Manitoba Centre for Health Policy

Methamphetamine Use in Manitoba: A Linked Administrative Data Study

Autumn 2020



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About the Manitoba Centre for Health Policy

The Manitoba Centre for Health Policy (MCHP) is located within the Department of Community Health Sciences, Max Rady College of Medicine, Rady Faculty of Health Sciences, University of Manitoba. The mission of MCHP is to provide accurate and timely information to healthcare decision-makers, analysts and providers, so they can offer services which are effective and efficient in maintaining and improving the health of Manitobans. Our researchers rely upon the unique Manitoba Population Research Data Repository (Repository) to describe and explain patterns of care and profiles of illness and to explore other factors that influence health, including income, education, employment, and social status. This Repository is unique in terms of its comprehensiveness, degree of integration, and orientation around an anonymized population registry.

Members of MCHP consult extensively with government officials, healthcare administrators, and clinicians to develop a research agenda that is topical and relevant. This strength, along with its rigorous academic standards, enables MCHP to contribute to the health policy process. MCHP undertakes several major research projects, such as this one, every year under contract to Manitoba Health, Seniors and Active Living. In addition, our researchers secure external funding by competing for research grants. We are widely published and internationally recognized. Further, our researchers collaborate with a number of highly respected scientists from Canada, the United States, Europe, and Australia.

We thank the Research Ethics Board on the Bannatyne Campus at the University of Manitoba, 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, Seniors and Active Living.

The Manitoba Centre for Health Policy

Data Insight Informing Solutions

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Abbreviations

WFPS	Winnipeg Fire Paramedic Service
DSM	Diagnostic Services of Manitoba Database
ADHD	Attention Deficit Hyperactive Disorder
CTADS	Canadian Tobacco, Alcohol and Drugs Survey
CSTADS	Canadian Student Tobacco, Alcohol, and Drugs Survey
PHIN	Personal Health Identification Number
MCHP	Manitoba Centre for Health Policy
EDIS	Emergency Department Information System

Executive **Summary**

Methamphetamine is a central nervous stimulant known by several street names, including meth, crystal meth and rock. Methamphetamine can be injected, inhaled, snorted or taken orally. Methamphetamine use results in wakefulness, vigour, euphoria and reduced appetite, and also contributes to severe physical health complications that may include lethal hyperthermia, myocardial infarction (heart attack), stroke, seizure and death.

People who have been systemically marginalized (for example, people who are insecurely housed, people who have experienced trauma and/or abuse, people with low income, and racialized groups) are disproportionately more likely to use methamphetamine compared with others who have not experienced any of these circumstances. People who have used methamphetamine explain that doing so makes them feel alert and wakeful, that their social interactions are enhanced, that the drug is a means to cope with negative emotions and traumatic memories, and that it is used as a substitute for psychiatric medications. Other factors that contribute to their use of methamphetamine include the fact that it is relatively inexpensive compared with other substances, and that it generates a long-lasting high.

Recent reports suggest that methamphetamine is cheap, simple to manufacture and easily accessible. A 2019 report from Saskatchewan found that 0.1g of methamphetamine cost as little as \$3.00 [1]. The low cost of methamphetamine may be contributing to an observed increase in the drug's use. Although it is used less commonly than other drugs in Canada, data from the Canadian Tobacco, Alcohol and Drug Survey suggest that the national prevalence of use increased from 3.0% to 3.7% between 2013 and 2017, with use being more common among males than females (5.4% vs. 2.2% in 2017) [2–4]. Other reports point to rising methamphetamine use in Manitoba.

Objectives

The overall goal of this study was to better understand the epidemiology of methamphetamine use in Manitoba.

Our research objectives were to:

- Describe the incidence rate of first-time health care system contacts documenting methamphetamine use from 2013 to 2018;
- 2. Describe the geographic distribution of Manitobans who had contact with the health care system related to their methamphetamine use;
- Describe the sociodemographic characteristics of Manitobans who had contact with the health care system related to their methamphetamine use;
- 4. Identify the prevalence and distribution of mental disorders among those who had a methamphetamine-related contact with the health care system, and compare the mental disorder profile in this population to all other Manitobans.

Methods

We used data housed within the Manitoba Population Research Data Repository (the Repository). The Repository is a whole-population suite of administrative databases containing a wealth of information across several domains, including health, social services, education and justice. Virtually every health care system contact made by Manitobans is documented in the Repository.

Using administrative health records from 2013 to 2018, we identified individuals whose methamphetamine use was documented by the health care system. We used data from the following sources:

- The Hospital Discharge Abstract Database: ICD-10 codes for amphetamine-related disorders; harms related to amphetamine use (e.g., poisoning from amphetamine).
- The Medical Claims Database: 5-digit ICD-9 codes, including amphetamine dependence, amphetamine abuse and poisoning by amphetamines.
- The Emergency Department Information System: Keyword searches in triage notes to identify people presenting with an indication of having used methamphetamine. These data were limited to Winnipeg.
- Winnipeg Fire Paramedic Service (WFPS)
 Database: Keyword searches in the WFPS data for methamphetamine use.
- Diagnostic Services Manitoba (DSM) Database:
 Diagnostic tests where methamphetamine was identified.

We identified 5,433 people who had a methamphetaminerelated health care contact recorded in the administrative data. We then excluded people if they:

- Lacked coverage with Manitoba Health at the time of the health care contact during which their methamphetamine use was documented (n=127);
- Had been diagnosed with Attention Deficit Hyperactive Disorder (ADHD) and had received a prescription drug to treat this disorder (n=508).

The final cohort of individuals whose methamphetamine use was documented in the administrative data included 4,798 Manitobans.

In our first set of analyses, we calculated the annual incidence rate of methamphetamine-related contacts with the health care system (i.e., the rate of *new* contacts). We ensured that the contact was their first methamphetamine-related one by looking back six years to ensure they had no other methamphetamine-related health care contacts during that time period.

We conducted area-analyses to identify geographic hotspots of methamphetamine use in Winnipeg. We used the geographic coordinates recorded in the WFPS data to identify where individuals received services from WFPS throughout the city. We used these to generate maps illustrating areas where methamphetamine use was occurring.

Next, we conducted analyses to describe the cohort's sociodemographic characteristics: biological sex (male/ female); age at point of first health care contact; area of residence (urban/rural and regional health authority); and average household income.

We examined the prevalence (existing cases) and incidence (new cases) of mental disorders in the cohort. We calculated the proportion of people who received a mental disorder diagnosis during the five years leading up to their first methamphetamine-related health care contact. We also calculated the incident rate of new mental disorder diagnoses in the year after their first methamphetaminerelated health care contact. We compared the five-year diagnostic prevalence and the one-year incident rate of mental disorders among Manitobans who had used methamphetamine to the prevalence and incident rate among all other Manitobans.

Finally, we looked at the annual rate of health system use among the cohort. We quantified the rate of service use by calculating the rate of contacts with WFPS, visits to the emergency department, hospitalizations and physician visits. For each type of health service, we calculated the rate of use in the calendar year following their first methamphetamine-related health care contact, and the annual rate of use from their first methamphetamine-related contact until the end of the study period.

Results

Using data from 2013 to 2018, we identified 4,798 Manitobans whose first methamphetamine-related health care contact was documented in this time period. The number of Manitobans with first-time methamphetaminerelated health care contacts increased by nearly 700% over the study period: from 208 Manitobans in 2013 to 1,454 Manitobans in 2018. These individuals tended to live in low-income neighbourhoods and most were between the ages of 18 and 34. Maps depicting where individuals who had used methamphetamine came into contact with WFPS showed that most contacts occurred in the downtown areas of Winnipeg; however over time, more WFPS contacts occurred in outlying areas of the city as well.

We found that Manitobans who had a methamphetaminerelated health care contact were far more likely than other Manitobans to have one or more co-occurring/co-morbid mental disorders. We looked at several mental disorders: mood or anxiety disorders, substance use disorders, psychotic disorders and personality disorders. In each case, Manitobans who had used methamphetamine were more likely to have received a mental disorder diagnosis (either in the five years leading up to and/or the year after their first methamphetaminerelated health care contact) than other Manitobans.

Finally, we saw that across the four health services we examined (care from paramedics, emergency department visits, hospitalizations and physician visits), Manitobans whose methamphetamine use had been documented used the health system more than other Manitobans. In many cases, their rates of health service use were highest during the first year after entering the cohort (i.e., the year after their first methamphetamine use was documented), and this was true in all calendar years of the study.

