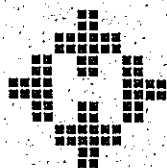


Population Health Information System
1991/92 (1986 Census Version)

Socio-Economic Characteristics

January 1994



**Manitoba Centre for
Health Policy and Evaluation**
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The Manitoba Centre for Health Policy and Evaluation

The Manitoba Centre for Health Policy and Evaluation (MCHPE) is a unit within the Department of Community Health Sciences, Faculty of Medicine, University of Manitoba. The MCHPE is active in health services research, evaluation and policy analysis, concentrating on using the Manitoba health data base to describe and explain patterns of care and profiles of health and illness.

Manitoba has one of the most complete, well-organized and useful health data bases in North America. The data base provides a comprehensive, longitudinal, population-based administrative record of health care use in the province.

Members of the MCHPE consult extensively with government officials, health care administrators, and clinicians to develop a research agenda that is topical and relevant. This strength, along with its rigorous academic standards and its exceptional data base, uniquely position the MCHPE to contribute to improvements in the health policy process.

The Centre's researchers are widely published and internationally recognized. They collaborate with a number of highly respected scientists from Canada, the United States and Europe.

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SOCIO-ECONOMIC CHARACTERISTICS

Introduction to the Population Health Information System

In January 1991, the Manitoba Centre for Health Policy and Evaluation (MCHPE) was established at the University of Manitoba to provide the Department of Health with research-based analyses, evaluation and policy options. The researchers agreed to undertake several specific projects each year. In addition, they agreed to develop a health information system for the province.

The Population Health Information System (PHIS) is designed to focus on the link between health care utilization and health, and to make it possible to examine how effectively and efficiently health care services produce health in the population. We have attempted to develop an information system to facilitate rational decision making and ultimately to permit shifting discussions from demand for health care to demand for health. The system is population-based, designed to track the health status and health care use of residents of given regions (regardless of where such use takes place), as distinct from examining use of clinical care for individual patients or treatments by specific providers.

The PHIS also identifies the socio-economic characteristics of regional residents since socio-economic status has long been linked to poorer health outcomes and greater need for health care.

The Population Health Information System will produce separate reports for each of the modules outlined below. Each module will contain a summary and detailed discussion of findings, as well as an appendix with detailed tables. This report contains the Socio-Economic Characteristics Module.

MODULES OF THE POPULATION HEALTH INFORMATION SYSTEM

Population Health: Health Status Indicators

Socio-Economic Characteristics

Utilization of Hospital Resources

Utilization of Personal Care Home Resources

Utilization of Physician Resources

We intend for this first report of the PHIS to have limited distribution, primarily to obtain comment and feedback. Subsequent versions of the system will include several years of data; trends over time will be of most interest.

Note that (with the exception of this module) the descriptive data to date are presented without benefit of statistical tests or confidence intervals. This is not a problem since we are dealing with data for an entire population, not a sample. Also, we use multiple independent indicators and only draw conclusions when several indicators point in the same direction. The data represent usage for the entire Manitoba population at one point in time. When indices are constructed, however, statistical tests are performed to test for statistically significant relationships between them and measures of health status and usage. The small size of some regions (specifically Thompson and Norman) must be acknowledged: conclusions drawn from the data from these regions must remain tentative. On the other hand, Winnipeg is a very large and internally diverse region containing more than half of the province's population. Conclusions about the average status of the Winnipeg region must be tempered by an appreciation of its internal heterogeneity.

Executive Summary

This report examines a variety of socio-economic characteristics of residents of Manitoba regions which may be related to differences in the health status of residents and to their use of health care. This module develops a prototype index of socio-economic risk factors that are shown to be related to regional differences identified in this and other modules of the Population Health Information System. The index is constructed to reflect potential relationships between the socio-economic status of a population and both its health status and utilization of health care resources. The data on the indicators is drawn from publicly available Statistics Canada data and the Manitoba Health Research Database.

Not surprisingly, significant differences are found among regions in a large number of socio-economic characteristics. Six indicators are selected for their strong relationship to health status and health care resource utilization. Three are found to be positively related to an index of poor health status. That is, as a region's score on the indicator increases so does their residents' poor health. These three are: the percentage of the labour force unemployed between the ages of 15 and 24, the percentage unemployed between 45 and 54, and the percentage of single parent female households. Three are negatively related to poor health status: as they rise poor health declines. These are the percentage of the population between the ages of 25 and 34 having graduated from high school or equivalent, the percentage of females participating in the labour force and the average dwelling value. Combined into a single index, these six variables explain roughly 87% (Figure 10) of the variation in a prototype poor health status index across regions in the province. The regional socio-economic risk index also explains 91% of the regional variation in standardized mortality rates of individuals between 0 and 64 years of age (Figure 11), and it explains 92% of the variance in regional area residents' use of short term hospital days (Figure 12). The Thompson and Norman regions have the highest level of socio-economic risk with Parklands not far behind. Winnipeg has below average risk while the other regions have risks slightly above the Manitoba average. (See Figure 7).

These analyses, as is true for the rest of the population health statistics system, have been developed first at the regional level; in the future we plan to repeat analyses for smaller

geographic areas. This is important particularly for Winnipeg, a region which contains half the province's population. It contains both very poor areas whose residents will be at a high socio-economic risk as well as very affluent areas. The identification of a socio-economic risk index which is related to both utilization and health status opens the possibility of using these indicators to assess social policy options regarding differences in usage and outcomes. Thus it provides additional data that may be useful in policy formation and implementation.

Regional Distribution of Socio-Economic Characteristics

Introduction

It has been long been established in the health care literature that there is a relationship between socio-economic status and both health status and utilization (1,5,6). Recently there has been increasing interest in the exact nature of those relationships in North America (8-11, 4). However, the direction of the relationship between health status and poverty is not necessarily one way (poorer people may become sicker, but sicker people may also become poorer). Similarly, the relationship between socio-economic status and utilization may be very sensitive to the institutional arrangements for health care. In the United States the poor may have restricted access to care, while in well functioning universal systems like Canada's, the poor - being sicker - may avail themselves of more services.

Ever since the "Lalonde Report" (19) population health researchers in Canada have been sensitized to the impact of both lifestyle and the environment (along with the more traditional factors of human biology and the health-care delivery system) on population health. There has been a growing movement to understand these determinants of health status. This module seeks to examine how these factors, as represented by socio-economic characteristics of the population, affect the health of Manitobans and their use of health care facilities.

The ideal method of examining these relationships is to have data on an individual's socio-economic status, an individual's health status and health care utilization, and a profile of the social, economic and physical environment in which the individual lives and works. The increasingly versatile application of routinely collected administrative information to describe health status and health service utilization is limited in the ability to describe these relationships, because of the frequent absence of measures of individual socio-economic and

health status. To overcome this obstacle, many researchers have attempted to supplement individual-level health information with measures of socio-economic characteristics of the area of residence, which are typically derived from census or tax filing information (10-18). This module applies this method of using geographic socio-economic profiles to examine differences in health status and health care utilization across the regions of Manitoba.

Description of the Socio-Economic Indicators

This report describes profiles for the eight health regions on 23 indicators of social and economic characteristics derived from the 1986 census. The report also describes the development of a composite socio-economic index which can be used to rank health regions. The original data reported in this module are routinely available for the province of Manitoba, and for geographic regions known as census divisions and census sub-divisions. In this module, however, we have grouped the units of census geography to match the administrative regions defined by Manitoba Health, to facilitate comparisons across different components of the Population Health Information System.

The source of census data for this report was the library of Basic User Summary Tapes released by Statistics Canada approximately two years after the 1986 census. This library contains comprehensive data from the 2A and 2B census forms, reported at the level of the enumeration area. There were 1,825 enumeration areas in Manitoba in 1986. Data for enumeration areas were aggregated to the level of the municipality, and then the level of the eight health regions of the Province.

Table 1 presents the values of the 23 socio-economic indicators for each of the 8 regions. The indicators have been grouped into six categories: dwelling characteristics, education, employment, income, mobility and social characteristics. Detailed definitions of these variables are provided in the methodological appendix.

Dwelling Characteristics

Across the eight health regions, the average market value of owner-occupied single detached dwellings ranges from \$68,442 in Winnipeg to \$39,030 in Thompson. These differences in dwelling values are not reliable as indicators of differences in housing quality. Instead, they

are best interpreted as one indicator of a mixture of differences in the cost of living across regions and the quality of those dwellings. Figure 1 sets out the distribution of dwelling values by region. Winnipeg has the highest dwelling values which are considerably above the provincial average, while the Eastman region is the only other region to have a dwelling value above average (although only marginally so). The Thompson and Parklands regions have the lowest values while the Norman, Westman and Central regions also have averages well below the provincial mean. The Interlake has a slightly below average dwelling value.¹

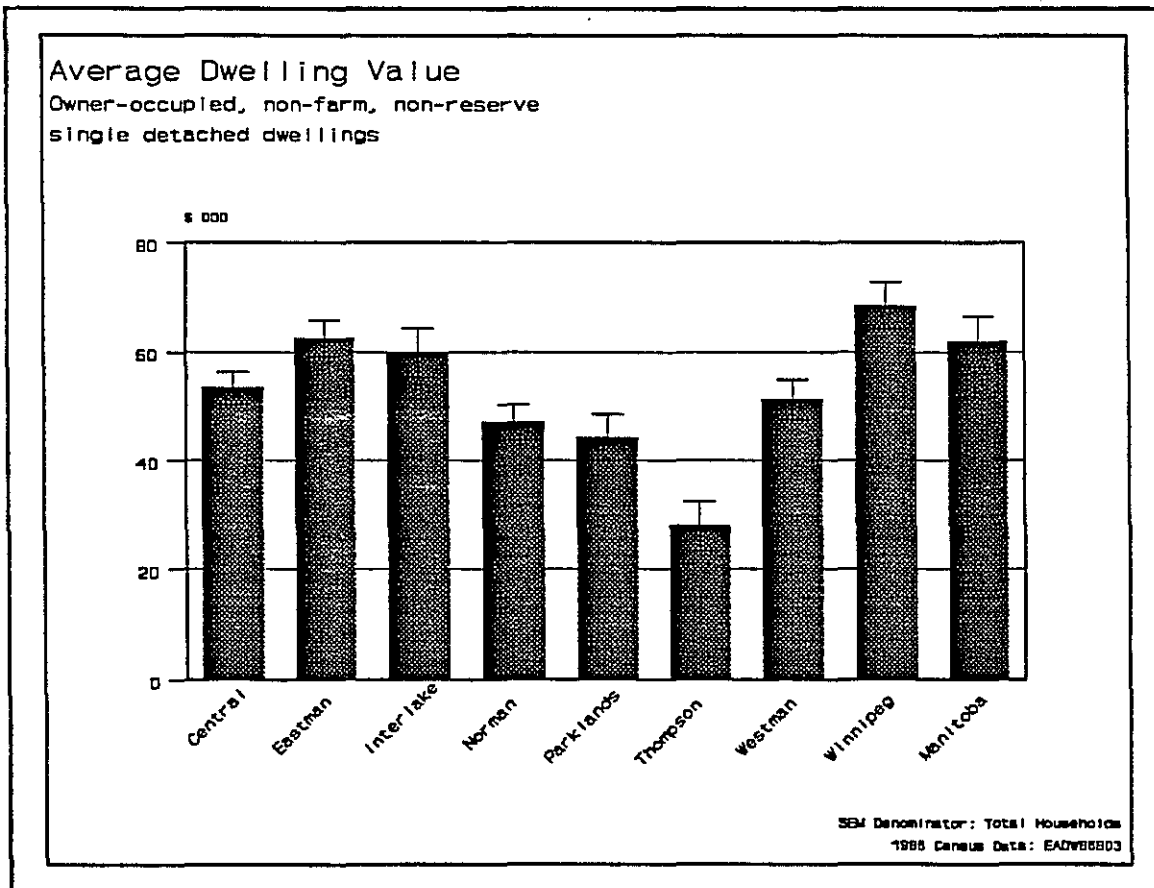


Figure 1

Education

The proportion of residents in each region who have attained a minimum of a high school diploma are reported for three age cohorts: those aged 25-34, 35-44 and 45-54 years of age.

