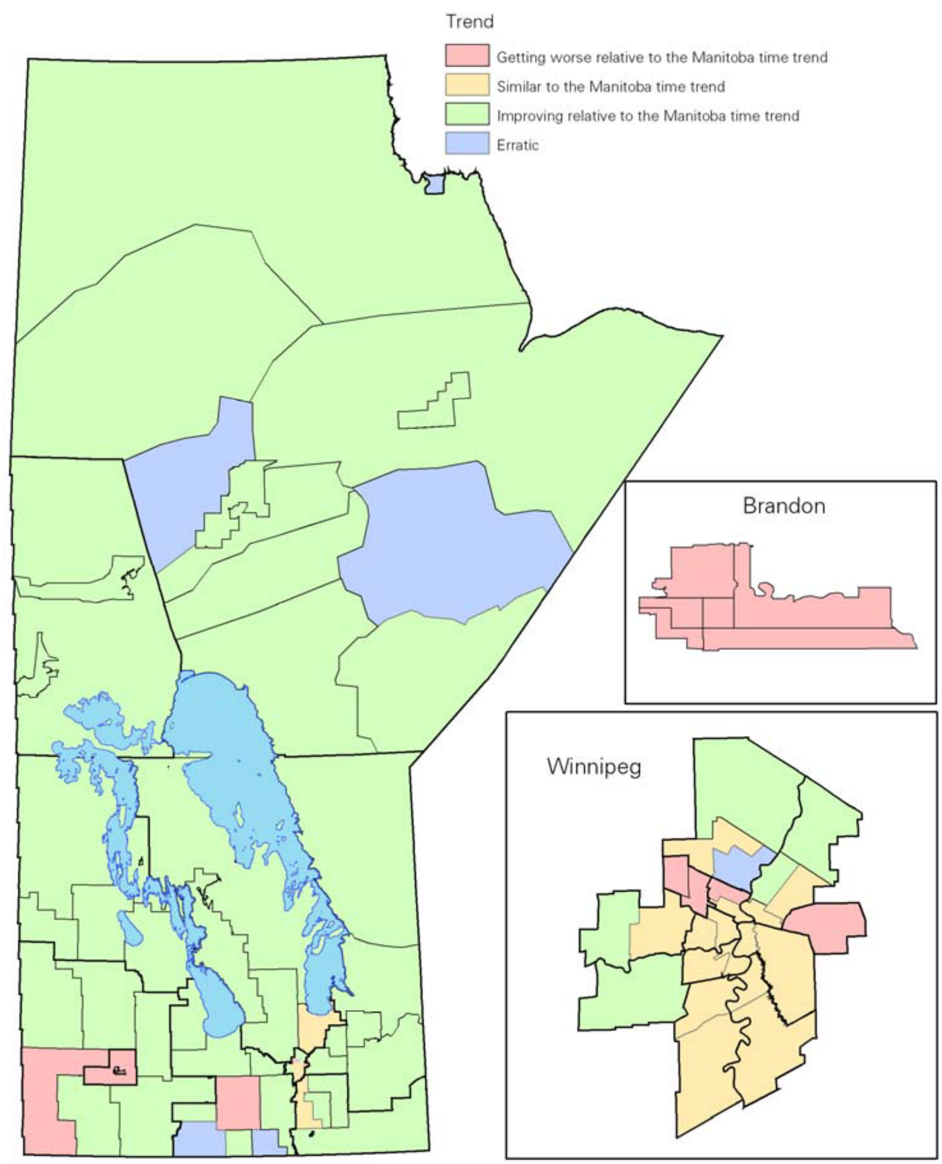
Age-adjusted annual rate of visits to specialist physicians, per resident, 1998/99-2005/06



Source: Manitoba Centre for Health Policy, 2008

Figure 15.8: Trends in Ambulatory Visits to Specialists Rates by RHA Districts and Winnipeg Neighbourhood Clusters

Age-adjusted annual rate of visits to specialist physicians, per resident, 1990/91-2005/06



Source: Manitoba Centre for Health Policy, 2008

15.1.2 Analyzing the Proportion of Specialist Visit Rates That Occur Outside the Patient's RHA of Residence:

Many RHAs are looking for ways to alleviate the travel burden on patients, including use of in–RHA specialists, travelling specialists and Telehealth. Common ways in which a person can receive a visit include:

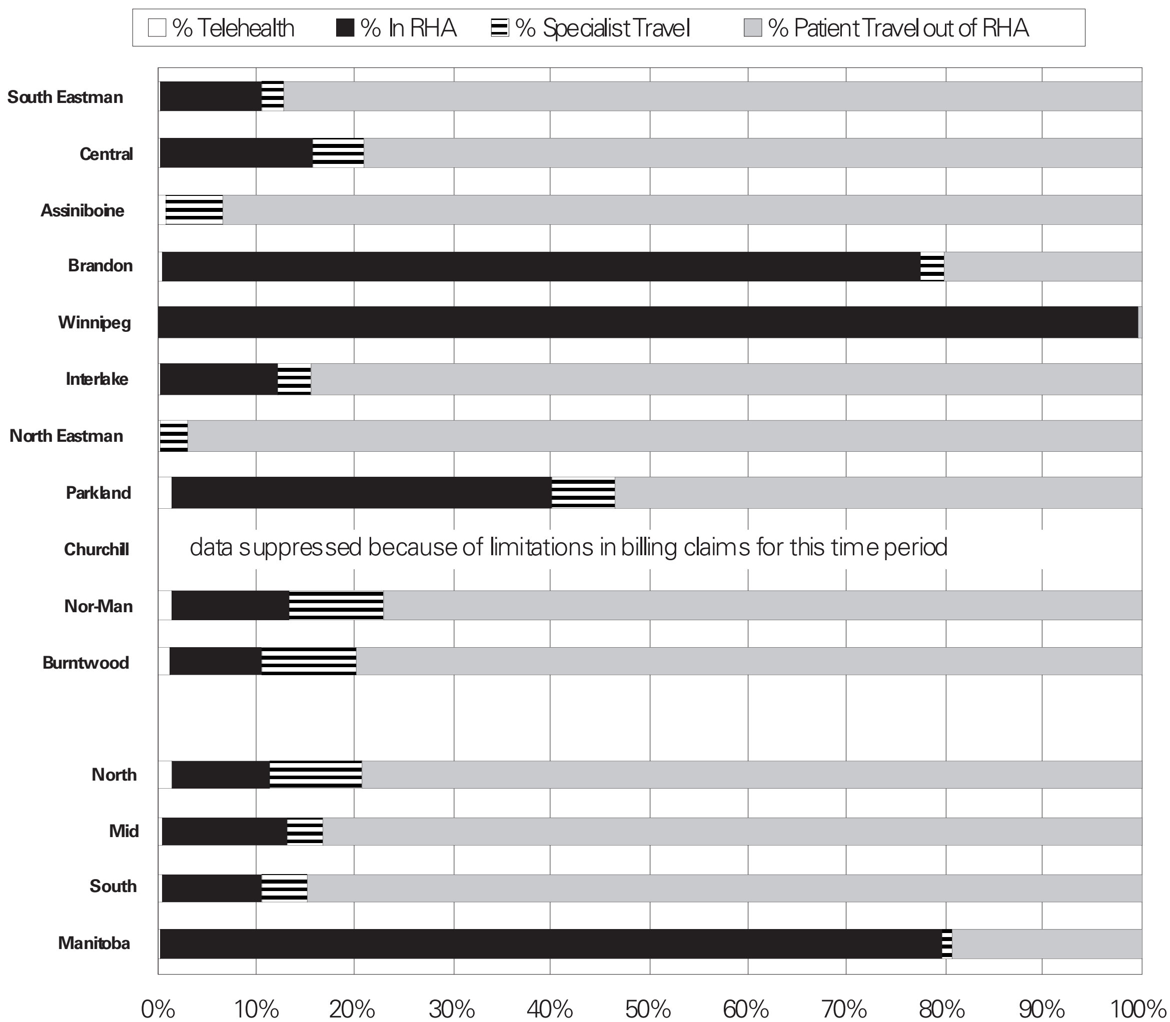
(a) A visit in which the patient travels within their RHA of residence to see a specialist who regularly practices in that RHA
(b) A visit in which the patient travels within their RHA of residence to see a specialist who occasionally travels to that RHA for visits
(c) A visit in which the patient travels outside their RHA of residence to see a specialist who regularly practices in a location outside the patient's RHA
(d) A 'Telehealth' visit, in which neither the patient nor the specialist travel outside their RHA—they see and talk to each other using the video conferencing facilities of the MBTelehealth program.

Figures 15.10 to 15.14 focus on scenario (c) above—visits for which RHA residents travelled outside their RHA to receive specialist care. (Note that virtually all (99.8%) of the specialist visits for Winnipeg residents occur within the Winnipeg RHA. Therefore, Winnipeg has been excluded from most of the graphs and maps in this section.)

Both sets of graphs, those showing total specialist visit rates and those showing visits for which the patient travelled out of RHA, must be examined together for a full understanding. For example, North Eastman has a relatively high specialist visit rate, but for almost all of them, residents had to travel out of their RHA for the visit. By contrast, Parkland residents received almost 40% of their specialist visits within their RHA, but their visit rate was much lower.

Figure 15.9: Where Residents Went for Visits to Specialists
2003/04 - 2005/06

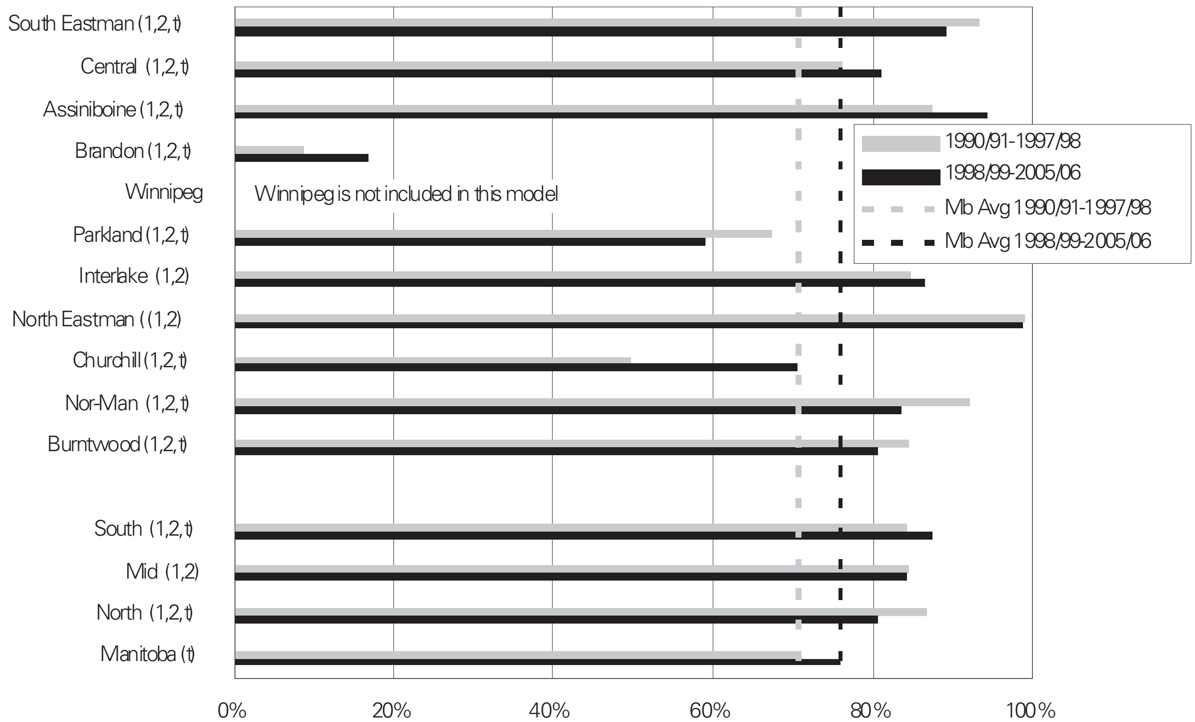
Percentage of specialist visits by location



Source: Manitoba Centre for Health Policy, 2008

Figure 15.10: Proportion of Ambulatory Visits to Specialists Where the Patient Travels Outside RHA, by RHA

Age-adjusted annual proportion of specialist visits

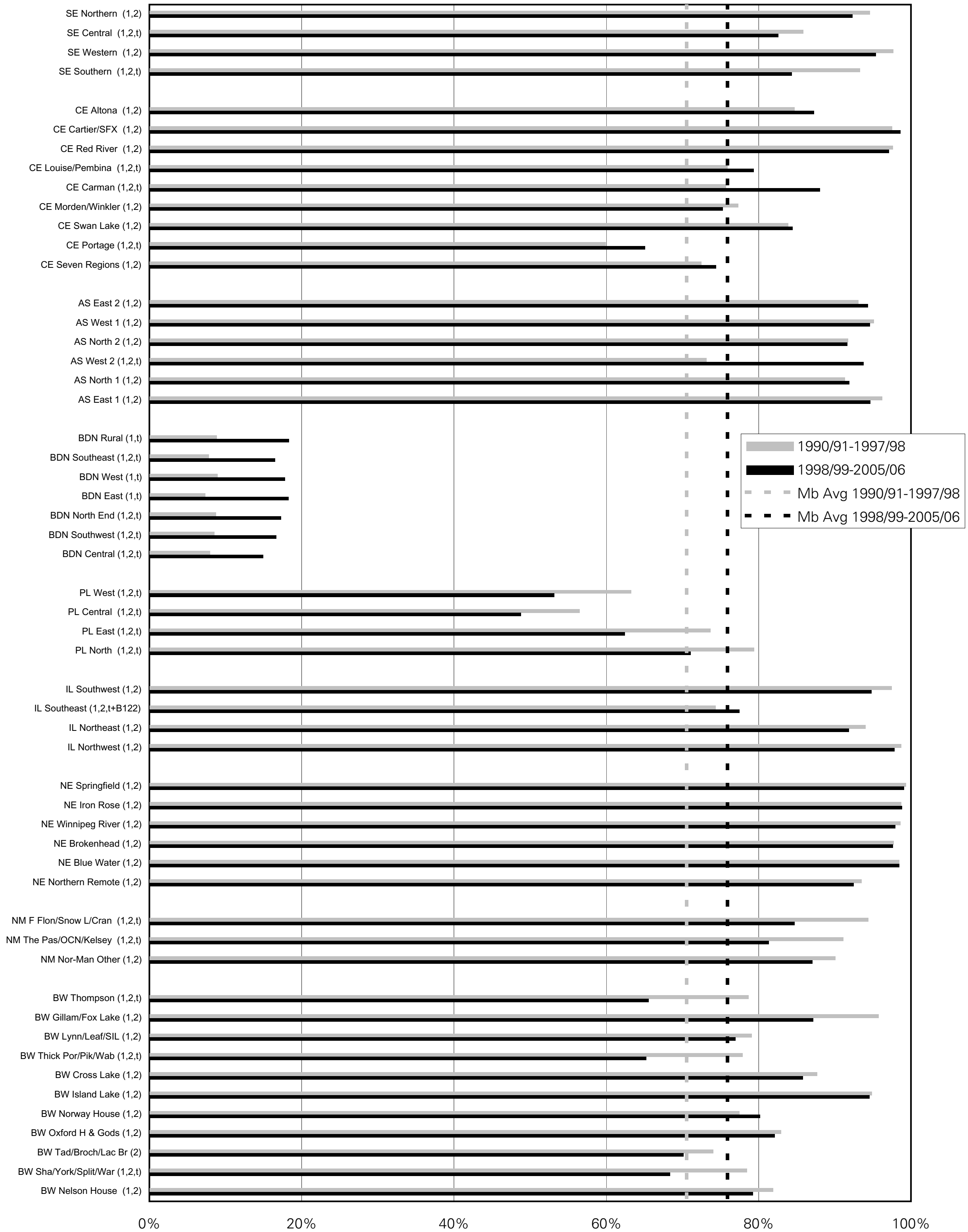


'1' indicates area's rate was statistically different from Manitoba average in first time period
'2' indicates area's rate was statistically different from Manitoba average in second time period
't' indicates change over time was statistically significant for that area
's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 15.11: Proportion of Ambulatory Visits to Specialists Where the Patient Travels Outside RHA, by District

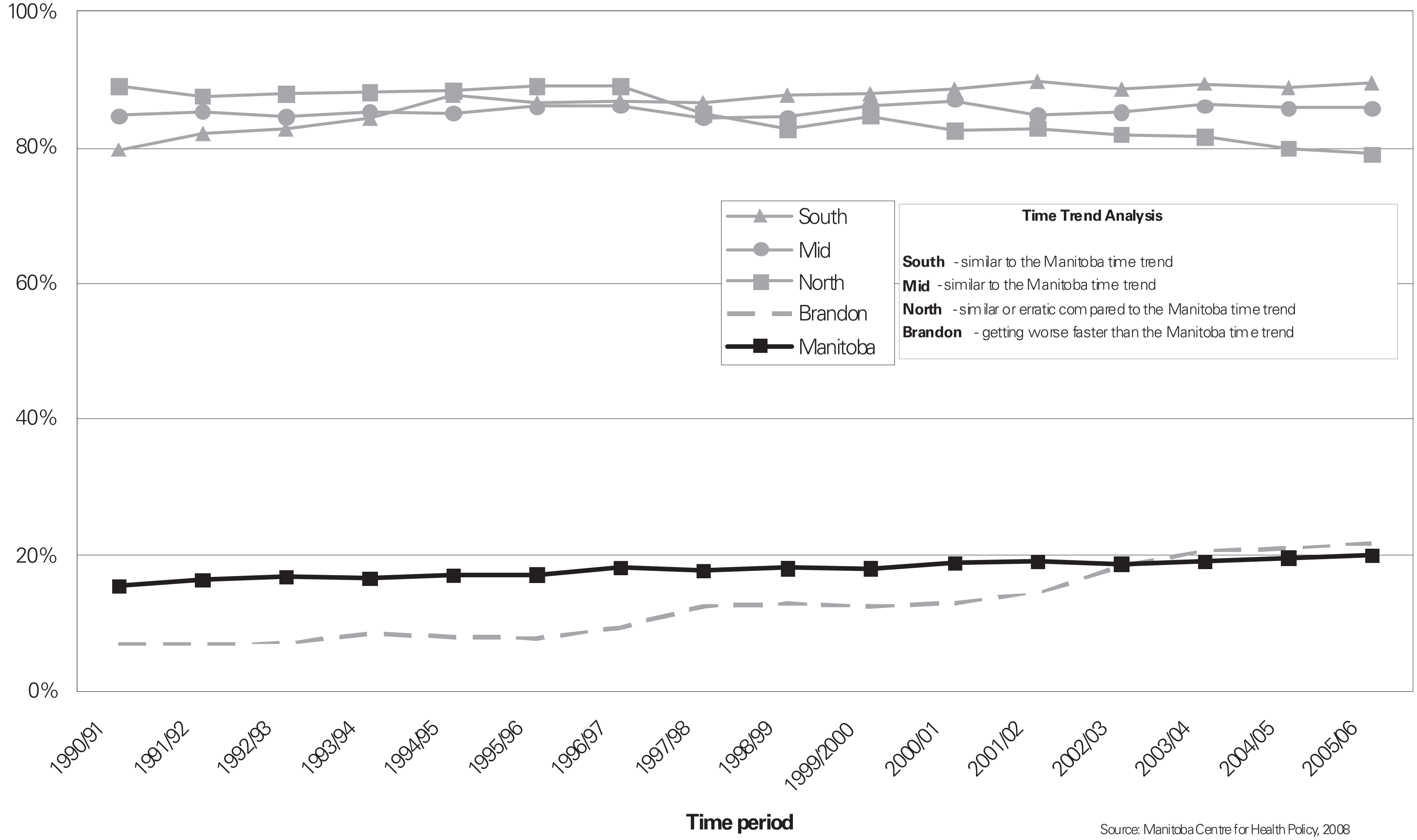
Age-adjusted annual proportion of specialist visits



Source: Manitoba Centre for Health Policy, 2008

Figure 15.12: Trends in Non-Winnipeg Proportion of Ambulatory Visits to Specialists Where the Patient Travels Outside of RHA

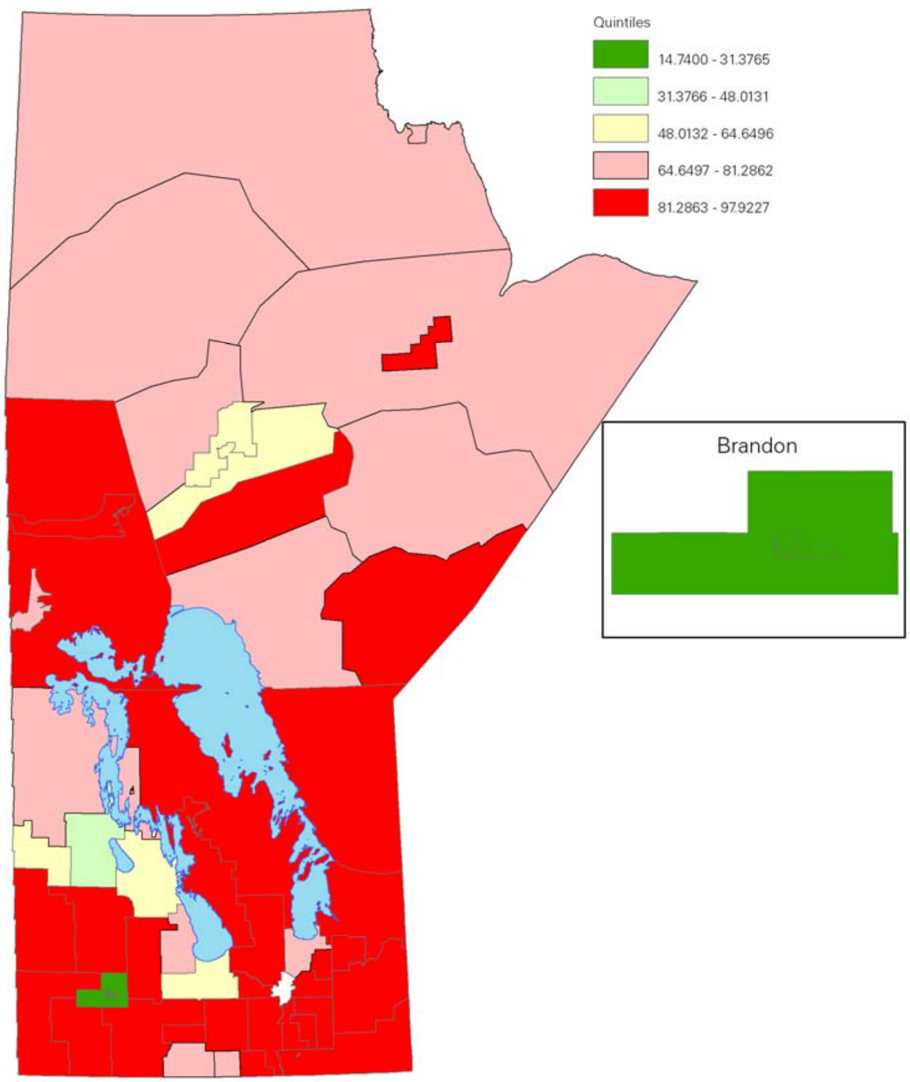
Age-adjusted annual proportion of specialist visits



Source: Manitoba Centre for Health Policy, 2008

Figure 15.13: Ambulatory Visits to Specialists Where the Patient Travels Outside of RHA, Rate Quintiles by non–Winnipeg RHA Districts

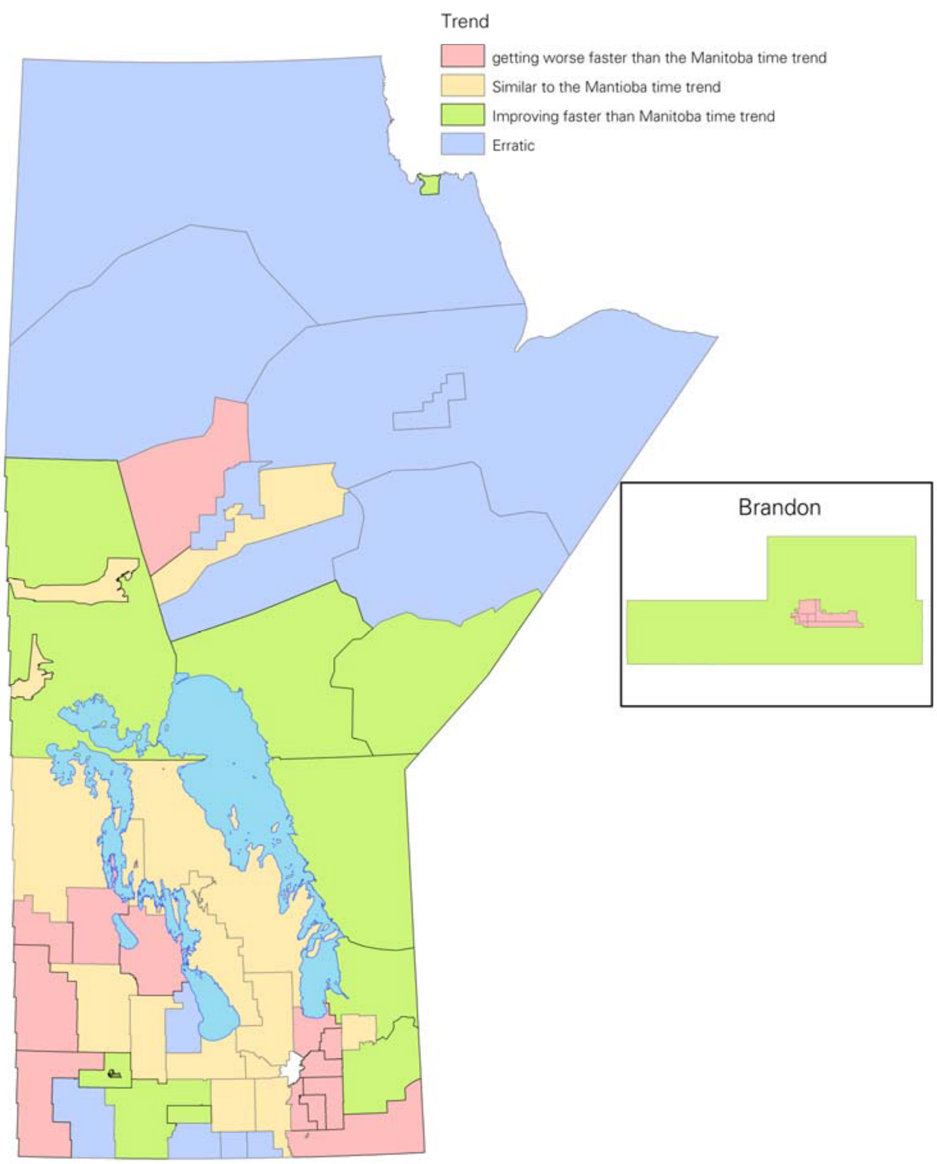
Age-adjusted annual rate of visits to specialist physicians, per resident, 1998/99-2005/06



Source: Manitoba Centre for Health Policy, 2008

Figure 15.14: Trends in Ambulatory Visits to Specialists Where the Patient Travels Outside of RHA, by non–Winnipeg RHA Districts

Age-adjusted annual rate of visits to specialist physicians, per resident, 1990/91-2005/06



Source: Manitoba Centre for Health Policy, 2008

15.1.3 Telehealth and its Impact on Specialist Visits for Non–Urban RHAs:

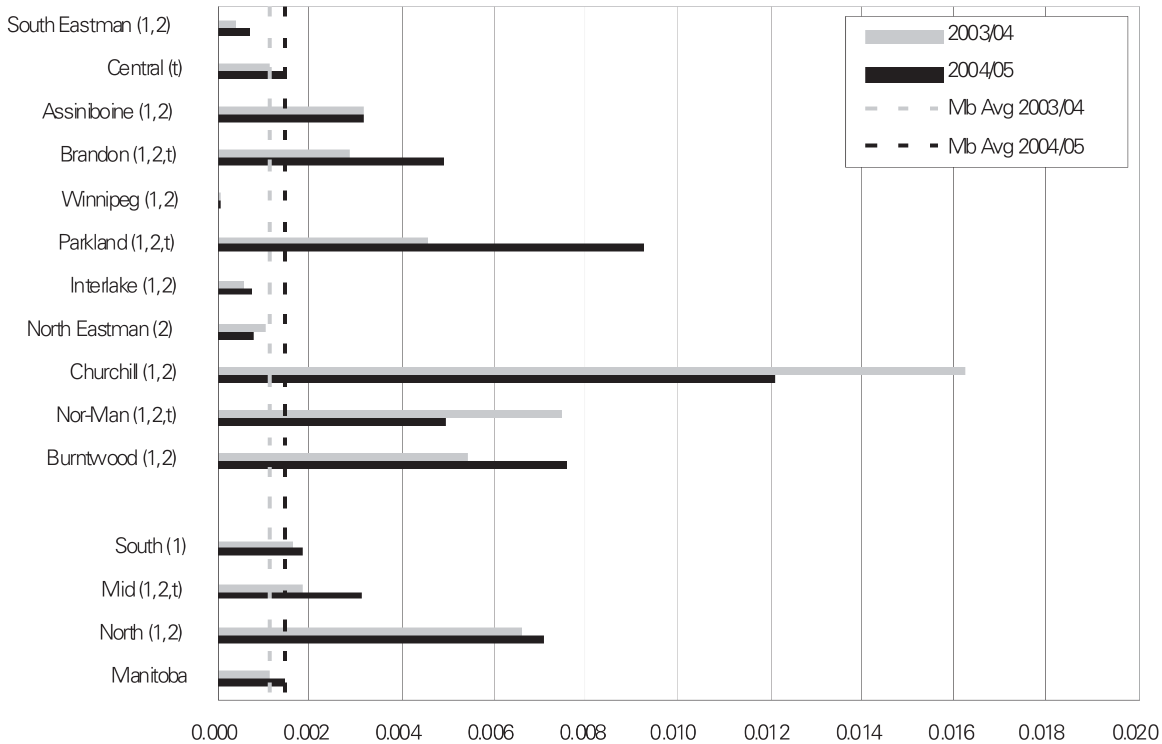
One of the ways in which a patient can receive specialist services in their region of residence is through Telehealth. This is a teleconference between the specialist in an urban centre and the patient in a Telehealth location outside Winnipeg. Although this currently represents a small portion of the total specialist visits in the province (approximately 0.2%), this could change, and so this project used Telehealth records to determine the feasibility of tracking specialist visits that took place through MBTelehealth.

MBTelehealth data were collected through booking form information, and included the location of the patient (RHA site), date, Tariff code, physician number and specialty, and service provided. No individual patient demographics were available, as this information is destroyed after the consultation. This lack of individual–level information hindered our ability to fully analyze visit rates and describe characteristics of users and non–users. In MCHP's anonymized data Repository, some specialists use a specific tariff code designated for telehealth visits, so these visits were linkable at the person–level. However, many visits were not coded this way, which meant that linkage had to be attempted using probabilistic methods, resulting in incomplete linkage (70%).

Figures 15.15 and 15.16 show rates of Telehealth contacts for records that were successfully linked at the person–level. Figure 15.17 shows actual rates of Telehealth contacts based on all MBTelehealth records (not required to link to the Repository)—note that these data represent the location of the facility, not necessarily the patient's area of residence.