Conclusions

This report highlights the growing rate of methamphetamine-related health care contacts in Manitoba. Our findings point to the complexities behind this trend. Many Manitobans who have had a methamphetamine-related health care contact live in lowincome neighbourhoods, are relatively young, and are likely to have been diagnosed with a mental disorder. The study has several strengths and limitations worth noting. Having access to whole-population data that capture virtually all contacts with the health care system is a major strength. Thus, we were able to construct a holistic picture of not only methamphetamine-related health care contacts made by Manitobans but also of their sociodemographic characteristics and mental health diagnoses. The study was however limited by a lack of access to emergency department and WFPS data from outside of Winnipeg. In addition, we were only able to describe the experiences of those whose methamphetamine use had been recorded by the health system; those who have not interacted with the health care system are missing from this report. Thus, caution should be taken in drawing conclusions from these findings about the province as a whole.

Seeking a Broader Understanding of Methamphetamine Use in Manitoba

In our study, essentially half of those who had used methamphetamine lived in the poorest areas of Manitoba. From the literature, we know that many people who use methamphetamine have experienced or are currently experiencing marginalizing circumstances. They may be insecurely housed, have a history of trauma and abuse, or be a member of a racialized group. They may also face structural barriers, such as colonial policies and laws rife with systemic racism. The result of such policies is major health and social inequities in the Canadian population, including high numbers of people living in poverty and high rates of mental disorders, and this may help to explain why the study shows that Manitobans living in low-income areas have higher rates of methamphetamine use. It is also possible that people in positions of privilege who use methamphetamine are less likely to have their methamphetamine use recorded in the health data and are not well represented in this report.

We were not able to fully examine these factors using the administrative data. However, the reader should guard against focusing solely on individual-level factors when considering solutions to the complex and challenging methamphetamine crisis that Manitoba is facing. There is a critical need to address the long-term as well as the shortterm issues when designing preventative solutions to this growing challenge.

Chapter 1: Background and Introduction

The province of Manitoba is in the midst of a methamphetamine epidemic that is placing a large burden on health, social and justice systems [5–7].

Amphetamines are stimulant drugs that increase the activity of the central nervous system. They can be used to treat narcolepsy, obesity and attention-deficit hyperactivity disorder (ADHD) by inducing wakefulness, weight loss, and improved memory and attention [8,9]. The long-term use of amphetamines at therapeutic doses has been shown to be safe and effective in the treatment of ADHD [10]. Non-medical and recreational uses of amphetamines include extensions of the therapeutic effects as well as effects that occur with higher-than-therapeutic doses. Examples of the former include activities such as non-therapeutic weight loss, wakefulness for working long hours and cognitive enhancement for students. Higher-than-therapeutic doses can also be used in athletic doping (improved endurance) and the induction of euphoria (exaggerated feelings of well-being) and aphrodisia (increased sexual desire).

The drug methamphetamine (or meth) is chemically related to amphetamines and is also a central nervous system stimulant. Methamphetamine was once used similarly to amphetamines in the treatment of narcolepsy, obesity and ADHD. However, methamphetamine is distinct in that it is neurotoxic (damaging to brain cells). Currently, reference to methamphetamine use is usually in the context of recreational use. Street names include speed, meth, crystal meth, glass, ice, jib, crank, tina, shards, peach, pink, tweak, blade, chalk, candy, rock, and peanut [11,12]. Methamphetamine can be injected into the bloodstream, inhaled (smoked) as crystal meth, snorted as powder, or taken orally in tablets. Inhalation or injection generates a rapid response (almost immediate), whereas snorting and oral ingestion generate responses after 5 and 20 minutes, respectively [11,13]. In general, the effect is much longer than intoxication from stimulants such as cocaine [14,15]. Depending on the route of administration and dose taken, the "high" caused by methamphetamine can last for up to 12 hours and repeated use can allow the user to stay awake on "a run" for more than a week [11]. The drug releases a chemical called dopamine in the reward areas of the brain, reinforcing the drug-taking behaviour and making methamphetamine highly addictive [16].

Acute intoxication from methamphetamine can manifest in a variety of ways. While a comprehensive discussion is beyond the scope of this review, several manifestations have important consequences on the health of the person using methamphetamine and the burdens placed on health and law enforcement services. To understand the effects of methamphetamine and amphetamines, it is useful to know that they are derivatives of ephedrine, which stimulates the sympathetic "fight or flight"

nervous system. It follows that many of the effects are what one would expect during an "adrenaline rush". Acute symptoms include wakefulness, vigour, euphoria, improved sexual performance and reduced appetite. Acute signs of physical health complications include high blood pressure, high heart rate, hyperthermia (increased body temperature) and rapid breathing. Severe complications can include lethal hyperthermia, myocardial infarction (heart attack), hemorrhagic or ischemic stroke, arrhythmia (abnormal heart rhythm), seizure and death. Severe psychological complications include psychosis, which can manifest as delusions (e.g., paranoid thoughts) and/or hallucinations (e.g., perception of bugs crawling beneath the skin). The psychosis may persist after the acute intoxication period and may become permanent with chronic use of methamphetamine [17].

A post-intoxication "crash" may be experienced for a couple days by those who are not yet dependent on the drug. Symptoms include anhedonia (depressive symptoms), fatigue, confusion, headaches, increased sleep and irritability. Dependent users go through a true withdrawal for 1-2 weeks after cessation of use, experiencing similar symptoms and also anxiety, poor concentration/memory, aches, pains and severe cravings [16].

Epidemiology

The wakefulness and endurance-stimulating properties of methamphetamine were first widely used in Japan, Germany, and the United States to increase the productivity of military personnel and military support industry workers during World War II. Oral methamphetamine was prescribed in the 1950s and 1960s in the United States to treat depression and obesity. Intravenous use began in the 1960s after a liquid form was developed as a treatment for heroin addiction. In the continental United States, illicit methamphetamine use was relatively isolated to white- and blue-collar workers, but then began to spread to college students and young professionals in the 1970s [13].

In the 1990s, illegal production, distribution and use of methamphetamine began to expand geographically to Mexico and eastward in the United States [13,18]. The National Survey on Drug Use and Health revealed that the percentage of Americans aged 12 and older reporting lifetime use of methamphetamine rose from 1.8% to 2.1% from 1994 to 1998 [13,19]. Over the same time period, the use of publicly-funded treatment programs more than tripled, and those admitted were predominantly – but as a declining fraction – white (81%) and male (53%) [13,19,20].

The prevalence of lifetime use of "amphetamine-type substances" and "speed" in North America increased in the new millennium. The 2005 National Survey on Drug Use and Health revealed 4.3% of Americans aged 12 and older reported lifetime use, and 0.5% reported use in the past year [21]. Similarly, the 2004 Canadian Addiction

Survey revealed 6.4% of Canadians aged 15 and older reported lifetime "speed" use (up from 1.8% in 1989), with 0.8% reporting use in the past year [11,22]. More males (8.7%) than females (4.1%) reported lifetime use. Among youth aged 15-24, lifetime use of methamphetamine was 9.8%, which was less than lifetime use of cannabis (61.4%), hallucinogens (16.4%), cocaine (12.5%) and ecstasy (11.9%) [22]. Despite the overall increase in lifetime use compared to the previous decades, there are some indications that the early-to-mid-2000s were characterized by a decline in new youth users. For example, the Ontario student drug survey revealed that methamphetamine use in the past year decreased from 5.0% in 1999 to 2.2% in 2005 among grade 7-12 students [23].

The 2004 Canadian Addictions Survey reported demographic characteristics (age, sex, province, urbanicity and income) for youth users of *any* of five illicit drugs (cocaine, speed, ecstasy, hallucinogens and heroin). However, the demographics of Manitobans using these drugs and people using methamphetamine specifically were not separately characterized [22].

The 2013, 2015 and 2017 Canadian Tobacco, Alcohol and Drugs Survey (CTADS) and the 2014-15 and 2016-17 Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS) provide recent epidemiological data on methamphetamine use in Canada [2-4,24,25]. Between 2013 and 2015, speed/meth/crystal meth use in the past year remained stable at 0.2% nationwide for those aged 15 and older. The national prevalence of lifetime use increased from 3.0% to 3.7% between 2013 and 2017, with use being more common among males than females (5.4% vs. 2.2% in 2017). The 2017 lifetime use prevalence was greater in the 20-24 age group (3.8%) and 25+ age group (3.9%) than the 15-19 age group (1%). It was not possible to determine a trend over time in Manitoba, but lifetime prevalence in the province was estimated at 2.4% with moderate sampling variability in 2013. The CSTADS 2014-15 and 2016-17 revealed that methamphetamine use in the past year among grade 7-12 students remained steady at 1.2% (males 1.7%; females 0.7% in 2016-2017). Use in the past year was higher among older students (1.8% of grade 10-12 participants) than younger students (0.6% of grade 7-9 participants).