1. Dwellings located on farms and on native reserves are excluded from the calculation of regional averages (See Table 1).

In the youngest cohort, the percent with a high school diploma in 1986 ranges from 50.5% in Thompson to 71.4% in Winnipeg. In the cohort aged 45-54, comparable percentages are 33.7% and 54.2%. A number of observations can be drawn from this cohort series. Despite the fact that younger cohorts have higher high school completion rates, there is little evidence that the differences among regions in these rates have narrowed over time. For example, the cohort aged 45-54 was of school age twenty years before the youngest cohort, yet the rank order of regions in those two cohorts does not differ notably. The persistence of differences in regional social and economic characteristics over time is also suggested by these data. We believe these findings are indicative of the persistence of many of the characteristics reported in this paper and supports the use of census data from a period 7 years earlier than the report date.

The percentage of the population between the ages of 25 and 34 who have completed high school or its equivalent can serve as an example of the distribution of educational attainment across the regions. Figure 2 is based on those numbers. Only Winnipeg has an above average high school completion rate within this age group. The Thompson and Parklands regions fare worst while the Central, Eastman and Interlake regions are not much better. The Norman region occupies an intermediate position while the Westman region approaches the provincial average.

Employment

Three indicators of labour force activity are described in this section: the percent of the labour force in each region engaged in three occupational groupings, female labour force participation and the regional unemployment rate in 1986 for four age cohorts.

The percent of the labour force engaged in farming ranges from greater than 20% in Westman, Parklands and Central regions to less than 2% in Thompson, Norman and Winnipeg regions. The percent of the labour force engaged in manufacturing, construction and transportation ranges from 26.9% in Eastman to 16.5% in Parklands. Little difference is observed across regions in the percent of the labour force engaged in managerial, administrative or scientific occupations, with the exception of a concentration of these

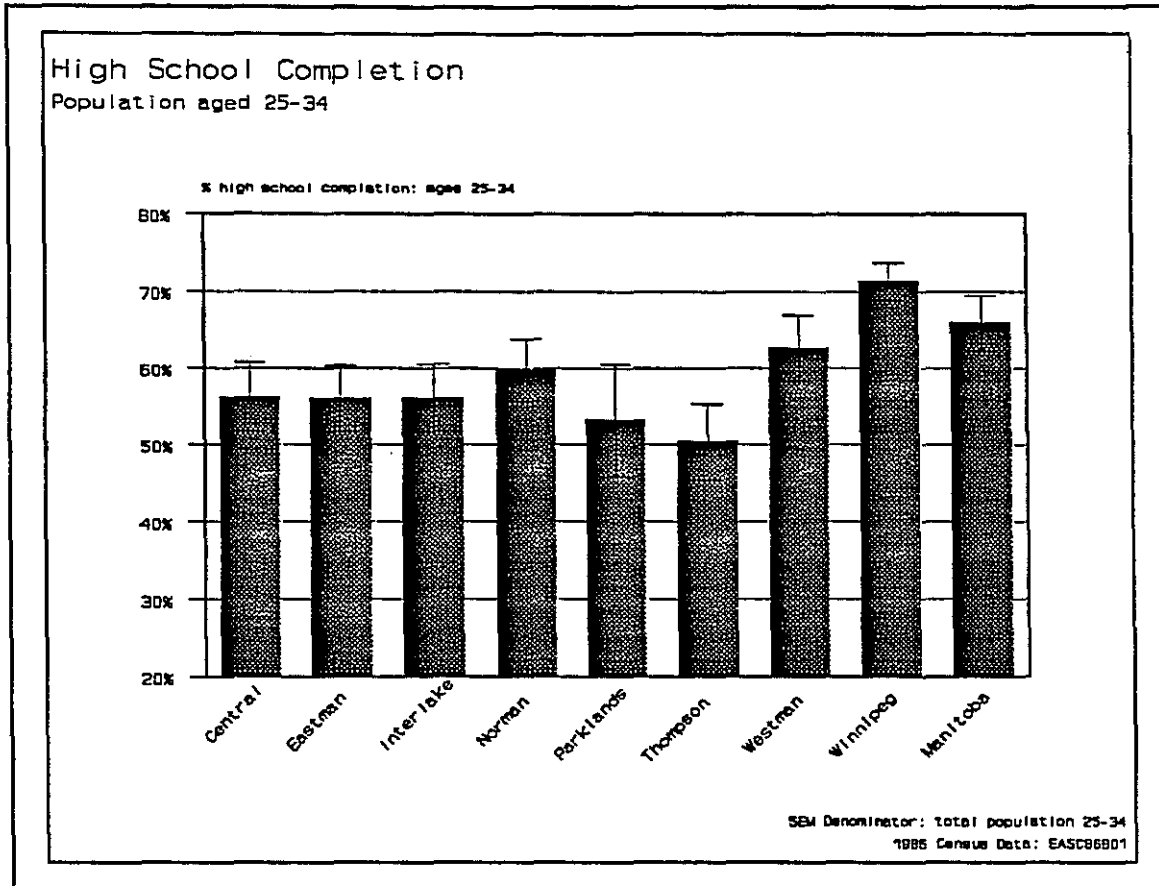


Figure 2

occupations in Winnipeg.

Approximately 56% of women in the province aged 15 or older are engaged in the labour force in 1986, ranging from a high of 59.3% in Winnipeg to a low of 45.6% in Parklands.

Unemployment rates for the census week in 1986 display some of the most dramatic regional differences among all the indicators reviewed for this report. As was also seen in description of age specific rates of high school completion, the pattern across regions in unemployment is consistent across age cohorts. However, the most substantial regional differences occur in the youngest age groups, especially the cohort aged 15-24, where unemployment rates range from 7.5% in Eastman to 30.1% in Thompson. Figure 3 shows the distribution across regions of unemployment rates for this cohort. It is clear that the Norman and Thompson regions have

the highest unemployment rates with Parklands possibly a bit above average. Interlake and Winnipeg hover near the provincial average while the Central region is below average and the Eastman and Westman regions are marginally below average. The variability in this characteristic seems to be different from that of the educational attainment rates reported above.

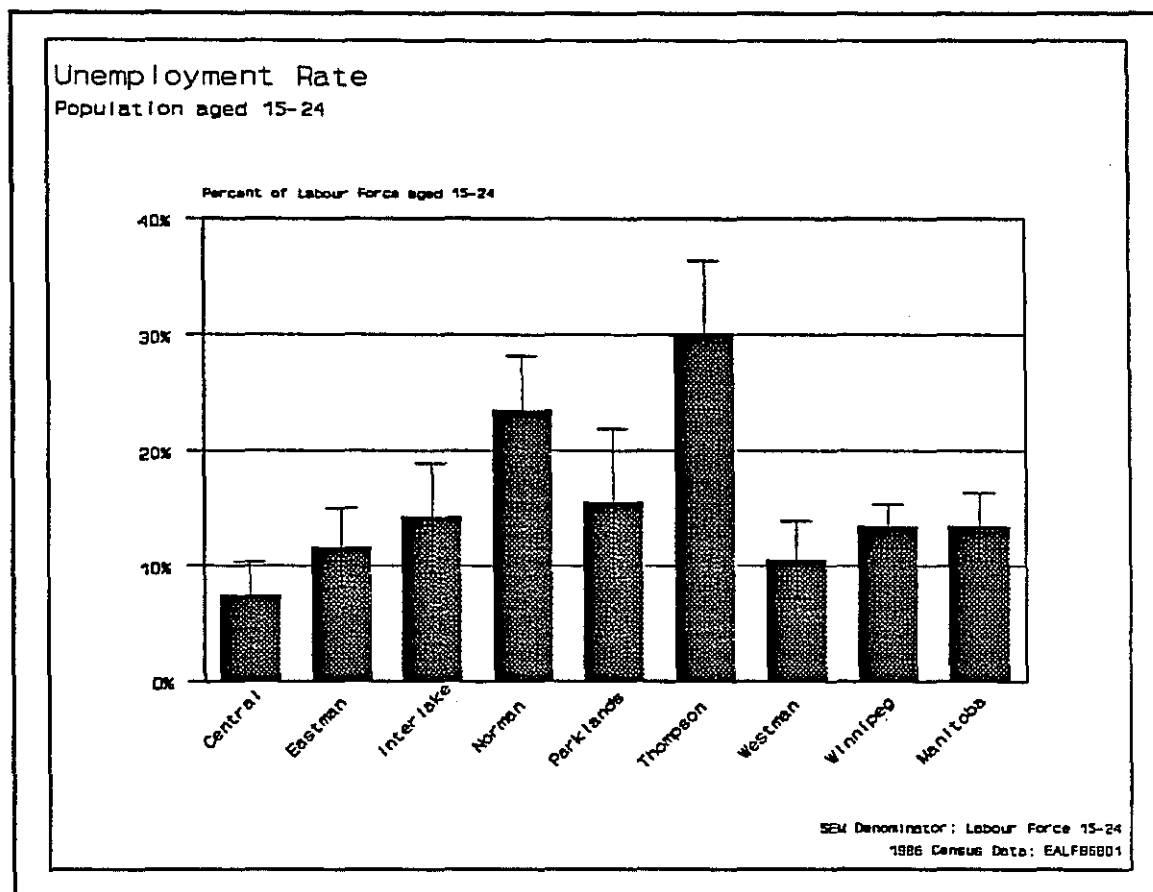


Figure 3

Income

A single indicator of household income: average household income from all sources, is provided in this report. In 1986, average household income ranges from a high of \$33,402 in Winnipeg to a low of \$22,616 in Parklands. These average income data are not adjusted for differences across regions in the age distribution of the population. The high average household incomes for Thompson and Norman regions reflect the influence of the mining centres in these regions. When considered at the smaller unit of the municipality, average

household income in these two regions is sharply bimodal, with many communities reporting among the lowest household incomes in the province. Figure 4 shows the distribution of income across the provincial regions.

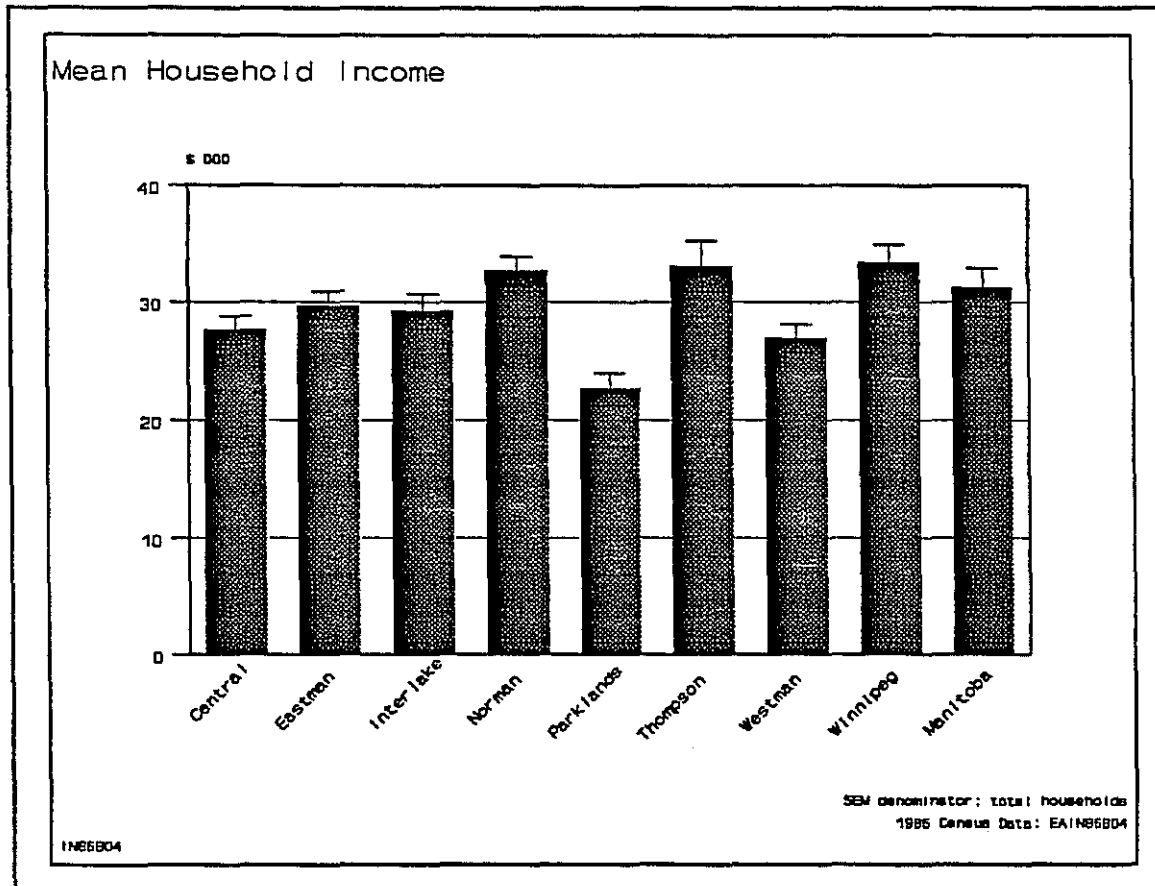


Figure 4

Mobility

A single indicator of population mobility is described in this report: the proportion of the region's population aged five years or older which moved into the region in the previous five years. Note that the indicator does not report net migration, which is the sum of in-migration and out-migration. Figure 5 represents the gross percentage of in-migrants into each region from within Canada over a five year period. Only the Winnipeg region has significantly below average levels of in-migration while Parklands' hovers near the average. The

Thompson region has the highest level, closely followed by Westman and Eastman. The other regions have slightly above average immigration.