Figure 15.15: Telehealth Specialist Visits by RHA

Age-adjusted annual rate of Telehealth visits to specialist physicians, per resident



'1' indicates area's rate was statistically different from Manitoba average in first time period

'2' indicates area's rate was statistically different from Manitoba average in second time period

't' indicates change over time was statistically significant for that area

's' indicates data suppressed due to small numbers

Source: Manitoba Centre for Health Policy, 2008

Figure 15.16: Telehealth Specialist Visits Rate Quintiles by non–Winnipeg RHAs

Age-adjusted annual rate of visits to specialist physicians, per resident, 1998/99-2005/06

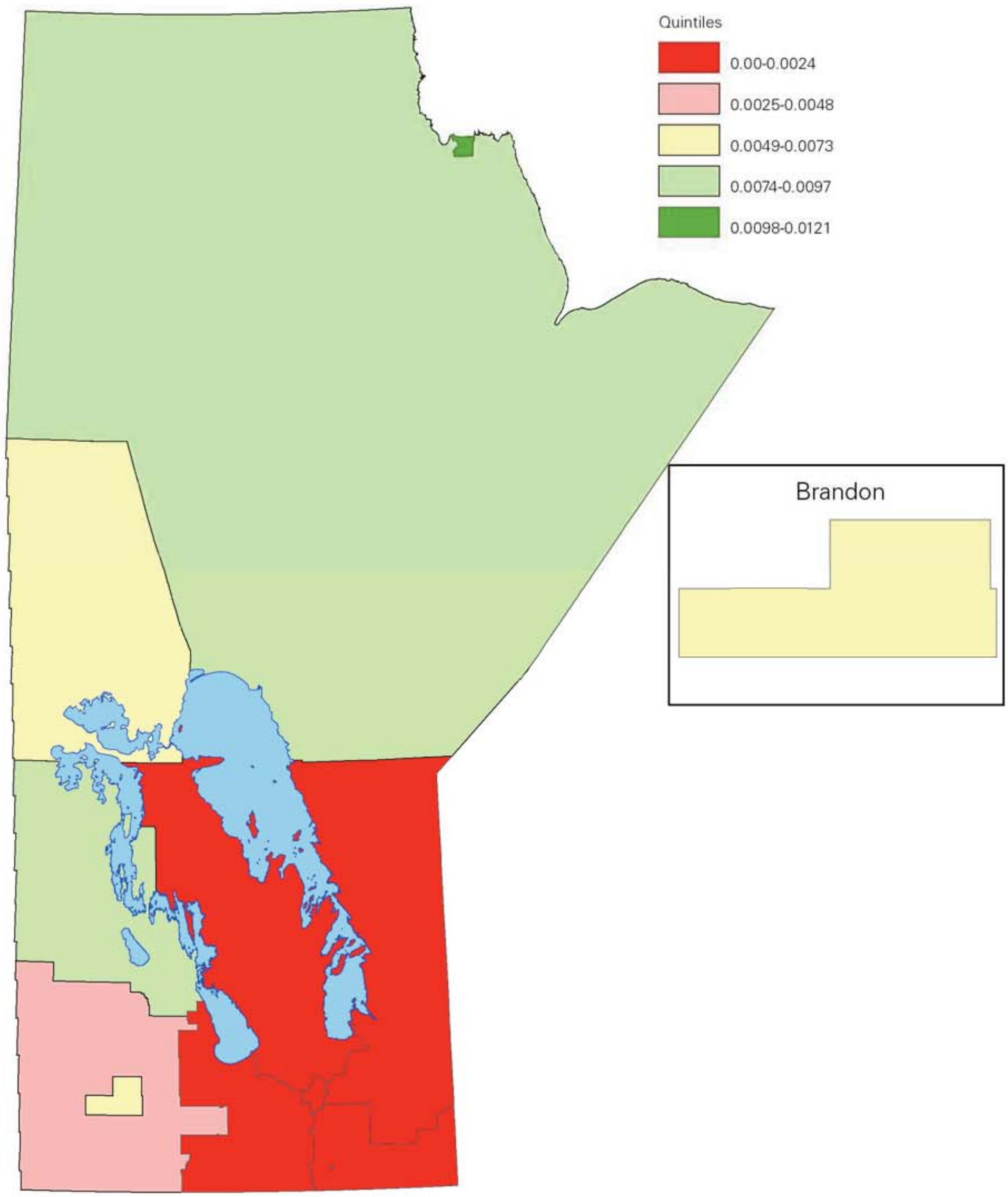


Figure 15.17: Location of and Overall Manitoba Telehealth Specialist Visit Rate Quintiles by RHA, as Indicated by Counts in the Telehealth Program Records

Crude rates

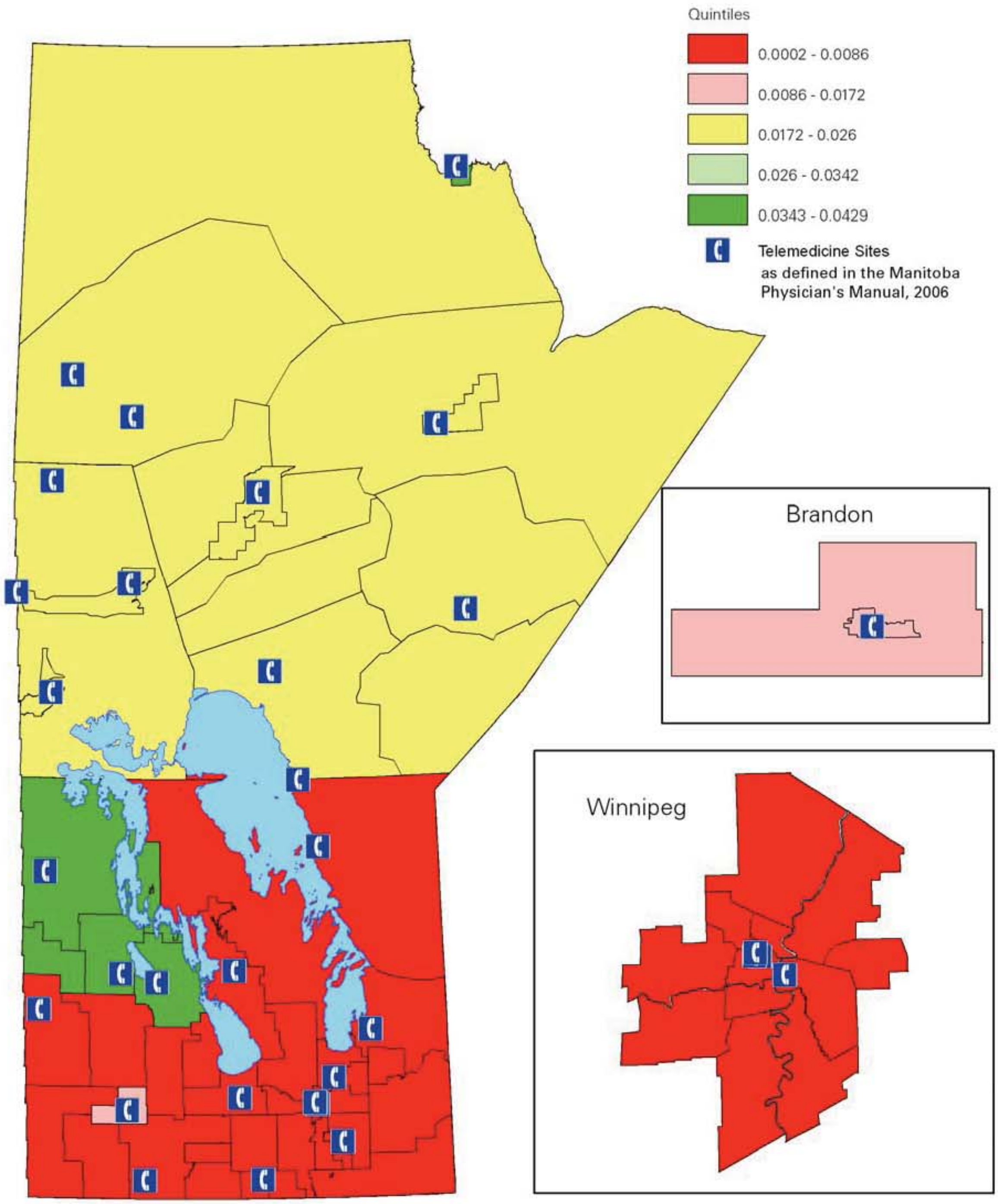
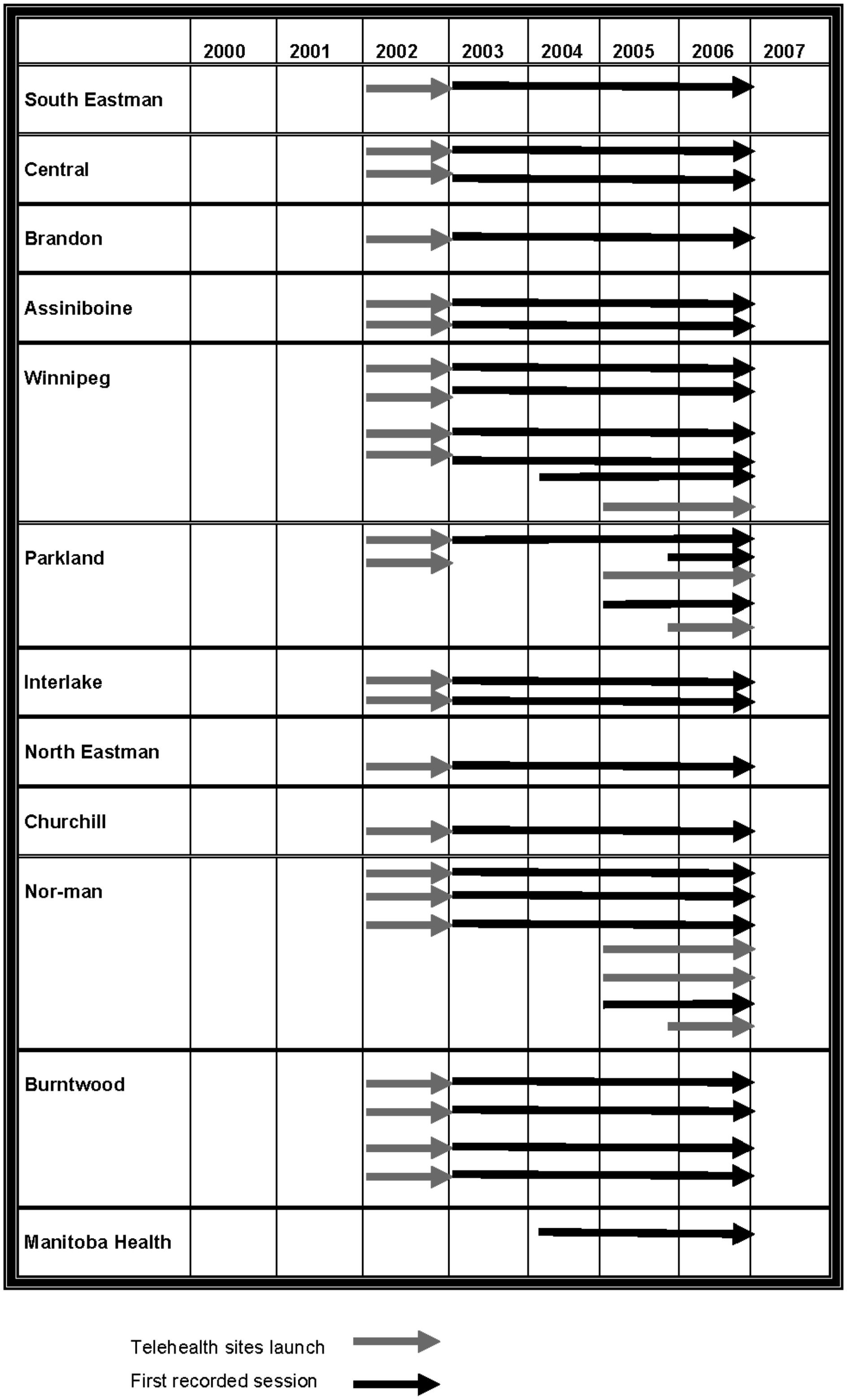


Table 15.1 Telehealth initiatives (site setup) by RHA



15.2 Discussion

When reviewing the results in this chapter, it is critical to understand the role of specialists and how various regions of the province use specialists in different ways. In MCHP reports, we often use the ambulatory 'consult' rate which is a better indicator of access to specialists than the total specialist visit rate. The consult rate represents the rate of first referral from one physician to another (usually referring to a specialist) and this better reflects need for specialist care. Family physicians in urban and rural areas often have quite different roles once the referral has taken place. In urban areas, the specialist often 'takes on' the patient for several repeat visits. In rural areas, the specialist may see the patient once for the condition and then refer the patient back to the family physician for follow–up unless other problems arise. Also, well–baby visits in urban areas are often done by paediatricians (specialists); whereas well–baby visits in rural areas are often done by family physicians (with referral to paediatricians when there is a problem beyond the scope of the family physician). Consult rates are more consistent across RHAs than total specialist visit rates which are much higher in Winnipeg and Brandon because of the repeat visit effect (and especially in Winnipeg, the paediatrician effect).

Therefore, the "right rate" for total specialist visits is not necessarily the high rate of the urban areas. Rather, the "right rate" is more importantly a rate that reflects appropriate use of specialists when needed, with family physicians providing follow–up care in most cases.

What the figures and maps tell us about overall rates and trends in specialist visit rates:
Total ambulatory specialist visit rates:

- Overall, visit rates to specialists are highest in Winnipeg, Brandon, and places that use Winnipeg services heavily (Interlake and North Eastman RHAs). Between 1990/91–1997/98 and 1998/99–2005/06, the overall Manitoba rate remained stable at about 1.2 visits per resident per year. The Mid (0.70 to 0.78) and North (0.35 to 0.48) aggregate areas had increases in specialist visit rates over time, while Brandon had a decrease (1.19 to 0.94). Rates for the South increased slightly and for Winnipeg decreased slightly, but neither of these changes were statistically significant.
- Districts within RHAs close to Winnipeg approximate the Winnipeg specialist visit rate patterns (Central's Cartier/SFX district, Interlake's Southeast district, and North Eastman's Springfield district).
- Every NC and CA within Winnipeg has a specialist visit rate higher than the provincial average in both time periods, and these rates have been mostly stable from 1990/91–1997/98 to 1998/99–2005/06. Specialist visit rates across CAs and NCs show less variation than among non–Winnipeg areas. River Heights has the highest rate (2.01) and Transcona has the lowest rate (1.33 visits per person per visit).
- A year–by–year analysis of the entire period studied (Figures 15.5 and 15.6) shows South rates are stable around 0.6; but between 1990/91 and 2005/06, there was a trend for increasing rates in the Mid (0.67 to 0.84) and North (0.33 to 0.54 visits per person per year). In contrast, Brandon shows a substantial decline (1.19 to 0.84) over this period of time. Despite the differing trends in non–Winnipeg areas, the difference among non–Winnipeg areas has become smaller (Brandon's rates are declining and the other aggregate areas increasing).

- In Winnipeg, analysis of trends over time (Figure 15.6) shows very little difference except for the Average Health area which has declined to a level similar to the rest of Winnipeg. In 2005/06, the Winnipeg rate of 1.6 visits per person per year is seen in all 3 of its aggregate areas and is much higher than the provincial rate of 1.2.
- The map in Figures 15.7 shows the relatively low overall rate of specialist visits outside Winnipeg and high rates in Winnipeg and periphery. However, the time trend map in Figure 15.8 shows overall improvement relative to the Manitoba time trend throughout the province, except in the Brandon area.

Proportion of specialist visits outside the patient's RHA of residence:

- Figure 15.9 shows that in the years 2003/04–2005/06, people living in Winnipeg received 99.6% of their specialist visits within Winnipeg. Those in Brandon have to travel outside their RHA for 20.0% of their specialist visits. Of all other RHAs, Parkland has the next lowest "outside–RHA" specialist visit proportion—around half (53.5%) of their visits outside the RHA, followed by Churchill at 70.5%. Residents of all other RHAs have around 80% or more of their specialist visits outside their RHA.
- Between 1990/91–1997/98 and 1998/99–2005/06, the percentage of visits occurring outside the RHA increased from 70.5% to 75.9% (see Figure 15.10). The Mid aggregate area had stable rates (84.5% to 84.3%). Rates worsened for the South (84.2% to 87.3%) and Brandon (8.6% to 16.8%), whereas improvements were seen in the North (86.6% to 80.5%).
- At the district level, in the most recent time period (1998/99–2005/06) areas that show lower levels (around 70% or less) include: all districts in Brandon RHA, West, Central, and East districts in Parkland RHA, Portage district in Central RHA, and four districts in Burntwood RHA (Thompson, Thicket Portage/Pikwitonei/ Wabowden, Tadoule Lake/Brochet/Lac Brochet, Shamattawa/York Factory/Split Lake/War Lake).
- The Manitoba time trend (Figure 15.12) shows a slight increase over time (15.6% in 1990/91 to 19.9% in 2005/06) in the proportion of specialist visits that occur outside a patient's RHA, though this average is heavily influenced by Winnipeg. The proportion increased among residents of the South (79.7% to 89.6%) and Brandon (6.9% to 21.8%), was relatively stable for Mid (84.6% to 85.8%), and decreased in the North (89.1% to 79.0%). Note, however, that earlier graphs showed that the total visit rates were increasing over this time period.
- The maps in Figures 15.13 and 15.14 reinforce the above observations. For non–Winnipeg RHAs, Brandon has the "best" (i.e., lowest) proportion of specialist visits occurring outside the resident's RHA, followed by the majority of districts in Parkland. Trends show that the areas of the province that are improving over time (i.e., green means fewer specialist visits occurring outside the patient's RHA). They include areas within Nor–Man, Burntwood, North Eastman, Brandon, Assiniboine, and Central RHAs.

Telehealth visits to specialists:

- For this analysis, we attempted to link Telehealth records with administrative data using the physician, date and reason for the Telehealth "visit". The rates in Figures 15.15 and 15.16 are for the 70.5% of records that linked successfully (see Glossary in Appendix 1 for detailed information on the linkage). Particularly high usage of Telehealth specialist visits was seen for Churchill RHA residents. These were followed by Burntwood and Parkland residents. Figure 15.17 shows the 'raw' Telehealth data (i.e., not just those that linked) and show that Churchill and Parkland are high–use RHAs for specialist visits (green on Figure 15.17).

What the regression modeling[1] tells us about predictors of having a specialist visit (for the complete regression model, refer to Appendix 4):

- Individual characteristics that increase the likelihood of receiving a specialist visit—having a higher burden of mental or physical illness, having good continuity of care, being from a neighbourhood of higher income, and being female.
- Comparing the regression model that included only non–Winnipeg RHAs to the model that included the entire province, the only individual characteristic that differed was the age factor. The non–Winnipeg model shows an increase in specialist visits with an increase in age. The provincial model shows an increase in specialist visits with a decrease in age, presumably driven by the high use of paediatricians by Winnipeg residents.
- Geographical characteristics that increase the likelihood of having a specialist visit—For the provincial model, a patient being from any sub–region of Winnipeg or from Interlake RHAs. For the model with only the non–Winnipeg RHAs in it, a patient being from Central, North Eastman, South Eastman, Interlake or Brandon RHAs.

How the above are associated with descriptive information on policy, program or support initiatives:

- Although Telehealth is playing a role in some RHAs (particularly Churchill and Parkland) in increasing "in–RHA" access to specialists, it has a rather limited overall effect on decreasing the patient travel outside the RHAs.
- Brandon has probably experienced the most dramatic changes in the past 15 years. It's the only RHA to see a drop in specialist visit rates; from the highest rate among non–Winnipeg RHAs in 1990/91 to a much lower rate in 2005/06 (see Figures 15.1 and 15.5). Simultaneously, the proportion of specialist visits for which Brandon residents travelled outside their RHA rose substantially during the 15 years (see Figure 15.12).

15.3 Comparison of Pertinent Literature Reviews and *Our Study Results*

15.3.1a Specialist Visit Rates, Telehealth Information:

Based upon the CCHS Cycle 3.1 data for 2005, 27% of Canadians ages 18–64 years old consulted a specialist at least once in the previous year (Nabalamba and Millar 2007). Two groups with lower specialist visit rates were rural residents and seniors over the age of 75. However, these two groups

[1] Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

were more likely to have four or more visits to general practitioners than urban residents or people less than 75 years old.

Data from the USA National Health Care Survey for 1999–2000 (US Department of Health and Human Services 2006) indicates that of the average 979.5 million ambulatory visits per year in 1999 and 2000, 17% were to office–based medical specialists and 16.3% were to surgical specialists. The visit rate per person to surgical specialists was 0.49 over two years in 1993 to 1994 which increased to 0.51 by 1999 to 2000. The visit rate per person to medical specialists was .85 in 1993 to 1994 which decreased to .60 by 1999 to 2000. For people in a managed care model in the USA, the annual specialist visit rate varied from 0.88 to 1.1 per patient in 1994 to 1995 (Joyce et al. 2000). A study comparing the USA and Britain (Forrest et al. 2002) found that 30–37% of patients in US health plans were referred to specialists in one year compared with only 14% of UK patients.

Access to specialists in remote regions of a country can sometimes be accomplished through telehealth (telemedicine). The use of telemedicine is on the rise in the USA (Bond Emrich 2006). Due to its cost–effectiveness and efficiency of care, telemedicine is extending from its traditional use by rural or underserved communities to become more widely used in urban settings. However, it is difficult to track telehealth services due to lack of a separate billing mechanism that would identify a visit as a telehealth visit (Bond Emrich 2006). One USA survey (Grigsby 2002) found that the most common services delivered through telehealth were in the area of mental health specialist services, followed by orthopedics, cardiology, dermatology and oncology. Other services included prescreening of patients, conducting case reviews, and providing home health services.

In Australia, a national hospital survey found that 49% reported some telehealth activity (Wootton et al. 2003). Ninety percent of very remote hospitals, 88% of remote, 67% of moderately accessible, 52% of accessible and 35% of highly accessible hospitals report using telehealth services.

15.3.1b The Manitoba Telehealth (MBTelehealth) Program:

MBTelehealth is "a network that enables residents of Manitoba and surrounding areas to receive comprehensive health care services while overcoming barriers of distance and time through the use of technology. MBTelehealth also supports health education delivery and administrative support to rural health authorities" (MBTelehealth program website 2007). The potential benefits to locations hosting a MBTelehealth site include: (a) decreased travel time and costs for patients, (b) decreased time away from the community, (c) staff recruitment and retention, (d) ability to work to the full extent of scope of practice and (e) reduced sense of isolation for practitioners. Examples of clinical specialty services that may be provided through MBTelehealth include: anesthesia, cardiology, clinical psychology, dermatology, diabetes education, dietetics, endocrinology, general surgery, genetics, hepatology, immunology and allergy, infectious diseases, neonatology, neurology, neurosurgery, oncology, orthopedics, otolaryngology, pediatrics, psychiatry, radiology, rehabilitation services, respirology, rheumatology, speech and language pathology, urology, vascular surgery, and wound management.

15.3.2 Policy and Program Initiatives Review:

An expectation that all Canadian citizens will be able to access health services (outlined in the Canada Health Act) is a strong driver behind the expansion of telehealth in Canada (Muttitt et al. 2004). In two recent reports, telehealth has been identified as a key mechanism for improving care for people living in rural and remote parts of Canada—the Commission of the Future of Health Care in Canada's "Building on our values: The Future of Health Care in Canada" (Romanow 2002) and the Standing Senate Committee on Social Affairs, Science and Technology (Kirby 2004).

However, the report by Muttitt et al. (2004) also comments on various barriers to the use of telehealth:

- A need for clinical 'champions' to take the lead in using telehealth for new projects and programs.
- A need for multiple advocates to help promote successful and sustainable telehealth services (e.g., people in senior positions of influence with government, organizations and communities).
- The importance of engaging clinical staff and promoting buy–in to help ensure programs are beneficial for patients and providers.
- The importance of sustainability to overcome the failure of telehealth programs.

A USA study of telehealth (Grigsby 2002) also noted the following as barriers to growth in the use of telehealth: (i) lack of reimbursement, (ii) problems with long–term funding, (iii) telecommunication charges, (iv) general cost, (v) lack of physician acceptance, (vi) lack of specialist participation, (vii) lack of internal institutional recognition, (viii) lack of nurse acceptance, (ix) lack of incentives for remote sites to participate, and (x) lack of integration of telemedicine into health care delivery. This was reiterated in a Texas article (Tieman 2000) that underscores the importance of having hospital boards and administrators supportive of telehealth for it to succeed. As well, it must be convenient for physicians and "fit" into their workflow. As a result, the hospital chose telehealth technology that could be used in the physicians' work areas rather than in designated telemedicine rooms on other floors or buildings.

Throughout Canada, there is an interest in pursuing telehealth. For example, the Alberta government lists one of its key actions to improve delivery of services through telehealth (Alberta Health and Wellness 2003). Ontario had extensive consultations with health care experts and produced the 2004 document, "Analysis and Opportunity for Expanding Home Telehealth in Ontario" (Canada Newswire 2004).

Although Telehealth is a useful way to decrease patient travel to specialists, the rates of use are still small compared to the overall specialist visit rates and the rates requiring travel by the patient. Presumably the use of Telehealth could become a much greater part of the rural and remote access route for patients. However, it will be critical to mandate proper recording of person–level data for all patient/specialist visits using Telehealth, so that these can be tracked for program and policy evaluations and health outcomes.

15.4 Recommendations

- Ensure all Telehealth visits are appropriately coded at the person–level so these visits may be distinguished from those requiring patient travel.
- Encourage greater use of Telehealth to reduce patient travel to specialists outside their region of residence.

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APPENDIX 1: GLOSSARY

Adjusted Rates
These are rate values that are statistically adjusted to control for different age and sex distributions of different areas—so that the rates for all areas (and for males versus females) can be fairly compared. The adjusted values are those which the area would have had if their age and sex distribution was the same as for a standard population (usually Manitoba overall).

Statistical models were used to calculate these rates, and to compare a given area's rate (i.e., RHA or Winnipeg Community Area) and the provincial rate, as well as to compare rates over time within an area. Appendix 3 provides crude (that is, unadjusted) rates and the observed number of events for all indicators.

Administrative Data / Databases
Data collected, usually by government, for some administrative purpose (e.g., keeping track of the population eligible for certain benefits, paying doctors or hospitals), but not primarily for research or surveillance purposes.

Age Calculations
For most indicators in this report, age is calculated as of December 31 of each study year for both the numerator and the denominator. Exceptions include when age is calculated as of the time of an event, such as breastfeeding initiation rates, where age of the mother is calculated as of date of admission to hospital.

Aggregated Diagnostic Group (ADG)
Formerly known as Ambulatory Diagnostic Groups, ADG's continue to be part of the Adjusted Clinical Group (ACG) case–mix system. The ACG method groups every ICD–9/ICD–9 CM medical diagnosis code assigned to a patient into one of 32 different ADGs based on five clinical and expected utilization criteria: 1) duration of the condition (acute, recurrent, or chronic); 2) severity of the condition (e.g., minor and stable versus major and unstable); 3) diagnostic certainty (symptoms focusing on diagnostic evaluation versus documented disease focusing on treatment services); 4) etiology of the condition (infectious, injury, or other); and 5) specialty care involvement (medical, surgical, obstetric, haematology, etc.).

For this report, the ADGs used to define mental or physical illness in the logistic regressions are as follows:

Mental ADGs:
ADG 23 = Psychosocial: Time Limited, Minor
ADG 24 = Psychosocial: Recurrent or Persistent, Stable
ADG 25 = Psychosocial: Recurrent or Persistent, Unstable

Physical ADGs:
ADG 3 = Time Limited: Major
ADG 4 = Time Limited: Major–Primary Infections
ADG 9 = Likely to Recur: Progressive
ADG 11 = Chronic Medical: Unstable
ADG 16 = Chronic Specialty: Unstable–Orthopedic
ADG 22 = Injuries/Adverse Effects: Major
ADG 32 = Malignancy

If individuals had at least one of the above ADGs, they were classified as having a mental or major physical ADG in the logistic regression. For the most part, the ADGs were identified and assigned prior to the event in the regression.

Ambulatory Visit Rates to Specialists
This is the average number of ambulatory visits to specialist physicians per resident in fiscal year 1990/91–2005/06. Specialist physicians include: all medical specialists, paediatricians, psychiatrists, obstetricians and gynaecologists, and surgeons. The reported rate of practitioner use may be underestimated for some rural and remote areas due to incomplete shadow billing claims.

Anatomical Therapeutic Chemical (ATC) Classification
A widely used drug classification system, derived from the WHO's Collaborating Centre for Drug Statistics Methodology. Drugs are divided into different groups at five levels according to the organ or system on which they act and/or therapeutic and chemical characteristics: 1) anatomical group; 2) therapeutic main group; 3) therapeutic/pharmacological subgroup; 4) chemical/therapeutic/pharmacological subgroup; and 5) subgroup for chemical substance.

Augmentation of Labour
Labour Augmentation is the act of stimulating labour contractions to speed up the birthing process when labour slows down or stops. The chemical oxytocin is administered to the mother intravenously to attempt to resume labour. Note that augmentation of labour is akin to induction of labour in method, but augmentation is only carried out after the onset of labour. See also "Induction of Labour" in the glossary for more information.

In this study, augmentation of labour is defined by physician tariff code 4834 (augmentation of labour, other than simple artificial rupture of membrane) combined with tariff prefix code 3 (maternity tariff) in the medical claims.

Baby–Friendly Hospital Initiative (BFHI)
The Baby–Friendly Hospital Initiative (BFHI), launched in 1991, is an effort by UNICEF and the World Health Organization (WHO) to ensure that all maternities, whether free standing or in a hospital, become centres of breastfeeding support. A maternity facility can be designated 'baby–friendly' when it does not accept free or low–cost breastmilk substitutes, feeding bottles or teats, and has im-

plemented 10 specific steps to support successful breastfeeding (called the Ten Steps to Successful Breastfeeding). The process is currently controlled by national breastfeeding authorities, using Global Criteria that can be applied to maternity care in every country. Implementation guides for the BFHI have been developed by UNICEF and WHO. The ten steps include: have a written breastfeeding policy that is routinely communicated to all health care staff; train all health care staff in skills necessary to implement this policy; inform all pregnant women about the benefits and management of breastfeeding; help mothers initiate breastfeeding within one half–hour of birth; show mothers how to breastfeed and maintain lactation even if they should be separated from their infants; give newborn infants no food or drink other than breastmilk, unless medically indicated; practice rooming–in, that is, allow mothers and infants to remain together 24 hours a day; encourage breastfeeding on demand; give no artificial teats or pacifiers (also called dummies or soothers) to breastfeeding infants; foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or clinic.

Breastfeeding Initiation Rate

The percentage of live born babies born in a Manitoba hospital with a Manitoba postal code or municipality code who were exclusively or partially breast fed (information recorded on the hospital discharge abstract), to the number of live born babies born in a Manitoba hospital with a Manitoba postal code or municipality code that have complete feeding information in the hospital discharge abstract.

The breastfeeding initiation rate is the percentage of live newborns who were either exclusively or partially breastfed, out of all of the births in 1988/89–2003/04 fiscal years. Region of residence assignment is based on the hospital birth record.

Percentage of Missing Breastfeeding Fields for each RHA by Year, 1988/89-2003/04

Year	S. Eastman	Central	Brandon	Assiniboine	Wpg	Parkland	Interlake	N. Eastman	Churchill	Nor-Man	Burntwood	MB
1988/89	1.9	12.0	s	17.8	0.5	4.4	14.8	1.7	s	s	1.4	3.7
1989/90	2.5	1.8	s	14.6	0.4	4.7	14.1	3.2	s	s	0.8	2.5
1990/91	2.5	0.9	1.2	15.7	0.6	7.3	13.6	3.3	s	1.3	0.7	2.6
1991/92	1.4	1.4	1.1	18.5	0.7	6.1	16.3	4.9	0.0	1.5	1.5	3.0
1992/93	3.4	0.8	1.1	18.8	0.6	6.4	14.3	3.8	0.0	2.0	1.2	2.9
1993/94	1.2	1.1	s	16.3	0.8	5.9	15.7	5.0	0.0	2.1	0.9	2.9
1994/95	1.7	0.7	s	16.1	0.9	8.2	15.4	4.7	0.0	s	1.1	2.9
1995/96	2.3	0.7	1.2	13.8	0.9	7.0	18.2	6.8	s	2.0	1.3	3.1
1996/97	2.2	1.6	s	14.3	0.7	7.5	20.2	10.0	s	1.7	1.4	3.4
1997/98	2.1	1.3	1.0	14.2	1.0	8.9	18.2	10.9	0.0	3.0	1.4	3.5
1998/99	2.1	1.6	2.7	16.1	0.6	7.4	1.1	s	s	2.0	1.4	2.1
1999/00	2.5	1.8	s	14.6	0.5	8.9	s	s	s	1.9	s	1.9
2000/01	2.0	1.3	1.1	12.4	0.5	10.9	0.8	s	s	1.9	s	1.8
2001/02	1.9	1.5	s	12.4	0.5	12.2	0.7	s	0.0	1.4	1.2	1.8
2002/03	2.2	1.5	s	9.1	0.3	9.7	0.8	s	0.0	s	1.2	1.4
2003/04	2.3	1.6	1.0	11.4	0.5	11.6	s	s	s	2.3	1.1	1.7
Overall	**2.1**	**2.0**	**0.9**	**15.0**	**0.6**	**7.8**	**10.8**	**3.7**	**3.6**	**1.6**	**1.1**	**2.6**
OOP Births	1.6	0.3	0.7	4.0	0.4	7.2	0.3	0.4	2.5	1.1	0.6	0.6

's' indicates data suppressed due to small numbers

OOP (Out of Province) Births attributed to Manitoba residents have missing breastfeeding data.

Live births are defined by newborn hospitalizations (abstract type = 4) with one of diagnosis codes V30 to V39 in any diagnosis field. Breastfeeding is defined by the breastfeeding field on the hospital abstract (nbfeedng) equal to either 1 (breast) or 3 (both breast and artificial). Newborn hospitaliza-

Number of Newborns and Percentage Breastfed by Gestational Age, 1988/89-2003/04

Gestational Age (weeks)	Number of Newborns	% of Total Newborns	Number Breastfed	% Breastfed
< 36	9405	3.98	5859	62.30
36	6055	2.56	4347	71.79
37	13562	5.73	10061	74.19
38	31087	13.14	23871	76.79
39	51192	21.64	40180	78.49
40	81024	34.25	63929	78.90
> 40	43937	18.57	35094	79.87
Error/Missing	303	0.13	181	59.74
All Ages	**236565**	**100.00**	**183522**	**77.58**

Percentage of Newborns at each Gestational Age by RHA, 1988/89-2003/04

RHA	< 37 weeks	37-40 weeks	41+ weeks	Error/Missing
South Eastman	6.01	72.88	21.01	0.10
Central	5.12	72.10	22.57	0.21
Brandon	6.18	76.70	17.05	0.07
Assiniboine	6.18	74.85	18.80	0.16
Winnipeg	6.91	74.76	18.25	0.08
Parkland	5.93	73.17	20.82	0.08
Interlake	7.25	72.38	20.26	0.11
North Eastman	6.55	75.30	17.89	0.26
Churchill	5.49	76.01	18.50	0.00
Nor-Man	5.99	79.41	14.50	0.10
Burntwood	6.31	78.49	14.77	0.43
Manitoba	**6.54**	**74.76**	**18.57**	**0.13**

Percentage of Newborns Breastfed by Gestational Age and RHA, 1988/89-2003/04

RHA	< 37 weeks	37-40 weeks	41+ weeks	Error/Missing
South Eastman	76.95	86.36	87.27	45.45
Central	66.13	83.37	86.42	77.78
Brandon	57.43	78.33	79.93	42.86
Assiniboine	66.52	80.57	81.54	88.89
Winnipeg	68.57	80.31	81.35	52.48
Parkland	50.64	67.74	71.03	16.67
Interlake	69.18	78.52	78.40	71.43
North Eastman	55.12	67.24	69.52	50.00
Churchill	73.68	80.61	85.94	0.00
Nor-Man	52.56	62.52	67.50	42.86
Burntwood	56.74	64.24	62.98	60.81
Manitoba	66.02	**78.05**	**79.87**	**59.74**

tions with a missing value for breastfeeding (nbfeedng = 0) are excluded from both the numerator and the denominator.