In Canada, methamphetamine is less commonly used than cannabis, hallucinogens, cocaine or ecstasy among the general population [4]. The aforementioned Canadian survey results do not reflect recent trends in health and social service use rates in Manitoba. While surveys capture the lifetime and past-year prevalence, this does not necessarily reflect the dose used or frequency of use beyond once per year. Widely distributed surveys also rely on responses from engaged citizens and students, and methamphetamine use likely decreases this participation.

Social Determinants

Certain subpopulations in North America are at greater risk of methamphetamine use than the general population.

Street youth find that accessing crystal meth is "very easy"[26]. A survey of British Columbian street-involved youth revealed 67% had ever used methamphetamine, the majority of whom reported using it multiple times per week or per day [27]. There have been dramatic increases in the number of street-involved youth using methamphetamine over the last five years in Victoria [28]. Homelessness is also predictive of initiating methamphetamine injection among adult intravenous drug users [29].

There is higher risk among youth who are gay, bisexual, transgender, or have a history of psychiatric illness or family history of drug use [30–32]. An estimated 9% of gay British Columbian males used crystal meth in 2004 [33]. It has been suggested that higher rates of use may be associated with the subculture of using methamphetamine as a sex drug in the gay community [33,34]. However, risky sexual behaviour is also common among heterosexual methamphetamine users [35,36]. Given the differing reasons for using methamphetamine among these populations, it is likely that interventions tailored to their specific characteristics are needed to address methamphetamine use.

Price & Accessibility

Methamphetamine is easily manufactured, cheap and accessible. It can be manufactured using common overthe-counter products that are difficult to fully regulate, and recipes for production can be found on the internet [37,38]. The cost of methamphetamine has been declining steadily since the 1980s [39]. While there is regional variation across North America, the British Columbia Drug Overdose and Alert Partnership reported that 0.1g of methamphetamine costs approximately \$10 in 2014 [28]. Another British Columbia report from 2005 stated: "\$5 of methamphetamine can give a high for 24 hours" [37]. Similar prices have been cited by the Winnipeg Regional Health Authority, along with the estimation that methamphetamine can be accessed in about 10 minutes [6]. There have even been recent media reports from Saskatoon that the price of 0.1g of methamphetamine has reached as little as \$3 [1]. The low cost of methamphetamine may be driving the increase in use among systemically marginalized populations [28].

Reasons People Use Methamphetamine

Reasons for using methamphetamine tend to vary between user groups [11]. Hobkirk et al. interviewed 30 people actively using methamphetamine (17 female, 13 male) in Cape Town, South Africa. Four major themes regarding their initiation of use were: social pressure from friends and family, lack of other recreational or employment options, using and selling to generate income, and to cope in areas with high levels of crime [40]. Females tended to use methamphetamine less than males, and they tended to do so for weight loss while men tended to seek increased sexual performance [18,41]. Other subpopulations such as long-distance truck drivers and female sex workers may take advantage of the drug's wakefulness properties.

Among youth surveyed in the 2004 Canadian Addictions Survey, the mean age at first use of methamphetamine was 17.7 years with no significant difference between males and females. The most common reasons for trying illicit drugs (not specifically methamphetamine) were, in descending order, "to try out or because of curiosity" (49.3%), "to get high" (11.2%), and "because family and friends were using" (10.8%) [22]. Among a small sample of street-involved youth, reasons included wakefulness to protect belongings, enhancement of social interaction, to cope with negative emotions and substitution of psychiatric medications [42].

Health Outcomes

Methamphetamine is highly addictive and can cause dependence as tolerance increases with continued use; this means that people who use methamphetamine need the drug more frequently or in greater doses to produce the desired effect [16]. Given the dramatic, sometimes violent, nature of acute psychotic episodes following methamphetamine use, other health effects are often overlooked by popular media. There are many severe mental and physical health outcomes of methamphetamine use beyond psychosis.

Intravenous drug users present to the emergency department for a variety of reasons. A 2003 prospective cohort study from Vancouver stratified the complaints leading to emergency department visits among intravenous drug users [43]. In order of descending frequency, chief reasons were: abscesses, cellulitis and other skin infections (18.3%), wounds, lacerations and contusions (8%), substance use and overdose (7.2%), respiratory infections and disorders (6.6%), musculoskeletal injuries (6.3%), miscellaneous bacterial and viral infections (6.1%), psychiatric disorders (5.6%), medication refills (5.4%), gastrointestinal disorders (4.1%), fractures and dislocations (4.1%) and neurological disorders or seizures (3.5%).

Methamphetamine-related deaths have been recently described as an under-addressed public health problem that requires more attention [44,45]. In a 2010 systematic review with strict inclusion criteria for measuring health outcomes, only one small study from Ontario in the early 1970s was eligible for inclusion with regards to mortality [46]. It suggested that the mortality rate among amphetamine users was approximately four times that of the general population [47]. More recently, much

larger studies have confirmed that people who inject methamphetamine have a higher mortality than the general population [48] and users of other illicit drugs (except for opioids) [49]. In Manitoba, methamphetamine-related deaths have been increasing; between 2014 and 2017, there were 50 methamphetamine-related deaths, with 35 of those deaths occurring in 2017 [7].

Cardiovascular complications contribute to a large proportion of methamphetamine-related deaths [48,50]. Notably, young persons are at increased risk of fatal and non-fatal stroke [51], coronary artery disease, cardiomyopathy and ventricular hypertrophy that increase the risk of arrhythmia and heart attack [52,53]. Other common underlying causes of death include HIV/AIDS, drug overdoses, cancer and homicide [50].

The psychiatric consequences of methamphetamine use extend well beyond the dramatic manifestations of acute psychosis. People who use methamphetamine have a higher rate of psychiatric illness than cocaine users [54]. The risk of depression, anxiety and suicide is higher among people who use methamphetamine than in the general population, especially among chronic users [55], and these factors increase the likelihood of premature death [50]. Among youth aged 10-24 years, methamphetamine use is associated with depression, suicidal ideation and psychosis. Suicide and non-fatal overdoses contribute to mortality and morbidity, respectively, in youth [46,56,57]. A Canadian study found that methamphetamine injection was an independent predictor of suicide attempts, and that people who were younger, female and Indigenous were also more likely to attempt suicide [58]. In methamphetamine-related suicides, males have a significantly higher crude mortality rate than females, and suicide is frequently associated with agitation prior to the death and violent methods of completion [57,59].

The oral health of people who use methamphetamine is often depicted in anti-drug campaign advertising and in the media. "Meth mouth" is characterized by multiple caries and tooth fractures, which can be so severe that the teeth must be extracted. It is thought to be due to a combination of dry mouth, extended periods of poor hygiene, teeth grinding, dehydration and frequent consumption of carbonated beverages [60,61]. However, in a systematic review, the association between methamphetamine use and dental disease was found to be more hypothetical than based on epidemiological evidence [46].

Nearly half of syphilis-positive patients report using crystal meth and, among female cases in the Winnipeg Regional Health Authority, 33% reported injection and 26% reported non-injection methamphetamine use [6,62,63]. Methamphetamine use has been associated with high-risk sexual behaviour among gay, bisexual and heterosexual persons [64,65], and with HIV and syphilis among gay men in the United States [66]. It may therefore be surprising that a systematic review of health outcomes among youth could not confirm associations between methamphetamine use and sexually transmitted infections (STIs). However, this review was published in 2009, may not reflect current associations among older populations, and did not report specifically on syphilis [46]. On a global scale across populations, it is not clear whether the high-risk behaviours among people who use methamphetamine contribute to higher HIV infection rates beyond that of other people who inject drugs [67].

If used in pregnancy, methamphetamine can cause fetal growth restriction [68] and may lead to neurocognitive consequences later in life (e.g., lower mathematics scores in adolescence), although few long-term data are available [69]. It is strongly suspected that methamphetamine is linked to the dramatic increase in cases of congenital syphilis in Manitoba. Mothers who inject methamphetamine during pregnancy make up many of those who have transmitted syphilis to their newborns [70]. Congenital syphilis can cause death, deformity, blindness, deafness and meningitis [71].

Methamphetamine is a highly addictive substance with a wide range of mental and physical consequences. While the acute psychosis that is a result of methamphetamine use gains much attention, the dramatic nature of these events should not over-shadow the other implications of a methamphetamine epidemic. The long-term public health burden will include not only acute medical complications, but also a large number of sub-acute and chronic conditions that will continue to appear over time throughout the health system, the justice system and a variety of social services.