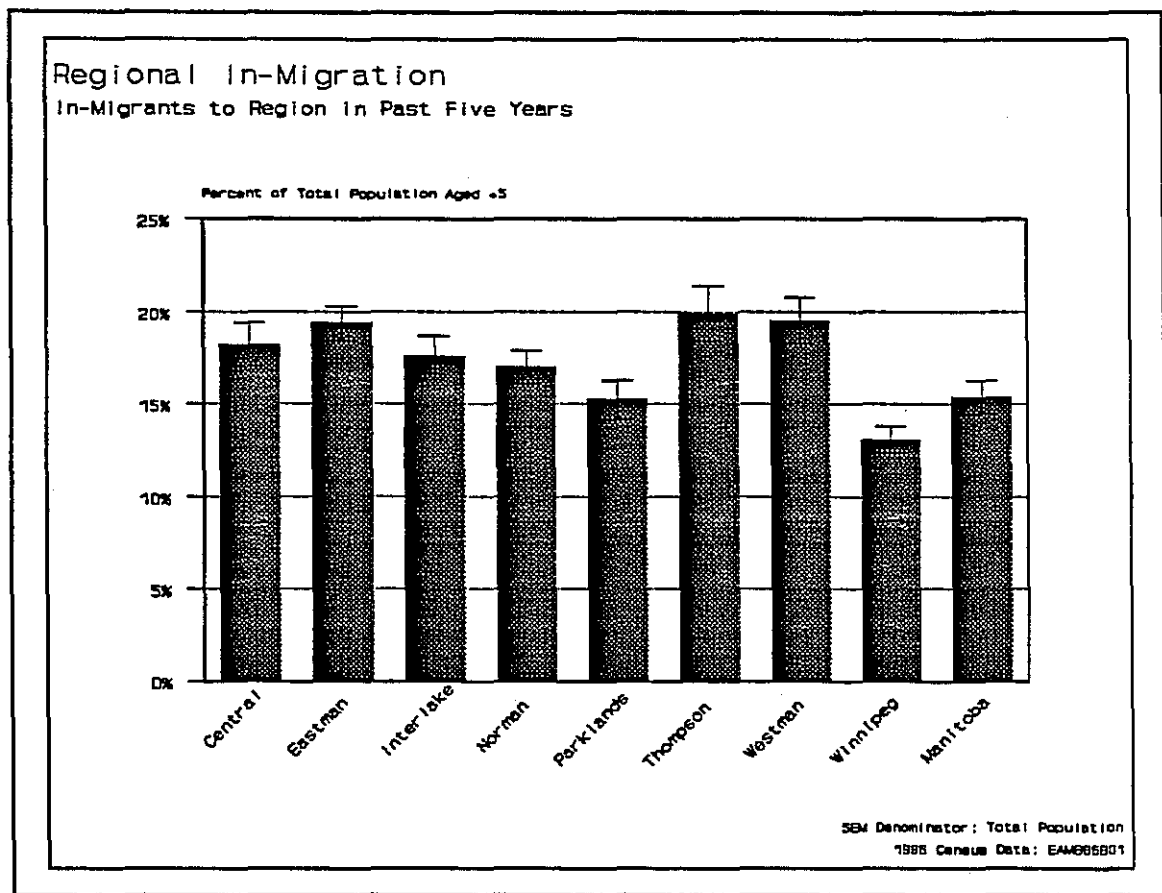


Figure 5

Social Characteristics

Three dimensions of regional social characteristics are described in this report: the age dependency ratio, the rate of single parenthood among families with young children, and the regional distribution of francophone and aboriginal language speakers.

The age dependency ratio is the ratio of the number of people in a region 65 years of age and older to the number of people aged 15-64. In Manitoba in 1986, this ratio ranges from a low of .046 in Thompson to a high of .315 in Parklands.

Three measures of single parenthood are reported: the percent of single parent households among households with children aged 0-14, the percent of single female parent households among households with children aged 0-14, and the percent of single female parent households among all households with parents aged 15-24 and children aged 0-14. Across all regions, single parent households are almost exclusively female headed, ranging from 3% of all households with children in Central region to rates in the range of 11-12% in Winnipeg and Thompson. Figure 6 depicts the distribution, across regions of single-parent households with children that are headed by females.

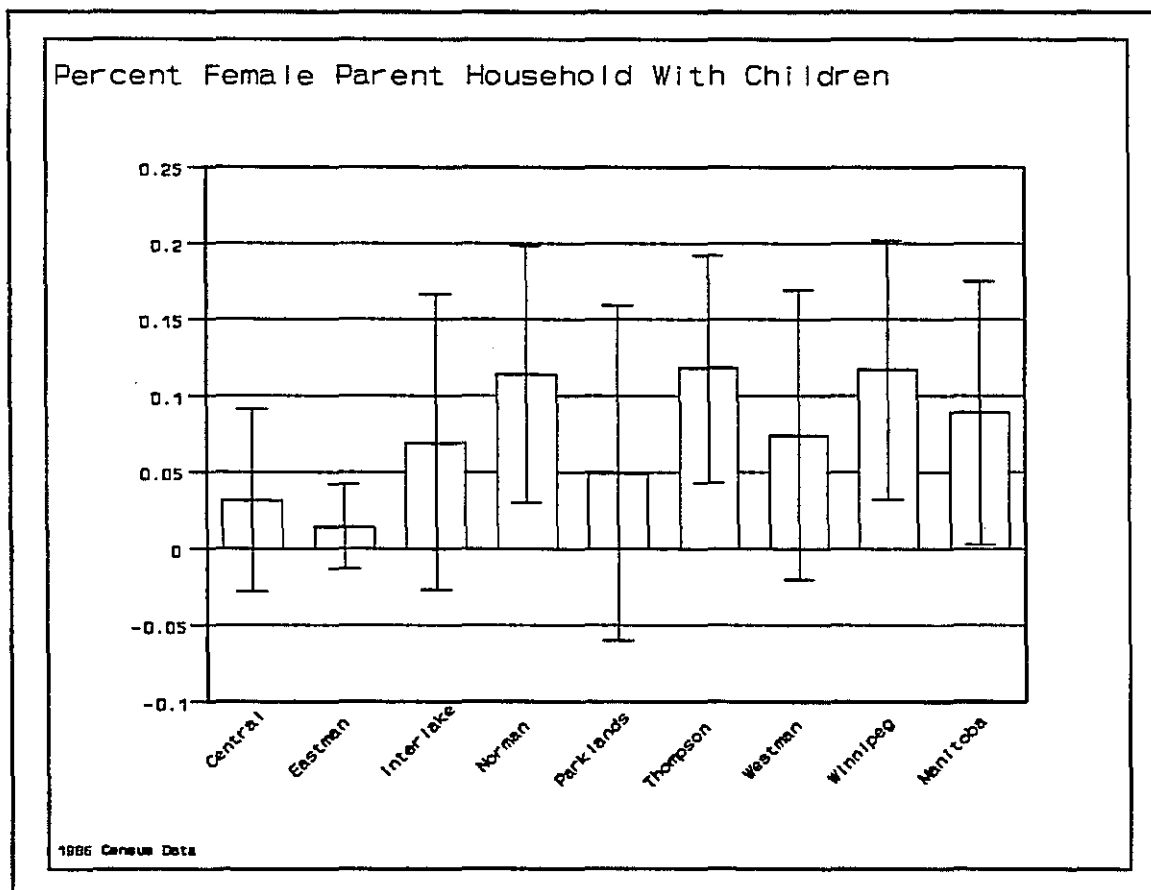


Figure 6

Central and Eastman regions contain the highest proportion of individuals reporting French as a mother tongue. Norman and Thompson contain the highest proportion of individuals reporting an aboriginal language as a mother tongue.

This brief presentation of a few findings demonstrates that there is considerable variation among the regions on a sampling of socio-economic characteristics. It confirms what is well known: the Province of Manitoba is diverse in many of its characteristics. But the regional data does not, by itself, provide a simple and straightforward picture of exactly how socio-economic status relates to health. To identify a specific pattern of socio-economic indicators that is closely linked to health status and health care utilization, further analysis was undertaken.

Development of the Socio-Economic Risk Index

All of the variables noted above may be thought of as measures of socio-economic status that potentially mark environmental, household and individual conditions which affect individuals' health. They can conceivably help explain both health status of different groups within the population and the differential needs for health care of those groups. One way of demonstrating the nature of the link between these background factors and health is to combine the most powerful explanatory factors into a single index: what might be called a Socio-Economic Risk Index. Such an index would have the virtue of simplicity.

There are, however, two fundamental problems that need to be solved in the construction of a socio-economic index which is predictive of differential health status. The first is deciding which of the many possible indicators should be chosen to be included in the index. The second is the method of assigning weight to the individual indicators selected for inclusion in the index. Thus, for example, how much importance should be given to a one percent difference in unemployment rates versus a one percent difference in high school completion? A wide range of candidate indicators were available for inclusion in the index. As demonstrated in the sample distributions in Figures 1-6, there is considerable variation in those distributions. For a socio-economic indicator to play a useful role in the index, it must be capable of explaining differences in health status. The best indicators are those which are most powerful in explaining differences in health status.

It was found that six socio-economic indicators were strongly related to regional differences in health status and health care resource utilization. These socio-economic indicators explained a substantial amount of the regional differences in a prototype index of five poor health status indicators.² Three were positively related to risk. As they rose, so did poor health. Those characteristics were: the percentage of the labour force unemployed between the ages of 15 and 24, the percentage unemployed between 45 and 54, and the percentage of single parent female households. Three were negatively related to risk. That is, the higher the score of a region's population on the indicator the less poor health was evident. The percentage of the population between the ages of 25 and 34 having graduated high school, the percentage of female labour force participation and the average dwelling value were all related to poor health in this inverse fashion. The other candidate socio-economic variables were not found to add significantly to the explanatory power of these six variables. Figure 7 shows how those six indicators are distributed across the regions of the province.³ The scale is centred on the provincial means, which are set at 0 so that higher scores on a characteristic indicate higher levels of risk. Bars below zero represent lower risk.