Caesarian Section (C–Section)
A Caesarian section is a procedure in which a baby, rather than being born vaginally, is surgically extracted (removed) from the uterus.

Rates of C–Sections were calculated over 20 fiscal years of hospitalizations, 1984/85–2003/04. C–Sections were defined by ICD–9 CM procedure codes of 74.0 (classical Caesarian section), 74.1 (low cervical Caesarian section), 74.2 (extraperitoneal Caesarian section), 74.4 (Caesarian section of other specified type), or 74.9 (Caesarian section of unspecified type). The denominator is all maternal birth hospitalizations in the time period, defined by ICD–9 CM diagnosis code V27 (Outcome of

Percentage of C-sections that were Scheduled by Year and RHA, 1984/85-2003/04

Year	S. Eastman	Central	Brandon	Assiniboine	Wpg	Parkland	Interlake	N. Eastman	Churchill	Nor-Man	Burntwood	MB
1984/85	c-section type n/a*											
1985/86	c-section type n/a*											
1986/87	c-section type n/a*											
1987/88	35.56	49.79	35.66	42.47	32.40	34.95	37.01	43.42	s	26.67	33.33	**35.49**
1988/89	33.72	44.26	33.33	39.72	31.71	33.68	42.19	35.06	s	37.00	27.27	**33.88**
1989/90	30.00	44.71	40.00	41.30	33.06	31.40	38.98	34.52	s	47.52	33.06	**35.43**
1990/91	42.59	42.61	38.61	37.78	35.68	26.40	32.76	32.86	s	35.71	29.58	**35.68**
1991/92	35.06	41.28	43.62	38.66	33.99	34.43	42.16	42.86	s	29.07	32.35	**35.76**
1992/93	41.49	40.00	39.08	40.48	33.21	43.62	37.39	31.82	s	29.41	38.93	**35.46**
1993/94	43.96	44.85	44.79	46.09	33.02	31.43	38.17	32.65	s	37.50	32.03	**35.75**
1994/95	39.22	45.28	45.38	47.97	35.71	39.62	41.82	33.33	s	45.26	31.21	**38.30**
1995/96	42.11	40.18	31.18	45.77	32.74	29.21	37.40	42.31	s	40.63	40.00	**35.74**
1996/97	43.00	41.63	35.42	39.69	31.74	39.47	47.26	49.25	s	44.44	23.13	**35.25**
1997/98	43.62	43.25	31.52	36.80	35.22	28.07	36.22	29.41	s	42.99	34.53	**36.16**
1998/99	48.62	37.56	44.68	41.33	33.33	27.27	35.43	31.43	s	30.49	36.31	**35.15**
1999/00	34.75	40.64	39.09	40.49	34.05	43.40	40.00	41.89	s	38.79	27.16	**36.04**
2000/01	39.81	46.18	35.25	43.06	37.81	35.51	49.64	47.17	s	41.67	30.63	**39.27**
2001/02	52.03	43.73	32.76	41.13	41.22	33.33	43.88	44.44	s	43.68	27.97	**40.88**
2002/03	38.28	43.31	32.76	41.89	41.46	42.27	41.61	39.47	s	36.17	31.54	**40.33**
2003/04	46.38	46.54	35.29	37.97	38.58	28.71	41.84	31.88	s	44.44	30.53	**38.84**
Overall	**40.96**	**43.37**	**37.37**	**41.28**	**34.96**	**34.01**	**40.38**	**37.49**	**40.38**	**38.54**	**31.58**	**36.70**

's' indicates data suppressed due to small numbers
*Type of c-section, either scheduled or emergency, was not coded in the hospital data until April 1, 1987.

Calendar Year
A calendar year runs from January 1 to December 31.

Cervical Cancer Screening
Also called a Pap (Papanicolau) test, cervical cancer screening is based on the examination of cells collected from the cervix to reveal pre–malignant (before cancer) and malignant (cancer) changes as well as changes due to non–cancerous conditions such as inflammation from infections.

Delivery). Age is calculated as of date of admission to hospital. Region of residence is assigned based on hospital record. (See also Robson Index)

For this report, the proportion of woman age 18–69 who received at least one Pap test in a three period was calculated for fiscal years 1986/87–2003/04. Cervical cancer screening was defined by:

1. A physician visit with a tariff code for a Pap test:
    - 8470—regional gynaecological exam, including cytological smear of the cervix, provided by a GP/FP
    - 8495—complete physical and gynaecological exam, including cytological smear of the cervix, provided by an OB/GYN specialist
    - 8496—regional gynaecological exam, including cytological smear of the cervix, provided by an OB/GYN specialist
    - 8498—complete physical and gynaecological exam, including cytological smear of the cervix, provided by a GP/FP
    - 9795—cytological smear of the cervix for cancer screening
2. A pathology or laboratory claim with a tariff code for a Pap test:
    - 9470—Cytological Examination—Vaginal Smear

Note that if a laboratory claim and a physician claim for a Pap test for the same individual are within 54 days of each other, they are counted as one Pap test to reduce double counting over three–year periods. 98.7% of lab claims are within 54 days of the physician claim.

Women who have had a hysterectomy surgery were excluded from both the numerator and denominator. Hysterectomy surgeries were defined by hospital separations with ICD–9 CM procedure codes 68.4–68.9. These codes include only total hysterectomies, not partial, as women who have a partial hysterectomy may still have a cervix and would require cervical cancer screening. Age is calculated as the physician visit date in numerator and December 31 in the denominator. Region of residence is assigned based on the first record for each three year period.

Rates for northern and remote areas served by nursing stations may be underestimated due to missing data. Prior to 2005, only physicians were able to code into the administrative billing system for Pap tests. As of 2005, nurses officially called “Nurse Practitioners” by Manitoba Health are now coding into the physician data system. However, “Advanced Practice Nurses” or other designations are not included in that, despite the fact that some do Pap tests. Nurses working at federally–operated Nursing Stations also do not record their work in the billing claims system.

Complete Physical Exams

This is the percentage of residents who received at least one Complete History and Physical Examination from any physician (GP or specialist) each fiscal year during 1984/85–2003/04. This was defined as a physician visit with any of the following physician tariff codes:

- 8450—complete physical and gynaecological exam, including cytological smear of the cervix, for patients aged 70 years and over
- 8460—complete physical and gynaecological exam, excluding cytological smear of the cervix, for patients aged 70 years and over
- 8495—complete physical and gynaecological exam, including cytological smear of the cervix, provided by an OB/GYN Specialist
- 8498—complete physical and gynaecological exam, including cytological smear of the cervix, provided by a GP/FP
- 8499—complete physical and gynaecological exam, excluding cytological smear of the cervix, provided by a GP/FP
- 8500—complete history and physical exam for patients aged 75 years and over
- 8540—complete history and physical exam for any patient
- 8594—complete history and physical exam for an unassigned patient

Physical exams could be provided during an ambulatory visit to a physician, or while in hospital. Approximately 6% of complete physicals were provided to patients while in hospital during the study period.

The denominator is the entire Manitoba population as of December 31 of each fiscal year. Age is calculated as of the date of the physical in the numerator and as of December 31 of the fiscal year in the denominator. Region of residence is assigned based on the first record in fiscal year. There is a possibility that there is missing data for this indicator because of an inability to pick up nurse practitioner, nursing station and salaried physician work.

Regarding the question about the number of complete physicals allowed per year: According to Manitoba Health, "a complete history and physical exam is that it is not an 'annual' event, but a comprehensive examination necessary to make a diagnosis of a condition. A physician cannot bill for another complete within 60 days of a previous one, unless it is for a different condition. A regional exam is second in the hierarchy with the same 60 day provision for the same diagnosis, but it is a less extensive exam. The subsequent visit is used for additional visits for the same condition within the 60 day period, unless the physician submits a Special Report. The Special Report must justify why a complete or regional is necessary (e.g., to properly manage a chronic illness)." The College of Physicians and Surgeons of Manitoba (CPSM) does not presently have a guideline that is more current than the recommendation that a routine physical exam is no longer appropriate. According to the Manitoba Medical Association, it is possible to bill for more than one complete physical per year (see above information from Manitoba Health).

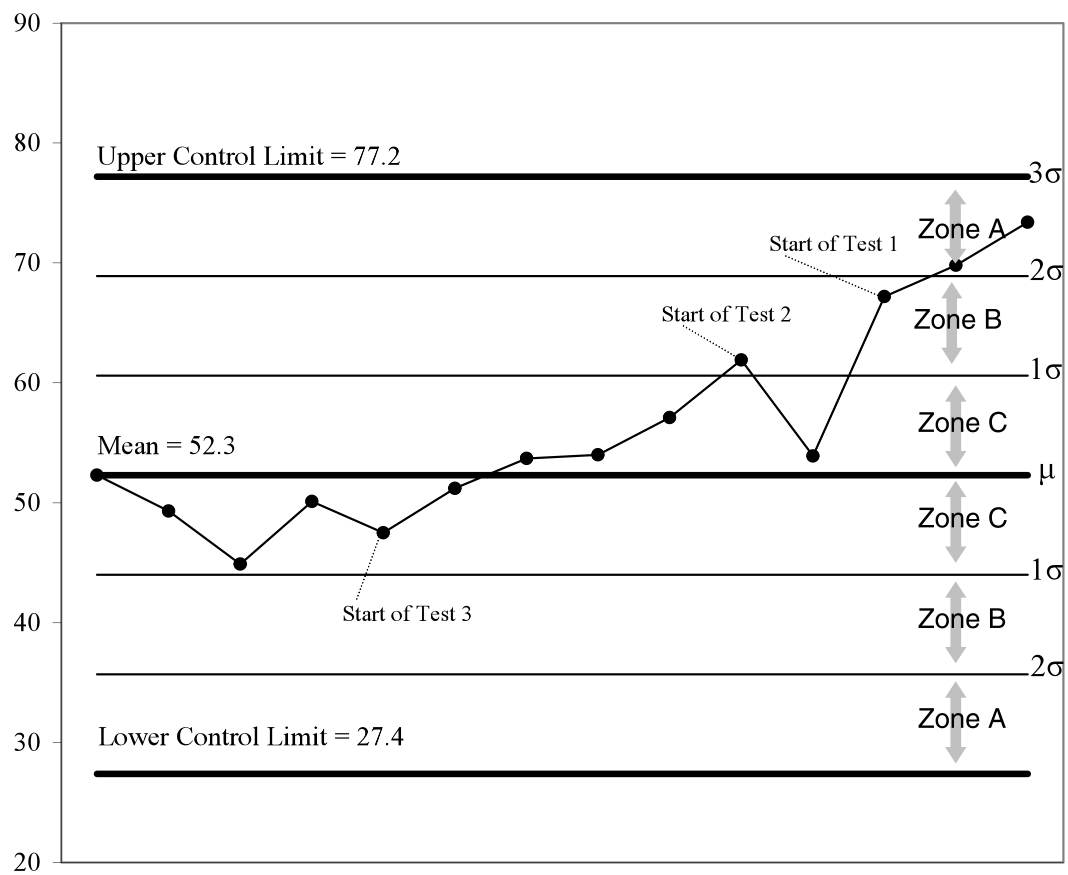
Confidence Interval (CI)
Confidence intervals, also known as confidence limits, are calculated from data, which contain a population parameter, such as the population median or mean, with specified probability. For example, a 95% confidence interval (written as 95% CI) would have a 95% probability of containing the true population value.

Continuity of Care
This is the percentage of residents receiving at least 50% of their ambulatory visits from the same physician, among those with at least three visits in a two–year period. For children 0 to 14, it could be a GP/FP or a Pediatrician; for those 15 to 59, only GP/FPs were used; for those 60+, it could be a GP/FP or an Internal Medicine specialist. Residents with less than three ambulatory visits over the two–year period are excluded from calculations.

Crude Rate
The number of persons with a given condition, divided by the number of persons living in that area, and multiplied by 1,000 to give a rate per 1,000. In contrast to adjusted rates, crude rates are helpful in figuring out how many people are "walking through the door" for treatment. This could potentially be affected by the age and sex distribution of an area; hence most rates are adjusted for fair comparisons between areas.

Control Charts
Control Charts are a visual statistical tool in Quality Control Analysis used to distinguish between normal and abnormal variation in a quality characteristic or indicator and to detect changes in indicators over time. An example of a control chart is displayed below.

Example Control Chart



The chart contains a centre line (μ) that represents the mean or average value of the quality characteristic corresponding to the in–control state. In this report, the centre line is always the estimate of the difference between a given area's rate at the start of the study period and the provincial rate at that time. Hence, if the "process" were in control, this difference would be maintained throughout the entire time period (i.e., the area's rate over time would be parallel—possibly higher, lower, or similar—to the provincial rate, throughout the entire time period tracked.

Two other horizontal lines, called the upper control limit and lower control limit, are also shown on the chart. These limits are always three standard deviations (3σ) from the estimate of the area's rate difference at the start of the study period. These control limits are chosen so that if the process is in control, nearly all of the sample points will fall within the control limits. The control chart is further partitioned into three zones A, B and C on each side of the centre line. Zone C lies between the centre line and one standard deviation from the centre, Zone B lies between one and two standard deviations of the centre and Zone A lies between two and three standard deviations from the centre. Increasing or decreasing trends as well as out–of–control–conditions can be easily visualized using control charts and quality control tests, often called the Western Electric Rules. The tests chosen to test for trends in this report are:

1. Two out of three consecutive points outside the 2–sigma warning limits (Zone A or beyond)—called "Test 5".
2. Four out of five consecutive points outside the 1–sigma warning limits (Zone B or beyond)—called "Test 6".
3. A run of six consecutive points steadily increasing or decreasing—called "Test 3".

In cases of very rare events, such as suicide, a control chart may have a small number of points due to the fact that several years of data were combined for more stable rates in each time period. In these cases an alternate quality control test will be employed:

4. One or more points outside the control limits (beyond Zone A)—called "Test 1".

(Reference: Montgomery, Douglas C., Introduction to Statistical Quality Control, Third Edition, John Wiley and Sons, Inc., New York, NY, 1996)

For the purpose of this study, control charts were created for each area in Manitoba (i.e., RHA, district, community area and neighbourhood cluster) for each indicator (e.g., rates of teen pregnancy, breastfeeding initiation, etc.).

These control charts were analyzed independently by at least five of the study staff, including the investigators, programmers and research assistant: each coded the trend as either "similar," "increasing," "decreasing" or "erratic":

- To qualify as similar, the trend line could not test positive for any of the quality control tests above, i.e., the trend line had to be all black and could not contain any red line segments indicative of a positive test.
- To qualify as increasing or decreasing, the trend line had to test positive for at least one of the quality control tests above. Also, the majority of the study staff who analyzed the chart had to have judged the trend to be rising or descending overall to qualify as increasing or decreasing, respectively.
- To qualify as erratic, the trend line had to test positive for at least one of the quality control tests above, but did not have a clear increasing or decreasing trend, i.e., the trend could have been increasing and then decreasing.
- For the very last segment in the trend line, absence of red, indicative of a positive test, was not considered sufficient evidence to conclude that rates were changing significantly. For example, a sharp rise in the last segment of the trend line was not considered to be evidence of a significant increase in rates, unless this increase was positive for any of the control chart rules. Without subsequent data points, it would be impossible to tell whether this increase was an anomaly or the start of a real change in the trend.

Coding results were compiled and reviewed as a group. Differences were discussed and a final code determined by consensus or majority. These final codes were then mapped to help visualize the trend in rates for each indicator in each area.

Data Suppression
Data is suppressed when the number of persons or events involved is five or less, in order to avoid potential identification of individuals in an area. Data is not suppressed when the actual event count is zero.

Diabetes Prevalence
Diabetes is a chronic condition in which the pancreas no longer produces enough insulin (Type I Diabetes) or when cells stop responding to the insulin that is produced (Type II Diabetes), so that glucose in the blood cannot be absorbed into the cells of the body. The most common endocrine disorder, Diabetes Mellitus affects many organs and body functions, especially those involved in metabolism, and can cause serious health complications including renal failure, heart disease, stroke, and blindness.

In this study, the treatment prevalence of diabetes was measured as the percentage of residents aged 20–79 diagnosed with diabetes (ICD–9 CM code 250) in at least two physician visits or one hospitalization during a three year period over 18 fiscal years, 1986/87–2003/04. The values reflect Type I and Type II diabetes, as physician claims data do not allow separate identification (gestational diabetes cases would also be included if coded as 250). It is expressed as a percentage because each resident is defined either as having been treated for diabetes, or not, in that period. Age is calculated as of December 31 of the denominator year for each three–year period. Region of residence is assigned based on the first record for each three–year period.

This definition is consistent with recent MCHP reports, and was shown in Lix et al. (2006) to provide good sensitivity (85%) and excellent specificity (99%). Alternate definitions providing higher sensitivity were available, but had lower specificity, making them less suitable for this analysis.

There is a possibility that there is missing data for this indicator because of an inability to pick up nurse practitioner, nursing station and salaried physician work.

Drug Programs Information Network (DPIN)
DPIN is an electronic, on–line, point–of–sale prescription drug database. It links all community pharmacies (but not pharmacies in hospitals or nursing care homes/personal care homes) and captures information about all Manitoba residents, including most prescriptions dispensed to status Indians. DPIN contains information such as unique patient identification, age, birth date, sex, medication history, over–the–counter medication history, patient postal code, new drug prescribed, date dispensed, and unique pharmacy identification number. DPIN is maintained by the Government of Manitoba's Ministry of Health.

Drug Identification Number (DIN).
An 8 digit number, assigned by the Therapeutic Products Directorate of Health Canada, to each drug approved for use in Canada in accordance with the Food and Drug Regulation. The same drug (e.g., Amoxicillin, 250 mg capsules) can have several different DINs associated with it (due to different manufacturers).

Fiscal Year
For most businesses, health care institutions included, the fiscal year is defined as starting at April 1 and ending the following year at March 31. For example the 1996/97 fiscal year would be April 1, 1996 to March 31, 1997. Users of hospital data should realize that it is separation based and that at the end of the fiscal year there may be some undercounting for individuals that are still in hospital.

General Practitioner/Family Practitioner (GP/FP)
A physician who operates a general or family practice and is not certified in another specialty in Manitoba.

Gestational Age
Gestational age is approximated from the age of a newborn infant from the first day of the woman's last menstrual period to birth and is often reported in weeks of gestation. The average gestational age of a newborn is 37 weeks.

Hospital Discharge Abstract Database
Hospital abstracts are completed at the point of discharge for all separations from acute care facilities in Manitoba. They include up to 16 diagnosis codes and 12 procedure codes based on the International Classification of Diseases, 9th Revision, Clinical Modification (ICD–9 CM).

Hysterectomy
A surgical operation to remove the uterus and, sometimes, the cervix. Removal of the body of the uterus without removing the cervix is referred to as a subtotal hysterectomy. Removal of the entire uterus and the cervix is referred to as a total hysterectomy.

In this report, hysterectomy rates were calculated for woman age 25 or older for fiscal years 1984/85–2003/04. Hysterectomy was defined as any hospitalization for a hysterectomy surgery, identified by ICD–9 CM procedure codes of 68.4, 68.5 or 68.9 present in any procedure field. (Note: this excludes procedure codes for radical hysterectomies typically associated with cancer cases, i.e., codes 68.6 and 68.7). Age and region of residence is determined as of date of admission to hospital in numerator and December 31 of each fiscal year in the denominator.

Immunization
Immunization is an intervention to initiate or increase resistance against infectious disease.

Analyses for this report include only children born and continuously resident in Manitoba. Rates of complete immunization schedule compliance were calculated for two–year–old children born in fiscal years 1988/89–2001/02 and followed from birth to age two.

The recommended immunization schedule for children under two years of age includes:
- Four Diphtheria, tetanus, pertussis (DTP or DTaP) vaccines. These are given at two, four, six, and 18 months of age. Prior to 1997 the DPT vaccine used whole cell pertussis, and after that, the vaccine used acellular pertussis (DTaP).
- Three to four inactivated Polio (IPV) vaccines. These are given at two, four, and 18 months of age, with an optional vaccine at six months of age.
- Four Haemophilus influenzae type b (Hib) vaccines. These are given at two, four, six, and 18 months of age (Hib is only required for children born after May 1, 1992).
- One Measles, Mumps and Rubella (MMR) vaccine. This is usually given at one year of age or later.
- The Hepatitus B (Hep B) vaccine may be given. The recommended schedule for Hep B consists of three doses at zero, one, and six–month intervals, where the second dose is given at least one month after the first, and the third dose is given at least four months after the first and two months after the second.
- Note: The Hepatitis B (Hep B) vaccine may be given to high risk infants, but is routinely provided to children in Grade 4. It is offered to infants of Hep B mothers. Others can buy it with a prescription.

In this report, two year olds were considered to have a complete immunization schedule if they had records for the following:
- For children born before May 1 1992: Four DTP/DTaP, three Polio, one MMR
- For children born after May 1 1992: Four DTP/DTaP, three Polio, four Hib, one MMR

In 1997, OPV was replaced with IPV (inactivated polio vaccine). This was combined with the DPT vaccine as a quadravalent vaccine. Hib was also added to form a pentavalent vaccine.

Induction of Labour
Labour Induction is the act of stimulating labour contractions to begin the birthing process, through either physical or medical means. Physical methods of induction include the artificial rupture of the membranes to break the water. Medical methods include the intravenous administration of the chemical oxytocin to initiate labour. Note that induction of labour is akin to augmentation of labour in method, but induction is only carried out before the onset of labour. See also "Augmentation of Labour" in the glossary for more information.

In this study, induction of labour included only medical induction, defined by ICD–9 CM procedure code 73.4 (medical induction of labour) in any procedure field on an obstetrical hospital abstract.

International Classification of Disease, 9th Revision Clinical Modification (ICD–9 CM) Chapters
The 9th version of the ICD coding system (with Clinical Modifications) was developed by the World Health Organization (WHO) and is used to classify diseases, health conditions and procedures. The chapters are (1) Infectious and parasitic Diseases, (2) Neoplasms (i.e., Cancer), (3) Endocrine, Nutritional and Metabolic Diseases, (4) Diseases of the Blood and Blood–forming Organs, (5) Mental Disorders, (6) Diseases of the Nervous System and Sense Organs, (7) Diseases of the Circulatory System, (8) Diseases of the Respiratory System, (9) Diseases of the Digestive System, (10) Diseases of the Genitourinary System, (11) Complications of Pregnancy, Childbirth and the Puerperium, (12) Diseases of the Skin and Subcutaneous Tissue, (13) Diseases of the Musculoskeletal System and Connective Tissue, (14) Congenital Anomalies, (15) Certain Conditions Originating in the Perinatal period, (16) Symptoms, Signs and Ill–Defined Conditions, and (17) Injury and Poisoning. Analyses performed by cause also include an 18th group for services related to pregnancy and childbirth.

Incidence
Incidence is the number of new cases of a given event over a specified time period. The incidence rate uses only new cases in the numerator; individuals with a history of the condition are not included. The denominator for incidence rates is the population at risk. Even though individuals who have already developed the condition should be excluded from the denominator, incidence rates are often expressed based on the average population rather than the population at risk. In the case of chronic conditions, where most people appear to be at risk, the distinction between populations at risk and the whole population appears to be less critical.

Injury Resulting in Hospitalization or Death
Counts of hospitalizations or death due to injury in fiscal years 1984/85–2003/04 include any inpatient hospitalization with an injury diagnosis or any death with an injury cause of death. Injuries were defined by ICD–9 E–codes (inclusions and exclusions below) in the cause of death field from death records in Vital Statistics or ICD–9 CM E–codes from any of the 16 diagnosis fields in hospital claims. In Vital Statistics, injury deaths on or after January 1, 2001 were coded in ICD–10, but were converted to ICD–9 codes using the CIHI conversion file. Newborn birth injuries or deaths,

stillborns and brain deaths are excluded from injury rates. Hospital episodes are counted, not individual separations, so that transfers between hospitals for the same injury do not result in double counting. Note that if a hospital separation and death are within 1 week, they are counted as the same injury. Or, if a hospital separation and death are within 1 month, but both records have the same E–code, they are counted as the same injury. Age is calculated as of December 31 of each year in both the numerator and the denominator. Region of residence is assigned based on the first record in the study period.

E–code diagnoses included in injury rates:

1. Railway Accidents (E800–E807)
2. Motor Vehicle Traffic Accidents (E810–E819)
3. Motor Vehicle Non–Traffic Accidents (E820–E825)
4. Other Road Vehicle Accidents (E826–E829)
5. Water Transport Accidents (E830–E838)
6. Air and Space Transport Accidents (E840–E845)
7. Vehicle Accidents, Other (E846–E848)
8. Accidental Poisoning by Drugs (E850–E858)
9. Accidental Poisoning by Other Substances (E860–E869)
10. Accidental Falls (E880–E888)
11. Accidents Caused by Fire and Flames (E890–E899)
12. Accidents due to Natural and Environmental Factors (E900–E909)
13. Accidents Caused by Submersion, Suffocation and Foreign Bodies (E910–E915)
14. Other Accidents (E916–E928)
15. Late Effects of Accidental Injury (E929)
16. Suicide and Self–Inflicted Injury (E950–E959)
17. Homicide and Injuries, Inflicted by Others (E960–E969)
18. Legal Intervention (E970–E978)
19. Injury Undetermined (E980–E989)
20. Injury due to War Operations (E990–E999)

E–code diagnoses excluded from injury rates:

1. Misadventures during Surgical or Medical Care (E870–E876)
2. Reactions or Complications due to Medical Care (E878–E879)
3. Adverse Effects due to Drugs (E930–E949)

Interaction Effect

The joint effect of two or more independent variables on a dependent variable. Interaction effects occur when independent variables not only have separate effects but also have combined effects on a dependent variable. Put somewhat differently, interaction effects occur when the relation between two variables differs depending on the value of another variable. (W. Paul Vogt, 1993)

Logistic Regression

The regression technique used when the outcome is a binary, or dichotomous, variable. Logistic regression models the probability of an event as a function of other factors. Note that these models are only able to state that there is a relationship ('association') between the explanatory and the outcome variables. This is not necessarily a causal relationship, since it is based on observational data for the most recent time period. The explanatory variable may be associated with an increase or decrease (not that it caused the increase or decrease).

Longitudinal Study

A longitudinal survey describes or measures a population at several points in time. Contrast this with cross–sectional study which is a study that examines the relationship between diseases (or other health–related characteristics) and other variables of interest as they exist in a defined population at one particular time. The presence or absence of disease and the presence or absence of the other variables (or, if they are quantitative, their level) are determined in each member of the study population or in a representative sample at one particular time. The temporal sequence of cause and effect cannot necessarily be determined in a cross–sectional study. Consequently, disease prevalence rather than incidence is normally recorded in a cross–sectional study.

Lower Limb Amputations among People with Diabetes:

The removal of the lower limb (below or including the knee) by amputation among those with a diagnosis of diabetes.

In this study, the rate of lower limb amputations was calculated over fiscal years 1984/85–2003/04 for Manitoba residents age 20 through 79 diagnosed with diabetes (see Diabetes Prevalence in the glossary for a definition of Diabetes). Amputation is defined by a hospitalization with a surgery for a lower limb amputation, identified by ICD–9 CM procedure codes 84.1–84.17 in any procedure field. The hospital abstract for the amputation must also indicate a diagnosis of diabetes in any diagnosis field, defined by ICD–9 CM diagnosis code 250. This definition does not include all amputations, but only those for which there was an existing condition of diabetes coded with the amputation. Amputations due to accidental injury (defined by ICD–9 CM diagnosis codes 895, 896, 897) were excluded. Age is calculated as of the date of surgery in the numerator and December 31 of each year in the denominator. Region of residence is assigned based on the first record in the study period.

Main Effect

The simple effect of an independent variable on a dependent variable; the effect of an independent variable uninfluenced by other variables. Used in contrast with the interaction effect of two or more independent variables on a dependent variable. There is some controversy about whether it is appropriate to try to interpret main effects in the presence of interaction effects.

Mammography

Mammography is a procedure to determine if a woman has breast cancer; it is commonly used for breast cancer screening. Manitoba introduced a province–wide breast screening program in 1995 which is operated by the Manitoba Breast Screening Program. It is recommended that all women between 50 and 69 years of age be screened every two years for breast cancer.

The percentage of women age 50–69 that have had at least one mammogram in a two–year period was calculated over 1984/85–2003/04 fiscal years, with the denominator being the number of women age 50–69 in Manitoba as of December 31 in the second fiscal year of the two–year period. Age is calculated as of the date of the mammogram in the numerator and December 31 of each fiscal year in the denominator. Region of residence is assigned based on the first record in the study period. In this report, five physician tariff codes in physician claims were used to define mammography:

- 7098 (Radiology, Intraluminal Dilatation, Mammography, Bilateral)
- 7099 (Radiology, Intraluminal Dilatation, Mammography, Unilateral)
- 7104 (Screening Mammography Bilateral)
- 7110 (Radiology, Intraluminal Dilatation, Xeromammography, and Unilateral)
- 7111 (Radiology, Intraluminal Dilatation, Xeromammography, Bilateral)

Tariff codes for diagnostic and screening mammography were used; but prior to fiscal year 1995/96, no screening tariff code existed. See the table below for the mammography tariff code distribution by year.

In 1996/97–1997/98, there was a slight drop in mammography rates in North Eastman and South Eastman Regional Health Authorities. A possible explanation relates to the scheduling of invitation letters that were sent to women in the RHAs when the program started. Initial letters inviting rural women to fixed sites created a bit of a peak in the 1995/96 rates. If capacity in Winnipeg was reached, letters to regions that would be getting the mobile screening unit were delayed. This likely caused a drop in mammography rates which would have increased again once the mobile units reached the region.

Mammography Tariff Code Distribution by 2 Year Time Periods, 1984/85-2003/04

2 Year Period	7098	7099	7104	7110	7111
1984/85 - 1985/86	2.42	0.24	0.00	8.68	88.67
1986/87 - 1987/88	33.64	3.27	0.00	4.05	59.05
1988/89 - 1989/90	45.22	2.38	0.00	2.95	49.45
1990/91 - 1991/92	86.10	3.35	0.00	0.75	9.81
1992/93 - 1993/94	95.24	4.68	0.00	s	0.08
1994/95 - 1995/96	86.10	4.80	9.09	0.00	0.00
1996/97 - 1997/98	34.74	4.66	60.60	0.00	s
1998/99 - 1999/00	20.49	3.35	76.16	0.00	0.00
2000/01 - 2001/02	19.44	3.21	77.34	0.00	0.00
2002/03 - 2003/04	17.90	2.97	79.13	0.00	0.00
Overall	**40.25**	**3.60**	**50.03**	**0.42**	**5.70**

‘s’ indicates data suppressed due to small numbers

Manitoba Formulary
The Manitoba Drug Benefits and Interchangeability Formulary lists therapeutically effective drugs of proven high quality that have been approved as eligible benefits under the Pharmacare drug benefit program. It also includes a list of interchangeable drugs. It is compiled with the advice of the Manitoba Drug Standards and Therapeutics Committee, assisted by Manitoba Health staff and outside consultants. The Minister of Health gives the final approval for benefits under the Pharmacare drug benefit program.

Manitoba Health Services Insurance Plan (MHSIP)
The health insurance plan provided by Manitoba Health. The Manitoba Health Services Insurance Plan is financed from general revenues of the Province of Manitoba and with funds provided by the Government of Canada.

Mid
Mid is an aggregate geography area which includes all of the RHAs in central Manitoba; that is, Interlake, North Eastman and Parkland.

Modelling and Estimation of Rates
To estimate and compare rates of events in this report, the count of events for each indicator was modelled using a generalized linear model (GLM). GLMs are used to model non–normal data such as count data. Essentially, when data follows a non–linear distribution, a link function transforms the data so that the non–linear response can be analyzed using linear regression techniques. Non–linear distributions chosen to model data in this report were the Poisson distribution, negative binomial distribution or binomial distribution, depending on which distribution provided the best fit to the data.

Covariates included in the model varied depending on the indicator under study, but all models contained covariates describing geography (reference=Manitoba) and time (reference=first time period), as well as the geography by time interaction. For a list of all covariates included in each model, please consult the table below.

Relative risks were estimated for each region and time period. To estimate relative risks of rates rather than events, the log of the population count in each stratum was included in the model as an offset. Relative risks were calculated from the parameter estimates of the model for each region, as well as for each time period within each region. Contrasts were used to compare the relative risks between time periods within a region, or to compare the relative risks between a region and the province as a whole. The values obtained from the contrasts were actually a linear combination of the natural logarithm of the parameter estimates, so an exponential transformation was necessary to obtain estimates of relative risk of events in their original scale. Finally, the estimated rates were calculated by multiplying the Manitoba crude reference rate by the appropriate relative risk estimate.