Impact of Methamphetamine Use on Health and Justice Systems

The impact of methamphetamine use on health and justice systems extends intuitively from the health outcomes described above. For example, excess demand is being placed on mental health services (e.g., for psychosis), acute care services (e.g., cardiovascular complications), hospitals (e.g., long stays for systemic infections) and the human resources required to contain outbreaks of sexually transmitted infections [6].

The national survey data on methamphetamine use, specifically the low and stable overall prevalence of methamphetamine use in Canada, stands in stark contrast to the dramatic rise in methamphetamine-related health and social service use. Given the limitations of surveys, the scope and scale of methamphetamine use may be better illustrated by local measurements of addiction treatment and counselling rates, crime rates, methamphetaminerelated emergency department visits, clean needle demand and other non-survey indicators of use [5].

Dramatic increases in presentation of methamphetamineinduced intoxication and psychosis are burdening Manitoba's emergency services, mental health crisis response centre and hospital and addiction resources [6]. Adults who use illicit drugs, including methamphetamine, access the emergency department and are admitted to hospital at much higher rates than the general population [43,72]. Health care use tends to be more frequent among adults with unstable housing, injection use and psychiatric illness [43,72]. Similarly, emergency department visits tend to be more frequent among street youth with lifetime use of methamphetamine and more frequent use of methamphetamine injection [73]. Methamphetamine-related visits to Winnipeg emergency departments increased seven-fold between 2013 and 2017; amphetamine-related presentations to the mental health crisis response centre also increased dramatically over a similar time period [6].

The increase in the number of people accessing harm reduction services and being admitted to addictions programs is putting a strain on Winnipeg's current capacity [6,63]. The Addictions Foundation of Manitoba has observed dramatic increases in the number of clients reporting methamphetamine use. Between 2014/15 and 2016/17, there was a 47% and 104% increase among youth and adults, respectively, reporting use in the past year, with more use among females than males [5]. This increase in injection drug use drove a three- to four-fold increase in demand for clean needles from 2013 to 2018 [6]. In response to the increasing rates of methamphetamine use and related social services and health care use, an interdisciplinary Illicit Drug Task Force was formed in Winnipeg in 2017.

Illicit drug use in general, and methamphetamine use in particular, cannot be considered outside of its social context. For example, most methamphetamine-related calls in 2017 to the Winnipeg Fire Paramedic Service occurred in the Point Douglas and Downtown areas [6], which have substantial Indigenous, low-income and transiently housed subpopulations. The Winnipeg Regional Health Authority notes the inter-relationships that likely exist between methamphetamine use and effects extending from colonization (family separation, trauma, institutionalized and structural racism, lack of Indigenous-led services) and the social determinants of health (low income, unemployment and unstable housing) [6].

The Illicit Drug Task Force notes the importance of the social determinants of health in a multi-level response to address the use of illicit drugs and their associated harms [7]. This consideration deserves even greater emphasis given the apparent paucity of peer-reviewed publications on methamphetamine use in Indigenous populations.

Study Purpose

Over the past five years, Manitoba has witnessed an increase in the number of people consuming methamphetamine. We lack a comprehensive picture of the impacts that methamphetamine use has on the health care system. Addressing this knowledge gap is critical to enhance our understanding of this population's health challenges and to inform strategies aimed at reducing methamphetamine use in Manitoba.

Identifying all Manitobans who have used methamphetamine is a difficult undertaking. We used the administrative data in the Manitoba Population Research Data Repository at the Manitoba Centre for Health Policy (MCHP) to identify individuals with an administrative record that documented their methamphetamine use. Because of this, our research objectives extend only to those who have come into contact with paramedics, emergency services and/or the health care system and have had their methamphetamine use documented in the administrative data. The objectives do not extend to all those who have used methamphetamine. Nonetheless, the objectives outlined below position us to provide much-needed data on the health system outcomes associated with methamphetamine use in Manitoba.

Research Objectives

- Describe the incidence rate of first-time health care system contacts documenting methamphetamine use from 2013 to 2018;
- 2. Describe the geographic distribution of Manitobans who have had contact with the health care system related to their methamphetamine use;
- Describe the sociodemographic characteristics of Manitobans who have had contact with the health care system related to their methamphetamine use;
- 4. Identify the prevalence and distribution of mental disorders among those who have had methamphetamine-related contact with the health care system, and compare the mental disorder profile in this population to all other Manitobans.

Chapter 2: Methods

In this chapter, we outline the methods used to complete this study. First, we provide a high-level overview of the data resource we used, and then we describe how we assembled a cohort of Manitobans whose administrative health records indicated that they had used methamphetamine. Finally, we outline the analytic techniques we applied to better understand the epidemiology and health service use outcomes associated with methamphetamine use.

Data Used in This Study

This study used data from several databases housed within the Manitoba Population Research Data Repository (the Repository). The Repository is a whole-population suite of administrative databases containing a wealth of information across several domains, including health, social services, education and justice. Virtually every contact Manitobans make with the health care system is documented in the Repository.

The Manitoba Population Research Data Repository

In 1979, researchers at the University of Manitoba established the Repository to conduct health research using administrative data. When it was first established, the Repository contained primarily administrative health data. Over the past 40 years, it has expanded considerably and now includes over 90 individual databases spanning multiple sectors. A few unique attributes of the Repository set it apart as a world-class resource for conducting health research:

- The Repository is a whole-population resource, meaning that it includes information on virtually every individual residing in Manitoba who is covered by the province's universal health insurance program.
- The data are linkable at the record, individual, and family level across databases and over time. This allows researchers to examine individuals' trajectories of health service use over time and conduct family-level analyses to identify intergenerational patterns of health.
- The Repository contains one of the world's richest linkable collections of social services and justice data. With these data, researchers can examine the intersection between health, socioeconomic position and intergenerational factors.

It is critical to bear in mind that numerous security measures are put in place to protect the data and ultimately Manitobans' privacy. First, the data are only accessible in a secure environment with dual authentication password protection. Second, the data are de-identified (meaning that all names and addresses are removed) prior to being transferred to MCHP. They contain a scrambled version of each person's Personal Health Identification Number (PHIN), which we use to link records at the individual and family levels. However, it is not possible for researchers or analysts at MCHP to unscramble these PHINs, and thus, individual people remain unidentifiable in the data. Finally, in the tables and figures we present, the data are aggregated to no fewer than six individuals to further protect against re-identification of Manitoba residents.

Table 2.1 lists the databases used in this study. Additional information about these data is available on MCHP's website: http://umanitoba.ca/faculties/health_sciences/ medicine/units/chs/departmental_units/mchp/resources/ repository/descriptions.html.

Table 2.1: Database Descriptions

Database Name	Database Description
Winnipeg Fire and Paramedic Service (WFPS)	Data on emergency response type and patient condition in Winnipeg, maintained by Winnipeg Fire Paramedic Services.
Emergency Department Information System (EDIS)	Health data consisting of all Emergency Department visits in Winnipeg, maintained by Winnipeg Regional Health Authority.
Hospital Discharge Abstract Database	Health data consisting of all the hospitalizations in Manitoba, maintained by Manitoba Health, Seniors and Active Living.
Medical Claims	Health data consisting of all ambulatory physician visits in Manitoba, maintained by Manitoba Health, Seniors and Active Living.
Diagnostic Services Manitoba (DSM)	The Diagnostic Services data tracks and records all of Manitoba's Hospital laboratory services and is maintained by Diagnostic Services Manitoba.
Manitoba Health Insurance Registry	A Registry of all Manitobans eligible to receive health services, maintained by Manitoba Health, Seniors and Active Living.
Drug Program Information Network (DPIN)	Data on all prescription drugs dispensed from retail pharmacies in Manitoba, maintained by Manitoba Health, Seniors and Active Living.

Constructing the Cohort

We used administrative health records from virtually all Manitobans (2013 to 2018) to identify individuals whose methamphetamine use was documented by the health care system. This group of Manitobans became the study cohort.

Because some of these data are available for Winnipeg residents only, we ultimately constructed two cohorts – a Manitoba cohort (including Winnipeg) and a Winnipeg-only

cohort. Table 2.2 shows which data were used for each cohort. In this report, we generally use the term cohort to refer to the larger whole-of-Manitoba cohort unless otherwise noted.

Please keep in mind that the indicators used in our study only describe the proportion of the Manitoba population whose methamphetamine use was documented by the health care system; the indicators do not represent the true prevalence or the true incidence of methamphetamine use in Manitoba.