2. For the Prototype Poor Health Status Index (PPHSI) a preliminary set of five health status indicators - which were deemed to be particularly sensitive to differences in socio-economic status - was chosen as a base against which to measure the explanatory power of candidate socio-economic indicators. The set consisted of 1) admissions to hospitals of females for injuries, 2) admissions to hospitals of males for injuries, 3) admissions to hospitals of children aged 0 to 4 years for respiratory infection, 4) admissions to hospitals of persons aged more than 65 years for respiratory infection and 5) fertility rates (See Table 2.). While high fertility is clearly not a measure of poor health, it was included in the test index because of its well established relationship with low socio-economic status.

3. The scale has been normalized so that all characteristics can be represented on the same graph. The scale of that figure represents units of standard deviations from the provincial mean on each characteristic.

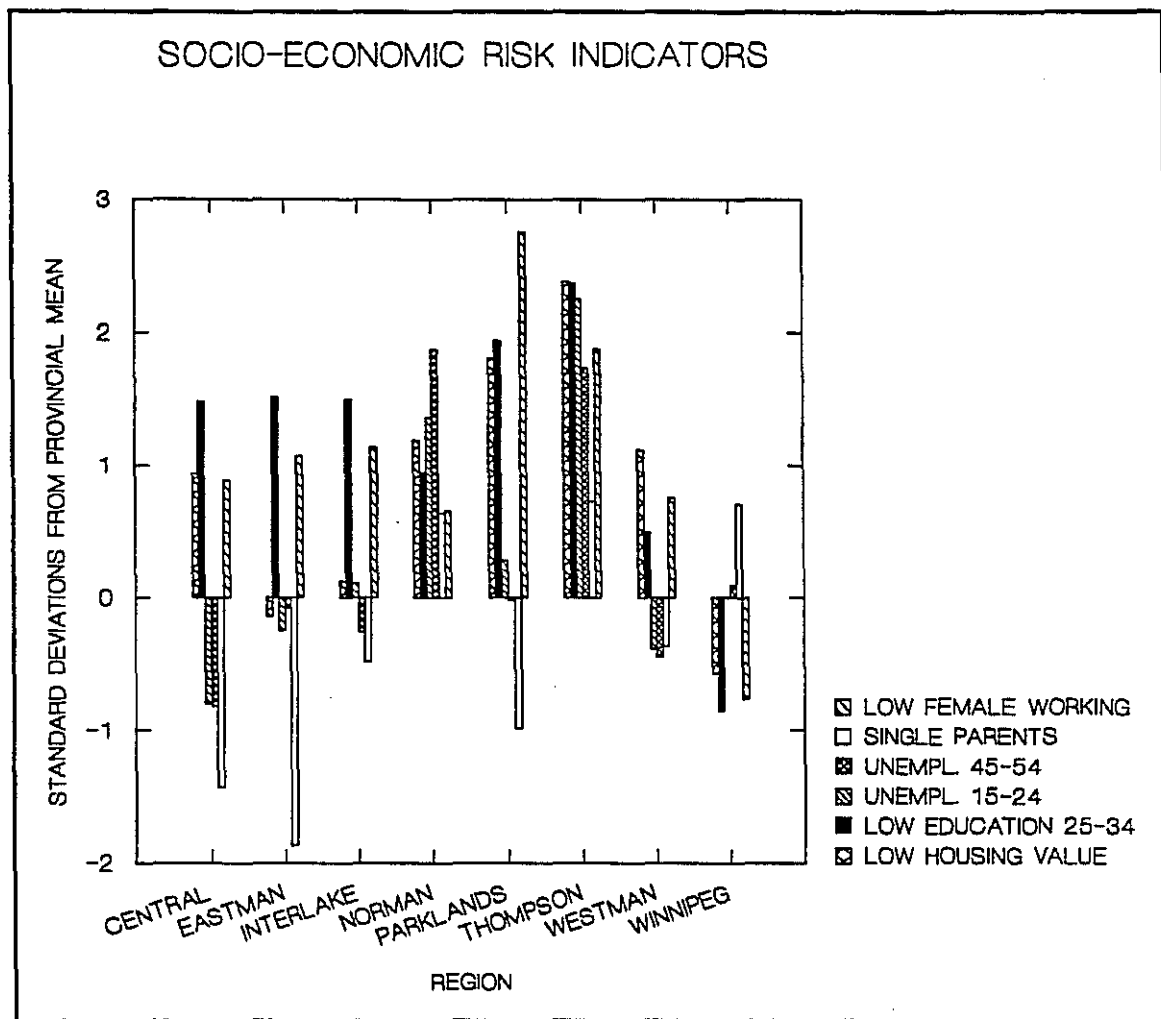


Figure 7

The data represented in Figure 7 indicate that many of the indicators vary together to a considerable degree. There is a tendency for a region that is high on one indicator to be high on the others. But the relationship is far from perfect. The Norman and Thompson regions are above average on all of the risk indicators while Parklands is above average on five of the six. Winnipeg by contrast is below average on three of the six, average on one, and above average on two. The other regions exhibit mixed patterns of above and below average on the risk factors. These patterns indicate that there is

considerable variation across the regions in the risk factors and that they are related to one another, but imperfectly. Table 3 shows the correlations among the components of the index.

The six variables which were successful in explaining poor health status, were combined into a Socio-Economic Risk Index and the distribution of this index across the regions is indicated by Figure 8.⁴ There it is clear that considerable regional variation occurs. As is evident in Figure 8, Winnipeg has the best socio-economic risk score - and Thompson, Norman, and Parklands the worst, with the other regions clustering towards the middle. Table 2 presents the regional values of the Socio-Economic Risk Index.

4. See the Methodological Appendix for a detailed discussion of the construction of the Socio-Economic Risk Index and the Prototype Poor Health Status Index. A simplified description of the method used to construct the Socio-Economic Risk Index, however, may clarify the process. The six indicators were adjusted (by subtracting and dividing by appropriate constants) so that they could all be represented on a single scale and so that they all pointed in the same direction. For example, unemployment enters the index with a positive sign since higher unemployment is associated with higher risk of poor health while dwelling value is first multiplied by -1 before being added to the index because higher dwelling values are associated with lower risk. Each was then weighted by a number representing the impact of that indicator in explaining poor health status as represented by the Prototype Poor Health Status Index. The weighted sum of the six indicators was then computed and divided by a suitable constant. The resulting index then represented a relative measure of socio-economic status associated with the risk of poor health. The units of measurement represent standard deviations in the index.

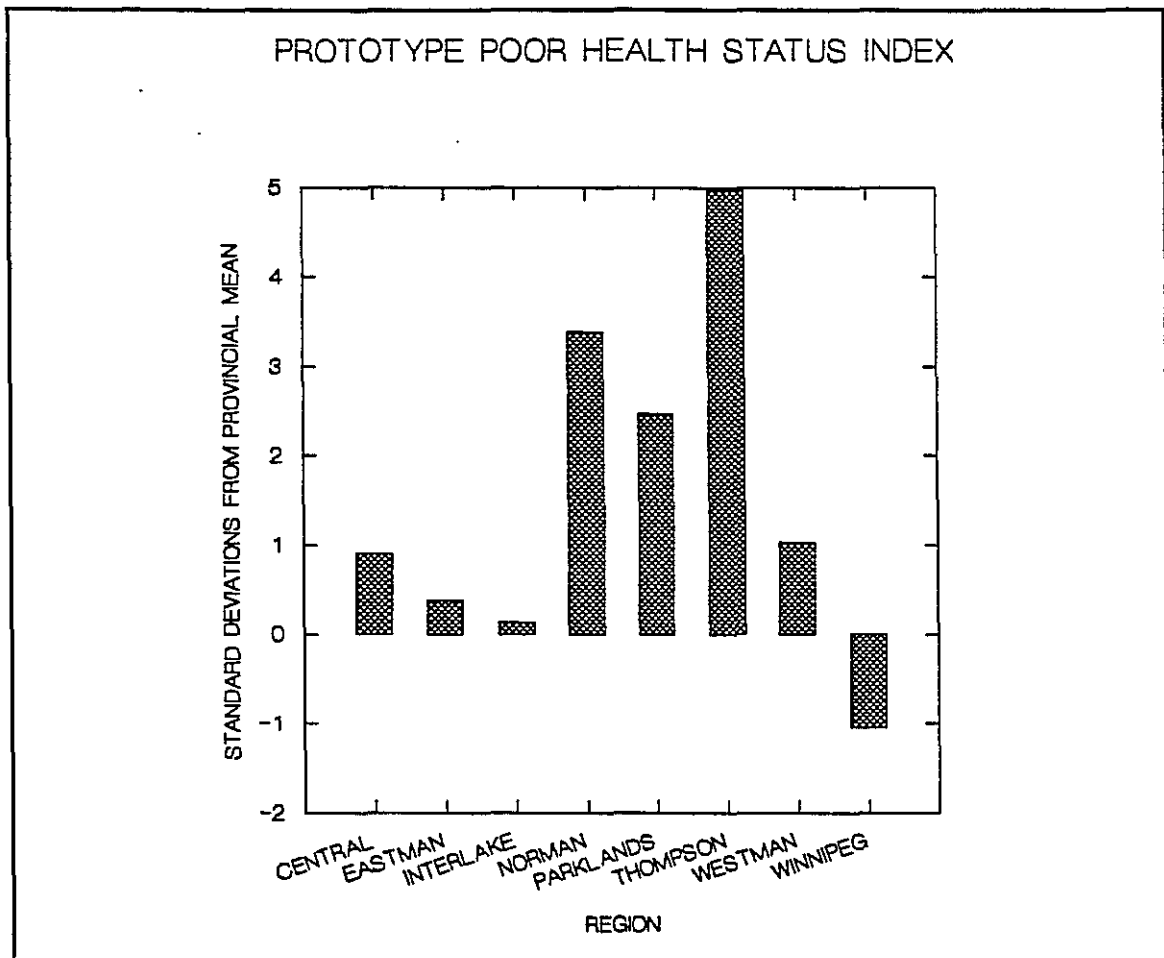


Figure 8

Figure 9 is a bar chart which gives a first indication of the relationship between the Socio-Economic Risk Index and the Prototype Poor Health Status Index at the regional level. In general, the higher the regions score on the Socio-Economic Risk Index, the higher the Region's score on its Poor Health Index.