Modelling Table of Indicators and Covariates

Indicator	Geographical Level	Method of Analysis	Covariates
Breastfeeding Initiation Rates	Aggregate Regions	Logistic Regression	• area - aggregate region • year - 1988/89-2003/04, single years • age - age of mother at birth (12-19, 20-24, 25-29, 30-34, 35+) • area x year interaction
	RHAs and Winnipeg CAs	Logistic Regression	• area - RHA/Winnipeg CA • year - 1988/89-2003/04, single years • age - age of mother at birth (12-19, 20-24, 25-29, 30-34, 35+) • area x year interaction
	RHA Districts and Winnipeg NCs	Logistic Regression	• area - RHA District/Winnipeg NC • year - 1988/89-2003/04, single years • age - age of mother at birth (12-19, 20-24, 25-29, 30-34, 35+) • area x year interaction
Casearian Section Rates	Aggregate Regions	Poission Regression	• area - aggregate region • year - 1984/85-2003/04, single years • age - age of mother at birth (12-19, 20-24, 25-29, 30-34, 35+) • area x year interaction
	RHAs and Winnipeg CAs	Negative Binomial Regression	• area - RHA/Winnipeg CA • year - 1984/85-2003/04, single years • age - age of mother at birth (12-19, 20-24, 25-29, 30-34, 35+) • area x year interaction
	RHA Districts and Winnipeg NCs	Poission Regression	• area - RHA District/Winnipeg NC • year - 1984/85-2003/04, 2 year groups • age - age of mother at birth (12-19, 20-24, 25-29, 30-34, 35+) • area x year interaction
Cervical Cancer Screening Rates	Aggregate Regions	Poission Regression	• area - aggregate region • year - 1986/87-2003/04, 3 year groups • age - 18-69, single years • area x year interaction
	RHAs and Winnipeg CAs	Negative Binomial Regression	• area - RHA/Winnipeg CA • year - 1986/87-2003/04, 3 year groups • age - 18-69, single years • area x year interaction
	RHA Districts and Winnipeg NCs	Poission Regression	• area - RHA District/Winnipeg NC • year - 1986/87-2003/04, 3 year groups • age - 18-69, single years • area x year interaction
Complete Physical Exam Rates	Aggregate Regions	Negative Binomial Regression	• area - aggregate region • year - 1984/85-2003/04, single years • age - all ages, 5 year groups • sex • area x year interaction
	RHAs and Winnipeg CAs	Negative Binomial Regression	• area - RHA/Winnipeg CA • year - 1984/85-2003/04, single years • age - all ages, 5 year groups • sex • area x year interaction
	RHA Districts and Winnipeg NCs	Negative Binomial Regression	• area - RHA District/Winnipeg NC • year - 1984/85-2003/04, single years • age - all ages, 10 year groups • sex • area x year interaction

Diabetes	Aggregate Regions	Negative Binomial Regression	• area - aggregate region • year - 1986/87-2003/04, 3 year groups • age - 20-79, 5 year groups • sex • area x year interaction
	RHAs and Winnipeg CAs	Negative Binomial Regression	• area - RHA/Winnipeg CA • year - 1986/87-2003/04, 3 year groups • age - 20-79, 5 year groups • sex • area x year interaction
	RHA Districts and Winnipeg NCs	Poission Regression	• area - RHA District/Winnipeg NC • year - 1986/87-2003/04, 3 year groups • age - 20-79, single years • sex • area x year interaction
Hysterectomy Rates	Aggregate Regions	Poission Regression	• area - aggregate region • year - 1984/85-2003/04, 2 year groups • age - 25+, 5 year groups • area x year interaction
	RHAs and Winnipeg CAs	Negative Binomial Regression	• area - RHA/Winnipeg CA • year - 1984/85-2003/04, 2 year groups • age - 25+, 5 year groups • area x year interaction
	RHA Districts and Winnipeg NCs	Poission Regression	• area - RHA District/Winnipeg NC • year - 1984/85-2003/04, 4 year groups • age - 25+, 5 year groups • area x year interaction
Immunization Rates for 2-year Olds	Aggregate Regions	Logistic Regression	• area - aggregate region • year - children born 1988/89-2001/02 (single years) • sex • area x year interaction
	RHAs and Winnipeg CAs	Logistic Regression	• area - RHA/Winnipeg CA • year - children born 1988/89-2001/02 (single years) • sex • area x year interaction
	RHA Districts and Winnipeg NCs	Logistic Regression	• area - RHA District/Winnipeg NC • year - children born 1988/89-2001/02 (2 year groups) • sex • area x year interaction
Injury Rates (Hospitalization or Death due to Injury)	Aggregate Regions	Negative Binomial Regression	• area - aggregate region • year - 1984/85-2003/04, 2 year groups • age - all ages, 5 year groups • area x year interaction • note: males and females modelled separately
	RHAs and Winnipeg CAs	Negative Binomial Regression	• area - RHA/Winnipeg CA • year - 1984/85-2003/04, 2 year groups • age - all ages, 5 year groups • area x year interaction • note: males and females modelled separately
	RHA Districts and Winnipeg NCs	Negative Binomial Regression	• area - RHA District/Winnipeg NC • year - 1984/85-2003/04, 2 year groups • age - all ages, 10 year groups • area x year interaction • note: males and females modelled separately

Lower Limb Amputation Rates with Comorbid Diabetes (diabetics as denominator)	Aggregate Regions	Negative Binomial Regression	• area - aggregate region • year - 1986/87-2003/04, 3 year groups • age - 20-79, 5 year groups (linear and quadratic age terms included) • area x year interaction
	RHAs and Winnipeg CAs	Negative Binomial Regression	• area - RHA/Winnipeg CA • year - 1986/87-2003/04, 3 year groups • age - 20-79, 5 year groups (linear and quadratic age terms included) • area x year interaction
	RHA Districts and Winnipeg NCs	Poission Regression	• area - RHA District/Winnipeg NC • year - 1986/87-2003/04, 9 year groups • age - 20-79, 5 year groups (linear and quadratic age terms included) • area x year interaction
Mammography Rates	Aggregate Regions	Negative Binomial Regression	• area - aggregate region • year - 1984/85-2003/04, 2 year groups • age - 50-69, single years • area x year interaction
	RHAs and Winnipeg CAs	Negative Binomial Regression	• area - RHA/Winnipeg CA • year - 1984/85-2003/04, 2 year groups • age - 50-69, single years • area x year interaction
	RHA Districts and Winnipeg NCs	Negative Binomial Regression	• area - RHA District/Winnipeg NC • year - 1984/85-2003/04, 2 year groups • age - 50-69, 3 year groups • area x year interaction
Polypharmacy Rates of Community Dwelling Seniors	Aggregate Regions	Negative Binomial Regression	• area - aggregate region • year - 1996/97-2003/04, single years • age - 65+, 5 year groups • area x year interaction
	RHAs and Winnipeg CAs	Negative Binomial Regression	• area - RHA/Winnipeg CA • year - 1996/97-2003/04, single years • age - 65+, 5 year groups • area x year interaction
	RHA Districts and Winnipeg NCs	Negative Binomial Regression	• area - RHA District/Winnipeg NC • year - 1996/97-2003/04, 2 year groups • age - 65+, 5 year groups • area x year interaction
Premature Mortality Rates	Aggregate Regions	Negative Binomial Regression	• area - aggregate region • year - 1984-2003, 4 year groups • age - 0-74, single years • area x year interaction • note: males and females modelled separately
	RHAs and Winnipeg CAs	Poission Regression	• area - RHA/Winnipeg CA • year - 1984-2003, 4 year groups • age - 0-74, single years • area x year interaction • note: males and females modelled separately
	RHA Districts and Winnipeg NCs	Poission Regression	• area - RHA District/Winnipeg NC • year - 1984-2003, 4 year groups • age - 0-74, 5 year groups • area x year interaction • note: males and females modelled separately

Negative Binomial Regression
Regression analyses for count data that follows a negative binomial distribution—which occurs when an event is relatively rare, but is highly variable over the entire population.

North
North is an aggregate geography area which includes all of the northern Manitoba RHAs—that is, Nor–Man, Burntwood and Churchill.

Pap Tests
Please see Cervical Cancer Screening

Physician Claims
These are the physician claims that are submitted to the provincial government by individual physicians for services they provide. Fee–for–service physicians receive payment based on these claims, while those submitted by salaried physicians are only for administrative purposes (sometimes referred to as “shadow billing”). The physician claims data file is part of the Population Health Research Data Repository.

Poisson Regression
Regression analyses for count data that follow a Poisson distribution, which has the assumption that the mean of an outcome is equal to its variance. Poisson regression is the best choice for modelling very rare events, such as death.

Polypharmacy
An individual taking multiple drugs in a measured time period meets the criteria for polypharmacy.

This study measures polypharmacy as the proportion of community–dwelling Manitoba residents age 65 or older taking six or more different drugs in a 121–day period in fiscal years 1996/97–2003/04. The number of drugs in each third of the year (121 days) is averaged over the fiscal year for each person to obtain an average annual number of drugs per person. Individuals had to be living in Manitoba for the entire 121–day period to be included in analyses for that time period. Individuals residing in a nursing home or personal care home at any time during a 121–day period are excluded from analyses for that time period. Individuals with inpatient hospitalizations totaling more than 60 days in hospital in a 121–day period are also excluded from analyses for that time period. These exclusions are necessary because drugs administered in hospitals and in some nursing homes and personal care homes are not entered into the province’s DPIN database, and thus there is no record of drug use.

The count of different drugs is determined by classifying each drug into its appropriate Anatomical Therapeutic Chemical (ATC) code and counting the number of different drugs at the 4th level of ATC, or the number of drugs with a different chemical, therapeutic or pharmacological subgroup. Over–the–counter drugs, such as acetaminophen, are excluded from the count of different drugs.

For a drug to be included in the count of different drugs over 121 days, an individual had to have at least 2 prescriptions in the 121–day period with a greater than 30 day supply for each prescription. This would exclude incidental prescriptions that are not part of an individual's regular therapeutic use, such as a single 10 day prescription for antibiotics.

Age is calculated as of the beginning of each 121–day period. Region of residence is assigned based on the first record in each time period.

Note that preliminary analyses examined excluding individuals in hospital for 15, 30, 45 and 60 days in a 121–day period, with minimal change in polypharmacy rates. Analyses using 90–day periods instead of 121–day periods were also carried out, resulting in lower polypharmacy rates, but identical increasing trends.

There is a possibility that there is missing data for this indicator because of an inability to pick up nurse practitioner, nursing station and salaried physician work. Twenty percent of DPIN data is missing for residents of the north.

Population Health Research Data Repository (PHRDP)
A comprehensive database developed to describe and explain patterns of health care and profiles of health and illness. It is located at the Manitoba Centre for Health Policy (MCHP). The database contains anonymized encounter–based records of individual's interactions with the health care system, including physicians, hospitals, nursing homes, home care, and pharmaceutical prescriptions. The Repository also includes data from other agencies, for example, Statistics Canada data at the level of enumeration area. Subsets of the data are used in specific approved research projects.

Population Registry
Also know as the Registry, the population registry which contains de–identified data on the insured population organized by family registration numbers. The registry contains information on dates of coverage, marital status and place of residence (by postal code and municipal code only; no addresses are contained in the file). Annual snapshots of this data have been received since 1970; marital status has been reconstructed from the family information. A massive programming effort maintained over many years has joined these snapshot files together such that individual histories can be constructed over the entire period of the data base. This results in the creation of the longitudinal population registry; many checks have been done on this registry. Software has been developed to facilitate longitudinal follow–up or mobility, migration, and mortality.

Premature Mortality Rate (PMR)
This is the age– and sex–adjusted rate of death among area residents 0–74 years old, per thousand 0–74 year olds in that area. Premature mortality rates are often used as an overall indicator of population health and are correlated with other commonly used measures such as disease prevalence, self–rated health and socioeconomic factors. It is often considered to be the best single indicator of population health status capturing the need for health services.

In this report, PMR is calculated for two purposes:

1) A ten year premature mortality rate is calculated over 1991–2000 calendar years for the purpose of ordering the geographical areas in all figures. RHAs are ordered from lowest PMR to highest PMR, or from best overall health status to poorest overall health status, on each graph. In figures showing RHA Districts, the ordering of RHAs is preserved, and the districts within the RHAs are also ordered from lowest to highest PMR. The same is true for the Winnipeg Regional Health Authority's 12 Community Areas and 25 Neighbourhood Clusters.
2) Four year premature mortality rates are calculated over 20 calendar years, 1984–2003, to determine trends in PMR in Manitoba over time.

Note that "wards of the state" were excluded from all PMR analyses, which is contrary to some previous MCHP reports. These individuals (who can be of any age but many are likely to be elderly without dependants) cannot look after their own affairs, and thus are the responsibility of The Office of the Public Trustee. This office has total responsibility for such persons, and as such, their address on record at the Manitoba Health Registry is the Public Trustee Office location from which their case is administered (either in Winnipeg or Brandon). As a group, these individuals tend to be of poor health, and have a higher than average PMR. Including these individuals in the PMR analyses would bias some of the smaller geographical regions in Winnipeg and Brandon to have a much higher PMR than the rest of the RHA since the "residence" of the many dependent persons is listed as the Office (but many would live in other districts of the cities).

For reference, age– and sex–adjusted rates of premature death over 1991–2000, including and excluding residents registered with the Public Trustee Office, are reported below for Winnipeg, Brandon and Manitoba.

Region	PMR Excluding Public Trustees (per 1000 residents age 0-74)	PMR Including Public Trustees (per 1000 residents age 0-74)
Winnipeg	3.45	3.59
Brandon	3.25	3.33
Manitoba	3.50	3.58

Prescription Drug Database
Please see Drug Programs Information Network (DPIN).

Prevalence
The term prevalence refers to the proportion of the population that 'has' a given disease at a given time. The administrative data used for this study do not directly indicate who 'has' a disease, but rather who received health services 'treatment' for that disease; that is, they received some combination of physician visits, hospitalizations, or prescription drugs.

Prevalence, Period
Period prevalence is the measure of a disease or condition in a population during a given period of time. It is a combination of point prevalence and incidence.

Prevalence, Point
Point Prevalence is the measure of a disease or condition in a population at a given point in time.

Quintiles
Quintiles of a distribution were created by dividing the range of values (from the minimum to the maximum) into five equal parts. Using this method of creating quintiles means that there will not necessarily be 20% of the observations within any given quintile.

Region of Residence
Virtually all analyses in this report allocate health service use to the area where the patient who received the service lived, regardless of where the service was provided. For example, if a resident of Interlake RHA travels to Winnipeg for a physician visit, that visit contributes to the visit rate for Interlake residents. With claims–based analyses, more than one record per person is possible. The residence information on the first–occurring record for a given year was generally used.

Regional Health Authority (RHA)
In 1997, Manitoba established 11 RHAs as governance structures for northern and rural health services: South Eastman, Central, Brandon, Assiniboine, Parkland, North Eastman, Interlake, Burntwood, Norman, Churchill and Winnipeg. Each RHA has the responsibility for providing for the delivery and administration of health services in a specified geographic area.

Robson Index
The Robson Index is comprised of the different categories of births by parity, category, course and gestation. This is part of an effort to use a medical audit cycle to diagnose dysfunctional labor early enough to allow for the implementation of labor management strategies, thus decreasing the necessity for cesarean section births (Robson et al, 1995). (See also 'Caesarian section')

The categories of birth are: (i) all singleton cephalic term; (ii) all breeches and abnormal lies; (iii) premature (<37 weeks): singleton cephalic only; (iv) all multiple births, (v) nulliparous women with singleton, cephalic term pregnancy, spontaneous labour; (vi) nulliparous women with singleton, cephalic term pregnancy, induced; (vii) nulliparous women with breech presentation, abnormal lie, multiple pregnancy, or preterm delivery; (viii) multiparous women with singleton, cephalic term pregnancy, without scarred uterus; (ix) multiparous women with singleton, cephalic term pregnancy, with scarred uterus; and (x) multiparous women with breech presentation, abnormal lie, multiple pregnancy, or preterm delivery.

Singleton: not a multiple birth; single or multiple births (twins, triplets, etc.) are defined through diagnosis codes on the mother's hospital record.

Cephalic: refers to a "head–down" presentation at birth; this is defined through a presentation a birth variable (nbprsntn) on the newborn's hospital record; the following presentations were classified as cephalic: Occiput Anterior, Occiput Posterior and Occiput Transverse.

Breech: refers to a "buttocks–first" presentation at birth; also defined through the presentation variable on the newborn's hospital record.

Abnormal lies: basically any presentation that wasn't cephalic or breech (as above) was considered abnormal.

Nulliparous: a woman who has never previously given birth. Note that a woman could have had more than one pregnancy and would still be considered nulliparous if she did not give birth to the baby, i.e., miscarriage, abortion. This is defined through the parity variable (obpara) on the mother's hospital record.

Multiparous: a woman who has previously given birth. Also defined through the parity variable on the mother's hospital record.

Spontaneous labour: not induced.

Scarred uterus: a woman has a scarred uterus if she has had a c–section.

South

South is an aggregate geography area which includes all of the southern rural Manitoba RHAs and excludes the two urban centres of Winnipeg and Brandon. The RHAs included are: South Eastman, Central and Assiniboine.

Specialist Visits

This is the average number of ambulatory visits to specialist physicians per resident in a fiscal year. Specialist physicians include: all medical specialists, paediatricians, psychiatrists, obstetricians and gynaecologists, and surgeons.

Individuals that travelled out side of their home RHA were identified using the following process:

1. Identify the 'home' location of the physician based on the billing address for the physician.
2. Confirm the physician is practicing in their 'home' location by checking if there are any patients getting a service that lived in the same region. If all of the patients seen are from a different location then the physician is considered to be working outside of their home region.
3. Identify all of the telehealth records either by linkage to the telehealth data or by specific telehealth tariff codes ('8480', '8479', '8478', '8481', '8482').

4. Visits to specialists were grouped in the following order:
   A. Telehealth Service (0.10%)
   B. Specialist and Patient in home RHA (22.20%)
   C. Specialist travelled to another RHA (4.39%)
   D. Remaining patients travelled to see the specialist (73.3%).

Number in parentheses are the percent of visits for individuals living in a non–Winnipeg RHA that fit into each group.

Standard Error
In statistics, the standard error of a measurement, value or quantity is the standard deviation of the process by which it was generated, after adjusting for sample size. In other words the standard error is the standard deviation of the sample mean.

Statistical Testing
Statistical testing was performed via contrasts in the model to determine whether regional rates were statistically significantly different from the Manitoba rate for a given time period, and whether rates over time were statistically significantly different within an area. For RHA and Winnipeg CA–level analyses, contrasts with significance level 0.01 were used; for RHA District and Winnipeg NC–level analyses, contrasts with significance level 0.005 were used.

Suicide or Suicide Attempts—Prevalence
Suicide is the act of intentionally killing oneself. Suicide attempt, also known as "self–inflicted injury" or para–suicide, does not result in death. The two–year prevalence of suicide or suicide attempts is the percentage of the population age 10 or older who attempted or completed suicide at least once in a two–year period in the fiscal years 1984/85–2003/04. The most recent event in the two year period (suicide or suicide attempt) is counted, with region of residence assigned and age calculated at the time of the event. The denominator is the December 31 population age 10 or older in the second year of the two–year period.

Suicidal individuals were identified by the presence of any of ICD–9 or ICD–10 codes in Vital Statistics records, physician billing claims, or hospital discharge abstracts as follows:
Suicide was defined as the presence of any cause of death in Vital Statistics data with a code of:

- ICD–9 CM codes: E850–E854, E858, E862, E868 (accidental poisoning), E950–E952 (self–inflicted poisoning), E953 (self–inflicted injury by hanging), E954 (drowning), E955 (self–inflicted injury by firearms), E956 (self–inflicted injury by cutting), E957 (self–inflicted injury by jumping from high places), E958 (other/unspecified self–inflicted injury), E959 (late effects of self–inflicted injury); or
- ICD–10 codes: X40– X42, X46, X47 (accidental poisoning by analgesics, antipyretics, anti–rheumatics, sedative–hypnotic, narcotics), X46 (solvents and vapours), X47 (other gasses and vapours), X60–X69 (intentional self poisoning), X70 (suicide hanging), X72–X74 (suicide by gunshot), X78 (suicide by cutting), X71, X75–X77, X79–X84 (other suicide).

Suicide attempts were defined as the presence of any of hospital or physician claims coding a suicide attempt using the following definitions:

1. A hospitalization with a diagnosis code of E950–E959 for suicide and self–inflicted injury.
2. A hospitalization with a diagnosis code for accidental poisoning only if there is a physician visit with a diagnosis code for accidental poisoning and a psychiatric tariff code either during the hospital stay or within 30 days post–discharge.

Accidental poisoning ICD–9 CM diagnosis codes are as follows:

- 965 poisoning by analgesics
- 967 poisoning by sedatives and hypnotics
- 969 poisoning by psychotropic agents
- 977.9 poisoning by unspecified drug or medicinal substance
- 986 toxic effects of carbon monoxide
- E850 accidental poisoning by analgesics, antipyretics, antirheumatics
- E851 accidental poisoning by barbiturates
- E852 accidental poisoning by other sedatives and hypnotics
- E853 accidental poisoning by tranquilizers
- E854 accidental poisoning by other psychotropic agents
- E858 a accidental poisoning by unspecified drug
- E862 accidental poisoning by petroleum products and vapours
- E868 accidental poisoning by other utility gas and carbon monoxide

Psychiatric tariff codes are as follows:
From the psychiatric schedule:

- 8444 Psychotherapy—group of two to four patients
- 8446 Psychotherapy—group of five or more patients
- 8472 Child and Youth Management Conference
- 8475 Psychiatry—Patient Care Family Conference
- 8476 Psychiatric Social Interview
- 8503 Complete history and psychiatric examination—adult
- 8504 Complete history and psychiatric examination—child
- 8553 Consultation—adult
- 8554 Consultation—child
- 8581 Psychotherapy—individual
- 8584 Psychiatric care—individual
- 8588 Electroshock therapy
- 8596 Consultation—Unassigned patient—child

From the general schedule:

- 8580 Psychotherapy—individual
- 8587 Electroshock therapy
- 8589 Psychotherapy—Group

Suppression
Please see Data Suppression.

Teenage Pregnancy
Teenage pregnancy includes live births, stillbirths, abortions and ectopic pregnancies of women under the age of twenty.

In this report, rates of teenage pregnancy are calculated for females age 15–19 over 1984/85–2003/04 fiscal years. Age is calculated as of date of admission to hospital in numerator and December 31 of each fiscal year in the denominator. Region of residence is assigned based on the first record in the study period. Teenage pregnancy is defined as one hospitalization with one of diagnosis codes: V27 (live birth), 632 (missed abortion), 633 (ectopic pregnancy), 634 (spontaneous abortion), 635 (legally induced abortion), 636 (illegally induced abortion), 637 (unspecified abortion) or 656.4 (intrauterine death), or with one of procedure codes: 66.62 (salpingectomy with removal of tubal pregnancy), 69.01 (dilation and curettage for termination of pregnancy), 69.51 (aspiration curettage of uterus for termination of pregnancy), 74.3 (removal of extratubal ectopic pregnancy), 74.91 (hysterotomy to terminate pregnancy) or 75.0 (intra–amniotic injection for abortion). Note that abortions performed in private clinics are not included in the count of teen pregnancies. The rate of pregnancies in teenagers age 10–14 was not analyzed due to very the small number of events. There is a possibility that there is missing data for this indicator because of an inability to pick up nurse practitioner, nursing station and salaried physician work.

Telehealth
Telehealth is the process of using information and communications technologies (ICTs) to deliver health information, services and expertise over short and long distances. Telehealth applications are important tools for enhancing health care delivery, particularly in rural and remote areas where health care resources and expertise are often scare or non–existent. Examples of Telehealth: teleconsultation such as telemedicine, teleimaging, telepsychiatry. (Source: http://www.hc–sc.gc.ca/hcs–sss/ehealth–esante/tele/index_e.html)

MBTelehealth is a network that enables residents of Manitoba and surrounding areas to receive comprehensive health care services while overcoming barriers of distance and time through the use of technology. MBTelehealth also supports health education delivery and administrative support to rural health authorities. (Source: http://www.mbtelehealth.ca/index.php).
The MBTelehealth data base used in this project (2003–2005) is a booking system for equipment, physicians (providers), and rooms; it did not capture individual patient information in electronic format. Although patient information was collected on the booking form it was not kept after the conference and the forms were shredded. (MBTelehealth is moving to a new system that maintains some patient information for 2008).

There were three tables used in this project for identification of services.

1. Sites—This is the location of the MBTelehealth centres (city/town/room number). The site name and site ID were the only useful fields for this work. There was other information

about the equipment but more recent entries are not completed. A combination of site name, address, and city allowed identification of RHA.

2. Conference—This data included booking date and if the conference had been cancelled. Conferences are booked into the future so the data had to be cut off as of the date the data was received (July 2006) since cancel information would not be available. The most useful field was a free text field that identified the conference type but also contained information on the booking physician, age group of service (peds/adult), and specialty of service. Unfortunately this was a free text field so not all of the information may appear and codes/names used have multiple spelling. There were also multiple specialists with the same name that could appear in the data.
3. Site/Conference information—This table allowed the identification each of the different sites that participated in the conference. The number of sites in a conference ranges from two to eight.

MBTelehealth bookings for clinical services were matched to the physician billing data using a probabilistic link to the physician billing claims using a combination of variables derived from both sources.

Vital Statistics
A Manitoba government department responsible for keeping records and registries of all births, deaths, marriages and stillbirths that takes place in Manitoba.

Winnipeg Average Health
Winnipeg Average Health is an aggregate geography area of Winnipeg Neighbourhood Clusters that have a premature mortality rate statistically similar to the premature mortality rate of Manitoba over calendar years 1991–2000. The Winnipeg Neighbourhood Clusters included are: Downtown West, River East South, River Heights East, Seven Oaks North, Seven Oaks East, Seven Oaks West, St. Vital North and Transcona.

Winnipeg Least Healthy
Winnipeg Least Healthy is an aggregate geography area of Winnipeg Neighbourhood Clusters that have a premature mortality rate statistically higher than the premature mortality rate of Manitoba over calendar years 1991–2000. The Winnipeg Neighbourhood Clusters included are: Downtown East, Inkster East, Point Douglas North, Point Douglas South, St. Boniface West and St. James–Assiniboia East.

Winnipeg Most Healthy
Winnipeg Most Healthy is an aggregate geography area of Winnipeg Neighbourhood Clusters that have a premature mortality rate statistically lower than the premature mortality rate of Manitoba over calendar years 1991–2000. The Winnipeg Neighbourhood Clusters included are: Assiniboine South, Fort Garry South, Fort Garry North, Inkster West, River East North, River East East, River East West, River Heights West, St. Boniface East, St. James–Assiniboia West and St. Vital South.

APPENDIX 2: MANITOBA REGIONAL HEALTH AUTHORITY DISTRICTS & WINNIPEG COMMUNITY AREAS AND NEIGHBOURHOOD CLUSTERS

Eleven Regional Health Authorities (RHAs) have been defined within Manitoba. The RHAs have the responsibility for providing for the delivery and administration of health services in specified geographic areas. The specific area definitions and responsibilities are outlined in The Regional Health Authorities Act (L.M. 1996 c. 53—Chap. R34).

This appendix provides an overview of the RHA districts, including a discussion of the consultation and development of the districts and a discussion of limitations and district assignment. For each RHA, the districts are listed along with the assigned municipal areas and, where necessary, postal codes.

Andrea Zajac (Manitoba Health, Regional Support Services) provided initial district definitions June 5, 2000. The initial districts were created in consultation between Regional Support Services and each RHA during 1999/2000. Further clarifications of districts, especially for RHAs with unorganized territories were made during the summer and fall of 2001. Final discussions happened as part of *The Need to Know* Team meeting September 18, 2001. There have been two subsequent changes made to the districts after the joining of South Westman and Marquette into Assiniboine as of July 2002, and this report reflects the districts subsequent to the amalgamation. In the spring of 2004, updates were made to the central districts to better reflect delivery of services and programs within the region. On September 9, 2005, Nancy McPherson from Brandon RHA provided information on dividing Brandon city into 6 public health areas to better represent planning needs in the RHA. The Brandon RHA provided a list of postal codes that belong in each area.

The use of these district definitions prior to 1996/97 fiscal may not be valid or should be used with some caution. Users should also be aware of changes to postal codes over time–additions, retirement and movement. The definitions of districts based on postal codes will need to be confirmed each year.

MCHP assigns districts for the regional health authorities using the following process:

1. Assign districts initially based on municipal code as provided by Manitoba Health. First Nations (A-code municipal areas) are assigned based on postal/municipal code combination.
2. Within some areas, assign districts based on six–digit postal code. It is important to understand that postal codes alone can only be used where there is a clear distinction between communities and where it is unlikely that individuals will use postal boxes from other communities or live on rural routes that are outside of the district.

Because of the potential cross over between districts in rural and northern areas (see point 2 above), only communities in the unorganized territories sections of Burntwood, Nor–Man and North Eastman have been assigned by postal code. Districts within Brandon and Winnipeg are also defined based on postal code since the error associated with rural routes and postal centres is minimized because of the population size. For purposes of the present report, Winnipeg is subdivided into twelve community areas and 25 neighbourhood clusters.

Further Notes:

1. The assignment of communities that fall within the unorganized territories of Burntwood are assigned by postal code. Some of these are assigned back to municipal code defined areas.
2. Assignment of Brandon districts (municipal area 026) is based on six–digit postal code. The division follows the provincial electoral boundary—north along 18th Street to the Assiniboine River, east along the Assiniboine River to 1st Street, north along 1st Street to boundary of the City of Brandon.
3. Assignment of unorganized territories and First Nations communities is based on six–digit postal code in North Eastman.
4. In Nor–Man, Cranberry Portage is divided from Kelsey by postal code.