Table 2.2: Data Sources

Database Name	Winnipeg Cohort	Manitoba Cohort
Winnipeg Fire and Paramedics Services (WFPS)	х	
Emergency Department Information System (EDIS)	Х	
Hospital Discharge Abstract Database	Х	х
Medical Claims	Х	х
Diagnostic Services Manitoba (DSM)	Х	Х

Identifying Methamphetamine Use in the Hospital Discharge Abstract Database

We used ICD-10 codes to identify individuals who had used methamphetamine in the Hospital Discharge Abstract Database. The final list of ICD-10 codes we used in our definition were chosen through a literature review [74] and research team discussions. For example, T43.6x codes identify instances of poisoning by amphetamines, and F15.x codes identify amphetamine-related disorders. A complete listing of the codes we used is presented in Appendix Table 1.1. A limitation should be noted – some of the codes capture a broader set of conditions and are not exclusive to methamphetamine use; as a result, we may have included individuals in the cohort who did not use methamphetamine. However, discussions with our clinical research team members and with practicing psychiatrists on our advisory group have led us to believe that the impact of this limitation on the cohort is minimal.

Identifying Methamphetamine Use in the Medical Claims Database

We used the first five digits of several ICD-9 codes to identify individuals who had used methamphetamine in the Medical Claims Database. The list of ICD-9 codes we used in our definition was agreed upon after discussions amongst our research team members and review of the literature.

- 304.4X: Amphetamine and other psychostimulant dependence
- 305.7X: Amphetamine abuse
- 969.72: Poisoning by amphetamines

We present a complete list of these codes in Appendix Table 1.1. A limitation worth noting is that we only had access to five digits of the codes in Medical Claims data beginning in 2015.

Identifying Methamphetamine Use in the Emergency Department Information System (EDIS)

We identified individuals who had used methamphetamine in the EDIS data using a keyword search of free-text fields. Because keyword searches could result in re-identification of individuals, this search was done by the data providers – i.e., staff at Manitoba Health. Staff at Manitoba Health reviewed the EDIS data using a keyword search that included words such as meth, crystal meth, and chrystal (sic) meth. A complete list of search terms is presented in Appendix Table 1.2. Manitoba Health staff then attached a flag to EDIS records indicating methamphetamine use. The EDIS data and the flag were sent to MCHP with the free text removed to protect individuals' identities.

Identifying Methamphetamine Use in the Winnipeg Fire Paramedic Service (WFPS) Database

We searched for indications of methamphetamine use in the database of WFPS electronic patient care reports. This database consists of core and subsidiary datasets corresponding to particular parts of the patient record, including patient assessments, vital signs, interventions and a free-text narrative. In consultation with the principal investigator, two research team members did a preliminary review of approximately 15% of comments to develop inclusion criteria. All remaining records were reviewed by one team member with assistance from a WFPS analyst. A portion (10%) of these records was randomly selected to be independently coded by both reviewers; decisions on these records showed very good agreement: kappa = 0.865 (95% CI 0.814 - 0.916), p < 0.0005.

Identifying Methamphetamine Use in Diagnostic Services Manitoba (DSM) Data

We considered two drug test codes in the DSM data to identify individuals who had used methamphetamine:

- TEST_CODE=1663 (methamphetamine): Although it is likely that a positive test result indicates methamphetamine use, it could also indicate use of other drugs. Only 9 individuals were identified in the DSM data using this test code. However, we opted to exclude them from the study cohort because we were not certain whether these individuals had tested positive for methamphetamine or for another substance.
- TEST_CODE=1605 (drug screen): A test result of 'MAMP' indicates that the individual was exposed to methamphetamine. We retained these individuals in the cohort.

Figure 2.1: Exclusion Criteria for the Methamphetamine Cohort, 2013-2018

Records and people with methamphetamine-related health care contact in the WFPS, EDIS, hospital, medical, and DSM data



* Some individuals had multiple records, therefore the number of individuals is lower than the number of records.

+ People with a record at first methamphetamine contact (i.e., mutually exclusive number of people)

Combining Methamphetamine Records from All Available Data Sources

We then combined all the records documenting methamphetamine use from the WFPS Database, EDIS, the Hospital Discharge Abstract Database, the Medical Claims Database, and the DSM data. If an individual had records from multiple sources indicating methamphetamine use on the same date, we sorted their records into the following chronological order: (1) WFPS, (2) EDIS, (3) Hospital, (4) Medical Claims, and (5) DSM. This was done so that we could identify a person's "first point of contact" for methamphetamine use documentation based on the expected flow through the health system.

Figure 2.1 presents a flow chart illustrating the process we used to construct the cohort.

Exclusions

We applied the following exclusions to the cohort (based on feedback from our advisory group):

- We excluded anyone lacking a valid PHIN and anyone not covered by Manitoba Health at the date of their methamphetamine use, because without a PHIN or health care coverage, we were unable to link records across databases.
- 2. We excluded individuals who were diagnosed with ADHD and had been dispensed prescription medication for amphetamine use during our study period. ADHD was defined using previously established algorithms [75]. The full case definition is provided in Appendix Table 1.3. We excluded these individuals because their health care contact could have been due to an adverse reaction to the ADHD medications and not methamphetamine use.
- 3. We excluded people younger than 10 years old from the health service use analyses because there were so few children in the cohort under the age of 10 that their results would be unstable and would need to be suppressed to protect their identity.

Covariates

Sociodemographic Characteristics

We described the study cohort according to the following characteristics:

- Biological sex (male/female), from the Manitoba Health Insurance Registry
- Age (based on date of birth), from the Manitoba Health Insurance Registry

- Area of residence (based on postal code), from the Manitoba Health Insurance Registry
 - Stratified by:
 - Urban or rural
 - Regional Health Authority
 - Socioeconomic status, from the 2016 Canada Census – we used the average household income of each individual's dissemination area (based on postal code of residence)

We matched the data used to determine these characteristics to the date of each individual's first point of contact. For example, if a person's first point of contact where methamphetamine use was recorded occurred on June 30, 2017, then we took their sex, age, postal code of residence, and socioeconomic characteristics on that date.

Comorbid Mental Disorders

We used medical records to identify comorbid mental disorders in the cohort using algorithms that have been previously established by members of our team [75]. A complete list of codes for each of the following sets of disorders is presented in Appendix Table 1.3.

- Mood or anxiety disorders: Briefly, an individual was considered to have a diagnosis for a mood or anxiety disorder if they met at least one of the following criteria:
 - They had at least one hospitalization with a diagnosis of depressive disorder, affective psychoses, neurotic depression, adjustment reaction or bipolar disorder; or
 - They had at least one hospitalization with a diagnosis for an anxiety state, phobic disorder or obsessive compulsive disorder; or
 - They had two or more physician visits with a diagnosis of depressive disorder, affective psychoses, adjustment reaction or anxiety disorders.
- Substance use disorders, other than disorders linked with amphetamine use: We wanted to determine whether individuals in the cohort had comorbid substance use disorders other than a disorder for (or as a result of) methamphetamine use. We classified individuals as having a substance use disorder if they met one of the following criteria:
 - At least one hospitalization with a diagnosis for alcohol or drug-induced psychosis, alcohol or drug dependence, or nondependent abuse of drugs; or
 - At least one physician visit with a diagnosis for alcohol or drug-induced psychosis, alcohol or drug dependence, or nondependent abuse of drugs.

- **Psychotic disorders**: An individual was considered to have a diagnosis for a psychotic disorder if they met at least one of the following criteria:
 - They had at least one hospitalization with a diagnosis of a psychotic disorder; or
 - They had at least one physician visit with a diagnosis of a psychotic disorder.
- **Personality disorders**: An individual was considered to have a diagnosis for a personality disorder if they met one of the following criteria:
 - At least one hospitalization with a diagnosis for a personality disorder; or
 - At least one physician visit with a diagnosis for a personality disorder.

We calculated the proportion of the cohort with a mental disorder during the five years prior to their first contact where methamphetamine use was recorded. As a means for comparison, we also calculated the proportion of all other Manitobans that had the same disorder during the calendar years 2014-2018. We stratified these calculations by age: children (age 10-17 years) and adults (age 18+).

Statistical Methods

In this section, we outline the statistical methods that we used to complete our study. For brevity, we use the term "cohort" to mean individuals in our study whose methamphetamine use was documented in the administrative data. We emphasize this because it is important to note that we are unable to identify all individuals who used methamphetamine, nor can we know when a person first started to use methamphetamine. When we refer to analyses based on data only available for Winnipeg residents, we reference the Winnipeg cohort – all other analyses are of the Manitoba cohort.

Are the Differences Meaningful?

We use statistical tests as a way to decide whether or not any differences are likely to be real or instead likely to be due to random chance. We focus on findings that are statistically significant. When we make a comparison and it is not statistically significant, we interpret this to mean that the two numbers are similar. Sometimes, even large differences are not statistically significant. This occurs when we are comparing two small groups of people or two events that are extremely rare. Most often, we use 95% confidence intervals to make these comparisons. When two 95% confidence intervals overlap, this shows us that they are not statistically significantly different from each other; when they do not, the difference is statistically significant.