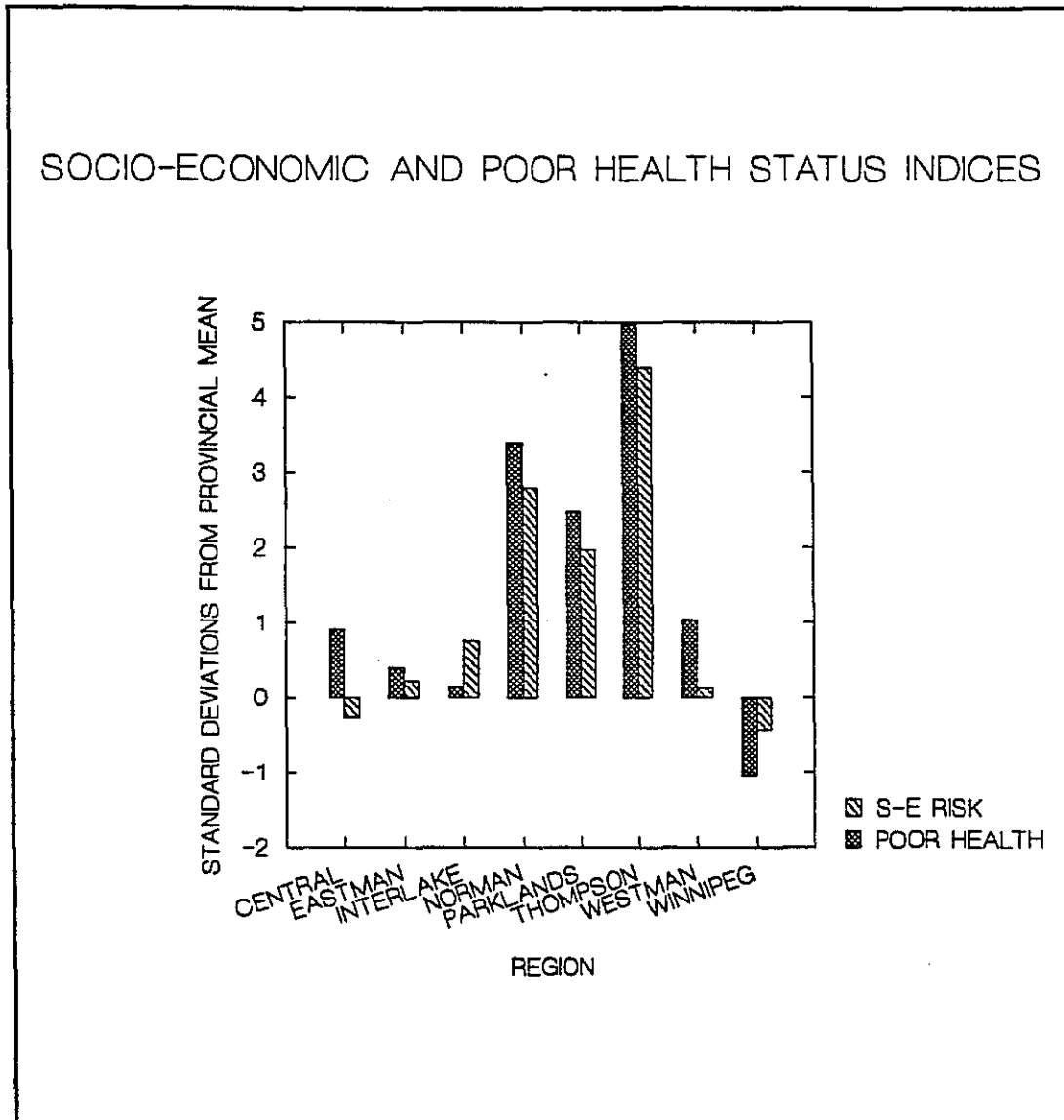


Figure 9

Winnipeg residents score best on the indicators of poor health and have the lowest scores on the indicators of socio-economic risk.⁵ However, just as high average household incomes for Thompson and Norman regions mask the existence of very poor communities, treating

5. Winnipeg residents have much lower hospitalization rates than residents of other regions. This likely influences their residents' scores on four of the five indicators of poor health status. However, further analysis in the health status module using indicators derived from such diverse sources as mortality records, physician contact data, and birth outcomes support the conclusion that Winnipeg residents have relatively better health.

Winnipeg as one region masks the existence of the very poor core area, whose residents are at high socio-economic risk and have been found to be of poor health status. Future versions of the health information system will replicate the analysis at smaller, possibly more meaningful geographic areas. The nature of the dependency between the indices is made explicit in the plot in Figure 10. When health status by regions is plotted against the risk index, 87% of the variation in poor health status is explained by differences in the Socio-Economic Risk Index. Since the Socio-Economic Risk Index was developed with municipal level data on the basis of its ability to explain differences in the Prototype Poor Health Status Index, and the components of the latter were explicitly chosen because they were expected to be sensitive to variation in socio-economic status, this result is not completely unexpected. However the relationship, is a strong one. Moreover, it is possible to get a separate validation of the explanatory power of the Socio-Economic Risk Index by using it to explain independently gathered data from the other modules of the Population Health Information System.

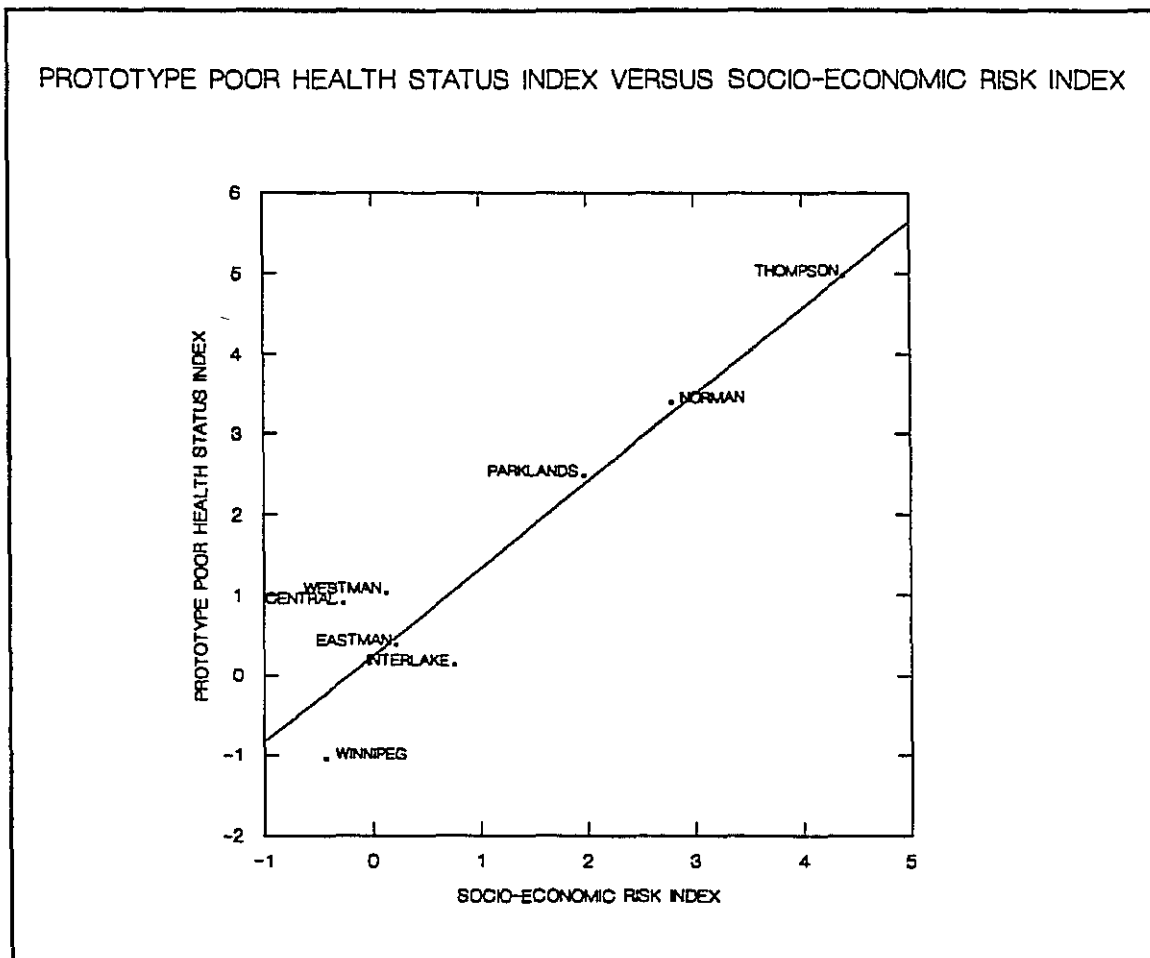


Figure 10

Explanatory Power of the Index

The Population Health: Health Status Indicators module of the Population Health Information System contains data on a variety of ill health conditions and indicators. The Standardized Mortality Rate of persons 0-64 may be seen as representing premature mortality. As such it indicates differences in the lifetime burdens of illness. It is therefore reasonable to conclude that this measure captures major elements of health status across regions in the province. The Socio-Economic Risk Index explains 91% of the variance in this measure of mortality, indicating that it has explanatory power well beyond the indicators of health status used to derive it (See Figure 11). A broad measure of health care resource usage is the days per capita spent by each region's residents in hospital for 1-59 day stays. The Short-Stay

inpatient care/stays data reported in the Utilization of Hospital Resources, 1991/92 module furnishes another possible basis for testing the explanatory power of the Index. We identify all 1991-92 hospital admissions of regional residents for stays of 59 days or less regardless of where these admissions took place (in their own region or outside). The rates were age and sex standardized so that accurate comparisons of use patterns could be made across regions. As Figure 12 demonstrates, the Index explains most (92%) of the regional variance in this measure as well. Thompson and Norman residents scored high on the socio-economic risk index and they spent more time in hospital than did residents of any other region.⁶

6. This strong relationship between the Socio-Economic Risk Index constructed from 1986 Census data and the 1991-92 hospital data suggests the persistence of regional differences through time and the utility of the Census data even though they are not timely. Future reports will incorporate data from the 1991 Census - just released.

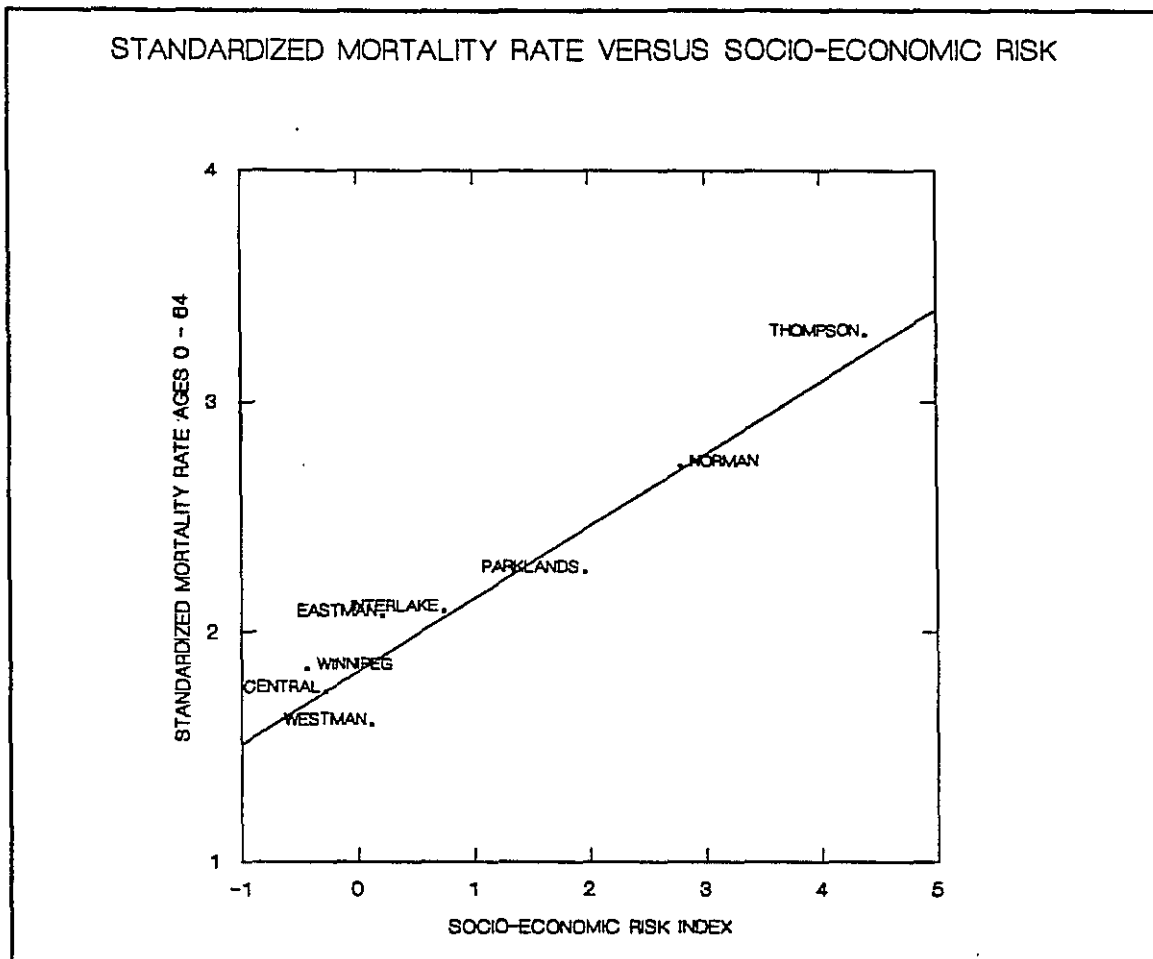


Figure 11

Discussion

The results identified in the process of constructing the Socio-Economic Risk Index raise a number of issues. First, much of the variation in the health status indicators examined can be explained by a few socio-economic factors. These factors appear to be strongly associated with both health status and usage; however this strong relationship is symptomatic of other underlying relationships. It is worth noting that socio-economic indicators such as low dwelling value, unemployment at all ages, lack of high school completion at all ages, female-headed single-parent families and female participation in the labour force are all strongly

interrelated with one another. In addition most of the other candidate socio-economic characteristics are highly correlated with the Socio-Economic Risk