Definitions of Districts within each RHA:

Assiniboine RHA

North 1
RM of Archie
RM of Birtle
Town of Birtle
RM of Boulton
RM of Ellice
Village of St. Lazare
RM of Hamiota
Village of Hamiota
RM of Miniota
RM of Rossburn
Town of Rossburn
RM of Russell
Town of Russell
Village of Binscarth
RM of Shellmouth
RM of Shoal Lake
Town of Shoal Lake
RM of Silver Creek
Birdtail Sioux First Nation
Gamblers First Nation
Waywayseecappo First Nation

North 2
RM of Blanshard
RM of Clanwilliam
Town of Erickson
RM of Harrison
RM of Minto
Town of Minnedosa
RM of Odanah
RM of Saskatchewan
Town of Rapid City
RM of Strathclair
RM of Park - Marquette
Keeseekoowenin First Nation
Rolling River First Nation

East 1
RM of Glenella
RM of Langford
Town of Neepawa
RM of Lansdowne
RM of North Cypress
Town of Carberry
RM of Rosedale

East 2
RM of Argyle
RM of Oakland
Village of Wawanesa
RM of Riverside
RM of Roblin
Village of Cartwright
RM of South Cypress
Village of Glenboro
RM of South Norfolk
Village of Treherne
RM of Strathcona
RM of Turtle Mountain
Town of Killarney
RM of Victoria

West 1
RM of Cameron
Town of Hartney
RM of Glenwood
Town of Souris
RM of Morton
Town of Boissevain
RM of Sifton
Town of Oak Lake
RM of Whitewater
RM of Winchester
Deloraine

West 2
RM of Albert
RM of Arthur
Town of Melita
RM of Brenda
Village of Waskada
RM of Daly
Town of Rivers
RM of Edward
RM of Pipestone
RM of Wallace
Town of Virden
Village of Elkhorn
RM of Woodworth
Oak Lake Sioux First Nation
Sioux Valley First Nation

Brandon RHA
Brandon Rural
Whitehead RM
Cornwallis RM
Elton RM
***see end of this document for more information about Brandon's city districts*

Burntwood RHA
Thompson
Thompson City

Lynn Lake, Leaf Rapids, South Indian Lake
Lynn Lake LGD
Leaf Rapids Town

Gillam, Fox Lake
Gillam LGD
Fox Lake First Nation

Nelson House
Nelson House First Nation

Norway House
Norway House Cree Nation

Cross Lake
Cross Lake First Nation

Island Lake
Garden Hill First Nation
Red Sucker Lake First Nation
St. Theresa Point First Nation
Wasagamack First Nation

Thicket Portage, Pikwitonei, Wabowden
Thicket Portage First Nation
Pikwitonei First Nation
Wabowden First Nation

Tadoule Lake, Brochet, Lac Brochet
Sayisi Dene (Tadoule Lake) First Nation
Barren Lands (Brochet) First Nation
Northlands (Lac Brochet) First Nation

Oxford House, Gods Lake
Oxford House First Nation
Gods Lake First Nation
Gods River First Nation

Shamattawa, York Factory, Split Lake, War Lake
Shamattawa First Nation
York Factory First Nation
Split Lake Cree Nation
War Lake First Nation

Central RHA
Seven Regions
Lakeview RM
Westbourne RM
Gladstone Town
Alonsa RM
Sandy Bay First Nation

Cartier/SFX
Cartier RM
Headingley RM
St. Francois Xavier RM

Portage
Macgregor Village
North Norfolk RM
Portage RM
Portage City
Dakota Tipi First Nation
Dakota Plains First Nation
Long Plain First Nation

Carman
Carman Town
Dufferin RM
Grey RM
Roland RM
St. Claude Village
Thompson RM

Swan Lake
Lorne RM
Notre Dame de Lourdes Village
Somerset Village
Swan Lake First Nation

Morden/Winkler
Stanley RM
Morden Town
Winkler City

Louise/Pembina
Crystal City Village
Louise RM
Manitou Village
Pembina RM
Pilot Mound Village

Altona
Altona Town
Gretna Village
Plum Coulee Village
Rhineland RM

Red River
Emerson Town
MacDonald RM
Montcalm RM
Morris RM
Morris Town
Roseau River First Nation

Churchill RHA
Churchill
Churchill

Interlake RHA
Northeast
Bifrost RM
Riverton Village
Gimli RM
Gimli Town
Dunnottar Village
Winnipeg Beach Town
Fisher LGD
Arborg Village
Unorganized Territories
Peguis First Nation
Fisher River
Jackhead First Nation

Northwest
Coldwell RM
Eriksdale RM
St. Laurent RM
Siglunes RM
Grahamdale LGD
Lake Manitoba First Nation
Fairford First Nation
Little Saskatchewan First Nation
Lake St. Martin First Nation
Dauphin River First Nation

Southeast
St. Andrews RM
Selkirk Town
St. Clements RM
Brokenhead Ojibway Nation

Southwest
Rockwood RM
Stonewall Town
Teulon Village
Rosser RM
Woodlands RM
Armstrong LGD

Nor-Man RHA
Flin Flon, Snow Lake, Cranberry Portage
Snow Lake Town
Flin Flon City
Cranberry Portage

The Pas, OCN, Kelsey
The Pas Town
Kelsey RM (Consol LGD)
Opaskwayak Cree Nation

Nor-Man Other
Unorganized Territories
Cormorant
Grand Rapids LGD
Sherridon
Grand Rapids First nation
Mosakahiken Cree Nation
Chemahawin First Nation
Mathias Colomb Cree Nation

North Eastman RHA
Bluewater
Alexander LGD (includes Belair)
Bissett
Black River
Manigotagan
Pine Falls Town
Powerview Village
Traverse Bay
Victoria Beach RM
Wanipagow
Sagkeeng (Fort Alexander) First Nation
Little Black River First Nation
Hollow Water First Nation

Brokenhead
Brokenhead
Beausejour Town
Garson Village

Iron Rose
Rennie
Reynolds RM (includes Hadashville)
Seven Sisters Falls
Whitemouth RM
Whiteshell

Springfield
Springfield RM

Northern Remote
Princes Harbour
Loon Straits
Pauingassi
Berens River First Nation
Bloodvein First Nation
Little Grand Rapids First Nation
Poplar River First Nation
Unorganized Territories

Winnipeg River
Lac Du Bonnet RM
Lac Du Bonnet Village
Pinawa LGD
Pointe du Bois
Seddon's Corner

Parkland RHA
Central District
Dauphin RM
Dauphin Town
Ethelbert RM
Ethelbert Town
Gilbert Plains RM
Gilbert Plains Village
Mossey River RM
Winnipegosis Village

East District
Lawrence RM
McCreary RM
Ochre River RM
Ste. Rose RM
Ste. Rose Du Lac Village
McCreary Village
Alonsa LGD
Waterhen First Nation
Ochi-Chak-Ko-Sipi (Crane River) First Nation
Ebb & Flow First nation

North District
Minitonas RM
Minitonas Village
Swan River RM
Swan River Town
Benito Village
Bowsman Village
Mountain LGD North
Mountain LGD South
Unorganized Territories
Sapotaweyak Cree Nation
Pine Creek First Nation
Wuskwi Sipihk (Indian Birch) First Nation

West District
Grandview RM
Grandview Town
Hillsburg RM
Shell River RM
Roblin Town
Park LGD North
Tootinaowaziibeeng Treaty Reserve (Valley River) First Nation

South Eastman RHA
Central
Hanover RM
Steinbach Town

Northern
La Broquerie RM
Ste. Anne RM
Tache RM
Ste. Anne Village

Southern
Franklin RM
Piney LGD
Stuartburn LGD
Unorganized Territories
Buffalo Point First Nation

Western
De Salaberry RM
St. Pierrie Jolys Village
Ritchot RM
Niverville Village

***Brandon City Districts*

The areas included are only those found within the municipality of Brandon. The public health areas, in some cases, extend into the surrounding municipalities; but those areas are not included because of difficulties separating location of residence based on postal code alone.

Southwest—Bounded by Victoria, 34th St, Richmond Avenue, 18th St. includes: Christian Heritage, Riverheights, Waverly Alexander.

West—Bounded by on the north by Pacific Avenue tracks 18th St., Richmond Avenue, 34th St, Victoria Avenue includes: JR Reid, Vincent Massey, Valleyview, Linden Lanes, BU, Earl Oxford.

Southeast—Bounded by Richmond Avenue, 18th St. includes: Meadows, Neelin, O'Kelly, Douglas, Spring Valley, Francophone School, Campbell's trailer court, RR#4.

Central—Bounded by Pacific Avenue tracks, 1st St., Richmond Avenue, 18th St. includes: George Fitton, St. Augustines, New Era, Betty Gibson, Harrison.

North End—Bounded by Pacific Avenue tracks, 1st St. includes: Kirkcaldy, Crocus.

East - Bounded by Richmond Avenue 1st St., Highway 1. Includes Green Acres, King George, Riverview, and ACC.

Definitions of Winnipeg Neighbourhood Clusters within each Community Area:

St. James - Assiniboia West
Assiniboia Downs Buchanan
Crestview
Glendale
Heritage Park Kirkfield
Saskatchewan North
Sturgeon Creek
Westwood

St. James - Assiniboia East
Airport
Birchwood
Booth
Bruce Park
Deer Lodge
Jameswood
Kensington
King Edward
Murray Industrial Park
Omand's Creek Industrial
Silver Heights
St. James Industrial
Woodhaven

Assiniboine South
Assiniboine Park
Betsworth
Edgeland
Elmhurst
Eric Coy
Marlton
Old Tuxedo
Ridgedale
Ridgewood South
River West Park
Roblin Park
South Tuxedo
Southboine
Tuxedo
Tuxedo Industrial
Varsity View
Vialoux
West Perimeter South
Westdale
Wilkes South

Fort Garry North
Beaumont
Brockville
Buffalo
Chevrier
Crescent Park
Linden Ridge
Linden Woods
Maybank
Parker
Pembina Strip
Point Road
West Fort Garry Industrial
Whyte Ridge
Wildwood

Fort Garry South
Agassiz
Cloutier Drive
Fairfield Park
Fort Richmond
La Barriere
Montcalm
Parc La Salle
Perrault
Richmond Lakes
Richmond West
St. Norbert
Trappistes
Turnbull Drive
University
Waverley Heights
Waverley West

St. Vital North
Alpine Place
Elm Park
Glenwood
Kingston Crescent
Lavalee
Norberry
Pulberry
St. George
Varennes
Victoria Crescent
Worthington

St. Vital South
Dakota Crossing
Maple Grove Park
Meadowood
Minnetonka
Normand Park
River Park South
St. Vital Centre
St. Vital Perimeter South
Vista

St. Boniface West
Central St. Boniface
North St. Boniface
Norwood East
Norwood West

St. Boniface East
Archwood
Dufresne
Dugald
Holden
Island Lakes
Maginot
Mission Industrial
Niakwa Park
Niakwa Place
Royalwood
South St. Boniface
Southdale
Southland Park
St. Boniface Industrial Park
Stock Yards
Symington Yards
The Mint
Tissot
Windsor Park

Transcona
Canterbury Park
Griffin
Kern Park
Kildare-Redonda
Meadows
Melrose
Mission Gardens
Peguis
Radisson
Regent
Transcona North
Transcona South
Transcona Yards
Victoria West

River East South
Chalmers
East Elmwood
Glenelm (formerly West Elmwood)
Talbot-Grey
Tyne-Tees

River East West
Kildonan Drive
Munroe West
River East
Rossmere-A
Rossmere-B
Valhalla

River East East
Eaglemere
Grassie
Kil-Cona Park
Kildonan Crossing
Mcleod Industrial
Munroe East
North Transcona Yards
Springfield North
Springfield South
Valley Gardens

River East North
RM of East St. Paul

Seven Oaks West
Amber Trails
Mandalay West
Rosser-Old Kildonan
The Maples

Seven Oaks East
Garden City
Jefferson
Kildonan Park
Leila North
Leila-Mcphillips Triangle
Margaret Park
Riverbend
Rivergrove
Seven Oaks
Templeton-Sinclair
West Kildonan Industrial

Seven Oaks North
RM of West St. Paul

Inkster West
Inkster Gardens
North Inkster Industrial
Oak Point Highway
Tyndall Park

Inkster East
Brooklands
Burrows-Keewatin
Inkster Industrial Park
Pacific Industrial
Shaughnessy Park
Weston
Weston Shops

Point Douglas North
Burrows Central
Inkster-Faraday
Luxton
Mynarski
Robertson
St. John's
St. John's Park

Point Douglas South
Dufferin
Dufferin Industrial
Lord Selkirk Park
North Point Douglas
South Point Douglas
William Whyte

Downtown West
Daniel Mcintyre
Minto
Polo Park
Sargent Park
St. Matthews
West Wolseley
Wolseley

Downtown East
Armstrong Point
Broadway-Assiniboine
Centennial
Central Park
China Town
Civic Centre
Colony
Exchange District
Legislature
Logan-C.P.R.
Portage & Main
Portage-Ellice
South Portage
Spence
The Forks
West Alexander
West Broadway

River Heights West
Central River Heights
Crescentwood
Earl Grey
Ebby-Wentworth
Grant Park
J. B. Mitchell
Mathers
North River Heights
Rockwood
Sir John Franklin
South River Heights
Wellington Crescent

River Heights East
Neighbourhood
Lord Roberts
McMillan
River-Osborne
Riverview
Roslyn

APPENDIX THREE - CRUDE RATE TABLES

Appendix Table 3.1: Premature Mortality Rate for Females

Region	Premature Mortality Rate for Females			
	Number Observed per Year	Crude Rate per 1000	Number Observed per Year	Crude Rate per 1000
	1988-1995		1996-2003	
South Eastman	45.3	1.96	48.5	1.93
Central	112.6	2.61	101.6	2.29
Assiniboine	109.9	3.33	88.4	2.81
Brandon	61.0	2.69	51.9	2.30
Winnipeg	891.3	2.89	830.0	2.72
Parkland	73.3	3.59	65.6	3.38
Interlake	108.9	3.27	97.0	2.83
North Eastman	48.5	2.91	52.0	2.88
Churchill	1.5	2.63	1.3	2.57
Nor-Man	35.5	2.94	37.0	3.11
Burntwood	52.5	2.57	53.0	2.45
South	267.8	2.70	238.5	2.36
Mid	230.6	3.28	214.6	2.99
North	89.5	2.71	91.3	2.68
Manitoba	1,540.1	2.88	1,426.3	2.67

blank cells = suppressed

Source: Manitoba Centre for Health Policy, 2008

Region	Premature Mortality Rate for Females			
	Number Observed per Year	Crude Rate per 1000	Number Observed per Year	Crude Rate per 1000
	1988-1995		1996-2003	
Fort Garry	54.1	1.96	53.6	1.79
Assiniboine South	34.8	1.97	39.5	2.25
Transcona	38.9	2.40	39.3	2.46
River Heights	87.4	3.09	74.8	2.82
St. Boniface	62.3	2.91	53.5	2.42
St. Vital	69.9	2.43	67.8	2.32
Seven Oaks	70.6	2.72	76.8	2.81
River East	120.8	2.77	113.9	2.62
St. James - Assiniboia	93.9	3.12	92.6	3.30
Inkster	37.1	2.48	35.3	2.36
Point Douglas	91.9	4.56	70.3	3.83
Downtown	129.8	3.80	112.9	3.49
Wpg Most Healthy	338.1	2.22	340.4	2.19
Wpg Avg Health	276.4	2.95	263.6	2.87
Wpg Least Healthy	276.8	4.39	226.0	3.86
Winnipeg	891.3	2.89	830.0	2.72

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.2: Premature Mortality Rate for Males

Region	Premature Mortality Rate for Males			
	Number Observed per Year	Crude Rate per 1000	Number Observed per Year	Crude Rate per 1000
	1988-1995		1996-2003	
South Eastman	84.9	3.50	80.0	3.03
Central	189.8	4.26	164.8	3.59
Assiniboine	183.8	5.36	170.5	5.23
Brandon	87.3	4.03	87.1	4.09
Winnipeg	1,347.6	4.48	1,191.3	3.97
Parkland	131.3	6.10	102.1	5.05
Interlake	185.8	5.30	168.8	4.71
North Eastman	84.3	4.72	90.0	4.72
Churchill	3.6	5.91	2.0	3.75
Nor-Man	66.4	5.16	53.9	4.30
Burntwood	79.1	3.62	92.1	4.03
South	458.4	4.45	415.3	3.96
Mid	401.3	5.39	360.9	4.80
North	149.1	4.22	148.0	4.12
Manitoba	2,443.6	4.57	2,202.5	4.10

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Source: Manitoba Centre for Health Policy, 2008

Region	Premature Mortality Rate for Males			
	Number Observed per Year	Crude Rate per 1000	Number Observed per Year	Crude Rate per 1000
	1988-1995		1996-2003	
Fort Garry	80.5	3.01	73.9	2.56
Assiniboine South	55.6	3.26	46.8	2.80
Transcona	57.6	3.54	57.9	3.60
River Heights	119.4	4.67	90.9	3.71
St. Boniface	93.9	4.50	79.1	3.65
St. Vital	97.9	3.60	91.4	3.29
Seven Oaks	103.6	4.19	104.1	3.99
River East	179.1	4.25	162.4	3.83
St. James - Assiniboia	139.9	4.85	123.4	4.63
Inkster	58.1	3.93	57.4	3.81
Point Douglas	146.8	7.13	110.3	5.69
Downtown	215.3	5.98	193.9	5.54
Wpg Most Healthy	501.0	3.42	458.3	3.08
Wpg Avg Health	407.8	4.51	364.6	4.06
Wpg Least Healthy	438.9	6.85	368.4	6.00
Winnipeg	1,347.6	4.48	1,191.3	3.97

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.3: Diabetes Treatment Prevalence

Region	Diabetes Treatment Prevalence			
	Number Observed per 3 yrs	Crude Percent (%)	Number Observed per 3 yrs	Crude Percent (%)
	1986/87-1994/95		1995/96-2003/04	
South Eastman	999.7	3.3	1,535.0	4.4
Central	2,161.0	3.6	3,101.3	5.0
Assiniboine	2,433.0	4.9	3,094.3	6.5
Brandon	1,125.0	3.5	1,772.7	5.5
Winnipeg	17,164.7	3.8	25,406.7	5.6
Parkland	1,734.0	5.7	2,322.7	7.9
Interlake	2,282.7	4.7	3,408.7	6.7
North Eastman	1,160.7	5.0	1,765.0	6.8
Churchill	35.3	4.6	63.0	8.9
Nor-Man	830.7	5.2	1,261.0	7.9
Burntwood	1,236.0	5.4	2,451.3	9.8
South	5,593.7	4.0	7,730.7	5.4
Mid	5,177.3	5.1	7,496.3	7.1
North	2,102.0	5.3	3,775.3	9.1
Manitoba	31,162.7	4.1	46,181.7	5.9

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Source: Manitoba Centre for Health Policy, 2008

Region	Diabetes Treatment Prevalence			
	Number Observed per 3 yrs	Crude Percent (%)	Number Observed per 3 yrs	Crude Percent (%)
	1986/87-1994/95		1995/96-2003/04	
Fort Garry	1,053.7	2.8	1,916.0	4.4
Assiniboine South	677.0	2.8	1,085.3	4.3
Transcona	740.3	3.3	1,290.7	5.6
River Heights	1,580.3	3.5	1,963.7	4.7
St. Boniface	1,132.7	3.6	1,682.7	5.0
St. Vital	1,318.0	3.3	2,064.0	4.8
Seven Oaks	1,571.7	4.3	2,630.7	6.5
River East	2,356.3	3.7	3,527.3	5.5
St. James - Assiniboia	1,736.3	3.7	2,491.3	5.7
Inkster	815.0	4.1	1,310.0	6.3
Point Douglas	1,737.3	5.8	2,146.3	7.9
Downtown	2,446.0	4.5	3,298.7	6.5
Wpg Most Healthy	6,760.3	3.2	10,929.7	4.8
Wpg Avg Health	5,523.7	4.0	8,184.3	5.9
Wpg Least Healthy	4,880.7	4.9	6,292.7	6.9
Winnipeg	17,164.7	3.8	25,406.7	5.6

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.4: Diabetes Related Lower Limb Amputation Rates

Region	Diabetes Related Lower Limb Amps.			
	Number Observed per 3 yrs	Crude Rate per 1000	Number Observed per 3 yrs	Crude Rate per 1000
	1986/87-1994/95		1995/96-2003/04	
South Eastman	14.3	14.34	19.0	12.38
Central	29.0	13.42	55.0	17.73
Assiniboine	27.3	11.23	42.3	13.68
Brandon	13.7	12.15	15.3	8.65
Winnipeg	198.0	11.53	297.7	11.72
Parkland	34.0	19.60	51.3	22.10
Interlake	38.3	16.79	56.0	16.43
North Eastman	24.7	21.25	37.3	21.15
Churchill				
Nor-Man	14.3	17.26	31.0	24.59
Burntwood	30.3	24.54	63.0	25.70
South	70.7	12.63	116.3	15.05
Mid	97.0	18.73	144.7	19.30
North	45.3	21.57	95.7	25.34
Manitoba	424.7	13.63	669.7	14.50

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Source: Manitoba Centre for Health Policy, 2008

Region	Diabetes Related Lower Limb Amps			
	Number Observed per 3 yrs	Crude Rate per 1000	Number Observed per 3 yrs	Crude Rate per 1000
	1986/87-1994/95		1995/96-2003/04	
Fort Garry	8.0	7.59	15.7	8.18
Assiniboine South	4.0	5.90	5.3	4.91
Transcona	11.0	14.86	11.7	9.04
River Heights	16.0	10.12	20.3	10.36
St. Boniface	17.3	15.29	13.3	7.92
St. Vital	11.0	8.35	20.3	9.85
Seven Oaks	15.3	9.75	33.0	12.54
River East	27.3	11.60	36.0	10.21
St. James - Assiniboia	14.0	8.06	21.0	8.43
Inkster	12.3	15.13	18.0	13.74
Point Douglas	27.3	15.74	40.3	18.79
Downtown	34.3	14.03	62.7	18.99
Wpg Most Healthy	59.3	8.77	81.7	7.47
Wpg Avg Health	59.7	10.80	97.7	11.93
Wpg Least Healthy	79.0	16.18	118.3	18.80
Winnipeg	198.0	11.53	297.7	11.72

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.5: Teen Pregnancy

Region	Teen Pregnancy			
	Number Observed per Year	Crude Rate per 1000	Number Observed per Year	Crude Rate per 1000
	1988/89-1995/96		1996/97-2003/04	
South Eastman	71.1	34.59	62.5	28.99
Central	176.1	48.23	149.4	38.26
Assiniboine	106.1	39.67	85.9	33.34
Brandon	94.5	59.15	89.9	53.95
Winnipeg	1,269.1	60.92	1,218.5	59.72
Parkland	127.8	71.87	104.1	66.07
Interlake	159.4	58.28	138.6	52.81
North Eastman	101.0	71.90	94.9	64.39
Churchill	6.4	124.39	5.4	179.17
Nor-Man	108.0	93.73	102.3	100.02
Burntwood	300.9	143.52	268.9	132.67
South	353.4	42.15	297.8	34.47
Mid	388.1	65.59	337.6	59.50
North	415.3	125.84	376.5	122.28
Manitoba	2,520.4	62.96	2,320.3	58.80

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Source: Manitoba Centre for Health Policy, 2008

Region	Teen Pregnancy			
	Number Observed per Year	Crude Rate per 1000	Number Observed per Year	Crude Rate per 1000
	1988/89-1995/96		1996/97-2003/04	
Fort Garry	63.5	32.53	60.3	29.00
Assiniboine South	38.5	27.45	39.1	29.34
Transcona	58.8	47.23	60.3	52.79
River Heights	82.8	55.99	59.5	44.51
St. Boniface	66.5	43.89	59.1	41.74
St. Vital	85.9	45.66	80.1	41.13
Seven Oaks	91.0	49.03	100.4	51.50
River East	174.5	58.48	170.5	56.88
St. James - Assiniboia	83.4	41.30	83.3	50.52
Inkster	85.1	79.15	95.3	80.46
Point Douglas	201.3	146.06	173.3	135.92
Downtown	238.0	116.31	237.5	113.23
Wpg Most Healthy	411.5	37.42	399.5	37.00
Wpg Avg Health	403.4	67.57	397.3	67.43
Wpg Least Healthy	454.3	117.55	421.8	113.52
Winnipeg	1,269.1	60.92	1,218.5	59.72

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.6: Injury Hospitalization or Death Rates for Females

Region	Injury Hosp. or Death Rates - Females			
	Number Observed per Year	Crude Rate per 1000	Number Observed per Year	Crude Rate per 1000
	1988/89-1995/96		1996/97-2003/04	
South Eastman	221.8	9.11	182.3	6.82
Central	545.3	11.68	461.9	9.55
Assiniboine	561.8	15.16	473.4	13.19
Brandon	226.8	9.27	199.6	8.09
Winnipeg	2,519.9	7.59	2,382.8	7.14
Parkland	398.6	17.55	304.4	13.86
Interlake	344.8	9.72	295.8	8.01
North Eastman	194.3	11.10	186.1	9.72
Churchill	11.0	19.04	7.1	14.34
Nor-Man	227.4	18.14	180.3	14.52
Burntwood	456.9	22.12	447.1	20.41
South	1,328.8	12.30	1,117.5	10.07
Mid	937.6	12.39	786.3	10.07
North	695.3	20.59	634.5	18.22
Manitoba	5,708.3	9.94	5,120.6	8.79

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Source: Manitoba Centre for Health Policy, 2008

Region	Injury Hosp. or Death Rates - Females			
	Number Observed per Year	Crude Rate per 1000	Number Observed per Year	Crude Rate per 1000
	1988/89-1995/96		1996/97-2003/04	
Fort Garry	141.8	4.93	161.3	5.07
Assiniboine South	114.6	6.11	128.5	6.74
Transcona	81.4	4.84	80.1	4.78
River Heights	290.5	9.14	276.4	9.14
St. Boniface	151.8	6.56	154.8	6.43
St. Vital	189.0	6.20	184.4	5.83
Seven Oaks	181.5	6.52	169.4	5.67
River East	312.8	6.71	327.3	6.90
St. James - Assiniboia	252.1	7.71	248.1	7.93
Inkster	94.3	6.06	75.1	4.76
Point Douglas	264.8	11.95	200.1	9.83
Downtown	445.5	11.88	377.4	10.61
Wpg Most Healthy	947.4	5.89	980.8	5.87
Wpg Avg Health	756.6	7.48	710.8	7.05
Wpg Least Healthy	815.9	11.63	691.3	10.49
Winnipeg	2,519.9	7.59	2,382.8	7.14

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.7: Injury Hospitalization or Death Rates for Males

Region	Injury Hosp. or Death Rates - Males			
	Number Observed per Year	Crude Rate per 1000	Number Observed per Year	Crude Rate per 1000
	1988/89-1995/96		1996/97-2003/04	
South Eastman	298.6	11.86	238.8	8.68
Central	676.9	14.41	547.8	11.27
Assiniboine	613.3	16.47	492.8	13.84
Brandon	219.8	9.71	199.1	8.84
Winnipeg	2,879.9	9.19	2,250.4	7.14
Parkland	460.9	19.81	321.8	14.60
Interlake	505.3	13.72	377.1	9.98
North Eastman	291.1	15.63	240.9	12.07
Churchill	14.5	23.36	11.3	20.88
Nor-Man	349.9	26.50	228.6	17.79
Burntwood	631.0	28.56	571.1	24.75
South	1,588.8	14.52	1,279.3	11.45
Mid	1,257.3	15.97	939.8	11.78
North	995.4	27.71	811.0	22.24
Manitoba	6,941.0	12.40	5,479.5	9.68

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Source: Manitoba Centre for Health Policy, 2008

Region	Injury Hosp. or Death Rates - Males			
	Number Observed per Year	Crude Rate per 1000	Number Observed per Year	Crude Rate per 1000
	1988/89-1995/96		1996/97-2003/04	
Fort Garry	160.5	5.84	145.3	4.84
Assiniboine South	107.4	6.10	95.8	5.47
Transcona	125.1	7.51	94.4	5.69
River Heights	243.3	8.94	183.8	7.00
St. Boniface	170.1	7.83	127.0	5.58
St. Vital	195.8	6.94	163.9	5.64
Seven Oaks	197.0	7.62	158.1	5.73
River East	360.0	8.22	293.8	6.59
St. James - Assiniboia	250.1	8.29	193.5	6.79
Inkster	148.0	9.74	102.1	6.56
Point Douglas	349.1	16.01	266.6	13.04
Downtown	573.5	15.26	426.3	11.66
Wpg Most Healthy	1,026.5	6.79	827.1	5.31
Wpg Avg Health	867.8	9.19	674.9	7.14
Wpg Least Healthy	985.6	14.55	748.4	11.48
Winnipeg	2,879.9	9.19	2,250.4	7.14

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.8: Prevalence of Suicide or Suicide Attempts

Region	Suicide & Attempts			
	Average Number per 2 yrs	Crude Percent (%)	Average Number per 2 yrs	Crude Percent (%)
	1988/89-1995/96		1996/97-2003/04	
South Eastman	46.0	0.11	46.3	0.10
Central	127.0	0.16	107.5	0.13
Assiniboine	92.3	0.14	98.0	0.16
Brandon	91.0	0.23	81.5	0.20
Winnipeg	859.0	0.15	725.3	0.13
Parkland	92.5	0.23	85.8	0.22
Interlake	97.5	0.16	72.5	0.11
North Eastman	60.3	0.20	90.3	0.27
Churchill	4.3	0.44	2.5	0.30
Nor-Man	117.8	0.56	98.8	0.48
Burntwood	283.3	0.87	319.3	0.93
South	265.3	0.14	251.8	0.13
Mid	250.3	0.19	248.5	0.18
North	405.3	0.75	420.5	0.75
Manitoba	1,870.8	0.19	1,727.5	0.17

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Source: Manitoba Centre for Health Policy, 2008

Region	Suicide & Attempts			
	Average Number per 2 yrs	Crude Percent (%)	Average Number per 2 yrs	Crude Percent (%)
	1988/89-1995/96		1996/97-2003/04	
Fort Garry	50.5	0.10	45.0	0.08
Assiniboine South	25.0	0.08	26.8	0.08
Transcona	23.8	0.08	32.8	0.11
River Heights	76.8	0.15	66.5	0.13
St. Boniface	51.0	0.13	44.8	0.11
St. Vital	61.8	0.12	52.5	0.10
Seven Oaks	57.0	0.12	49.0	0.10
River East	91.5	0.12	92.3	0.11
St. James - Assiniboia	75.5	0.14	50.3	0.09
Inkster	39.3	0.15	34.0	0.13
Point Douglas	108.5	0.30	80.8	0.23
Downtown	198.5	0.31	150.8	0.24
Wpg Most Healthy	282.3	0.10	249.0	0.09
Wpg Avg Health	257.8	0.15	232.0	0.14
Wpg Least Healthy	319.0	0.27	244.3	0.22
Winnipeg	859.0	0.15	725.3	0.13

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.9: Breastfeeding Inititation

Region	Breastfeeding Inititation			
	Number Observed per Year	Crude Percent (%)	Number Observed per Year	Crude Percent (%)
	1988/89-1995/96		1996/97-2003/04	
South Eastman	612.9	82.6	628.3	89.4
Central	1,160.9	82.0	1,110.9	84.4
Assiniboine	576.8	77.7	513.6	82.5
Brandon	485.3	74.2	451.9	80.9
Winnipeg	6,801.8	76.5	6,091.8	83.5
Parkland	346.0	64.4	324.1	70.8
Interlake	601.3	75.5	608.3	80.2
North Eastman	330.8	64.2	317.3	69.8
Churchill	22.1	82.7	13.0	78.8
Nor-Man	280.9	60.6	280.6	64.8
Burntwood	705.5	62.3	676.6	65.0
South	2,350.5	81.1	2,252.8	85.3
Mid	1,278.0	69.1	1,249.6	74.8
North	1,008.5	62.1	970.3	65.1
Manitoba	11,924.0	74.9	11,016.3	80.7

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Source: Manitoba Centre for Health Policy, 2008

Region	Breastfeeding Initiation			
	Number Observed per Year	Crude Percent (%)	Number Observed per Year	Crude Percent (%)
	1988/89-1995/96		1996/97-2003/04	
Fort Garry	638.9	85.9	605.6	91.0
Assiniboine South	324.3	83.5	265.0	89.7
Transcona	379.1	78.3	321.4	84.0
River Heights	612.5	85.1	535.3	90.5
St. Boniface	435.9	80.6	445.6	88.2
St. Vital	741.8	82.7	589.9	89.1
Seven Oaks	496.8	75.7	485.9	82.9
River East	942.8	77.7	835.4	83.8
St. James - Assiniboia	572.1	80.7	498.5	86.8
Inkster	359.1	68.5	319.1	76.3
Point Douglas	458.8	60.9	425.5	70.7
Downtown	839.9	66.5	764.6	75.6
Wpg Most Healthy	3,252.1	82.6	2,871.6	88.6
Wpg Avg Health	2,114.4	75.8	1,895.0	82.7
Wpg Least Healthy	1,435.3	66.3	1,325.1	75.4
Winnipeg	6,801.8	76.5	6,091.8	83.5

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.10: Proportion of Children Born in 1990/91 to 2001/02 With Complete Immunizations at Two Years

Region	Complete Immunizations @ 2-years			
	Number Observed per Year	Crude Percent (%)	Number Observed per Year	Crude Percent (%)
	1990/91-1995/96		1996/97-2001/02	
South Eastman	667.3	80.4	544.3	77.1
Central	1,115.0	75.7	908.0	68.3
Assiniboine	708.7	80.9	559.3	76.8
Brandon	447.2	73.4	399.2	74.9
Winnipeg	6,427.2	76.9	5,350.2	74.3
Parkland	434.8	75.8	378.5	74.6
Interlake	752.7	74.6	607.5	72.9
North Eastman	411.0	68.7	312.5	63.5
Churchill	17.2	81.7	15.7	88.7
Nor-Man	289.3	63.0	287.7	66.6
Burntwood	456.7	42.0	509.5	49.3
South	2,491.0	78.3	2,011.7	72.8
Mid	1,598.5	73.3	1,298.5	70.8
North	763.2	48.7	812.8	54.8
Manitoba	11,727.0	73.8	9,872.3	71.5

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Source: Manitoba Centre for Health Policy, 2008

Region	Complete Immunizations @ 2-years			
	Number Observed per Year	Crude Percent (%)	Number Observed per Year	Crude Percent (%)
	1990/91-1995/96		1996/97-2001/02	
Fort Garry	613.3	80.0	493.3	74.5
Assiniboine South	336.2	79.5	236.0	79.1
Transcona	388.5	80.7	314.7	79.3
River Heights	430.2	77.9	421.7	75.9
St. Boniface	465.5	82.0	394.2	78.5
St. Vital	694.3	83.9	528.3	80.1
Seven Oaks	566.2	80.4	449.0	77.1
River East	955.5	80.0	769.7	76.8
St. James - Assiniboia	546.5	81.8	440.5	77.3
Inkster	369.7	73.1	312.2	72.5
Point Douglas	419.5	61.6	374.3	61.9
Downtown	641.8	65.1	616.3	65.8
Wpg Most Healthy	3,272.0	81.8	2,578.3	78.7
Wpg Avg Health	1,939.5	76.4	1,664.2	74.5
Wpg Least Healthy	1,215.7	66.8	1,107.7	65.5
Winnipeg	6,427.2	76.9	5,350.2	74.3

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.11: Complete Physical Exams

Region	Complete Physical Exams Number Observed per Year	Crude Percent (%)	Number Observed per Year	Crude Percent (%)
	1988/89-1995/96		1996/97-2003/04	
South Eastman	18,929.0	38.2	18,785.9	34.6
Central	29,504.9	31.5	27,964.9	28.8
Assiniboine	22,037.8	29.7	20,956.0	29.3
Brandon	17,670.3	37.5	18,183.0	38.5
Winnipeg	318,832.9	49.4	297,708.4	45.9
Parkland	14,062.6	30.6	12,512.1	28.4
Interlake	29,773.0	41.2	28,586.1	38.3
North Eastman	13,767.9	38.1	14,423.5	36.9
Churchill	316.3	26.4	243.4	23.5
Nor-Man	7,205.9	28.0	5,694.1	22.5
Burntwood	11,839.0	27.7	11,461.9	25.5
South	70,471.6	32.4	67,706.8	30.4
Mid	57,603.5	37.3	55,521.8	35.2
North	19,361.1	27.8	17,399.4	24.4
Manitoba	483,939.4	42.7	456,519.3	39.8

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Source: Manitoba Centre for Health Policy, 2008