Incidence Rates of First-Time Contacts with the Health Care System

We first identified the annual rate of first indications of methamphetamine use in the administrative data. While we do not know when someone began to use methamphetamine, this analysis provides information on when the methamphetamine use came to the attention of health or emergency services, thus giving an indication of whether the rate of new methamphetamine use is increasing.

For each person in the cohort, we identified the first time that their methamphetamine use was documented in the administrative data. We used a 6-year washout period to isolate individuals' first record where methamphetamine was documented. Rates were modeled using generalized linear models with a Poisson distribution and a log offset of person-years to account for person-time to test for trends over time.

Sociodemographic Characteristics

We described the cohort by the following characteristics:

- Biological sex (male/female)
- Age at first contact (based on birthdate)
- Urbanicity (urban Winnipeg or Brandon; rural rest of Manitoba)
- Regional Health Authority in which they lived
- Income quintile (based on the average household income for their neighbourhood)

We calculated the mean and median age at first contact, and proportions of sex, urbanicity, Regional Health Authority, income quintile and age groupings.

Comorbid Mental Disorders

We calculated the proportion of the cohort with a comorbid mental disorder in two ways:

- The proportion of the cohort with a diagnosed mental disorder during the five years leading up to the first time their methamphetamine use was recorded in the administrative data;
- 2. The mental disorder diagnosis rate in the year after first contact (i.e., after coming into contact with the health care system for methamphetamine use, they then received a first-time diagnosis for a mental disorder).

We determined that it was an individual's first diagnosis if they had no previous diagnosis for that disorder in the prior six years. The rates accounted for differing follow-up times amongst individuals in the cohort.

We compared the cohort with all other Manitobans, as follows:

- The proportion of the cohort with a mental disorder diagnosis during the five years prior to first methamphetamine-related health care contact compared with the five-year prevalence of mental disorders (2014-2018) among all other Manitobans. We used 95% confidence intervals to compare the two proportions and calculated corresponding ageand sex- adjusted risk ratios.
- The rate of new mental disorder diagnoses (the incident rate) in the cohort compared with the one-year incident rate (in 2018) among all other Manitobans. We used 95% confidence intervals to assess whether these two rates were similar and we calculated age- and sex-adjusted rate ratios comparing these two groups.

Rates of Health Service Use

We also aimed to quantify the health services used by the cohort. We did this by calculating the following rates:

- Contacts with WFPS
- Visits to the Emergency Department
- Hospitalizations
- Physician Visits

We calculated annual rates of contact with each of these four health services for the study cohort. Rates were calculated by totaling the number of times an individual came into contact with each health service and dividing that by their time in the study in each calendar year. Rates were calculated using generalized linear models with a Poisson distribution and a person-years log offset. We compared rates in the cohort with rates among all other Manitobans using these models and identified significant differences using 95% confidence intervals. All data management, programming, and analyses were performed using SAS® statistical analysis software version 9.4.

Chapter 3: Describing the Cohort

This chapter presents the annual rates of first methamphetamine-related health care contacts. We add a caveat to this since we cannot know for certain that these people came to the attention of the health care system because of their methamphetamine use, but it is the first time that their use of methamphetamine was documented. Each record indicates that a health care provider perceived that the individual's methamphetamine use was an important part of their current or previous health situation. Thus, this chapter provides a snapshot of the scope of methamphetamine-related health care contacts in Manitoba and how this is changing over time. This chapter also describes the cohort's sociodemographic characteristics.

We remind the reader that although we often refer to "the cohort" in the following chapters, there were actually two cohorts in the study – a Manitoba cohort and a Winnipeg cohort. Unless otherwise noted, "the cohort" refers to the Manitoba cohort.

It is reasonable to expect that the experiences and characteristics of the two cohorts may differ based on their first point of contact with the health care system. Individuals who enter the cohort through a record in the WFPS data – i.e., their first point of contact with the health care system for methamphetamine use is when they came into contact with the WFPS – may be very different from individuals who enter the cohort through the medical claims data. Because of this, we present the data by the Manitoba cohort, the Winnipeg cohort, and by first point of contact.

First-Time Methamphetamine-Related Health Care Contacts

Figures 3.1 and 3.2 present the incidence rate of first-time methamphetamine-related contacts with the health care system for Manitoba and Winnipeg, respectively. We used a six-year washout period to identify individuals' first methamphetamine-related contact. For Manitoba, the rate in 2013 was 1.42 contacts per 10,000 person-years and it increased to 11.92 contacts per 10,000 person-years in 2018. For Winnipeg, rates increased from 1.90 contacts per 10,000 person-years in 2013 to 14.87 contacts per 10,000 person-years in 2018. In both cohorts, the increase in the incidence rate of first-time contacts related to methamphetamine use leveled off between 2017 and 2018.





Figure 3.2: Incidence of Methamphetamine-related Contacts with the Health Care System for Winnipeg Per 10,000 Person-Years, All Ages, 2013-2018



Table 3.1 below presents descriptive information on the cohort. Overall, there was an increase each year in the number of first-time methamphetamine-related contacts. There was a similar pattern when we examined these annual trends by data source. Some of the steepest increases were seen among individuals who had their first methamphetamine-related contact in hospital. Meanwhile, the rate of increase in the WFPS and EDIS data was more or less constant over time. However, across all data sources the number of new methamphetamine-related health care contacts increased each year. This is in line with findings presented in recently published reports [6].

Table 3.1 also presents sociodemographic information on the Manitoba cohort overall and stratified by where their first contact occured. The age and sex distributions were comparable across data sources. While the urban/rural split differed across data sources, this is to be expected since WFPS data and EDIS data are based on Winnipeg residents and so very few non-Winnipeg residents accessed these services. The majority (just over half) of the cohort lived in low-income neighbourhoods; however, when looking at each database individually, a slightly different story emerges. Those whose first contact occurred in hospital were the least likely to live in a low-income neighbourhood (45.8%) and those whose first contact was from WFPS and DSM data were the most likely to live in a low-income neighbourhood (56.3% and 55.5%, respectively).

Indicator	Total ((N=4	Cohort 798)	WF (N=2,	PS 113)	(N=1	llS (352)	Hosp (N=6	oital 827)	Medical (N=4	Claims (03)	DS (N=3	M 03)
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Year of 1st Contact*												
2013	208	4.34	88	4.16	73	5.40	39	6.22	n/a	n/a	ω	2.64
2014	312	6.50	138	6.53	106	7.84	47	7.50	n/a	n/a	21	6.93
2015	520	10.84	220	10.41	156	11.54	73	11.64	39	9.68	32	10.56
2016	952	19.84	425	20.11	285	21.08	86	13.72	66	16.38	06	29.70
2017	1,352	28.18	574	27.17	365	27.00	134	21.37	127	31.51	152	50.17
2018	1,454	30.30	668	31.61	367	27.14	248	39.55	171	42.43	0	00.00
Sex												
Male	2,392	49.85	1,031	48.79	711	52.59	297	47.37	197	48.88	156	51.49
Female	2,406	50.15	1,082	51.21	641	47.41	330	52.63	206	51.12	147	48.51
Age Groups**												
10-17	180	3.75	106	5.02	32	2.37	23	3.67	16	3.97	S	S
18-24	1,156	24.09	535	25.32	352	26.04	127	20.26	84	20.84	58	19.14
25-29	1,118	23.30	489	23.14	368	27.22	114	18.18	86	21.34	61	20.13
30-34	837	17.44	350	16.56	249	18.42	106	16.91	73	18.11	59	19.47
35-39	610	12.71	260	12.30	170	12.57	75	11.96	60	14.89	45	14.85
40-44	378	7.88	168	7.95	83	6.14	55	8.77	32	7.94	40	13.20
45-49	225	4.69	97	4.59	49	3.62	44	7.02	20	4.96	15	4.95
50-54	157	3.27	55	2.60	30	2.22	38	6.06	19	4.71	15	4.95
55+	132	2.75	50	2.37	18	1.33	44	7.02	13	3.23	7	2.31
* DSM data on methamphetamine use end in 2017												

Table 3.1: Descriptive Information on the First Use of Methamphetamine by Data Entry Point (Dataset)

** DSM, Hospital and Medical Claims data starts at age 10; Age Group 0-9 is not presented due to small cell sizes and corresponding rules regarding privacy. As a result, numbers may not add up to the total counts at the top of the table.