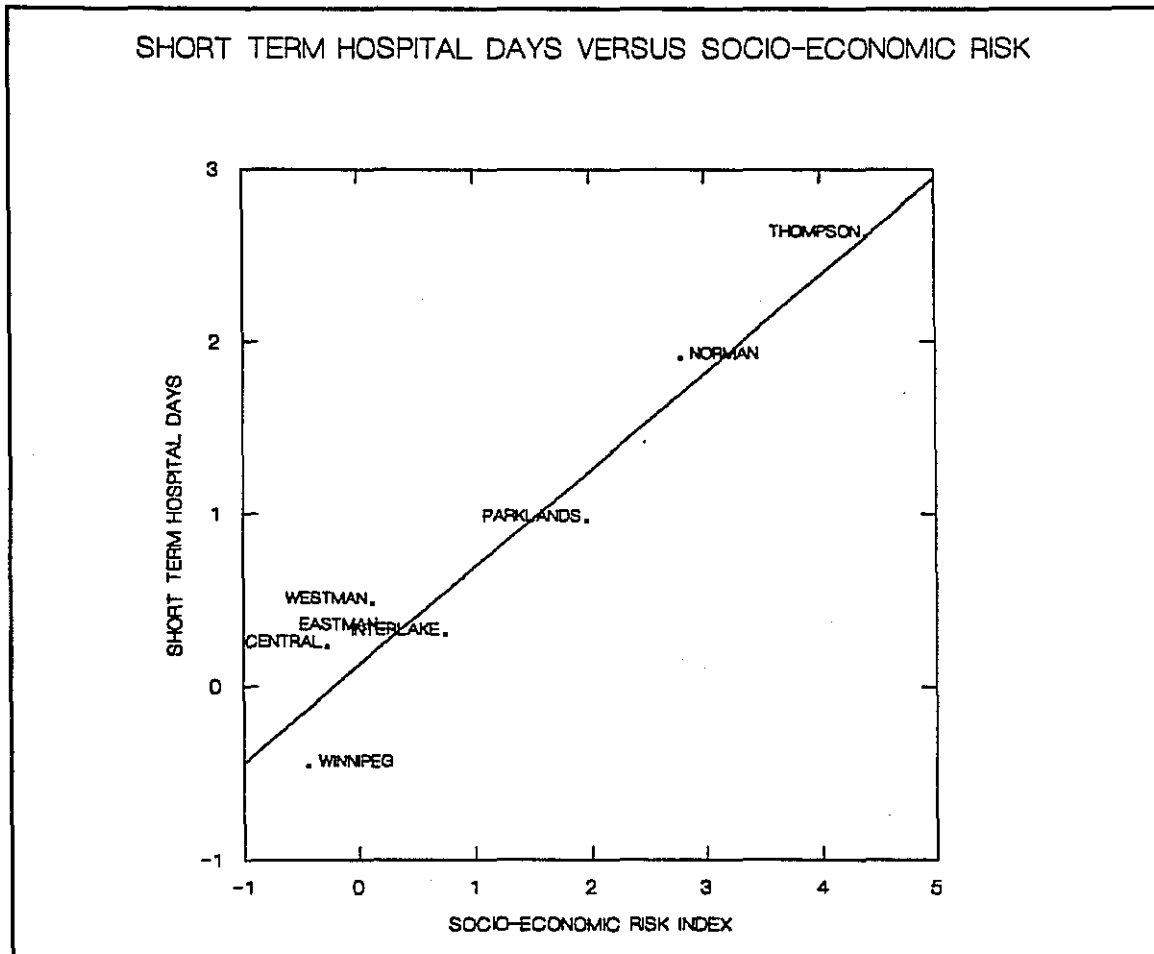


Figure 12

Index.⁷ These strong relationships allow for the construction of a simple index of risk factors, but point to the existence of a complex of interrelated socio-economic status factors. It is important to determine the extent to which the relationship between socio-economic risk factors and poor health revealed by use of the Prototype Poor Health Status Index and

7. See the Methodological Appendix for Table 3 which gives the relationships of components of the index and for Table 4 which presents the relationship between the other variables and the index.

Standardized Mortality Rates is generalizable to yet other measures of health status.

Integration of the various modules within the Population Health Information System should allow for a determination of these relationships.

An immediate policy issue is raised for those health status indicators which are related to socio-economic risk factors. What is the best way to redress poor health status? Are more health care services needed in some areas with already high levels of utilization to redress the effects of socio-economic risk, or is health status more amenable to improvement by improving socio-economic status? Are fewer resources needed in some areas of low socio-economic risk? Are the utilization patterns of ambulatory care and other resources variable across different strata of socio-economic risk? Can differences in utilization patterns explain differences in health status?⁸ Identifying the relationship between socio-economic risk factors, health services utilization and health status as described in other modules in the System is a first step in attempting to answer these questions.

In conceptualizing this module, a conscious decision was taken not to use the Standardized Mortality Ratio for individuals aged 0-64 (SMR's) as the measure of need for health services as has recently been suggested by Eyles et al. (1991) (3). As reported in the module on health status indicators, SMR's are properly viewed as a measure of health status. They do not, in any way, explain health status. Other underlying factors are likely responsible for the poor health that results in differences in SMR's. If policy is to be directed at changing conditions which account for differences in health status, then the factors which have an explanatory role in accounting for those differences must be addressed. We believe that differences in various socio-economic risk factors may play such a role. An examination of that role may help clarify what the relationship is, and what benefits in improved health status might accrue from changing the underlying inequities in amenable socio-economic risk factors. This contrasts with a strategy of simply increasing the services available to those who are more predisposed towards low health status. Indeed, the regions reporting the worst

8. Any answer to this question must take into account which of the disease burdens are intervenable and medically preventable.

health status on some indicators are already among the highest consumers of health services. Thus, it appears clear that the relative efficacy of additional services versus the provision of programs that address the underlying predispositions needs to be assessed.

Planned analysis of the data base should provide tentative answers of relevance to policy makers. The use of these findings to adjust utilization rates for underlying need as represented by socio-economic risk is one possible way of casting new light on how utilization patterns conform to need. This may be examined not only with regard to hospital use but potentially for Personal Care Home and possibly need for physician's services.

However, a caveat is in order. Although strong regional variations have been found in the Socio-Economic Risk Index and it has considerable explanatory power, it will be necessary to use data from the municipal level to validate the relationships. Moreover, there is considerable variation among municipalities within regions on the two indices developed. This is particularly important to bear in mind with regard to Winnipeg which contains over one half of the Province's population and shows great internal diversity. Thus, any policy prescriptions needs to address the intra-regional variation as well as the regional variations, and future analysis should be at the sub-regional level, (and even at smaller levels where feasible) both to provide data for future policy initiatives, and to monitor progress.

METHODOLOGICAL APPENDIX

Construction of the Socio-Economic Risk Index and the Prototype Poor Health Status Index

The data source for the socio-economic indicators described in this report was the library of Basic User Summary Tapes released by Statistics Canada approximately two years after the 1986 census. This library contains comprehensive data from the 2A and 2B census forms, reported at the level of the enumeration area. There were 1,825 populated enumeration areas in Manitoba in 1986. Data for enumeration areas was aggregated to the level of the municipality, and then to level of the health region. The health status indicators used to develop the Prototype Poor Health Status Index were derived from computerized hospital separation abstracts for FY 86/87 for the entire province of Manitoba. The health status indicators were constructed at the municipal level, and then aggregated to the level of the health region.

In a review of the literature, Libertos et al. (1) note that systematic relationships have been observed between socio-economic characteristics and health status for roughly one hundred years in England and France. Carstairs and Morris (2) note that the World Health Organization, conscious of differences in health status across many countries and within them, has set up targets for the reduction in those differences among groups. Those targets have been endorsed by the 33 countries in the European Region. Among the socio-economic indicators found to co-vary with health status, income, education, and occupational measures have been identified as being the most prominent. The construction of the Socio-Economic Risk Index was undertaken with an understanding that the sociological literature has identified a variety of factors related to health status and health care utilization. On the other hand, no consensus on the exact nature of the relationships has been reached. The candidate variables for analysis here were selected with these arguments in mind, and the statistical relationships within the data dictated the components of the Socio-Economic Risk Index. In other words, we proceeded inductively, using the literature to identify a broad spectrum of candidate indicators, and allowing the empirical evidence to identify the significant relationships.

For the Prototype Poor Health Status Index (PPHSI) a preliminary set of five poor health status indicators - which were deemed to be particularly sensitive to differences in socio-economic status - was chosen as a base against which to measure the explanatory power of candidate socio-economic indicators. The set consisted of 1) admissions to hospitals of females for injuries, 2) admissions to hospitals of males for injuries, 3) admissions to hospitals of children aged 0 to 4 years for respiratory infection, 4) admissions to hospitals of persons aged more than 65 years for respiratory infection and 5) fertility rates (See Table A.1.). These indicators were viewed as being particularly sensitive to variation in socio-economic status. While high fertility is clearly not a measure of poor health, it was included in the test index because of its well established relationship with low socio-economic status.

As a basis for generating the Socio-Economic Risk Index (SERI) twenty-three variables were selected. For conceptual purposes they may be thought of as being grouped into six broad categories: Dwelling Characteristics, Employment, Education, Income, Mobility, and Social characteristics (See Table A.2). The categorization was not utilized in the statistical analysis, and indeed, the final index of six variables included representatives from only four of the categories:

The procedure followed to construct the indices was as follows:

- 1) Data was aggregated to the municipality level on all variables. In all, 280 municipalities were used.
- 2) Pearson product moment correlations were computed for all relationships between pairs of variables.
- 3) Each of the health status indicators was regressed against the socio-economic variables which showed significant correlations to it in a stepwise regression.
- 4) The health status indicators and the socio-economic indicators which showed a significant explanatory role were normalized by subtracting the provincial average

from the municipal level score for each municipality and dividing the result by the standard deviation of that variable.

5) A Prototype Poor Health Status Index (PPHSI) was constructed by taking the sum of the five normalized health status indicators:

- Hospitalization of Females for Injury
- Hospitalization of Males for Injury
- Hospitalization of Children 0-4 for Respiratory Infection
- Hospitalization of Persons Aged > 65 for Respiratory Infection
- Fertility

That sum was divided by the square root of 5 so that the scale of the index would read in standard deviations from the provincial mean. Figure 13 presents the distribution of the indicators across regions. Zero represents the Provincial mean and the scale is in standard deviations with poor health corresponding to higher scores.

6) The normalized socio-economic indicators identified in step 4 which correlated at 0.1 or over with the Prototype Poor Health Status Index (PPHSI) were entered into a stepwise regression against the (PPHSI) and those showing a significant explanatory role were selected for the model.⁹ For test purposes, to insure enough data for a reliable outcome, municipal level data were used. Six were found to explain significant amounts of the variance in the (PPHSI). They were: the percentage of the labour force between the ages of 15 and 24, and between 45 and 54 unemployed, the percentage of single parent female households, the percentage of the population

9. A preliminary run produced a model in which the percentage of the population having a native language as a mother tongue entered. However, since many municipalities had a zero score for that variable it was decided that its inclusion in the SERI would limit the generality of the model. It was removed and the stepwise regression was repeated. The model presented in the body of the paper resulted. Surprisingly, the latter model had slightly *greater* explanatory power than the initial model. Thus, it had both greater generalizability and greater power.