Region	Complete Physical Exams Number Observed per Year	Crude Percent (%)	Number Observed per Year	Crude Percent (%)
	1988/89-1995/96		1996/97-2003/04	
Fort Garry	27,332.0	48.6	28,488.5	46.1
Assiniboine South	17,530.6	48.2	16,950.9	46.4
Transcona	14,977.8	44.7	14,367.5	43.1
River Heights	30,812.6	52.2	27,259.3	48.3
St. Boniface	22,796.0	50.8	22,920.6	48.9
St. Vital	29,816.6	50.8	28,869.3	47.6
Seven Oaks	27,369.6	51.0	26,849.5	46.7
River East	43,872.5	48.5	41,402.5	45.0
St. James - Assiniboia	30,613.5	48.7	28,130.3	47.1
Inkster	15,245.6	49.6	13,744.9	43.9
Point Douglas	21,553.4	49.0	17,115.5	41.9
Downtown	36,912.6	49.2	31,609.8	43.8
Wpg Most Healthy	154,211.0	49.4	150,805.5	46.7
Wpg Avg Health	96,276.1	49.2	88,610.4	45.4
Wpg Least Healthy	68,345.8	49.6	58,292.5	44.5
Winnipeg	318,832.9	49.4	297,708.4	45.9

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.12: Mammography

Region	Mammography Number Observed per 2 yrs	Crude Percent (%)	Number Observed per 2 yrs	Crude Percent (%)
	1988/89-1995/96		1996/97-2003/04	
South Eastman	1,019.5	28.1	2,567.3	57.2
Central	1,682.8	21.8	4,967.8	60.2
Assiniboine	1,020.3	13.7	4,765.8	64.0
Brandon	791.3	19.7	2,972.5	66.5
Winnipeg	20,618.0	35.9	36,393.5	56.9
Parkland	586.0	13.0	2,778.3	62.3
Interlake	1,707.5	25.6	4,530.8	57.6
North Eastman	877.3	28.2	2,124.0	53.4
Churchill	4.3	6.9	36.3	48.8
Nor-Man	213.0	13.2	1,124.8	60.1
Burntwood	116.5	6.8	1,036.5	44.4
South	3,722.5	19.8	12,300.8	60.9
Mid	3,170.8	22.2	9,433.0	57.8
North	333.8	9.9	2,197.5	51.3
Manitoba	28,636.3	29.3	63,297.3	57.9

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Source: Manitoba Centre for Health Policy, 2008

Region	Mammography Number Observed per 2 yrs	Crude Percent (%)	Number Observed per 2 yrs	Crude Percent (%)
	1988/89-1995/96		1996/97-2003/04	
Fort Garry	1,938.5	41.7	3,547.5	58.3
Assiniboine South	1,325.5	43.0	2,672.0	64.8
Transcona	1,029.3	38.4	1,887.8	60.9
River Heights	2,344.3	40.8	3,540.8	60.5
St. Boniface	1,661.0	37.7	3,010.0	61.3
St. Vital	1,654.0	35.2	3,427.8	57.6
Seven Oaks	1,750.8	34.5	3,261.3	52.8
River East	3,014.0	35.5	5,092.5	55.1
St. James - Assiniboia	3,192.8	45.1	4,706.0	66.2
Inkster	517.0	24.4	1,251.5	49.2
Point Douglas	880.8	23.5	1,527.3	46.8
Downtown	1,310.3	23.3	2,469.3	43.9
Wpg Most Healthy	11,276.5	40.5	20,714.0	61.0
Wpg Avg Health	5,790.5	33.3	10,066.5	53.3
Wpg Least Healthy	3,551.0	29.2	5,613.0	50.4
Winnipeg	20,618.0	35.9	36,393.5	56.9

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.13: Cervical Cancer Screening Rates (excluding those who have had a hysterectomy)

Region	Cervical Cancer Screening Rates			
	Number Observed per 3 yrs	Crude Percent (%)	Number Observed per 3 yrs	Crude Percent (%)
	1986/87-1994/95		1995/96-2003/04	
South Eastman	9,735.0	70.7	10,446.0	68.6
Central	16,843.3	63.5	16,715.7	62.3
Assiniboine	13,473.7	63.7	12,235.7	62.0
Brandon	11,167.7	74.0	10,761.3	73.6
Winnipeg	157,144.3	74.0	150,856.0	73.3
Parkland	8,355.3	64.9	7,261.0	60.8
Interlake	14,949.0	69.8	14,904.0	68.5
North Eastman	6,781.7	66.1	7,339.0	66.0
Churchill	220.3	58.6	166.3	50.7
Nor-Man	4,400.0	60.6	3,712.0	52.8
Burntwood	6,375.3	57.2	5,840.3	49.3
South	40,052.0	65.2	39,397.3	63.8
Mid	30,086.0	67.5	29,504.0	65.8
North	10,995.7	58.6	9,718.7	50.6
Manitoba	249,445.7	70.8	240,237.3	69.4

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Source: Manitoba Centre for Health Policy, 2008

Region	Cervical Cancer Screening Rates			
	Number Observed per 3 yrs	Crude Percent (%)	Number Observed per 3 yrs	Crude Percent (%)
	1986/87-1994/95		1995/96-2003/04	
Fort Garry	14,357.3	77.0	15,514.7	76.1
Assiniboine South	9,193.0	78.0	8,982.7	76.7
Transcona	8,051.7	75.4	8,090.7	76.9
River Heights	16,177.7	76.4	14,675.7	76.1
St. Boniface	11,395.3	76.2	11,596.7	77.2
St. Vital	14,777.7	76.8	15,207.3	77.3
Seven Oaks	12,229.7	71.1	12,994.3	70.8
River East	22,412.7	74.7	21,326.7	73.9
St. James - Assiniboia	17,157.0	78.5	14,742.7	76.6
Inkster	6,469.0	69.0	6,393.3	66.7
Point Douglas	8,846.7	65.8	7,347.0	64.0
Downtown	16,076.7	66.6	13,984.3	64.4
Wpg Most Healthy	79,510.7	76.9	79,809.0	76.2
Wpg Avg Health	46,882.7	72.2	44,857.0	71.8
Wpg Least Healthy	30,751.0	69.7	26,190.0	67.9
Winnipeg	157,144.3	74.0	150,856.0	73.3

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.14: Polypharmacy Rates

Region	Polypharmacy			
	Number Observed per Year	Crude Percent (%)	Number Observed per Year	Crude Percent (%)
	1996/97-1999/00		2000/01-2003/04	
South Eastman	195.0	3.6	393.3	6.9
Central	497.8	4.0	983.0	7.9
Assiniboine	535.0	4.0	1,149.3	9.0
Brandon	256.3	4.0	562.8	8.7
Winnipeg	2,519.0	2.9	4,275.8	4.9
Parkland	437.5	5.4	796.5	10.3
Interlake	360.3	3.8	674.0	6.7
North Eastman	127.3	3.0	250.3	5.4
Churchill	2.3	5.6	7.5	15.3
Nor-Man	115.0	6.4	219.8	11.7
Burntwood	43.3	3.4	161.8	10.7
South	1,227.8	3.9	2,525.5	8.2
Mid	925.0	4.2	1,720.8	7.6
North	160.5	5.1	389.0	11.3
Manitoba	5,088.5	3.4	9,473.8	6.3

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Source: Manitoba Centre for Health Policy, 2008

Region	Polypharmacy			
	Number Observed per Year	Crude Percent (%)	Number Observed per Year	Crude Percent (%)
	1996/97-1999/00		2000/01-2003/04	
Fort Garry	163.3	2.5	319.5	4.3
Assiniboine South	133.3	2.6	233.8	4.6
Transcona	73.5	2.5	124.8	3.8
River Heights	271.8	2.9	455.8	5.1
St. Boniface	199.5	3.4	358.3	5.7
St. Vital	214.5	2.8	379.0	4.9
Seven Oaks	264.3	3.2	417.3	5.1
River East	359.5	2.8	564.8	4.3
St. James - Assiniboia	273.5	2.7	448.3	4.4
Inkster	75.8	2.9	120.0	4.6
Point Douglas	177.0	3.2	297.8	5.9
Downtown	313.3	3.2	556.8	6.2
Wpg Most Healthy	1,034.0	2.6	1,806.0	4.3
Wpg Avg Health	746.3	2.9	1,265.8	4.9
Wpg Least Healthy	738.8	3.5	1,204.0	6.2
Winnipeg	2,519.0	2.9	4,275.8	4.9

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.15: C-Section

Region	C-Section			
	Number Observed per Year	Crude Percent (%)	Number Observed per Year	Crude Percent (%)
	1988/89-1995/96		1996/97-2003/04	
South Eastman	96.5	12.8	114.8	16.3
Central	206.5	14.1	244.9	18.2
Assiniboine	129.9	14.4	145.0	20.2
Brandon	102.1	15.2	114.5	20.0
Winnipeg	1,371.6	15.1	1,345.1	18.2
Parkland	107.1	18.3	101.6	19.8
Interlake	118.9	12.5	134.3	16.6
North Eastman	75.5	13.8	66.4	14.0
Churchill	3.1	11.0	3.1	18.9
Nor-Man	95.0	19.9	97.1	21.9
Burntwood	132.8	11.4	155.9	14.7
South	432.9	13.9	504.6	18.2
Mid	301.5	14.5	302.3	16.9
North	230.9	13.8	256.1	16.9
Manitoba	2,439.0	14.7	2,522.6	18.0

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Source: Manitoba Centre for Health Policy, 2008

Region	C-Section			
	Number Observed per Year	Crude Percent (%)	Number Observed per Year	Crude Percent (%)
	1988/89-1995/96		1996/97-2003/04	
Fort Garry	115.5	15.4	131.3	19.8
Assiniboine South	62.4	15.9	58.3	19.6
Transcona	69.4	14.2	72.0	18.9
River Heights	117.9	16.1	120.5	20.2
St. Boniface	81.1	14.9	93.5	18.5
St. Vital	143.4	15.8	124.0	18.8
Seven Oaks	109.8	16.4	114.5	19.4
River East	184.4	15.0	184.8	18.5
St. James - Assiniboia	97.8	13.6	112.3	19.4
Inkster	79.0	14.8	72.4	17.2
Point Douglas	109.5	14.0	92.4	14.6
Downtown	201.6	15.3	169.4	16.0
Wpg Most Healthy	613.5	15.4	629.1	19.4
Wpg Avg Health	444.4	15.6	421.0	18.2
Wpg Least Healthy	313.8	14.0	295.0	16.2
Winnipeg	1,371.6	15.1	1,345.1	18.2

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.16: Hysterectomy Rates

Region	Hysterectomy Rates			
	Number Observed per Year	Crude Rate per 1000	Number Observed per Year	Crude Rate per 1000
	1988/89-1995/96		1996/97-2003/04	
South Eastman	88.8	6.22	100.4	6.17
Central	152.4	5.35	159.3	5.31
Assiniboine	127.3	5.15	133.6	5.48
Brandon	84.1	5.33	96.1	5.86
Winnipeg	1,102.9	4.96	1,006.4	4.37
Parkland	82.8	5.56	96.6	6.57
Interlake	129.1	5.65	126.9	5.15
North Eastman	68.1	6.34	67.6	5.54
Churchill	1.1	3.56	1.3	4.13
Nor-Man	48.5	7.01	42.0	5.87
Burntwood	48.3	5.19	50.1	4.79
South	368.4	5.46	393.3	5.57
Mid	280.0	5.77	291.1	5.65
North	97.9	5.92	93.4	5.21
Manitoba	1,933.3	5.21	1,880.3	4.86

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Source: Manitoba Centre for Health Policy, 2008

Region	Hysterectomy Rates			
	Number Observed per Year	Crude Rate per 1000	Number Observed per Year	Crude Rate per 1000
	1988/89-1995/96		1996/97-2003/04	
Fort Garry	86.4	4.66	86.5	4.04
Assiniboine South	72.9	5.96	62.6	4.78
Transcona	59.8	5.61	62.6	5.62
River Heights	101.1	4.30	79.1	3.47
St. Boniface	75.5	4.79	72.3	4.30
St. Vital	110.0	5.43	100.0	4.58
Seven Oaks	97.5	5.22	91.8	4.42
River East	161.3	5.17	149.8	4.59
St. James - Assiniboia	129.8	5.64	113.8	4.98
Inkster	50.4	5.31	50.4	5.10
Point Douglas	66.3	4.62	59.3	4.47
Downtown	92.1	3.71	78.4	3.31
Wpg Most Healthy	564.1	5.31	520.6	4.53
Wpg Avg Health	330.9	4.82	301.4	4.29
Wpg Least Healthy	207.9	4.37	184.4	4.10
Winnipeg	1,102.9	4.96	1,006.4	4.37

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.17: Ambulatory Visit Rates to Specialists

Region	Ambulatory Visit Rates to Specialists			
	Number Observed per Year	Crude Rate per Resident	Number Observed per Year	Crude Rate per Resident
	1990/91-1997/98		1998/99-2005/06	
South Eastman	34,335.9	0.68	39,317.6	0.70
Central	54,791.5	0.58	61,167.0	0.62
Assiniboine	37,022.4	0.50	35,453.8	0.50
Brandon	52,989.8	1.13	41,915.9	0.88
Winnipeg	1,055,723.8	1.63	1,042,724.3	1.60
Parkland	15,440.3	0.34	18,874.9	0.44
Interlake	71,260.3	0.98	78,555.8	1.04
North Eastman	29,380.1	0.79	34,736.1	0.88
Churchill	548.1	0.48	585.4	0.58
Nor-Man	6,109.3	0.24	8,205.9	0.33
Burntwood	16,796.0	0.39	22,076.4	0.49
South	126,149.8	0.58	135,938.4	0.61
Mid	116,080.6	0.75	132,166.8	0.84
North	23,453.4	0.33	30,867.6	0.43
Manitoba	1,374,397.3	1.21	1,383,612.9	1.20

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Source: Manitoba Centre for Health Policy, 2008

Region	Ambulatory Visit Rates to Specialists			
	Number Observed per Year	Crude Rate per Resident	Number Observed per Year	Crude Rate per Resident
	1990/91-1997/98		1998/99-2005/06	
Fort Garry	89,825.8	1.55	96,671.9	1.53
Assiniboine South	58,436.0	1.61	63,669.4	1.73
Transcona	44,457.8	1.32	44,265.4	1.33
River Heights	119,846.3	2.06	108,476.8	1.93
St. Boniface	68,890.4	1.53	71,189.5	1.48
St. Vital	91,613.1	1.53	89,627.1	1.47
Seven Oaks	100,070.5	1.81	101,431.4	1.74
River East	149,372.3	1.65	148,924.3	1.60
St. James - Assiniboia	93,156.1	1.51	96,039.3	1.62
Inkster	47,988.8	1.54	46,702.8	1.49
Point Douglas	66,480.5	1.55	58,980.1	1.44
Downtown	125,586.4	1.70	116,746.5	1.60
Wpg Most Healthy	508,827.4	1.61	521,775.1	1.60
Wpg Avg Health	327,556.3	1.67	313,331.3	1.61
Wpg Least Healthy	219,340.1	1.62	207,617.9	1.57
Winnipeg	1,055,723.8	1.63	1,042,724.3	1.60

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.18: Proportion of Ambulatory Visits to Specialists Where the Patient Travels Outside RHA

Region	Specialist Visits Outside Patient's RHA			
	Number Observed per Year	Crude Rate per Resident	Number Observed per Year	Crude Rate per Resident
	1990/91-1997/98		1998/99-2005/06	
South Eastman	31,564.8	0.92	34,654.9	0.88
Central	40,830.6	0.75	48,816.4	0.80
Assiniboine	31,753.4	0.86	32,282.4	0.92
Brandon	4,246.1	0.08	7,130.6	0.17
Parkland	10,018.1	0.65	10,458.5	0.56
Interlake	57,380.9	0.81	65,979.8	0.84
North Eastman	28,494.0	0.97	33,582.5	0.97
Churchill	266.8	0.50	397.6	0.69
Nor-Man	5,503.9	0.91	6,715.6	0.83
Burntwood	13,842.9	0.84	17,192.1	0.79
South	104,148.8	0.83	115,753.6	0.86
Mid	95,893.0	0.83	110,020.8	0.84
North	19,613.5	0.85	24,305.4	0.80
Manitoba	223,901.4	0.71	257,210.4	0.76

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Source: Manitoba Centre for Health Policy, 2008

Appendix Table 3.19: Telehealth Specialist Visits

Region	Telehealth Specialist Visits			
	Number Observed per Year	Crude Rate per Resident	Number Observed per Year	Crude Rate per Resident
	2003/04		2004/05	
South Eastman	23.0	0.0004	38.0	0.0007
Central	112.0	0.0011	140.0	0.0014
Assiniboine	252.0	0.0036	260.0	0.0038
Brandon	155.0	0.0032	250.0	0.0052
Winnipeg	17.0	0.0000	27.0	0.0000
Parkland	221.0	0.0052	402.0	0.0094
Interlake	46.0	0.0006	58.0	0.0008
North Eastman	42.0	0.0011	31.0	0.0008
Churchill	16.0	0.0155	10.0	0.0103
Nor-Man	169.0	0.0068	112.0	0.0045
Burntwood	237.0	0.0052	354.0	0.0079
South	387.0	0.0017	438.0	0.0019
Mid	309.0	0.0020	491.0	0.0031
North	422.0	0.0059	476.0	0.0067
Manitoba	1,290.0	0.0011	1,682.0	0.0014

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Source: Manitoba Centre for Health Policy, 2008

APPENDIX 4: LOGISTIC REGRESSIONS

Appendix Table 4.1: Diabetes (Prevalence) Logistic Regression

Variable	ClassVal0	ClassVal1	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept				0.0008	0.0006	0.0009	0.0000	-7.1899	0.0904	6327.0181
area2	A-40 Central		Manitoba	0.8705	0.8260	0.9174	0.0000	-0.1387	0.0268	26.8259
area2	BN-20 North Eastman		Manitoba	0.9232	0.8635	0.9870	0.0191	-0.0799	0.0341	5.4926
area2	BS-25 South Eastman		Manitoba	0.8030	0.7514	0.8581	0.0000	-0.2194	0.0339	42.0203
area2	C-30 Interlake		Manitoba	0.9502	0.9024	1.0006	0.0529	-0.0510	0.0264	3.7476
area2	D-70 Nor-Man		Manitoba	1.0187	0.9366	1.1081	0.6654	0.0185	0.0429	0.1870
area2	E-60 Parkland		Manitoba	0.8152	0.7655	0.8680	0.0000	-0.2044	0.0321	40.6090
area2	FB-80 Burntwood		Manitoba	1.6454	1.5403	1.7577	0.0000	0.4980	0.0337	218.6286
area2	FC-90 Churchill		Manitoba	1.3422	0.9266	1.9441	0.1195	0.2943	0.1890	2.4237
area2	G-15 Brandon		Manitoba	0.9466	0.8885	1.0084	0.0890	-0.0549	0.0323	2.8922
area2	GA-45 Assiniboine		Manitoba	0.8014	0.7603	0.8447	0.0000	-0.2214	0.0269	68.0025
area2	W01 St. James - Assiniboia		Manitoba	0.9763	0.9222	1.0335	0.4087	-0.0240	0.0291	0.6824
area2	W02 Assiniboine South		Manitoba	1.1760	1.0883	1.2708	0.0000	0.1621	0.0396	16.8033
area2	W03 Fort Garry		Manitoba	1.1605	1.0907	1.2348	0.0000	0.1489	0.0317	22.0993
area2	W04 St. Vital		Manitoba	1.0278	0.9668	1.0926	0.3797	0.0274	0.0312	0.7717
area2	W05 St. Boniface		Manitoba	1.0549	0.9902	1.1238	0.0979	0.0534	0.0323	2.7391
area2	W06 Transcona		Manitoba	1.0934	1.0152	1.1776	0.0183	0.0893	0.0379	5.5663
area2	W07 River East		Manitoba	0.9554	0.9101	1.0031	0.0662	-0.0456	0.0248	3.3749
area2	W08 Seven Oaks		Manitoba	1.1842	1.1210	1.2510	0.0000	0.1691	0.0280	36.5070
area2	W09 Inkster		Manitoba	1.0694	0.9899	1.1553	0.0886	0.0671	0.0394	2.8998
area2	W10 Point Douglas		Manitoba	0.8167	0.7618	0.8755	0.0000	-0.2025	0.0355	32.5332
area2	W11 Downtown		Manitoba	0.7564	0.7154	0.7997	0.0000	-0.2792	0.0284	96.6001
area2	W12 River Heights		Manitoba	0.9930	0.9314	1.0587	0.8305	-0.0070	0.0327	0.0458
age				1.2063	1.2002	1.2125	0.0000	0.1876	0.0026	5280.0173
sex	2 Female	Female	Male	0.8798	0.8537	0.9066	0.0000	-0.1281	0.0154	69.6553
avghh_income				0.9018	0.8967	0.9069	0.0000	-0.1033	0.0029	1281.4368
mental_adg	Yes		No	1.0463	1.0208	1.0725	0.0003	0.0453	0.0126	12.8992
phys_adg	Yes		No	1.6526	1.6206	1.6851	0.0000	0.5023	0.0100	2545.1269
adj_brst_feed_88_89				0.8651	0.8515	0.8789	0.0000	-0.1449	0.0081	321.3101
age*age				0.9988	0.9987	0.9988	0.0000	-0.0012	0.0000	2777.2395
area2*sex	A-40 Central	Female	MB*Male	0.9047	0.8406	0.9737	0.0076	-0.1001	0.0375	7.1272
area2*sex	BN-20 North Eastman	Female	MB*Male	1.1487	1.0446	1.2633	0.0043	0.1387	0.0485	8.1727
area2*sex	BS-25 South Eastman	Female	MB*Male	0.8878	0.8049	0.9793	0.0174	-0.1190	0.0500	5.6579
area2*sex	C-30 Interlake	Female	MB*Male	1.0026	0.9309	1.0798	0.9450	0.0026	0.0378	0.0048
area2*sex	D-70 Nor-Man	Female	MB*Male	1.4973	1.3374	1.6764	0.0000	0.4037	0.0576	49.0593
area2*sex	E-60 Parkland	Female	MB*Male	1.0286	0.9417	1.1234	0.5314	0.0282	0.0450	0.3918
area2*sex	FB-80 Burntwood	Female	MB*Male	1.7154	1.5714	1.8726	0.0000	0.5396	0.0447	145.5526
area2*sex	FC-90 Churchill	Female	MB*Male	2.0836	1.2705	3.4170	0.0036	0.7341	0.2524	8.4603
area2*sex	G-15 Brandon	Female	MB*Male	0.8184	0.7465	0.8972	0.0000	-0.2004	0.0469	18.2717
area2*sex	GA-45 Assiniboine	Female	MB*Male	0.9166	0.8497	0.9888	0.0244	-0.0871	0.0387	5.0694
area2*sex	W01 St. James - Assiniboia	Female	MB*Male	0.8284	0.7638	0.8985	0.0000	-0.1882	0.0414	20.6671
area2*sex	W02 Assiniboine South	Female	MB*Male	0.6481	0.5770	0.7281	0.0000	-0.4336	0.0593	53.4129
area2*sex	W03 Fort Garry	Female	MB*Male	0.7739	0.7089	0.8449	0.0000	-0.2563	0.0448	32.7663
area2*sex	W04 St. Vital	Female	MB*Male	0.8450	0.7754	0.9208	0.0001	-0.1685	0.0439	14.7543
area2*sex	W05 St. Boniface	Female	MB*Male	0.7238	0.6585	0.7955	0.0000	-0.3233	0.0482	44.9953
area2*sex	W06 Transcona	Female	MB*Male	0.8862	0.7956	0.9872	0.0282	-0.1208	0.0551	4.8163
area2*sex	W07 River East	Female	MB*Male	0.8839	0.8250	0.9470	0.0005	-0.1234	0.0352	12.2968
area2*sex	W08 Seven Oaks	Female	MB*Male	0.8876	0.8214	0.9591	0.0026	-0.1192	0.0395	9.1031
area2*sex	W09 Inkster	Female	MB*Male	1.0556	0.9483	1.1750	0.3228	0.0541	0.0547	0.9777
area2*sex	W10 Point Douglas	Female	MB*Male	1.3368	1.2216	1.4629	0.0000	0.2903	0.0460	39.8312
area2*sex	W11 Downtown	Female	MB*Male	1.2930	1.2008	1.3923	0.0000	0.2570	0.0377	46.3563
area2*sex	W12 River Heights	Female	MB*Male	0.8120	0.7431	0.8873	0.0000	-0.2082	0.0453	21.1741

Appendix Table 4.2: Amputation Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept			0.0001	0.0000	0.0011	0.0000	-8.9058	1.0518	71.6957
area2	A-40 Central	Manitoba	0.9754	0.6967	1.3656	0.8848	-0.0249	0.1717	0.0210
area2	BN-20 North Eastman	Manitoba	1.1358	0.7460	1.7293	0.5526	0.1274	0.2145	0.3527
area2	BS-25 South Eastman	Manitoba	0.7572	0.4436	1.2925	0.3080	-0.2781	0.2728	1.0393
area2	C-30 Interlake	Manitoba	1.1644	0.8520	1.5911	0.3395	0.1522	0.1593	0.9121
area2	D-70 Nor-Man	Manitoba	1.3275	0.8154	2.1613	0.2546	0.2833	0.2487	1.2978
area2	E-60 Parkland	Manitoba	0.9365	0.6449	1.3599	0.7302	-0.0656	0.1903	0.1189
area2	**FB-80 Burntwood**	Manitoba	**2.3480**	**1.7419**	**3.1650**	**0.0000**	**0.8536**	**0.1523**	**31.3925**
area2	**FC-90 Churchill**	Manitoba	**7.2410**	**2.3418**	**22.3898**	**0.0006**	**1.9798**	**0.5759**	**11.8159**
area2	**G-15 Brandon**	Manitoba	**0.5641**	**0.3239**	**0.9824**	**0.0431**	**-0.5726**	**0.2831**	**4.0912**
area2	**GA-45 Assiniboine**	Manitoba	**0.6663**	**0.4540**	**0.9778**	**0.0380**	**-0.4060**	**0.1957**	**4.3040**
area2	W01 St. James - Assiniboia	Manitoba	0.7233	0.4507	1.1608	0.1796	-0.3239	0.2413	1.8011
area2	W02 Assiniboine South	Manitoba	0.9283	0.4230	2.0372	0.8528	-0.0744	0.4010	0.0345
area2	W03 Fort Garry	Manitoba	0.9910	0.5986	1.6405	0.9718	-0.0091	0.2572	0.0012
area2	W04 St. Vital	Manitoba	0.7127	0.4251	1.1947	0.1988	-0.3387	0.2636	1.6514
area2	W05 St. Boniface	Manitoba	0.7121	0.4085	1.2411	0.2309	-0.3396	0.2835	1.4352
area2	W06 Transcona	Manitoba	0.6528	0.3171	1.3440	0.2471	-0.4264	0.3684	1.3399
area2	W07 River East	Manitoba	0.7812	0.5403	1.1294	0.1892	-0.2469	0.1881	1.7240
area2	W08 Seven Oaks	Manitoba	1.1791	0.8131	1.7099	0.3850	0.1647	0.1896	0.7547
area2	W09 Inkster	Manitoba	0.9873	0.5660	1.7223	0.9641	-0.0128	0.2839	0.0020
area2	W10 Point Douglas	Manitoba	1.0929	0.7586	1.5746	0.6333	0.0889	0.1863	0.2277
area2	W11 Downtown	Manitoba	1.1863	0.8755	1.6075	0.2704	0.1709	0.1550	1.2147
area2	W12 River Heights	Manitoba	0.4958	0.2707	0.9081	0.0231	-0.7016	0.3087	5.1636
age			**1.1633**	**1.0845**	**1.2478**	**0.0000**	**0.1513**	**0.0358**	**17.8673**
sex	**2 Female**	Male	**0.5358**	**0.4434**	**0.6475**	**0.0000**	**-0.6239**	**0.0966**	**41.7298**
avghh_income			**0.7670**	**0.7135**	**0.8245**	**0.0000**	**-0.2653**	**0.0369**	**51.7165**
coc50	**Yes**	No	**0.7615**	**0.6225**	**0.9315**	**0.0080**	**-0.2725**	**0.1028**	**7.0249**
mental_adg	Yes	No	0.9766	0.7729	1.2341	0.8431	-0.0236	0.1194	0.0392
phys_adg	**Yes**	No	**4.0065**	**3.2265**	**4.9750**	**0.0000**	**1.3879**	**0.1105**	**157.8484**
age*age			**0.9989**	**0.9983**	**0.9995**	**0.0004**	**-0.0011**	**0.0003**	**12.7675**

Appendix Table 4.3: Teen Pregnancy Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept			0.0000	0.0000	0.0000	0.0000	-26.0119	5.3045	24.0468
area2	**A-40 Central**	Manitoba	**0.5292**	**0.4317**	**0.6487**	**0.0000**	**-0.6365**	**0.1039**	**37.5236**
area2	**BN-20 North Eastman**	Manitoba	**0.7670**	**0.5901**	**0.9970**	**0.0474**	**-0.2652**	**0.1338**	**3.9316**
area2	**BS-25 South Eastman**	Manitoba	**0.5334**	**0.4055**	**0.7017**	**0.0000**	**-0.6285**	**0.1399**	**20.1815**
area2	**C-30 Interlake**	Manitoba	**0.6055**	**0.4736**	**0.7742**	**0.0001**	**-0.5017**	**0.1254**	**16.0132**
area2	**D-70 Nor-Man**	Manitoba	**1.3548**	**1.0667**	**1.7208**	**0.0128**	**0.3037**	**0.1220**	**6.1956**
area2	**E-60 Parkland**	Manitoba	**0.6981**	**0.5455**	**0.8935**	**0.0043**	**-0.3594**	**0.1259**	**8.1466**
area2	**FB-80 Burntwood**	Manitoba	**1.9192**	**1.6306**	**2.2589**	**0.0000**	**0.6519**	**0.0831**	**61.4748**
area2	**FC-90 Churchill**	Manitoba	**3.4811**	**1.0538**	**11.4999**	**0.0408**	**1.2474**	**0.6097**	**4.1857**
area2	G-15 Brandon	Manitoba	0.8819	0.6853	1.1348	0.3284	-0.1257	0.1286	0.9551
area2	**GA-45 Assiniboine**	Manitoba	**0.4581**	**0.3541**	**0.5927**	**0.0000**	**-0.7807**	**0.1314**	**35.2985**
area2	W01 St. James - Assiniboia	Manitoba	1.1657	0.8946	1.5191	0.2562	0.1534	0.1351	1.2890
area2	W02 Assiniboine South	Manitoba	1.1365	0.7676	1.6827	0.5226	0.1280	0.2002	0.4087
area2	W03 Fort Garry	Manitoba	0.8934	0.6522	1.2239	0.4828	-0.1127	0.1606	0.4926
area2	W04 St. Vital	Manitoba	1.0653	0.8094	1.4022	0.6518	0.0633	0.1402	0.2037
area2	W05 St. Boniface	Manitoba	0.8550	0.6155	1.1877	0.3503	-0.1566	0.1677	0.8724
area2	W06 Transcona	Manitoba	0.9041	0.6474	1.2627	0.5543	-0.1008	0.1704	0.3497
area2	W07 River East	Manitoba	0.8716	0.7038	1.0794	0.2079	-0.1374	0.1091	1.5861
area2	W08 Seven Oaks	Manitoba	1.2675	0.9893	1.6240	0.0608	0.2371	0.1265	3.5146
area2	**W09 Inkster**	Manitoba	**1.3632**	**1.0579**	**1.7565**	**0.0166**	**0.3098**	**0.1293**	**5.7387**
area2	**W10 Point Douglas**	Manitoba	**1.3385**	**1.0936**	**1.6382**	**0.0047**	**0.2915**	**0.1031**	**7.9968**
area2	**W11 Downtown**	Manitoba	**1.2279**	**1.0228**	**1.4740**	**0.0277**	**0.2053**	**0.0932**	**4.8479**
area2	W12 River Heights	Manitoba	1.2386	0.9336	1.6431	0.1379	0.2140	0.1442	2.2012
age			**13.8398**	**4.1516**	**46.1359**	**0.0000**	**2.6275**	**0.6143**	**18.2949**
momage_fbirth			**0.8831**	**0.8713**	**0.8952**	**0.0000**	**-0.1243**	**0.0069**	**323.7985**
avghh_income			**0.7650**	**0.7356**	**0.7956**	**0.0000**	**-0.2679**	**0.0200**	**179.0810**
contraceptive_use	Yes	No	0.9736	0.8548	1.1090	0.6873	-0.0267	0.0664	0.1620
mental_adg	**Yes**	No	**1.7375**	**1.5271**	**1.9769**	**0.0000**	**0.5524**	**0.0658**	**70.3908**
phys_adg	**Yes**	No	**1.2167**	**1.0626**	**1.3932**	**0.0045**	**0.1962**	**0.0691**	**8.0597**
age*age			**0.9398**	**0.9078**	**0.9730**	**0.0005**	**-0.0620**	**0.0177**	**12.2683**