Note: Information in missing or 'not found' indicators are not included in this table, and therefore percents may not add to 100

n/a indicates this information is not available
	Total (cohort	WF	PS	ш Ш	SIC	Hos	pital	Medical	Claims	DS	W
Indicator	(N=4	(862)	(N=2	,113)	(N=1	,352))=()	327)	/N=⊄	103)	(N=3	:03)
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Urbanicity												
Urban (Winnipeg or Brandon)	3,800	79.20	1,742	82.44	1,113	82.32	415	66.19	323	80.15	207	68.32
Rural	998	20.80	371	17.56	239	17.68	212	33.81	80	19.85	96	31.68
Regional Health Authority ⁺												
Interlake-Eastern	328	6.84	141	6.67	92	6.80	32	5.10	29	7.20	34	11.22
Northern	276	5.75	137	6.48	68	5.03	27	4.31	12	2.98	32	10.56
Southern	187	3.90	63	2.98	56	4.14	38	6.06	18	4.47	12	3.96
Prairie Mountain	340	7.09	43	2.04	34	2.51	201	32.06	42	10.42	20	6.60
Winnipeg	3,665	76.39	1,728	81.78	1,102	81.51	328	52.31	302	74.94	205	67.66
Income Quintile ^T												
Q1 (Lowest)	2,515	52.42	1,190	56.32	687	50.81	287	45.77	183	45.41	168	55.45
Q2	971	20.24	418	19.78	279	20.64	139	22.17	80	19.85	55	18.15
Q3	559	11.65	204	9.65	161	11.91	98	15.63	66	16.38	30	9.90
Q4	427	8.90	159	7.52	138	10.21	62	9.89	40	9.93	28	9.24
Q5 (Highest)	221	4.61	80	3.79	99	4.88	26	4.15	31	7.69	18	5.94
FRHA – Missing is not presented due to small cell si	sizes and corre	esponding ru	les regarding	privacy. As a	result, numb	ers may not a	idd up to the t	otal counts at	t the top of the	e table.		

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T Income Not Found is not presented due to small cell sizes and corresponding rules regarding privacy. As a result, numbers may not add up to the total counts at the top of the table.

Note: Information in missing or 'not found' indicators are not included in this table, and therefore percents may not add to 100

n/a indicates this information is not available

Table 3.1: Continued

Population Pyramid

Population pyramids are useful visuals for examining whether the age and sex distribution of a particular cohort differs from the age and sex distribution of the general population. Figure 3.3 presents a population pyramid for the study cohort compared with all other Manitobans. The bulge appearing between the ages of 20 and 34 indicates that the cohort tends to be younger than the 'all other Manitobans' group.

Figure 3.3: Age and Sex Profile for People Who Use Methamphetamine Crude percent



Cohort Population: 4,793 All Other Manitoba Population: 1,219,029

Geographic Mapping of Contacts with the Winnipeg Fire Paramedic Service

Services in Winnipeg

We conducted descriptive area-based analyses to map where individuals received services from WFPS. By analyzing WFPS data, we can identify areas where an individual is likely to have had an adverse event associated with methamphetamine use that required urgent medical services (as opposed to focusing on where a person lived). The intent of these analyses is to provide data on geographic hotspots of methamphetamine use. Unfortunately, this analysis is limited to Winnipeg contacts because we do not have this data for the rest of the province.

We first generated dot plots using the latitude and longitudinal coordinates of incident locations recorded in the WFPS data. These plots show the numbers of individuals who received services from WFPS in 23 Winnipeg neighbourhood clusters. It is critical for us to let the reader know that we added random variation to these coordinates before plotting the dots, meaning the dots do not depict a person's exact location, but rather provide an approximation for it. We did this to protect the identities of people in the cohort.

Next, we generated area plots depicting rates of contacts with WFPS for each of the 23 neighbourhood clusters. These rates were calculated as the number of contacts per square kilometre in the neighbourhood cluster.

We present both types of maps because they communicate different important pieces of information. The dot maps provide a "noses through the door" depiction of the location and volume/magnitude of methamphetamine use across the Winnipeg Regional Health Authority, and can provide important insights into where and how upstream prevention efforts may need to be focused and scaled. The rate maps provide a measure of the intensity of methamphetamine use and clues as to the social and ecological factors that put geographically defined populations at higher risk of use and associated harms.

We created maps for each calendar year, 2013 to 2017 to show how the geography of methamphetamine use has changed over time.

Annual Maps – 2013 to 2017

Figures 3.4 to 3.8 show the dot maps for 2013 to 2017. These maps highlight how contacts with WFPS associated with methamphetamine use have increased over time. In 2013, there were relatively few methamphetaminerelated contacts with WFPS, and these contacts were clustered in the downtown region. In 2017, the number of methamphetamine-related contacts with WFPS had increased and had spread to other areas of the city, although the increase was still largely concentrated in the downtown region of the city.

Figures 3.9 to 3.13 show area maps that depict rates of methamphetamine-related WFPS contacts per square kilometre. The deep red areas are the neighbourhood clusters with the highest rates of methamphetamine-related contacts with the WFPS, and these areas spread out from the downtown region from 2013 to 2017. In 2013, the highest rates were isolated to the downtown area of the city. With each subsequent year, the darkest shaded areas spread to additional neighbourhood clusters.

Figure 3.4: Number of Methamphetamine-Related WFPS Contacts in Winnipeg, 2013 Each + = 10 Incidents



Figure 3.5: Number of Methamphetamine-Related WFPS Contacts in Winnipeg, 2014 Each + = 10 Incidents



Figure 3.6: Number of Methamphetamine-Related WFPS Contacts in Winnipeg, 2015 Each + = 10 Incidents



Figure 3.7: Number of Methamphetamine-Related WFPS Contacts in Winnipeg, 2016 Each + = 10 Incidents



Figure 3.8: Number of Methamphetamine-Related WFPS Contacts in Winnipeg, 2017 Each + = 10 Incidents



Figures 3.9 to 3.13 show area maps that depict rates of methamphetamine-related WFPS contacts per square kilometre. The deep red areas are the neighbourhood clusters with the highest rates of methamphetamine-related contacts with the WFPS, and these areas spread out from

the downtown region from 2013 to 2017. In 2013, the highest rates were isolated to the downtown area of the city. With each subsequent year, the darkest shaded areas spread to additional neighbourhood clusters.

Figure 3.9: Area-Level Number of Methamphetamine-Related WFPS Contacts in Winnipeg, 2013 Contacts per Square Kilometre



Figure 3.10: Area-Level Number of Methamphetamine-Related WFPS Contacts in Winnipeg, 2014 Contacts per Square Kilometre







Figure 3.12: Area-Level Number of Methamphetamine-Related WFPS Contacts in Winnipeg, 2016 Contacts per Square Kilometre



Figure 3.13: Area-Level Number of Methamphetamine-Related WFPS Contacts in Winnipeg, 2017 Contacts per Square Kilometre



What Do These Results Mean?

In this chapter, we provided an overview of the sociodemographic characteristics of Manitobans whose methamphetamine use was documented during a health care contact from 2013 to 2017. We saw that these individuals were very likely to live in a lower income neighbourhood (this was true for over half of the cohort, and between 39% and 55% in each database). Although the geographic analyses were limited to Winnipeg, they provide an important set of results that can be used to develop strategies and services aiming to support individuals who use methamphetamine. First, we see that although methamphetamine-related contacts with WFPS were concentrated in the downtown regions, these contacts were not exclusive to downtown Winnipeg. Both the dot maps and the rate maps point to the fact that methamphetamine use occurred in all parts of the city. Second, we see that these contacts spread from downtown to other communities from 2013 to 2017. Together, these two complementary sets of data point to the conclusion that the impacts of methamphetamine use extend to many neighbourhoods in the city.

The entire city of Winnipeg has a vested interest in identifying, developing and implementing evidence-

informed strategies that address the upstream social and structural determinants that predispose people to use methamphetamine to prevent first time use, and in supporting those who are using methamphetamine by applying a harm-reduction approach.

Both quantitative and qualitative studies have documented that individuals who use methamphetamine face a myriad of socioeconomic challenges in their lives, including things like homelessness, job insecurity and adverse lived experiences. For many Manitobans who face these challenges, consuming methamphetamine is a strategy to deal with these and many other challenges.

Manitobans in our study who used methamphetamine were on average younger than the general population, although there were a number of people who used methamphetamine who were over 40. This suggests that while methamphetamine use is a challenge that disproportionately impacts younger Manitobans, it cuts across generational lines. Critically, we saw that the number of Manitobans coming into contact with the health care system following methamphetamine use increased on a yearly basis. Curbing this trend will require that we address the underlying social and structural determinants that disproportionately predispose some populations to turn to methamphetamine as a coping strategy or to manage social situations.