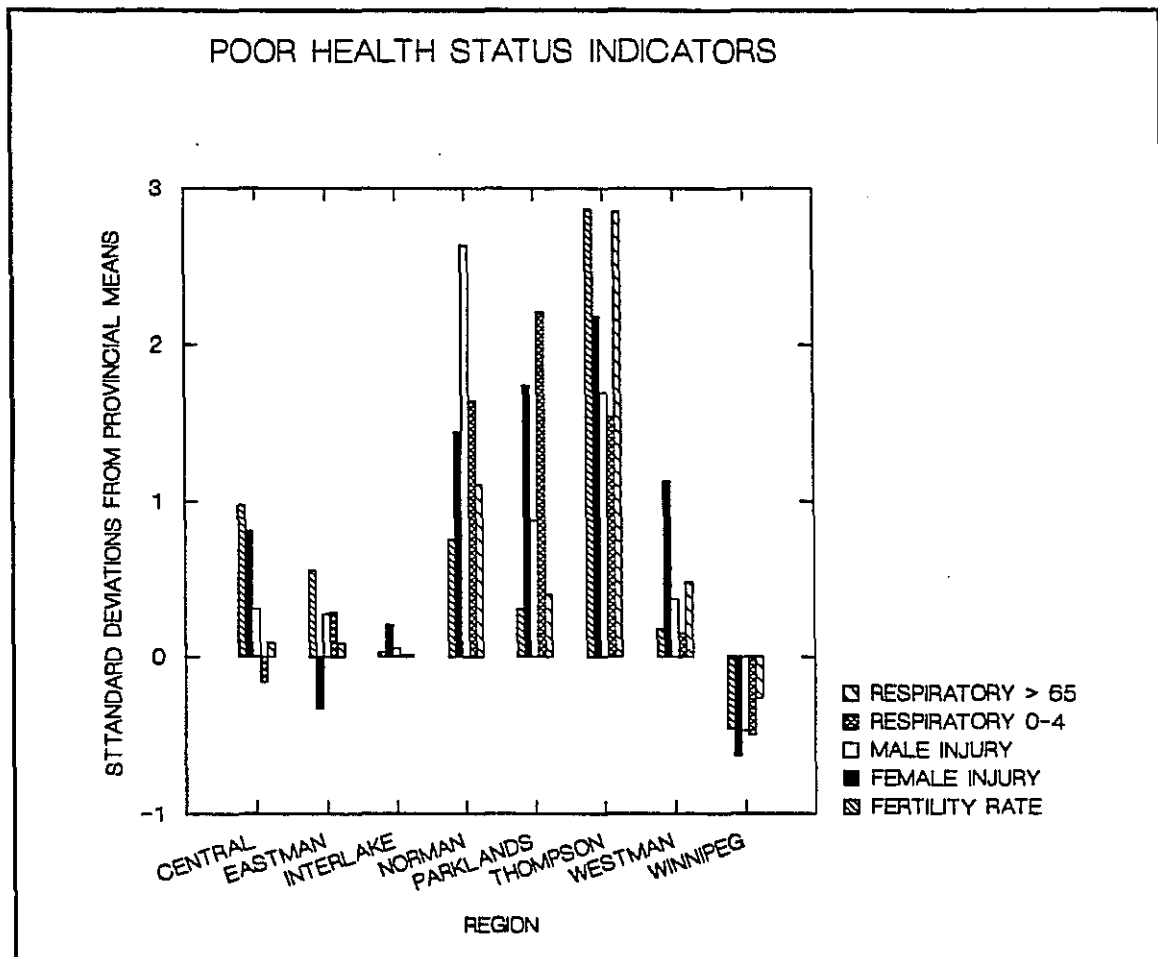


Figure 13

between the ages of 25 and 34 having graduated high school, the percentage of female labour force participation and the average dwelling value. As noted above, the first three characteristics were positively related to poor health, the last three negatively.

Figure 7 displays the distribution of these indicators across the eight health regions. The indicators are normalized so that 0 is the Manitoba average. It is clear from the figure that considerable regional variation occurs. Winnipeg enjoys the best scores while Thompson has the worst, with Norman and Parklands not far behind. The other regions are distributed in the middle range.

- 7) A Socio-Economic Risk Index (SERI) was constructed from the selected socio-economic indicators identified in the previous step. The Index consisted of the weighted sum of the standardized variables with the weights being the regression coefficients obtained from the stepwise regression in step 6:

$$\text{SERI} = .347* (\text{percent unemployed between the ages of 15 and 24}) + .390*(\text{percent unemployed between the ages of 45 and 54}) + .181*(\text{female headed single parent families}) - .212* (\text{percentage of persons 25-34 having completed high school}) - .271* (\text{percent of women participating in the labour force}) - .128* (\text{average dwelling value}).$$

All variables were significant at the $p < .05$ level with three significant at the $p < .001$ level.

Again, as in step 5, this sum was divided by the square root of the sum of the squares of the regression coefficients, so that the scale would be in standard deviations.¹⁰

At the Municipal level, the Socio-Economic Risk Index was able to explain almost 60% of the variance in the Prototype Poor Health Status Index. Figure 14 presents a plot of the two indices against one another at the municipal level.

10. Since this is a measure of risk, some factors which reduce risk entered in negatively as they do in the regression. Statistics Canada sets the value of dwellings on Native Reserves equal to 0. Rather than drop these as data points we set the values of dwellings on reserves to the regional mean value. This, we believe, is a conservative estimation since dwelling value is negatively associated with risk. The result is likely to understate the effect of dwelling value on health status and utilization.

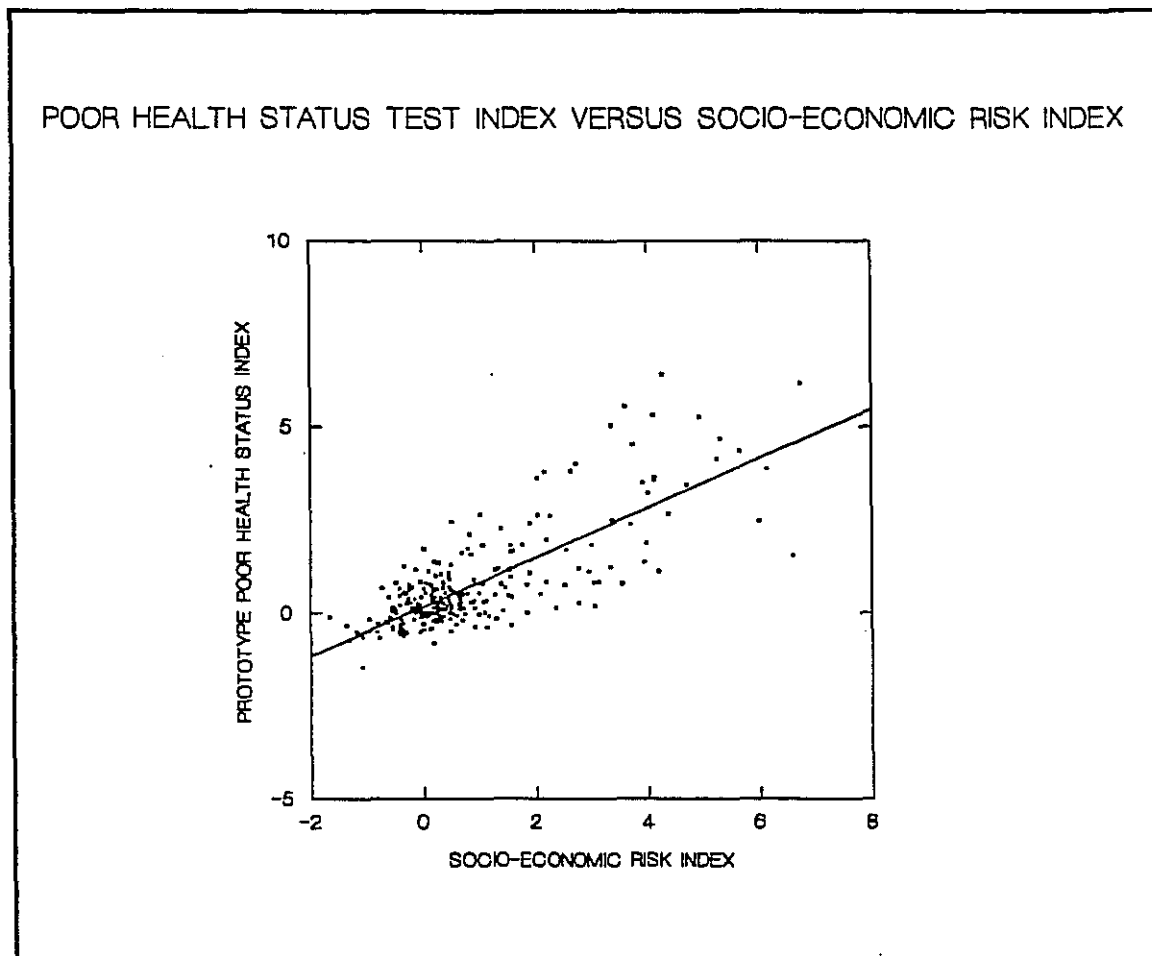


Figure 14

8) Various sensitivity tests were conducted to test the robustness of both indices:

Winnipeg municipalities were removed from the data set and the PPHSI, was regressed against the Socio-Economic Risk Index; the relationship between the two indices was checked within each region; fertility was removed from the Prototype Poor Health Status Index; each of the health status test indicators was regressed individually against the Socio-Economic Risk Index.

In each of these tests the relationships continued to be significant and in consistent directions.

Table A.1

**Definition of Individual Health Status Measures
in the Prototype Poor Health Status Index**

1. Hospital Admissions with a Primary Diagnosis of Injury, Females
2. Hospital Admissions with a Primary Diagnosis of Injury, Males

All admissions to Manitoba hospitals for Manitoba residents in FY 86/87 which contained a primary diagnosis for injury were extracted from the computerized file of hospital separation abstracts. Injury diagnoses were in the ranges ICD9-CM 800-904, 925-929, 940-949, 950-957. All hospital admissions occurring in facilities outside the resident's home region were assigned back to the region of residence. Status natives were assigned region of residence on the basis of postal code.

3. Hospital Admissions with a Primary Diagnosis for Acute Respiratory Infection, Ages 0-4 years of age.
4. Hospital Admissions with a Primary Diagnosis for Acute Respiratory Infection, Ages 65 and older.

All admissions to Manitoba hospitals for Manitoba residents in FY 86/87 which contained a primary diagnosis for acute respiratory infection (ICD9-CM 460-466, 480-487) were extracted from the computerized file of hospital separation abstracts. Admissions for individuals between the ages of 0-4 and 65 years of age or older were retained. All hospital admissions occurring in facilities outside the resident's home region were assigned back to the region of residence. Status natives were assigned region of residence on the basis of postal code.

5. Fertility

A measure of the general fertility rate for each region was calculated from the sum of births to women in a region in FY 86/87, divided by the number of women in the region between the ages of 15 and 49. Births were enumerated from the computerized file of hospital separation abstracts. All births occurring in facilities outside the mother's home region were assigned back to the region of residence. Status natives were assigned region of residence on the basis of postal code.

Table A.2
Description of Definition and Source
of Regional Socio-Economic Measures

For additional detail on these measures, consult the 1986 Census Dictionary (21).

Dwelling Characteristics

1. Dwelling Value

Average value of all owner-occupied, non-farm, non-reserve, single detached dwellings. Dwelling value is based on a self-reported estimate by the household head. Because of the unique tenancy practices on native reserves, no housing in these communities was classified as owner-occupied in the 1986 Census. Similarly, the value of a dwelling located on a farm cannot be determined separately from the total farm value, and was therefore excluded from the enumeration of average dwelling value in the 1986 census.

Education

2. High School Completion Rate

Ages 25-34

3. High School Completion Rate

Ages 35-44

4. High School Completion Rate

Ages 45-54

The count of the number of household residents on census day reporting attaining a minimum of a minimum of a high school diploma. The three age-specific rates were computed by dividing this count by the total number of household residents in the age group. The completion rate for residents aged 15-24 was not included as an indicator because a large number of people in this age group have not completed their educational careers.