Appendix Table 4.4: Injury Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept			0.0148	0.0134	0.0163	0.0000	-4.2125	0.0501	7069.5226
area2	**A-40 Central**	Manitoba	**1.1108**	**1.0312**	**1.1965**	**0.0056**	**0.1051**	**0.0379**	**7.6678**
area2	**BN-20 North Eastman**	Manitoba	**1.2283**	**1.1039**	**1.3667**	**0.0002**	**0.2056**	**0.0545**	**14.2391**
area2	**BS-25 South Eastman**	Manitoba	**0.8333**	**0.7480**	**0.9284**	**0.0009**	**-0.1823**	**0.0551**	**10.9493**
area2	C-30 Interlake	Manitoba	0.9806	0.8965	1.0725	0.6676	-0.0196	0.0457	0.1844
area2	**D-70 Nor-Man**	Manitoba	**1.5918**	**1.4140**	**1.7919**	**0.0000**	**0.4649**	**0.0604**	**59.1971**
area2	**E-60 Parkland**	Manitoba	**1.1612**	**1.0572**	**1.2754**	**0.0018**	**0.1495**	**0.0479**	**9.7474**
area2	**FB-80 Burntwood**	Manitoba	**3.1352**	**2.8998**	**3.3898**	**0.0000**	**1.1427**	**0.0398**	**823.2634**
area2	FC-90 Churchill	Manitoba	1.2851	0.6604	2.5004	0.4602	0.2508	0.3396	0.5453
area2	G-15 Brandon	Manitoba	0.9183	0.8265	1.0203	0.1128	-0.0852	0.0537	2.5152
area2	GA-45 Assiniboine	Manitoba	1.0711	0.9879	1.1613	0.0961	0.0687	0.0413	2.7694
area2	**W01 St. James - Assiniboia**	Manitoba	**0.8488**	**0.7678**	**0.9384**	**0.0014**	**-0.1639**	**0.0512**	**10.2587**
area2	**W02 Assiniboine South**	Manitoba	**1.2070**	**1.0584**	**1.3765**	**0.0050**	**0.1881**	**0.0670**	**7.8739**
area2	**W03 Fort Garry**	Manitoba	**0.8467**	**0.7553**	**0.9490**	**0.0043**	**-0.1665**	**0.0582**	**8.1718**
area2	**W04 St. Vital**	Manitoba	**0.7486**	**0.6693**	**0.8374**	**0.0000**	**-0.2895**	**0.0571**	**25.6643**
area2	**W05 St. Boniface**	Manitoba	**0.6739**	**0.5919**	**0.7673**	**0.0000**	**-0.3947**	**0.0662**	**35.5257**
area2	**W06 Transcona**	Manitoba	**0.7177**	**0.6154**	**0.8371**	**0.0000**	**-0.3317**	**0.0785**	**17.8629**
area2	**W07 River East**	Manitoba	**0.7846**	**0.7188**	**0.8564**	**0.0000**	**-0.2426**	**0.0447**	**29.4930**
area2	**W08 Seven Oaks**	Manitoba	**0.7245**	**0.6473**	**0.8110**	**0.0000**	**-0.3222**	**0.0575**	**31.4001**
area2	**W09 Inkster**	Manitoba	**0.7798**	**0.6695**	**0.9084**	**0.0014**	**-0.2487**	**0.0778**	**10.2035**
area2	W10 Point Douglas	Manitoba	0.9791	0.8807	1.0885	0.6956	-0.0212	0.0540	0.1531
area2	W11 Downtown	Manitoba	1.0422	0.9605	1.1309	0.3207	0.0414	0.0416	0.9859
area2	**W12 River Heights**	Manitoba	**0.8619**	**0.7791**	**0.9535**	**0.0039**	**-0.1486**	**0.0515**	**8.3102**
sex	**2 Female**	Male	**0.4127**	**0.3770**	**0.4518**	**0.0000**	**-0.8850**	**0.0462**	**366.5148**
age			**0.9722**	**0.9693**	**0.9751**	**0.0000**	**-0.0282**	**0.0015**	**339.5303**
avghh_income			**0.8669**	**0.8550**	**0.8790**	**0.0000**	**-0.1428**	**0.0071**	**407.0144**
mental_adg	**Yes**	No	**1.9108**	**1.8213**	**2.0047**	**0.0000**	**0.6475**	**0.0245**	**699.6289**
phys_adg	**Yes**	No	**1.7852**	**1.7066**	**1.8674**	**0.0000**	**0.5795**	**0.0230**	**636.7269**
age*age			**1.0004**	**1.0004**	**1.0005**	**0.0000**	**0.0004**	**0.0000**	**679.8638**
age*sex	**2 Female**	Male	**1.0146**	**1.0130**	**1.0163**	**0.0000**	**0.0145**	**0.0008**	**299.5187**

Appendix Table 4.5: Suicide Attempts Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept			0.0255	0.0209	0.0310	0.0000	-3.6707	0.0999	1350.8779
area2	A-40 Central	Manitoba	0.8158	0.7214	0.9227	0.0012	-0.2036	0.0628	10.5125
area2	BN-20 North Eastman	Manitoba	1.3532	1.1699	1.5652	0.0000	0.3024	0.0743	16.5852
area2	BS-25 South Eastman	Manitoba	0.6276	0.5220	0.7546	0.0000	-0.4658	0.0940	24.5422
area2	C-30 Interlake	Manitoba	0.6525	0.5582	0.7627	0.0000	-0.4270	0.0796	28.7555
area2	D-70 Nor-Man	Manitoba	2.5848	2.2674	2.9466	0.0000	0.9497	0.0668	201.8620
area2	E-60 Parkland	Manitoba	0.9086	0.7791	1.0595	0.2214	-0.0959	0.0784	1.4950
area2	FB-80 Burntwood	Manitoba	4.5093	4.1419	4.9092	0.0000	1.5061	0.0434	1206.9766
area2	FC-90 Churchill	Manitoba	2.6070	1.3322	5.1017	0.0052	0.9582	0.3425	7.8253
area2	G-15 Brandon	Manitoba	1.1033	0.9469	1.2854	0.2076	0.0983	0.0780	1.5884
area2	GA-45 Assiniboine	Manitoba	0.8008	0.6960	0.9213	0.0019	-0.2222	0.0715	9.6488
area2	W01 St. James - Assiniboia	Manitoba	0.7507	0.6276	0.8980	0.0017	-0.2867	0.0914	9.8395
area2	W02 Assiniboine South	Manitoba	1.1788	0.9300	1.4943	0.1738	0.1645	0.1210	1.8497
area2	W03 Fort Garry	Manitoba	0.7739	0.6352	0.9430	0.0110	-0.2563	0.1008	6.4635
area2	W04 St. Vital	Manitoba	0.7452	0.6230	0.8914	0.0013	-0.2941	0.0914	10.3535
area2	W05 St. Boniface	Manitoba	0.7713	0.6336	0.9389	0.0097	-0.2597	0.1003	6.6965
area2	W06 Transcona	Manitoba	0.8770	0.7139	1.0775	0.2115	-0.1312	0.1050	1.5610
area2	W07 River East	Manitoba	0.7563	0.6601	0.8665	0.0001	-0.2793	0.0694	16.2054
area2	W08 Seven Oaks	Manitoba	0.6853	0.5714	0.8220	0.0000	-0.3778	0.0928	16.5936
area2	W09 Inkster	Manitoba	0.7817	0.6326	0.9660	0.0226	-0.2463	0.1080	5.2015
area2	W10 Point Douglas	Manitoba	0.8935	0.7700	1.0368	0.1380	-0.1126	0.0759	2.2004
area2	W11 Downtown	Manitoba	0.8114	0.7173	0.9179	0.0009	-0.2090	0.0629	11.0403
area2	W12 River Heights	Manitoba	0.8942	0.7606	1.0512	0.1753	-0.1119	0.0826	1.8367
sex	2 Female	Male	2.3388	2.0295	2.6952	0.0000	0.8496	0.0724	137.8233
age			0.9697	0.9616	0.9778	0.0000	-0.0308	0.0043	51.8663
avghh_income			0.7670	0.7487	0.7856	0.0000	-0.2653	0.0123	466.7174
mental_adg	Yes	No	4.1155	3.8398	4.4110	0.0000	1.4148	0.0354	1599.1320
phys_adg	Yes	No	1.9981	1.8667	2.1386	0.0000	0.6922	0.0347	398.2666
age*age			0.9999	0.9998	1.0000	0.0619	-0.0001	0.0001	3.4851
age*sex	2 Female	Male	0.9873	0.9830	0.9916	0.0000	-0.0128	0.0022	33.8693

Appendix Table 4.6: Suicide Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept			0.0024	0.0017	0.0035	0.0000	-6.0182	0.1803	1114.5313
area3	G-15 Brandon	Manitoba	0.8065	0.5985	1.0867	0.1575	-0.2151	0.1522	1.9985
area3	M Mid	Manitoba	1.0768	0.9248	1.2537	0.3404	0.0740	0.0776	0.9088
area3	N North	Manitoba	1.3620	1.1141	1.6651	0.0026	0.3090	0.1025	9.0841
area3	S South	Manitoba	0.7173	0.6136	0.8387	0.0000	-0.3322	0.0797	17.3582
area3	WA Wpg Avg Health	Manitoba	1.1164	0.9724	1.2817	0.1180	0.1101	0.0704	2.4443
area3	WH Wpg Least Healthy	Manitoba	1.2454	1.0710	1.4480	0.0043	0.2194	0.0769	8.1350
area3	WL Wpg Most Healthy	Manitoba	0.8477	0.7275	0.9878	0.0342	-0.1652	0.0780	4.4848
sex	2 Female	Male	0.3754	0.2694	0.5233	0.0000	-0.9796	0.1694	33.4481
age			1.0163	1.0018	1.0310	0.0270	0.0162	0.0073	4.8934
avghh_income			0.8636	0.8288	0.8998	0.0000	-0.1467	0.0210	49.0050
mental_adg	Yes	No	3.1937	2.7751	3.6755	0.0000	1.1612	0.0717	262.4081
phys_adg	Yes	No	1.3218	1.1504	1.5186	0.0001	0.2790	0.0708	15.5034
age*age			0.9998	0.9996	0.9999	0.0023	-0.0002	0.0001	9.2619
age*sex	2 Female	Male	0.9955	0.9881	1.0029	0.2339	-0.0045	0.0038	1.4172

Appendix Table 4.7: Breastfeeding Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept		Manitoba	0.0001	0.0000	0.0005	0.0000	-9.6720	1.1019	77.0421
area2	A-40 Central	Manitoba	1.3505	1.0482	1.7400	0.0201	0.3005	0.1293	5.4001
area2	BN-20 North Eastman	Manitoba	0.7029	0.5492	0.8994	0.0051	-0.3526	0.1258	7.8527
area2	BS-25 South Eastman	Manitoba	1.7565	1.2880	2.3953	0.0004	0.5633	0.1583	12.6685
area2	C-30 Interlake	Manitoba	1.1148	0.8839	1.4061	0.3585	0.1087	0.1184	0.8430
area2	D-70 Nor-Man	Manitoba	0.9103	0.5754	1.4401	0.6879	-0.0940	0.2340	0.1614
area2	E-60 Parkland	Manitoba	0.5987	0.3829	0.9360	0.0245	-0.5130	0.2280	5.0621
area2	FB-80 Burntwood	Manitoba	0.6533	0.5223	0.8172	0.0002	-0.4257	0.1142	13.8931
area2	FC-90 Churchill	Manitoba	0.3285	0.1064	1.0146	0.0530	-1.1131	0.5753	3.7436
area2	G-15 Brandon	Manitoba	1.0238	0.6816	1.5378	0.9097	0.0235	0.2075	0.0129
area2	GA-45 Assiniboine	Manitoba	0.8327	0.5719	1.2125	0.3397	-0.1830	0.1917	0.9115
area2	W01 St. James - Assiniboia	Manitoba	1.2915	0.9836	1.6957	0.0656	0.2558	0.1389	3.3893
area2	W02 Assiniboine South	Manitoba	1.0421	0.7121	1.5249	0.8319	0.0412	0.1942	0.0451
area2	W03 Fort Garry	Manitoba	1.2166	0.9083	1.6295	0.1885	0.1961	0.1491	1.7290
area2	W04 St. Vital	Manitoba	1.9474	1.4282	2.6553	0.0000	0.6665	0.1582	17.7512
area2	W05 St. Boniface	Manitoba	1.3287	0.9740	1.8126	0.0729	0.2842	0.1585	3.2171
area2	W06 Transcona	Manitoba	1.1518	0.8248	1.6084	0.4067	0.1413	0.1704	0.6884
area2	W07 River East	Manitoba	1.0667	0.8729	1.3035	0.5281	0.0645	0.1023	0.3980
area2	W08 Seven Oaks	Manitoba	1.0330	0.8058	1.3244	0.7976	0.0325	0.1267	0.0658
area2	W09 Inkster	Manitoba	0.7158	0.5528	0.9267	0.0112	-0.3344	0.1318	6.4393
area2	W10 Point Douglas	Manitoba	0.8559	0.6967	1.0514	0.1383	-0.1556	0.1050	2.1968
area2	W11 Downtown	Manitoba	1.0768	0.8886	1.3049	0.4502	0.0740	0.0980	0.5702
area2	W12 River Heights	Manitoba	1.5209	1.1209	2.0636	0.0071	0.4193	0.1557	7.2522
hospital	0001: Brandon	HSC	1.4309	0.9423	2.1728	0.0927	0.3583	0.2131	2.8261
hospital	0005: St Boniface	HSC	1.1159	0.9765	1.2753	0.1072	0.1097	0.0681	2.5945
hospital	0007: Victoria	HSC	1.6376	1.2397	2.1632	0.0005	0.4932	0.1420	12.0601
hospital	0110: Steinbach	HSC	2.9143	1.5713	5.4050	0.0007	1.0696	0.3152	11.5185
hospital	0114: Boundary Trails, Winkler-Morden	HSC	2.5177	1.6417	3.8611	0.0000	0.9233	0.2182	17.9105
hospital	0122: Dauphin	HSC	1.2509	0.7388	2.1180	0.4047	0.2239	0.2687	0.6943
hospital	0134: Flin Flon	HSC	1.1520	0.5413	2.4518	0.7134	0.1415	0.3853	0.1349
hospital	0162: Portage	HSC	0.7494	0.5132	1.0943	0.1353	-0.2885	0.1932	2.2302
hospital	0170: The Pas	HSC	0.7618	0.4555	1.2742	0.2999	-0.2720	0.2624	1.0745
hospital	0173: Selkirk	HSC	1.1602	0.7727	1.7421	0.4735	0.1486	0.2074	0.5137
hospital	0177: Swan River	HSC	1.1352	0.5728	2.2497	0.7164	0.1268	0.3490	0.1319
hospital	0187: Thompson	HSC	0.8670	0.6496	1.1572	0.3326	-0.1427	0.1473	0.9386
hospital	Intermediate Rural	HSC	2.0455	1.2046	3.4736	0.0081	0.7157	0.2702	7.0164
hospital	Small Rural	HSC	1.2223	0.7418	2.0141	0.4309	0.2007	0.2548	0.6204
momage_fbirth			1.0897	1.0775	1.1020	0.0000	0.0859	0.0057	225.2058
avghh_income			1.1197	1.0800	1.1609	0.0000	0.1131	0.0184	37.6969
parity	1	0	0.6525	0.5758	0.7394	0.0000	-0.4270	0.0638	44.8128
parity	2+	0	0.5682	0.5010	0.6445	0.0000	-0.5652	0.0643	77.3853
csection	Yes	No	0.7735	0.6728	0.8893	0.0003	-0.2569	0.0712	13.0198
epidural	Yes	No	0.9533	0.8446	1.0760	0.4391	-0.0478	0.0618	0.5985
apgar	-6	7+	0.7413	0.5062	1.0856	0.1240	-0.2994	0.1947	2.3656
mental_adg	Yes	No	0.9651	0.8575	1.0861	0.5554	-0.0356	0.0603	0.3477
phys_adg	Yes	No	0.8533	0.7555	0.9637	0.0106	-0.1586	0.0621	6.5306
gestage			1.2488	1.1782	1.3237	0.0000	0.2222	0.0297	55.9912
weight			9.8237	4.3735	22.0658	0.0000	2.2848	0.4129	30.6242
gestage*weight			0.9459	0.9265	0.9658	0.0000	-0.0556	0.0106	27.5086

Appendix Table 4.8: 2-Year Immunization Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept			0.2737	0.2178	0.3438	0.0000	-1.2959	0.1164	123.8404
area2	A-40 Central	Manitoba	0.9978	0.8634	1.1531	0.9761	-0.0022	0.0738	0.0009
area2	**BN-20 North Eastman**	Manitoba	**0.7480**	**0.6048**	**0.9253**	**0.0075**	**-0.2903**	**0.1085**	**7.1607**
area2	BS-25 South Eastman	Manitoba	1.2073	0.9964	1.4630	0.0545	0.1884	0.0980	3.6968
area2	C-30 Interlake	Manitoba	0.9785	0.8178	1.1708	0.8120	-0.0218	0.0915	0.0565
area2	D-70 Nor-Man	Manitoba	1.1326	0.9042	1.4187	0.2784	0.1245	0.1149	1.1748
area2	**E-60 Parkland**	Manitoba	**1.5403**	**1.2015**	**1.9745**	**0.0007**	**0.4320**	**0.1267**	**11.6214**
area2	**FB-80 Burntwood**	Manitoba	**0.6257**	**0.5402**	**0.7247**	**0.0000**	**-0.4689**	**0.0750**	**39.1199**
area2	FC-90 Churchill	Manitoba	1.4627	0.5007	4.2730	0.4868	0.3803	0.5469	0.4835
area2	G-15 Brandon	Manitoba	1.1516	0.9305	1.4253	0.1943	0.1412	0.1088	1.6847
area2	**GA-45 Assiniboine**	Manitoba	**1.2405**	**1.0081**	**1.5265**	**0.0418**	**0.2155**	**0.1058**	**4.1453**
area2	W01 St. James - Assiniboia	Manitoba	0.9837	0.7936	1.2193	0.8805	-0.0165	0.1096	0.0226
area2	W02 Assiniboine South	Manitoba	0.9842	0.7103	1.3638	0.9237	-0.0159	0.1664	0.0092
area2	**W03 Fort Garry**	Manitoba	**0.7507**	**0.6139**	**0.9180**	**0.0052**	**-0.2867**	**0.1026**	**7.8045**
area2	**W04 St. Vital**	Manitoba	**1.2472**	**1.0004**	**1.5548**	**0.0495**	**0.2209**	**0.1125**	**3.8568**
area2	W05 St. Boniface	Manitoba	0.9785	0.7767	1.2328	0.8538	-0.0217	0.1179	0.0339
area2	W06 Transcona	Manitoba	0.9245	0.7183	1.1898	0.5418	-0.0785	0.1287	0.3721
area2	**W07 River East**	Manitoba	**1.1893**	**1.0006**	**1.4136**	**0.0492**	**0.1734**	**0.0882**	**3.8686**
area2	W08 Seven Oaks	Manitoba	1.0128	0.8180	1.2538	0.9073	0.0127	0.1089	0.0136
area2	W09 Inkster	Manitoba	0.8334	0.6635	1.0468	0.1172	-0.1822	0.1163	2.4546
area2	W10 Point Douglas	Manitoba	0.8561	0.7015	1.0447	0.1262	-0.1554	0.1016	2.3388
area2	W11 Downtown	Manitoba	0.9138	0.7767	1.0751	0.2772	-0.0901	0.0829	1.1808
area2	**W12 River Heights**	Manitoba	**0.7721**	**0.6240**	**0.9554**	**0.0173**	**-0.2586**	**0.1086**	**5.6648**
momage_fbirth			**1.0789**	**1.0690**	**1.0890**	**0.0000**	**0.0760**	**0.0047**	**258.0919**
sex	**2 Female**	Male	**1.0953**	**1.0072**	**1.1910**	**0.0333**	**0.0910**	**0.0428**	**4.5277**
avghh_income			**1.0426**	**1.0142**	**1.0719**	**0.0031**	**0.0417**	**0.0141**	**8.7399**
preterm	Yes	No	0.8577	0.7303	1.0075	0.0616	-0.1534	0.0821	3.4949
breastfed	**Yes**	No	**1.1251**	**1.0117**	**1.2512**	**0.0296**	**0.1179**	**0.0542**	**4.7331**
coc50	**Yes**	No	**1.5646**	**1.4257**	**1.7171**	**0.0000**	**0.4476**	**0.0474**	**89.0323**
chiropractor	Yes	No	0.9893	0.8727	1.1215	0.8666	-0.0107	0.0640	0.0282

Appendix Table 4.9: Complete Physicals Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept			0.1838	0.1809	0.1868	0.0000	-1.6939	0.0082	42359.8243
area2	**A-40 Central**	Manitoba	**0.6835**	**0.6726**	**0.6947**	**0.0000**	**-0.3805**	**0.0082**	**2130.7021**
area2	BN-20 North Eastman	Manitoba	1.0176	0.9950	1.0406	0.1274	0.0174	0.0114	2.3242
area2	**BS-25 South Eastman**	Manitoba	**0.9018**	**0.8847**	**0.9193**	**0.0000**	**-0.1034**	**0.0098**	**111.7924**
area2	**C-30 Interlake**	Manitoba	**1.0834**	**1.0647**	**1.1024**	**0.0000**	**0.0801**	**0.0089**	**81.3483**
area2	**D-70 Nor-Man**	Manitoba	**0.4193**	**0.4063**	**0.4327**	**0.0000**	**-0.8693**	**0.0161**	**2930.2187**
area2	**E-60 Parkland**	Manitoba	**0.6520**	**0.6370**	**0.6673**	**0.0000**	**-0.4278**	**0.0118**	**1308.7098**
area2	**FB-80 Burntwood**	Manitoba	**0.6099**	**0.5958**	**0.6243**	**0.0000**	**-0.4945**	**0.0119**	**1719.7585**
area2	**FC-90 Churchill**	Manitoba	**0.3973**	**0.3411**	**0.4627**	**0.0000**	**-0.9232**	**0.0778**	**140.7628**
area2	**G-15 Brandon**	Manitoba	**1.0854**	**1.0637**	**1.1075**	**0.0000**	**0.0820**	**0.0103**	**63.3809**
area2	**GA-45 Assiniboine**	Manitoba	**0.6979**	**0.6849**	**0.7110**	**0.00000E-309**	**-0.3597**	**0.0096**	**1419.9633**
area2	**W01 St. James - Assiniboia**	Manitoba	**1.3164**	**1.2925**	**1.3409**	**0.0000**	**0.2749**	**0.0094**	**859.3791**
area2	**W02 Assiniboine South**	Manitoba	**1.1670**	**1.1398**	**1.1949**	**0.0000**	**0.1545**	**0.0120**	**164.7430**
area2	**W03 Fort Garry**	Manitoba	**1.3336**	**1.3097**	**1.3580**	**0.0000**	**0.2879**	**0.0092**	**970.8021**
area2	**W04 St. Vital**	Manitoba	**1.4448**	**1.4189**	**1.4713**	**0.0000**	**0.3680**	**0.0093**	**1579.6583**
area2	**W05 St. Boniface**	Manitoba	**1.5363**	**1.5062**	**1.5669**	**0.0000**	**0.4293**	**0.0101**	**1815.2555**
area2	**W06 Transcona**	Manitoba	**1.3207**	**1.2905**	**1.3517**	**0.0000**	**0.2782**	**0.0118**	**554.4785**
area2	**W07 River East**	Manitoba	**1.2643**	**1.2450**	**1.2840**	**0.0000**	**0.2346**	**0.0079**	**889.7436**
area2	**W08 Seven Oaks**	Manitoba	**1.3577**	**1.3330**	**1.3829**	**0.0000**	**0.3058**	**0.0094**	**1063.3845**
area2	**W09 Inkster**	Manitoba	**1.3913**	**1.3585**	**1.4249**	**0.0000**	**0.3302**	**0.0122**	**735.2401**
area2	**W10 Point Douglas**	Manitoba	**1.1622**	**1.1369**	**1.1881**	**0.0000**	**0.1503**	**0.0112**	**179.0332**
area2	**W11 Downtown**	Manitoba	**1.2969**	**1.2745**	**1.3198**	**0.0000**	**0.2600**	**0.0089**	**851.1798**
area2	**W12 River Heights**	Manitoba	**1.3567**	**1.3315**	**1.3823**	**0.0000**	**0.3050**	**0.0096**	**1018.4004**
ageg			**1.0047**	**1.0046**	**1.0049**	**0.0000**	**0.0047**	**0.0001**	**2429.3586**
sex	**2 Female**	Male	**1.7214**	**1.7076**	**1.7353**	**0.0000**	**0.5431**	**0.0041**	**17524.6886**
avghh_income			**1.0470**	**1.0449**	**1.0491**	**0.0000**	**0.0459**	**0.0010**	**2014.8032**
coc50	**Yes**	No	**1.3847**	**1.3729**	**1.3965**	**0.0000**	**0.3255**	**0.0043**	**5636.2068**
mental_adg	**Yes**	No	**1.6540**	**1.6355**	**1.6727**	**0.0000**	**0.5032**	**0.0057**	**7699.3948**
phys_adg	**Yes**	No	**2.9596**	**2.9312**	**2.9882**	**0.0000**	**1.0850**	**0.0049**	**48627.9256**

Appendix Table 4.10: Mammography Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept			0.0000	0.0000	0.0000	0.0000	-20.5995	0.7402	774.4361
area2	**A-40 Central**	Manitoba	**1.1745**	**1.1183**	**1.2336**	**0.0000**	**0.1609**	**0.0250**	**41.3534**
area2	**BN-20 North Eastman**	Manitoba	**1.1255**	**1.0529**	**1.2030**	**0.0005**	**0.1182**	**0.0340**	**12.0760**
area2	**BS-25 South Eastman**	Manitoba	**1.0979**	**1.0328**	**1.1671**	**0.0027**	**0.0934**	**0.0312**	**8.9778**
area2	**C-30 Interlake**	Manitoba	**1.1859**	**1.1263**	**1.2486**	**0.0000**	**0.1705**	**0.0263**	**42.0155**
area2	D-70 Nor-Man	Manitoba	1.0792	0.9854	1.1819	0.1004	0.0762	0.0464	2.6989
area2	**E-60 Parkland**	Manitoba	**1.4541**	**1.3610**	**1.5536**	**0.0000**	**0.3744**	**0.0338**	**122.9616**
area2	FB-80 Burntwood	Manitoba	0.9245	0.8505	1.0049	0.0650	-0.0785	0.0425	3.4058
area2	FC-90 Churchill	Manitoba	0.7722	0.5029	1.1858	0.2375	-0.2585	0.2188	1.3952
area2	**G-15 Brandon**	Manitoba	**1.5023**	**1.4093**	**1.6014**	**0.0000**	**0.4070**	**0.0326**	**155.8086**
area2	**GA-45 Assiniboine**	Manitoba	**1.5194**	**1.4396**	**1.6036**	**0.0000**	**0.4183**	**0.0275**	**231.0355**
area2	**W01 St. James - Assiniboia**	Manitoba	**1.0632**	**1.0078**	**1.1217**	**0.0247**	**0.0613**	**0.0273**	**5.0447**
area2	W02 Assiniboine South	Manitoba	0.9718	0.9066	1.0416	0.4190	-0.0286	0.0354	0.6532
area2	W03 Fort Garry	Manitoba	1.0144	0.9591	1.0728	0.6179	0.0143	0.0286	0.2488
area2	**W04 St. Vital**	Manitoba	**1.0584**	**1.0017**	**1.1184**	**0.0435**	**0.0568**	**0.0281**	**4.0758**
area2	**W05 St. Boniface**	Manitoba	**1.1305**	**1.0640**	**1.2012**	**0.0001**	**0.1227**	**0.0309**	**15.7299**
area2	W06 Transcona	Manitoba	0.9453	0.8793	1.0162	0.1276	-0.0563	0.0369	2.3216
area2	**W07 River East**	Manitoba	**0.8703**	**0.8311**	**0.9113**	**0.0000**	**-0.1389**	**0.0235**	**34.9931**
area2	**W08 Seven Oaks**	Manitoba	**0.8084**	**0.7663**	**0.8529**	**0.0000**	**-0.2127**	**0.0273**	**60.6633**
area2	**W09 Inkster**	Manitoba	**0.6954**	**0.6438**	**0.7512**	**0.0000**	**-0.3632**	**0.0394**	**85.0639**
area2	**W10 Point Douglas**	Manitoba	**0.6269**	**0.5830**	**0.6741**	**0.0000**	**-0.4670**	**0.0370**	**159.1309**
area2	**W11 Downtown**	Manitoba	**0.6400**	**0.6044**	**0.6778**	**0.0000**	**-0.4462**	**0.0292**	**232.7556**
area2	W12 River Heights	Manitoba	0.9764	0.9230	1.0330	0.4064	-0.0238	0.0287	0.6893
age			**1.9248**	**1.8318**	**2.0224**	**0.0000**	**0.6548**	**0.0253**	**672.4447**
avghh_income			**1.0925**	**1.0854**	**1.0995**	**0.0000**	**0.0884**	**0.0033**	**725.6503**
coc50	**Yes**	No	**1.9715**	**1.9159**	**2.0287**	**0.0000**	**0.6788**	**0.0146**	**2164.3977**
mental_adg	**Yes**	No	**1.0737**	**1.0408**	**1.1077**	**0.0000**	**0.0712**	**0.0159**	**20.0512**
phys_adg	**Yes**	No	**1.1757**	**1.1437**	**1.2086**	**0.0000**	**0.1619**	**0.0141**	**132.1553**
age*age			**0.9947**	**0.9943**	**0.9951**	**0.0000**	**-0.0053**	**0.0002**	**621.9411**

Appendix Table 4.11: Cervical Cancer Screening Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept			0.8218	0.7966	0.8477	0.0000	-0.1963	0.0158	153.4570
area2	**A-40 Central**	Manitoba	**0.8985**	**0.8744**	**0.9233**	**0.0000**	**-0.1070**	**0.0139**	**59.3663**
area2	BN-20 North Eastman	Manitoba	1.0076	0.9673	1.0496	0.7156	0.0076	0.0208	0.1327
area2	**BS-25 South Eastman**	Manitoba	**1.1732**	**1.1326**	**1.2152**	**0.0000**	**0.1597**	**0.0179**	**79.2600**
area2	**C-30 Interlake**	Manitoba	**1.1629**	**1.1266**	**1.2003**	**0.0000**	**0.1509**	**0.0162**	**87.1037**
area2	**D-70 Nor-Man**	Manitoba	**0.5358**	**0.5106**	**0.5622**	**0.0000**	**-0.6241**	**0.0246**	**644.5214**
area2	**E-60 Parkland**	Manitoba	**0.8738**	**0.8398**	**0.9092**	**0.0000**	**-0.1349**	**0.0203**	**44.2771**
area2	**FB-80 Burntwood**	Manitoba	**0.3892**	**0.3742**	**0.4047**	**0.0000**	**-0.9437**	**0.0200**	**2231.7171**
area2	**FC-90 Churchill**	Manitoba	**0.3716**	**0.3010**	**0.4588**	**0.0000**	**-0.9899**	**0.1076**	**84.6866**
area2	**G-15 Brandon**	Manitoba	**1.5373**	**1.4802**	**1.5965**	**0.0000**	**0.4300**	**0.0193**	**496.6931**
area2	GA-45 Assiniboine	Manitoba	1.0300	0.9973	1.0638	0.0723	0.0296	0.0165	3.2294
area2	**W01 St. James - Assiniboia**	Manitoba	**1.4423**	**1.3932**	**1.4931**	**0.0000**	**0.3662**	**0.0177**	**430.0277**
area2	**W02 Assiniboine South**	Manitoba	**1.0861**	**1.0390**	**1.1355**	**0.0003**	**0.0826**	**0.0227**	**13.2942**
area2	**W03 Fort Garry**	Manitoba	**1.2429**	**1.2020**	**1.2853**	**0.0000**	**0.2175**	**0.0171**	**161.5856**
area2	**W04 St. Vital**	Manitoba	**1.4345**	**1.3858**	**1.4850**	**0.0000**	**0.3609**	**0.0176**	**418.3905**
area2	**W05 St. Boniface**	Manitoba	**1.5391**	**1.4806**	**1.5999**	**0.0000**	**0.4312**	**0.0198**	**475.7602**
area2	**W06 Transcona**	Manitoba	**1.4651**	**1.3997**	**1.5336**	**0.0000**	**0.3819**	**0.0233**	**268.3669**
area2	**W07 River East**	Manitoba	**1.2908**	**1.2549**	**1.3277**	**0.0000**	**0.2553**	**0.0144**	**315.0387**
area2	**W08 Seven Oaks**	Manitoba	**1.0937**	**1.0579**	**1.1307**	**0.0000**	**0.0895**	**0.0170**	**27.7743**
area2	**W09 Inkster**	Manitoba	**0.8469**	**0.8117**	**0.8836**	**0.0000**	**-0.1662**	**0.0216**	**58.9494**
area2	**W10 Point Douglas**	Manitoba	**0.8741**	**0.8400**	**0.9096**	**0.0000**	**-0.1346**	**0.0203**	**43.9473**
area2	**W11 Downtown**	Manitoba	**0.8421**	**0.8171**	**0.8679**	**0.0000**	**-0.1718**	**0.0154**	**124.2803**
area2	**W12 River Heights**	Manitoba	**1.3625**	**1.3170**	**1.4095**	**0.0000**	**0.3093**	**0.0173**	**319.2429**
agegroup	**18-29**	40-49	**0.9743**	**0.9535**	**0.9956**	**0.0183**	**-0.0260**	**0.0110**	**5.5694**
agegroup	**30-39**	40-49	**1.1480**	**1.1222**	**1.1744**	**0.0000**	**0.1380**	**0.0116**	**142.1060**
agegroup	**50-59**	40-49	**0.8197**	**0.8001**	**0.8398**	**0.0000**	**-0.1988**	**0.0123**	**259.6261**
agegroup	**60-69**	40-49	**0.5137**	**0.5002**	**0.5276**	**0.0000**	**-0.6661**	**0.0136**	**2394.7433**
avghh_income			**1.0902**	**1.0857**	**1.0947**	**0.0000**	**0.0864**	**0.0021**	**1657.7268**
coc50	**Yes**	No	**1.8209**	**1.7927**	**1.8496**	**0.0000**	**0.5994**	**0.0080**	**5650.4388**
mental_adg	**Yes**	No	**1.5697**	**1.5392**	**1.6008**	**0.0000**	**0.4509**	**0.0100**	**2031.4017**
phys_adg	**Yes**	No	**1.2527**	**1.2290**	**1.2768**	**0.0000**	**0.2253**	**0.0097**	**534.8142**

Appendix Table 4.12: Polypharmacy Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept			0.0000	0.0000	0.0000	0.0000	-12.9613	1.0187	161.8856
area2	**A-40 Central**	Manitoba	**1.2419**	**1.1537**	**1.3369**	**0.0000**	**0.2167**	**0.0376**	**33.2091**
area2	BN-20 North Eastman	Manitoba	0.9225	0.8153	1.0437	0.2003	-0.0807	0.0630	1.6403
area2	BS-25 South Eastman	Manitoba	1.0547	0.9536	1.1665	0.3002	0.0533	0.0514	1.0732
area2	C-30 Interlake	Manitoba	1.0831	0.9957	1.1781	0.0629	0.0798	0.0429	3.4583
area2	**D-70 Nor-Man**	Manitoba	**1.9635**	**1.7056**	**2.2603**	**0.0000**	**0.6747**	**0.0718**	**88.2190**
area2	**E-60 Parkland**	Manitoba	**1.4773**	**1.3594**	**1.6053**	**0.0000**	**0.3902**	**0.0424**	**84.6684**
area2	**FB-80 Burntwood**	Manitoba	**2.7325**	**2.3499**	**3.1773**	**0.0000**	**1.0052**	**0.0769**	**170.6505**
area2	**FC-90 Churchill**	Manitoba	**3.0228**	**1.5087**	**6.0564**	**0.0018**	**1.1062**	**0.3546**	**9.7333**
area2	**G-15 Brandon**	Manitoba	**1.5211**	**1.3919**	**1.6624**	**0.0000**	**0.4195**	**0.0453**	**85.7477**
area2	**GA-45 Assiniboine**	Manitoba	**1.4883**	**1.3864**	**1.5978**	**0.0000**	**0.3977**	**0.0362**	**120.5927**
area2	**W01 St. James - Assiniboia**	Manitoba	**0.6048**	**0.5501**	**0.6649**	**0.0000**	**-0.5029**	**0.0483**	**108.3244**
area2	**W02 Assiniboine South**	Manitoba	**0.7367**	**0.6438**	**0.8431**	**0.0000**	**-0.3056**	**0.0688**	**19.7249**
area2	**W03 Fort Garry**	Manitoba	**0.7381**	**0.6626**	**0.8223**	**0.0000**	**-0.3036**	**0.0551**	**30.3759**
area2	**W04 St. Vital**	Manitoba	**0.7225**	**0.6529**	**0.7995**	**0.0000**	**-0.3251**	**0.0517**	**39.5514**
area2	**W05 St. Boniface**	Manitoba	**0.8392**	**0.7547**	**0.9331**	**0.0012**	**-0.1753**	**0.0541**	**10.4985**
area2	**W06 Transcona**	Manitoba	**0.5600**	**0.4735**	**0.6623**	**0.0000**	**-0.5799**	**0.0856**	**45.8570**
area2	**W07 River East**	Manitoba	**0.6157**	**0.5651**	**0.6708**	**0.0000**	**-0.4850**	**0.0438**	**122.8400**
area2	**W08 Seven Oaks**	Manitoba	**0.7400**	**0.6712**	**0.8160**	**0.0000**	**-0.3011**	**0.0498**	**36.4909**
area2	**W09 Inkster**	Manitoba	**0.7025**	**0.5857**	**0.8425**	**0.0001**	**-0.3532**	**0.0928**	**14.4919**
area2	**W10 Point Douglas**	Manitoba	**0.8051**	**0.7152**	**0.9063**	**0.0003**	**-0.2168**	**0.0604**	**12.8902**
area2	**W11 Downtown**	Manitoba	**0.7166**	**0.6533**	**0.7859**	**0.0000**	**-0.3333**	**0.0471**	**49.9991**
area2	**W12 River Heights**	Manitoba	**0.6833**	**0.6217**	**0.7511**	**0.0000**	**-0.3808**	**0.0482**	**62.3111**
age			**1.2802**	**1.2157**	**1.3481**	**0.0000**	**0.2470**	**0.0264**	**87.6660**
sex	**2 Female**	Male	**1.1774**	**1.1288**	**1.2281**	**0.0000**	**0.1633**	**0.0215**	**57.7139**
avghh_income			**0.9298**	**0.9179**	**0.9419**	**0.0000**	**-0.0728**	**0.0066**	**122.1886**
coc50	Yes	No	0.9720	0.9267	1.0195	0.2429	-0.0284	0.0243	1.3639
homecare	**Long-term**	No	**4.2970**	**4.0999**	**4.5036**	**0.0000**	**1.4579**	**0.0240**	**3702.4856**
homecare	**Short-term**	No	**2.1915**	**1.9524**	**2.4598**	**0.0000**	**0.7846**	**0.0589**	**177.1969**
mental_adg	**Yes**	No	**1.5665**	**1.4926**	**1.6441**	**0.0000**	**0.4489**	**0.0247**	**331.5666**
phys_adg	**Yes**	No	**3.4139**	**3.2497**	**3.5864**	**0.0000**	**1.2278**	**0.0252**	**2383.0625**
age*age			**0.9984**	**0.9981**	**0.9987**	**0.0000**	**-0.0016**	**0.0002**	**88.1587**

Appendix Table 4.13: Emergency Caesarean Sections Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept			0.0000	0.0000	0.0000	0.0000	-67.9021	5.1027	177.0764
area2	A-40 Central	Manitoba	0.8683	0.6934	1.0872	0.2183	-0.1412	0.1147	1.5152
area2	BN-20 North Eastman	Manitoba	1.1183	0.8663	1.4437	0.3907	0.1118	0.1303	0.7368
area2	BS-25 South Eastman	Manitoba	0.9288	0.7345	1.1745	0.5374	-0.0739	0.1197	0.3804
area2	C-30 Interlake	Manitoba	0.9917	0.7983	1.2318	0.9396	-0.0084	0.1107	0.0057
area2	D-70 Nor-Man	Manitoba	1.4294	0.9358	2.1833	0.0984	0.3572	0.2161	2.7320
area2	E-60 Parkland	Manitoba	1.0507	0.6765	1.6318	0.8259	0.0494	0.2246	0.0484
area2	FB-80 Burntwood	Manitoba	1.1756	0.9066	1.5246	0.2223	0.1618	0.1326	1.4892
area2	FC-90 Churchill	Manitoba	0.5285	0.1299	2.1492	0.3729	-0.6378	0.7158	0.7939
area2	G-15 Brandon	Manitoba	0.9207	0.6444	1.3153	0.6497	-0.0827	0.1820	0.2063
area2	GA-45 Assiniboine	Manitoba	0.9732	0.6957	1.3614	0.8741	-0.0271	0.1712	0.0251
area2	W01 St. James - Assiniboia	Manitoba	0.9871	0.7934	1.2282	0.9076	-0.0129	0.1115	0.0135
area2	W02 Assiniboine South	Manitoba	1.0674	0.8062	1.4132	0.6486	0.0652	0.1432	0.2076
area2	W03 Fort Garry	Manitoba	0.9929	0.8048	1.2248	0.9466	-0.0072	0.1071	0.0045
area2	W04 St. Vital	Manitoba	1.0669	0.8680	1.3114	0.5383	0.0648	0.1053	0.3787
area2	W05 St. Boniface	Manitoba	0.9490	0.7531	1.1959	0.6575	-0.0523	0.1180	0.1966
area2	W06 Transcona	Manitoba	1.1960	0.9248	1.5468	0.1726	0.1790	0.1312	1.8604
area2	W07 River East	Manitoba	1.1099	0.9311	1.3232	0.2446	0.1043	0.0897	1.3538
area2	W08 Seven Oaks	Manitoba	1.1760	0.9531	1.4510	0.1306	0.1621	0.1072	2.2852
area2	W09 Inkster	Manitoba	0.8623	0.6501	1.1439	0.3042	-0.1481	0.1442	1.0555
area2	W10 Point Douglas	Manitoba	1.0151	0.8080	1.2754	0.8975	0.0150	0.1164	0.0166
area2	W11 Downtown	Manitoba	1.0154	0.8453	1.2198	0.8698	0.0153	0.0936	0.0269
area2	W12 River Heights	Manitoba	0.9098	0.7374	1.1226	0.3781	-0.0945	0.1072	0.7768
hospital	**0001: Brandon**	HSC	**1.6400**	**1.1340**	**2.3718**	**0.0086**	**0.4947**	**0.1882**	**6.9069**
hospital	0005: St Boniface	HSC	1.0554	0.9420	1.1826	0.3526	0.0539	0.0580	0.8641
hospital	0007: Victoria	HSC	0.9193	0.7572	1.1161	0.3953	-0.0841	0.0990	0.7226
hospital	0110: Steinbach	HSC	1.0138	0.6893	1.4909	0.9446	0.0137	0.1968	0.0048
hospital	0114: Boundary Trails, Winkler	HSC	1.3020	0.9529	1.7791	0.0975	0.2639	0.1593	2.7464
hospital	0122: Dauphin	HSC	0.9891	0.5870	1.6668	0.9673	-0.0109	0.2662	0.0017
hospital	0134: Flin Flon	HSC	1.6568	0.8721	3.1476	0.1231	0.5049	0.3274	2.3780
hospital	0162: Portage	HSC	0.7378	0.4914	1.1078	0.1425	-0.3041	0.2074	2.1502
hospital	**0170: The Pas**	HSC	**0.5713**	**0.3398**	**0.9606**	**0.0347**	**-0.5598**	**0.2651**	**4.4584**
hospital	**0173: Selkirk**	HSC	**0.4385**	**0.2948**	**0.6523**	**0.0000**	**-0.8243**	**0.2026**	**16.5584**
hospital	0177: Swan River	HSC	0.7026	0.3502	1.4096	0.3204	-0.3529	0.3552	0.9871
hospital	0187: Thompson	HSC	0.8803	0.6299	1.2301	0.4551	-0.1275	0.1707	0.5580
hospital	**Intermediate/Small Rural**		**0.2760**	**0.1782**	**0.4274**	**0.0000**	**-1.2874**	**0.2232**	**33.2790**
age			**1.0606**	**1.0521**	**1.0692**	**0.0000**	**0.0588**	**0.0041**	**204.4953**
avghh_income			**0.9505**	**0.9263**	**0.9753**	**0.0001**	**-0.0508**	**0.0132**	**14.8736**
prev_csect	**Yes**	No	**3.9005**	**3.3565**	**4.5328**	**0.0000**	**1.3611**	**0.0766**	**315.4029**
mult_birth	Yes	No	1.1228	0.8358	1.5085	0.4418	0.1159	0.1507	0.5915
parity	**1**	0	**0.2422**	**0.2153**	**0.2725**	**0.0000**	**-1.4178**	**0.0601**	**557.0256**
parity	**2+**	0	**0.1735**	**0.1519**	**0.1982**	**0.0000**	**-1.7515**	**0.0679**	**665.9770**
induction	**Augmentation**	None	**1.9414**	**1.7092**	**2.2053**	**0.0000**	**0.6634**	**0.0650**	**104.1308**
induction	**Induction**	None	**2.0828**	**1.8750**	**2.3136**	**0.0000**	**0.7337**	**0.0536**	**187.2295**
presentation	**Abnormal (breech)**	Normal (head down)	**8.7207**	**7.7230**	**9.8473**	**0.0000**	**2.1657**	**0.0620**	**1220.6991**
diab	**Diabetic**	Not Diabetic	**2.0398**	**1.5337**	**2.7130**	**0.0000**	**0.7129**	**0.1455**	**24.0020**
diab	**Gestational**	Not Diabetic	**1.5400**	**1.2465**	**1.9026**	**0.0001**	**0.4318**	**0.1079**	**16.0189**
mental_adg	Yes	No	1.0199	0.9174	1.1339	0.7149	0.0197	0.0540	0.1334
phys_adg	Yes	No	0.9576	0.8533	1.0746	0.4614	-0.0433	0.0588	0.5425
nbsex	**2 Female**	Male	**0.8652**	**0.7943**	**0.9425**	**0.0009**	**-0.1448**	**0.0436**	**11.0073**
gestage			**74.3642**	**39.4861**	**140.0504**	**0.0000**	**4.3090**	**0.3230**	**177.9982**
weight			**1.05E+14**	**2.32E+11**	**4.76E+16**	**0.0000**	**32.2852**	**3.1207**	**107.0308**
gestage*weight			**0.1408**	**0.1037**	**0.1910**	**0.0000**	**-1.9606**	**0.1557**	**158.5005**
gestage*gestage			**0.9335**	**0.9244**	**0.9427**	**0.0000**	**-0.0688**	**0.0050**	**188.7438**
gestag*gestag*weight			**1.0296**	**1.0256**	**1.0336**	**0.0000**	**0.0292**	**0.0020**	**216.6692**

Appendix Table 4.14: Scheduled Caesarean Section Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept			1268.2884	0.0000	2.00E+15	0.6180	7.1454	14.3296	0.2487
area2	A-40 Central	Manitoba	1.0705	0.8187	1.3999	0.6185	0.0682	0.1369	0.2480
area2	BN-20 North Eastman	Manitoba	0.7078	0.4953	1.0114	0.0577	-0.3456	0.1821	3.6022
area2	BS-25 South Eastman	Manitoba	0.8807	0.6443	1.2039	0.4258	-0.1270	0.1595	0.6343
area2	C-30 Interlake	Manitoba	0.9210	0.7030	1.2066	0.5505	-0.0823	0.1378	0.3565
area2	D-70 Nor-Man	Manitoba	1.4865	0.8426	2.6226	0.1711	0.3964	0.2897	1.8734
area2	E-60 Parkland	Manitoba	1.2992	0.7223	2.3369	0.3821	0.2618	0.2995	0.7638
area2	**FB-80 Burntwood**	Manitoba	**0.5602**	**0.3812**	**0.8234**	**0.0032**	**-0.5794**	**0.1965**	**8.6972**
area2	FC-90 Churchill	Manitoba	1.7510	0.4518	6.7872	0.4177	0.5602	0.6912	0.6568
area2	G-15 Brandon	Manitoba	1.5049	0.9388	2.4125	0.0896	0.4087	0.2408	2.8821
area2	**GA-45 Assiniboine**	Manitoba	**1.6121**	**1.0565**	**2.4600**	**0.0268**	**0.4775**	**0.2156**	**4.9056**
area2	W01 St. James - Assiniboia	Manitoba	0.8085	0.6044	1.0815	0.1521	-0.2126	0.1484	2.0515
area2	W02 Assiniboine South	Manitoba	1.1688	0.8110	1.6845	0.4028	0.1560	0.1865	0.7001
area2	W03 Fort Garry	Manitoba	1.1118	0.8504	1.4536	0.4385	0.1060	0.1368	0.6002
area2	W04 St. Vital	Manitoba	0.8516	0.6447	1.1250	0.2581	-0.1606	0.1420	1.2790
area2	W05 St. Boniface	Manitoba	0.9442	0.7060	1.2627	0.6985	-0.0574	0.1483	0.1500
area2	W06 Transcona	Manitoba	0.8508	0.5946	1.2173	0.3766	-0.1616	0.1828	0.7817
area2	W07 River East	Manitoba	1.0524	0.8404	1.3179	0.6563	0.0511	0.1148	0.1980
area2	W08 Seven Oaks	Manitoba	0.9898	0.7491	1.3079	0.9427	-0.0102	0.1422	0.0052
area2	W09 Inkster	Manitoba	1.0048	0.7126	1.4168	0.9782	0.0048	0.1753	0.0007
area2	**W10 Point Douglas**	Manitoba	**0.5874**	**0.4266**	**0.8086**	**0.0011**	**-0.5321**	**0.1631**	**10.6417**
area2	W11 Downtown	Manitoba	0.8714	0.6801	1.1166	0.2765	-0.1376	0.1265	1.1842
area2	W12 River Heights	Manitoba	0.9193	0.6916	1.2221	0.5626	-0.0841	0.1452	0.3353
hospital	**0001: Brandon**	HSC	**0.5480**	**0.3370**	**0.8912**	**0.0153**	**-0.6014**	**0.2480**	**5.8785**
hospital	0005: St Boniface	HSC	1.0451	0.8979	1.2165	0.5689	0.0441	0.0775	0.3245
hospital	**0007: Victoria**	HSC	**0.5180**	**0.3944**	**0.6803**	**0.0000**	**-0.6579**	**0.1391**	**22.3681**
hospital	0110: Steinbach	HSC	0.8017	0.4859	1.3228	0.3871	-0.2210	0.2555	0.7481
hospital	**0114: Boundary Trails, Winkler**	HSC	**0.4728**	**0.3117**	**0.7171**	**0.0004**	**-0.7492**	**0.2126**	**12.4206**
hospital	0122: Dauphin	HSC	0.5926	0.3006	1.1682	0.1308	-0.5233	0.3463	2.2831
hospital	**0134: Flin Flon**	HSC	**0.2378**	**0.0825**	**0.6855**	**0.0078**	**-1.4363**	**0.5401**	**7.0710**
hospital	**0162: Portage**	HSC	**0.1995**	**0.1110**	**0.3583**	**0.0000**	**-1.6122**	**0.2989**	**29.0966**
hospital	**0170: The Pas**	HSC	**0.2862**	**0.1438**	**0.5697**	**0.0004**	**-1.2511**	**0.3512**	**12.6870**
hospital	**0173: Selkirk**	HSC	**0.1961**	**0.1097**	**0.3504**	**0.0000**	**-1.6291**	**0.2962**	**30.2511**
hospital	**0177: Swan River**	HSC	**0.1404**	**0.0433**	**0.4547**	**0.0011**	**-1.9634**	**0.5996**	**10.7225**
hospital	**0187: Thompson**	HSC	**0.1988**	**0.1164**	**0.3395**	**0.0000**	**-1.6156**	**0.2732**	**34.9787**
hospital	**Intermediate/Small Rural**		**0.2319**	**0.1466**	**0.3667**	**0.0000**	**-1.4615**	**0.2338**	**39.0829**
age			**1.0529**	**1.0410**	**1.0650**	**0.0000**	**0.0515**	**0.0058**	**78.5217**
avghh_income			0.9868	0.9543	1.0204	0.4367	-0.0133	0.0171	0.6050
prev_csect	**Yes**	No	**26.6527**	**23.1708**	**30.6578**	**0.0000**	**3.2829**	**0.0714**	**2112.4739**
mult_birth	**Yes**	No	**2.5820**	**1.8132**	**3.6766**	**0.0000**	**0.9485**	**0.1803**	**27.6700**
parity	**1**	0	**1.5014**	**1.2748**	**1.7684**	**0.0000**	**0.4064**	**0.0835**	**23.6884**
parity	**2+**	0	**1.2387**	**1.0370**	**1.4797**	**0.0183**	**0.2141**	**0.0907**	**5.5714**
presentation	**Abnormal (breech)**	Normal (head down)	**19.0255**	**16.3067**	**22.1976**	**0.0000**	**2.9458**	**0.0787**	**1401.9270**
diab	Diabetic	Not Diabetic	1.3813	0.9569	1.9939	0.0846	0.3230	0.1873	2.9743
diab	Gestational	Not Diabetic	0.8642	0.6363	1.1737	0.3502	-0.1459	0.1562	0.8729
mental_adg	Yes	No	1.1192	0.9696	1.2919	0.1240	0.1126	0.0732	2.3663
phys_adg	Yes	No	1.1207	0.9639	1.3029	0.1385	0.1139	0.0769	2.1949
nbsex	2 Female	Male	1.0392	0.9243	1.1682	0.5203	0.0384	0.0597	0.4132
gestage			0.4652	0.0902	2.3985	0.3604	-0.7654	0.8368	0.8365
weight			**0.0000**	**0.0000**	**0.0000**	**0.0000**	**-65.0565**	**7.2037**	**81.5580**
gestage*weight			**33.9852**	**16.3806**	**70.5100**	**0.0000**	**3.5259**	**0.3724**	**89.6638**
gestage*gestage			1.0110	0.9871	1.0355	0.3692	0.0110	0.0122	0.8065
gestag*gestag*weight			**0.9537**	**0.9446**	**0.9628**	**0.0000**	**-0.0474**	**0.0049**	**94.7878**

Appendix Table 4.15: Hysterectomy Logistic Regression

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	prob	Estimate	StdErr	chisq
Intercept			0.0000	0.0000	0.0001	0.0000	-10.1851	0.2383	1827.1194
area2	**A-40 Central**	Manitoba	**1.2928**	**1.1387**	**1.4679**	**0.0001**	**0.2568**	**0.0648**	**15.7177**
area2	BN-20 North Eastman	Manitoba	1.1190	0.9292	1.3476	0.2359	0.1124	0.0948	1.4052
area2	**BS-25 South Eastman**	Manitoba	**1.5933**	**1.3808**	**1.8384**	**0.0000**	**0.4658**	**0.0730**	**40.6981**
area2	C-30 Interlake	Manitoba	1.0152	0.8750	1.1778	0.8426	0.0151	0.0758	0.0394
area2	D-70 Nor-Man	Manitoba	1.0882	0.8591	1.3784	0.4834	0.0845	0.1206	0.4912
area2	**E-60 Parkland**	Manitoba	**1.2875**	**1.0836**	**1.5297**	**0.0041**	**0.2527**	**0.0879**	**8.2561**
area2	**FB-80 Burntwood**	Manitoba	**1.2693**	**1.0465**	**1.5395**	**0.0155**	**0.2384**	**0.0985**	**5.8627**
area2	FC-90 Churchill	Manitoba	0.7093	0.1879	2.6776	0.6123	-0.3435	0.6778	0.2569
area2	**G-15 Brandon**	Manitoba	**1.2493**	**1.0658**	**1.4644**	**0.0060**	**0.2226**	**0.0811**	**7.5403**
area2	**GA-45 Assiniboine**	Manitoba	**1.3213**	**1.1478**	**1.5210**	**0.0001**	**0.2786**	**0.0718**	**15.0569**
area2	W01 St. James - Assiniboia	Manitoba	0.9911	0.8496	1.1560	0.9091	-0.0090	0.0786	0.0130
area2	**W02 Assiniboine South**	Manitoba	**0.7661**	**0.6150**	**0.9543**	**0.0175**	**-0.2664**	**0.1121**	**5.6498**
area2	**W03 Fort Garry**	Manitoba	**0.7530**	**0.6327**	**0.8961**	**0.0014**	**-0.2837**	**0.0888**	**10.2127**
area2	W04 St. Vital	Manitoba	0.9344	0.7979	1.0942	0.3997	-0.0678	0.0806	0.7093
area2	**W05 St. Boniface**	Manitoba	**0.8276**	**0.6889**	**0.9943**	**0.0433**	**-0.1892**	**0.0936**	**4.0826**
area2	W06 Transcona	Manitoba	1.1254	0.9308	1.3607	0.2226	0.1181	0.0969	1.4877
area2	W07 River East	Manitoba	0.9661	0.8451	1.1043	0.6129	-0.0345	0.0682	0.2560
area2	W08 Seven Oaks	Manitoba	0.8554	0.7251	1.0092	0.0642	-0.1562	0.0844	3.4261
area2	W09 Inkster	Manitoba	1.0858	0.8845	1.3329	0.4313	0.0823	0.1046	0.6193
area2	W10 Point Douglas	Manitoba	1.0660	0.8800	1.2913	0.5136	0.0639	0.0978	0.4267
area2	**W11 Downtown**	Manitoba	**0.6506**	**0.5414**	**0.7818**	**0.0000**	**-0.4299**	**0.0937**	**21.0279**
area2	**W12 River Heights**	Manitoba	**0.6629**	**0.5513**	**0.7971**	**0.0000**	**-0.4112**	**0.0941**	**19.1010**
age			**1.2519**	**1.2295**	**1.2747**	**0.0000**	**0.2247**	**0.0092**	**595.9639**
avghh_income			0.9965	0.9785	1.0148	0.7047	-0.0035	0.0093	0.1436
mental_adg	**Yes**	No	**1.2444**	**1.1493**	**1.3474**	**0.0000**	**0.2186**	**0.0406**	**29.0388**
phys_adg	**Yes**	No	**1.1294**	**1.0450**	**1.2207**	**0.0021**	**0.1217**	**0.0396**	**9.4204**
age*age			**0.9978**	**0.9977**	**0.9980**	**0.0000**	**-0.0022**	**0.0001**	**608.2809**

Appendix Table 4.16: Specialist Visit Logistic Regression: Non-Winnipeg RHAs

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	Estimate	StdErr	chisq	prob
Intercept			0.07189943	0.0695022	0.0743793	-2.63250	0.01730	23153	0
area2	A-40 Central	Manitoba	1.09343075	1.0687835	1.1186464	0.08930	0.01160	58.9625	1.61E-14
area2	BN-20 North Eastman	Manitoba	1.51341165	1.4721636	1.5558154	0.41440	0.01410	863.8058	7.25E-190
area2	BS-25 South Eastman	Manitoba	1.24464127	1.2135573	1.2765215	0.21880	0.01290	287.6394	1.63E-64
area2	C-30 Interlake	Manitoba	1.76210910	1.7209829	1.8042181	0.56650	0.01200	2210.663	0
area2	D-70 Nor-Man	Manitoba	0.58187326	0.5608544	0.6036799	-0.54150	0.01880	832.1862	5.42E-183
area2	E-60 Parkland	Manitoba	0.78017579	0.7571601	0.8038911	-0.24820	0.01530	264.0005	2.30E-59
area2	FB-80 Burntwood	Manitoba	0.79648412	0.7733585	0.8203013	-0.22750	0.01500	229.1181	9.28E-52
area2	FC-90 Churchill	Manitoba	0.75462686	0.6495063	0.8767608	-0.28150	0.07650	13.53075	0.000235
area2	G-15 Brandon	Manitoba	1.17474843	1.1441470	1.2061684	0.16110	0.01350	143.0284	5.79E-33
area2	GA-45 Assiniboine	Manitoba	0.85960616	0.8379147	0.8818591	-0.15130	0.01300	134.5946	4.05E-31
ageg			1.00498958	1.0046703	1.0053089	0.00498	0.00016	942.7715	4.94E-207
sex	2 Female	Male	1.41515423	1.3954056	1.4351824	0.34720	0.00717	2345.327	0
avghh_income			1.11156951	1.1056916	1.1174786	0.10580	0.00271	1528.948	0
coc50	Yes	No	1.13983778	1.1232185	1.1567030	0.13090	0.00749	305.0612	2.60E-68
mental_adg	Yes	No	1.81300303	1.7778440	1.8488574	0.59500	0.00999	3546.132	0
phys_adg	Yes	No	4.74021907	4.6684780	4.8130625	1.55610	0.00778	39996.76	0

Appendix Table 4.17: Specialist Visit Logistic Regression: RHAs & Winnipeg CAs

Variable	ClassVal0	reference	odds_ratio	lcl_odds	ucl_odds	Estimate	StdErr	chisq	prob
Intercept			0.222064	0.218426	0.225762	-1.5048	0.00843	31882.82	0
area2	A-40 Central	Manitoba	0.660188	0.648961	0.671608	-0.4152	0.00875	2251.685	0
area2	BN-20 North Eastman	Manitoba	0.931823	0.909911	0.954263	-0.0706	0.01210	33.82627	6.03E-09
area2	BS-25 South Eastman	Manitoba	0.748965	0.733630	0.764621	-0.2891	0.01060	750.0105	3.99E-165
area2	C-30 Interlake	Manitoba	1.110689	1.090687	1.131057	0.1050	0.00927	128.2032	1.01E-29
area2	D-70 Nor-Man	Manitoba	0.339768	0.328033	0.351922	-1.0795	0.01790	3623.924	0
area2	E-60 Parkland	Manitoba	0.454746	0.442949	0.466858	-0.7880	0.01340	3452.93	0
area2	FB-80 Burntwood	Manitoba	0.444389	0.432945	0.456136	-0.8111	0.01330	3712.65	0
area2	FC-90 Churchill	Manitoba	0.469185	0.400577	0.549542	-0.7568	0.08070	88.02784	6.45E-21
area2	G-15 Brandon	Manitoba	0.722331	0.706530	0.738486	-0.3253	0.01130	830.8203	1.07E-182
area2	GA-45 Assiniboine	Manitoba	0.518483	0.507785	0.529405	-0.6568	0.01060	3813.384	0
area2	W01 St. James - Assiniboia	Manitoba	1.584186	1.554641	1.614292	0.4601	0.00961	2294.257	0
area2	W02 Assiniboine South	Manitoba	1.515265	1.479254	1.552153	0.4156	0.01230	1146.883	2.13E-251
area2	W03 Fort Garry	Manitoba	1.541158	1.512796	1.570051	0.4325	0.00948	2083.235	0
area2	W04 St. Vital	Manitoba	1.432353	1.405777	1.459432	0.3593	0.00956	1414.045	0.00000E-309
area2	W05 St. Boniface	Manitoba	1.465670	1.436118	1.495829	0.3823	0.01040	1353.395	2.82E-296
area2	W06 Transcona	Manitoba	1.359872	1.327727	1.392794	0.3074	0.01220	634.316	5.76E-140
area2	W07 River East	Manitoba	1.594448	1.569454	1.619839	0.4665	0.00806	3349.52	0
area2	W08 Seven Oaks	Manitoba	1.685182	1.653807	1.717153	0.5219	0.00959	2962.078	0
area2	W09 Inkster	Manitoba	1.572747	1.534711	1.611727	0.4528	0.01250	1314.241	9.09E-288
area2	W10 Point Douglas	Manitoba	1.445265	1.413082	1.478181	0.3683	0.01150	1027.503	1.89E-225
area2	W11 Downtown	Manitoba	1.514741	1.487773	1.542199	0.4152	0.00917	2052.536	0
area2	W12 River Heights	Manitoba	1.657630	1.626167	1.689702	0.5054	0.00978	2671.957	0
ageg			0.996307	0.996109	0.996505	-0.0037	0.00010	1329.133	5.28E-291
sex	2 Female	Male	1.458834	1.446595	1.471177	0.3776	0.00430	7718.164	0
avghh_income			1.042749	1.040611	1.044891	0.0419	0.00105	1598.206	0
coc50	Yes	No	1.051298	1.041974	1.060706	0.0500	0.00455	121.125	3.59E-28
mental_adg	Yes	No	1.886130	1.864465	1.908047	0.6345	0.00589	11588.42	0
phys_adg	Yes	No	5.163832	5.111803	5.216390	1.6417	0.00517	100960.7	0

APPENDIX 5: DETAILED INFORMATION AVAILABLE ON THE WEBSITE

The following information is provided on the MCHP website, under Data Extras or under Reports:

(a) detailed descriptive information on policy, program and support initiatives by RHA.
Note: This descriptive information at times appears to be associated with the health outcome data. This is not necessarily a causal relationship since it is based on observational data alone. The program or policy may or may not be causing the observed results.

(b) detailed quantitative information for each RHA and district as to the rates and time trends for the indicators.

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Sex Differences in Health Status, Health Care Use, and Quality of Care: A Population-Based Analysis for Manioba's Regional Health Authorities by Randy Fransoo, Patricia Martens, *The Need to Know* Team (funded through CIHR), Elaine Burland, Heather Prior, Charles Burchill, Dan Chateau, and Randy Walld.

Health and Health Care Use Among Older Adults: Using Population-Based Information Systems to Inform Policy in Manitoba, Canadian Journal on Aging, Volume 24, Supplement 1, 2005.

High-Cost Users of Pharmaceuticals: Who Are They? by Anita Kozyrskyj, Lisa Lix, Matthew Dahl and Ruth-Ann Soodeen.

Primary Prevention: An Examination of Data Capabilities in Manitoba, by Lisa Lix, Greg Finlayson, Marina Yogendran, Ruth Bond, Jennifer Bodnarchuk, and Ruth-Ann Soodeen.

Aboriginal Health Research and Policy: First Nations-University Collaboration in Manitoba, Canadian Journal of Public Health, Volume 96, Supplement 1, January/February 2005.

2004

Patterns of Regional Mental Illness Disorder Diagnoses and Service Use in Manitoba: A Population-Based Study, by Patricia Martens, Randy Fransoo, Nancy McKeen, *The Need To Know Team* (funded through CIHR), Elaine Burland, Laurel Jebamani, Charles Burchill, Carolyn De Coster, Okechukwu Ekuma, Heather Prior, Dan Chateau, Renée Robinson, and Colleen Metge.

Diagnostic Imaging Data in Manitoba, Assessment and Applications, by Greg Finlayson, Bill Leslie and Leonard MacWilliam with Sandor Demeter, Lisa Lix, Roger Philipp, and Martin Reed.

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