Employment

5. Percent of Labour Force Engaged in

Farming Occupations

6. Percent of Labour Force Engaged in Managerial,

Administrative or Scientific Occupations

7. Percent of Labour Force Engaged in Manufacturing,

Construction and Transportation

**Table A.2
Description of Definition and Source
of Regional Socio-Economic Measures**

For additional detail on these measures, consult the 1986 Census Dictionary (21).

Employment, Continued

The Basic User Summary Files, from which data for this report were extracted, classify self-reported occupation on census day into 21 groups (20). In this report we have reported data for seven occupational groups: the single category of farming, a category which combines the managerial, administrative and scientific classifications and a category which combines the manufacturing, construction and transportation groups. Other occupational categories were excluded either because they did not exhibit important differences across regions, or because there were many regions in which fewer than 5% of the workforce was engaged in the occupation. The seven occupational groups which are included in the three measures described in this report represent approximately 25% of labour force participation in the Winnipeg, and 50% of labour force participation in the other seven regions. The occupational classification system adopted by Statistics Canada was not designed to reflect a hierarchy of occupational status: for example, the transportation category includes both taxi drivers and airline pilots.

8. Female Labour Force Participation

Female labour force participants are defined as women working or seeking work on census day. Consistent with the census practice, the denominator for this rate is based on the count of all women over the age of 15, including women aged 65 or older.

9. Labour Force Unemployment

Ages 15-24

10. Labour Force Unemployment

Ages 25-34

11. Labour Force Unemployment

Ages 35-44

12. Labour Force Unemployment

Ages 45-54

Four age-specific unemployment rates were computed for each region. The unemployed include persons during the week prior to the census were without work, had looked for work in the previous four weeks and were available for work in the week of the census. The denominator for each age-specific unemployment rate was the count of the total labour force in that age group.

Table A.2
Description of Definition and Source
of Regional Socio-Economic Measures

For additional detail on these measures, consult the 1986 Census Dictionary (21).

Income

13. Average Household Income

Average household income is computed from the sum of total household income in a geographic area, divided by the number of households in the area. Household income is the sum of income earned in calendar year 1985 reported by all members of the household over the age of fifteen from the following sources: wages and salaries, net non-farm self-employment income, net farm self-employment income, family allowances, federal child tax credits, old age security pensions, benefits from the Canada Pension Plan, unemployment insurance payments, dividends and interest, retirement pensions and other income sources. Total household income can be a negative value.

14. Percent of Households in Owner-Occupied Dwellings

A dwelling is classified as owned even if it is not fully paid for. The denominator for this measure is the count of all occupied dwellings in the geographic area. Dwellings on native reserves are excluded from both numerator and denominator counts.

15. Percent of Owner-Occupied Households

Spending 30% or More of Household Income on Housing Costs

16. Percent of Tenant-Occupied Households

Spending 30% or More of Household Income on Housing Costs

These two measures report the proportion of households in owner-occupied or tenant-occupied dwellings which spend 30% or more of household income on major payments or gross rent. Major payments are defined to include utilities, taxes for municipal services, mortgage payments and property taxes. Gross rent includes utility costs and cash rent payments.

Mobility

17. In-Migration as a Proportion of Total Population

This measure reports the proportion of the total population aged five years or older in a geographic area that moved into the region in the previous five years from a location elsewhere in Canada. Note that this is not a net migration measure. Information on the rate of out-migration is not available directly from census data.

**Table A.2
Description of Definition and Source
of Regional Socio-Economic Measures**

For additional detail on these measures, consult the 1986 Census Dictionary (21).

Social

18. Age Dependency Ratio

This variable expresses the ratio of the population aged 65 years or older in a region 65 by the population aged 15-64.

**19. Percent of Single Parent Households
among Households with Children aged 0-14.**

**20. Percent of Single Female Parent Households
among Households with Children aged 0-14**

These measures report the proportion of single parent households, and the proportion of single female parent households, among all households with children between the ages of 0 and 14. The second measure, as a sub-set, should always be equal to or less than the first measure. However, public release census data published by Statistics Canada has been randomly rounded to maintain individual confidentiality (22). This random rounding accounts for the discrepancies in the reported rates.

**21. Percent of Single Female Parent Households
among All Households with Parents Aged 15-24 and Children aged 0-14**

This measure reports the frequency of single female parenthood among a sub-set of households with children: those households with parents aged 15-24.

22. French Mother Tongue

This measure reports the proportion of the total population for whom French was the first language learned in the home and is still understood by the informant. This is a more restricted definition of cultural identification than census data on self-reported ethnic origin.

23. Native Mother Tongue

This measure reports the proportion of the total population for whom a native language was the first language learned in the home and is still understood by the informant. This is a more restricted definition of cultural identification than census data on self-reported aboriginal or metis status.

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TABLE 1

SOCIO-ECONOMIC INDICATORS

	Central	Eastman	Interlake	Norman	Parklands	Thompson	Westman	Winnipeg	Manitoba
DWELLING CHARACTERISTICS									
1. Mean Value of Dwelling (\$)	53488	64205	61535	50970	44805	39030	51682	68442	62799
EDUCATION									
2. Percent Population Aged 25-34, High School Diploma or Equivalent	0.563	0.561	0.561	0.598	0.533	0.505	0.627	0.714	0.659
3. Percent Population Aged 35-44, High School Diploma or Equivalent	0.497	0.499	0.545	0.597	0.517	0.451	0.580	0.681	0.619
4. Percent Population Aged 45-54, High School Diploma or Equivalent	0.372	0.384	0.384	0.404	0.335	0.337	0.442	0.542	0.478
EMPLOYMENT									
5. Percent Labour Force, Farming	0.260	0.148	0.169	0.019	0.280	0.007	0.227	0.010	0.083
6. Percent Labour Force, Managerial/Sciences	0.093	0.113	0.098	0.090	0.093	0.104	0.092	0.140	0.123
7. Percent Labour Force, Manufact/Constr/Transport	0.197	0.269	0.234	0.241	0.165	0.236	0.166	0.209	0.209
8. Labour Force Participation %, Women Aged 15+	0.529	0.521	0.519	0.537	0.456	0.490	0.534	0.593	0.563
9. Unemployment Rate, Aged 15-24	0.075	0.116	0.142	0.235	0.155	0.301	0.106	0.134	0.134
10. Unemployment Rate, Aged 25-34	0.055	0.064	0.082	0.121	0.091	0.162	0.060	0.074	0.076
11. Unemployment Rate, Aged 35-44	0.036	0.038	0.050	0.097	0.054	0.102	0.036	0.054	0.052
12. Unemployment Rate, Aged 45-54	0.027	0.047	0.042	0.100	0.049	0.096	0.037	0.052	0.049
INCOME									

	Central	Eastman	Interlake	Norman	Parklands	Thompson	Westman	Winnipeg	Manitoba
13. Average Household Income	27604	29697	29248	32721	22616	33109	26898	33402	31267
14. Percent all Household in Owner/Occupant Dwellings	0.638	0.730	0.706	0.645	0.623	0.491	0.609	0.599	0.617
15. Percent Owner/Occupant Household with Costs = 30% Income	0.116	0.120	0.108	0.105	0.110	0.084	0.114	0.112	0.112
16. Percent Tenant/Occupant Household with Costs = 30% Income	0.273	0.267	0.288	0.275	0.279	0.238	0.322	0.347	0.331
MOBILITY									
17. Percent In-migrants, within Canada	0.182	0.194	0.177	0.170	0.153	0.200	0.196	0.132	0.154
SOCIAL									
18. Age Dependency Ratio	0.231	0.170	0.194	0.121	0.315	0.046	0.262	0.169	0.185
19. Percent Sole Parent Household with Children	0.030	0.058	0.076	0.129	0.045	0.104	0.082	0.120	0.095
20. Percent Female Parent Household with Children	0.032	0.014	0.070	0.114	0.050	0.118	0.075	0.117	0.090
21. Percent Female Parent, Aged 15-24	0.044	0.025	0.070	0.099	0.052	0.083	0.061	0.090	0.076
22. Percent French Mother Tongue	0.069	0.121	0.019	0.017	0.031	0.013	0.017	0.040	0.043
23. Percent Native Mother Tongue	0.003	0.020	0.025	0.077	0.017	0.375	0.007	0.004	0.023

TABLE 2
SOCIO-ECONOMIC RISK INDEX AND
PROTOTYPE POOR HEALTH STATUS INDEX BY REGION

	Central	Eastman	Interlake	Norman	Parklands	Thompson	Westman	Winnipeg	Manitoba
Socio-Economic Risk Index	-0.273	0.216	0.746	2.790	1.966	4.393	0.123	-0.440	0
Prototype Poor Health Status Index	0.899	0.383	0.133	3.390	2.469	4.977	1.028	-1.047	0

TABLE 3
CORRELATION BETWEEN ELEMENTS OF THE
SOCIO-ECONOMIC RISK INDEX

	25-34 Completed High School	15-24 Unemployed	45-54 Unemployed	Women in the work force	Single Pa Female
Percent Population Aged 25-34, High School Diploma or equivalent					
Unemployment Rate, Aged 15-24	-0.450 ^{***}				
Unemployment Rate, Aged 45-54	-0.405 ^{***}	0.474 ^{***}			
Labour Force Participation %, Women Aged 15+	0.531 ^{***}	-0.460 ^{***}	-0.240 ^{***}		
Percent Female Parent Household with Children	-0.038	0.306 ^{***}	0.051	-0.241 ^{***}	
Mean Value of Dwelling	0.312 ^{***}	-0.174 ^{**}	-0.119 [*]	0.360 ^{***}	-0.050

These correlations are at the municipal level.

- *** represents a significance at the .001 level.
- ** represents a significance at the .01 level.
- * represents a significance at the .05 level.

TABLE 4
CORRELATION BETWEEN THE SOCIO-ECONOMIC RISK INDEX
AND THE NON-SELECTED SOCIO-ECONOMIC CHARACTERISTICS

	Socio-Economic Risk Index
3. Percent Population Aged 35-44, High School Diploma or Equivalent	-0.568 ^{***}
4. Percent Population Aged 45-54, High School Diploma or Equivalent	-0.535 ^{***}
5. Percent Labour Force, Farming	-0.346 ^{***}
6. Percent Labour Force, Managerial/Sciences	-0.136 [*]
7. Percent Labour Force, Manufact/Constr/Transport	0.303 ^{***}
10. Unemployment Rate, Aged 25-34	0.719 ^{***}
11. Unemployment Rate, Aged 35-44	0.627 ^{***}
13. Average Household Income	-0.574 ^{***}
14. Percent all Household in Owner/Occupant Dwellings	0.012
15. Percent Owner/Occupant Household with Costs = 30% Income	0.071
16. Percent Tenant/Occupant Household with Costs = 30% Income	0.182 ^{**}
17. Percent In-migrants, within Canada	-0.164 ^{***}
18. Age Dependency Ratio	-0.148 [*]
19. Percent Sole Parent Household with Children	0.174 ^{***}
21. Percent Female Parent, Aged 15-24	0.076
22. Percent French Mother Tongue	0.043
23. Percent Native Mother Tongue	0.023

These correlations are at the municipal level

- ^{***} represents a significance at the .001 level.
- ^{**} represents a significance at the .01 level.
- ^{*} represents a significance at the .05 level.

MANITOBA CENTRE FOR HEALTH POLICY AND EVALUATION

Report List: January 1994

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| 91-04-01 | <i>Manitoba Health Care Studies and Their Policy Implications</i> , by Evelyn Shapiro |
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| 92-10 | <i>An Assessment of How Efficiently Manitoba's Major Hospitals Discharge Their Patients</i> , by Marni Brownell, Ph.D. and Noralou Roos, Ph.D. |
| 93-01 | <i>The Utilization of Prenatal Care and Relationship to Birthweight Outcome in Winnipeg, 1987-88</i> , by Cam Mustard, Sc.D. |
| 93-02 | <i>Assessing Quality of Care in Manitoba Personal Care Homes by Using Administrative Data to Monitor Outcomes</i> , by Evelyn Shapiro, M.A. and Robert B. Tate, M.Sc. |

Population Health Information System (analyses for 1991/92 to be released in 1993/94)

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