Chapter 4: Mental Health Comorbidities

People who use methamphetamine face a disproportionate number of socioeconomic and structural challenges, and are more likely than other Manitobans to experience poor mental health. This chapter examines pre-existing comorbid (co-occurring) mental disorders among individuals who use methamphetamine – that is, the presence of a mental disorder diagnosis *before* first contact with the health care system where methamphetamine use is documented. We also examined the rate of receiving a new mental disorder diagnosis in the year following first contact.

These analyses were completed for the overall cohort, and also stratified by age and by database in which methamphetamine use was first documented. We hypothesized that people's mental health profiles would differ based on where their first methamphetamine use was recorded – however, it turned out that there were very few differences across different data sources, so we only included the total cohort results in this report. The results by data source can be found in Appendix 2 in the Online Supplement that can be accessed via http://mchp-appserv.cpe.umanitoba. ca/deliverablesList.html.

Mental Disorders in the 5 Years Before First Contact

Figure 4.1 shows the five-year prevalence for each of the four categories of mental disorders we examined for people who used methamphetamine (lighter bar) and for all other Manitobans (darker bar). For each of the four mental health categories, the prevalence was significantly higher in the cohort compared with all other Manitobans.



Figure 4.1: Prevalence of Mental Disorders Among People Using Methamphetamine, 5 Years Before Contact with Health Care System Crude rate

*Substance Use Disorders exclude amphetamine use.

Mood or Anxiety Disorders in the 5 **Years Before First Contact**

Figure 4.2 shows the age- and sex-adjusted prevalence estimates for mood or anxiety disorders for the cohort and for all other Manitobans and the risk ratio comparing the prevalence of the mood or anxiety disorders in the cohort

(age 18+) versus all other Manitobans. After adjusting for age and sex, the five-year prevalence of mood or anxiety disorders in the cohort was just under 70%, whereas among all other Manitobans, it was just over 20%. The rate of being diagnosed with a mood or anxiety disorder was three times higher in the cohort than among all other Manitobans.

Figure 4.2: Prevalence of Mood or Anxiety Disorders among Adults in the Cohort Compared to All Other Manitobans

Age- and sex-adjusted percent, age 18+, five-year prevalence as of 2018;



Substance Use Disorders in the 5 Years Before First Contact

Figure 4.3 shows the five-year prevalence of substance use disorders for the cohort compared to all other Manitobans, and the risk ratio comparing the cohort (age 18+) to all other Manitobans. We excluded any disorders related to

amphetamine-related substance use from this indicator. After adjusting for age and sex, the five-year prevalence of substance use disorders in the cohort was nearly 60%, while among all other Manitobans, it was roughly 4.5%. The rate of being diagnosed with a substance use disorder was 11-15 times higher in the cohort compared with all other Manitobans.

Figure 4.3: Prevalence of Substance Use Disorders, excluding Amphetamine-Related Substance Use,

among Adults in the Cohort Compared to All Other Manitobans

Age- and sex-adjusted percent, age 18+, five-year prevalence as of 2018;



Psychotic Disorders in the 5 Years Before First Contact

As shown in Figure 4.4, the age- and sex-adjusted five-year prevalence of psychotic disorders in the cohort was over 21%, while it was less than 2% among all other Manitobans. The rate of people in the cohort being diagnosed with a psychotic disorder was 12 times higher compared with all other Manitobans.

Figure 4.4: Prevalence of Psychotic Disorders among Adults in the Cohort Compared to All Other Manitobans

Age- and sex- adjusted percent, age 18+, five-year prevalence as of 2018;



Personality Disorders in the 5 Years Before First Contact

As shown in Figure 4.5, the age- and sex-adjusted fiveyear prevalence of personality disorders among people in the cohort was 9.5%, but less than 1% among all other Manitobans. People in the cohort were at 11 times the risk of being diagnosed with a personality disorder compared with all other Manitobans.

Figure 4.5: Prevalence of Personality Disorder among Adults in the Cohort Compared to All Other Manitobans

Age- and sex- adjusted percent, age 18+, five-year prevalence as of 2018;



Mental Disorders in the Year After First Contact

In the year following the first methamphetamine-related contact with the health care system, we determined the proportion of the cohort who were diagnosed with mood or anxiety disorders, substance use disorders, psychotic disorders or personality disorders. In this first analysis, we retained individuals who had a pre-existing mental disorder in the cohort. Figure 4.6 shows the one-year prevalence of any of the four above-mentioned mental disorder categories in the cohort compared with all other Manitobans. For each type of mental disorder, the one-year prevalence in the cohort was substantially higher than among all other Manitobans. We remind the reader that our definition of substance use disorders excludes any amphetamine-related substance use disorders.

Figure 4.6: Prevalence of Mental Disorders Among People Using Methamphetamine, 1 Year after Contact with Health Care System Crude rate



*Substance Use Disorders exclude amphetamine use.

In the next analysis, we limited the cohort to individuals who had no **indication** of a mental disorder during the five years before their first meth-related health care contact, and identified the proportion of individuals who received a diagnosis for a mental disorder during the year following their first methamphetamine-related contact. As seen in Figure 4.7, in the year after their first methamphetamine-related health care contact, just over 10% of the cohort received a diagnosis for a mood or anxiety disorder; 24.7% received a diagnosis for a substance use disorder; 7.5% received a diagnosis for a psychotic disorder and 1.3% for personality disorders.

Figure 4.7: Prevalence of Mental Disorders Among People Using Methamphetamine, 1 Year After Contact with Health Care System and No Mental Health Conditions 5 Years Before Contact Crude rate



*Substance Use Disorders exclude amphetamine use. Note: No data for All Other Manitobans.

We next calculated the age- and sex-adjusted one-year incidence rates of people in the cohort being diagnosed with each of the four categories of mental disorders, and compared these with all other Manitobans.

Mood or Anxiety Disorders in the Year After First Contact

Figure 4.8 shows the age- and sex-adjusted one-year incidence rates for mood or anxiety disorders in the cohort and among all other Manitobans, and risk ratios comparing

the cohort with all other Manitobans. The age- and sexadjusted incidence rate of mood or anxiety disorders in the cohort was 4.8 cases per 100 person-years. The rate of being diagnosed with a mood or anxiety disorder was 2.1 times higher in the cohort than among all other Manitobans.

Figure 4.8: Incidence Rate of Mood or Anxiety Disorders among Adults in the Cohort Compared to All Other Manitobans

Age- and sex- adjusted rate per 100 person-years, age 18+, 2018; 1 year after first methamphetamine-related contact with health care system



Substance Use Disorders in the Year After First Contact

Figure 4.9 shows the age- and sex-adjusted one-year incidence rates for substance use disorders in the cohort and among all other Manitobans, and risk ratios comparing the cohort with all other Manitobans. The age- and sex-

adjusted incidence rate of substance use disorders in the cohort was 12.9 cases per 100 person-years, while among all other Manitobans it was 0.7 cases per 100 person-years. The rate of being diagnosed with a substance use disorder was 18.6 times higher in the cohort than among all other Manitobans.

Figure 4.9: Incidence Rate of Substance Use Disorders, excluding Amphetamine-Related Substance Use, among Adults in the Cohort Compared to All Other Manitobans

Age- and sex- adjusted rate per 100 person-years, age 18+, 2018; 1 year after first methamphetamine-related contact with health care system



Psychotic Disorders in the Year After First Contact

Figure 4.10 shows the age- and sex-adjusted one-year incidence rates for psychotic disorders in the cohort and among all other Manitobans, and risk ratios comparing the

cohort with all other Manitobans. The age- and sex-adjusted incidence rate of psychotic disorders in the cohort was 12.6 cases per 100 person-years, while among all other Manitobans it was 0.3 cases per 100 person-years. The rate of being diagnosed with a psychotic disorder was 43.7 times higher in the cohort than among all other Manitobans.

Figure 4.10: Incidence Rate of Psychotic Disorders among Adults in the Cohort Compared to All Other Manitobans

Age- and sex-adjusted rate per 100 person-years, age 18+, 2018; 1 year after first methamphetamine-related contact with health care system



Personality Disorders in the Year After First Contact

Figure 4.11 shows the age- and sex-adjusted one-year incidence rates for personality disorders in the cohort and among all other Manitobans, and risk ratios comparing the

cohort with all other Manitobans. The age- and sex-adjusted incidence rate of personality disorders in the cohort was 6.4 cases per 100 person-years. The rate of being diagnosed with a personality disorder was 20.3 times higher in the cohort than among all other Manitobans.

Figure 4.11: Incidence Rate of Personality Disorder among Adults in the Cohort Compared to All Other Manitobans

Age- and sex-adjusted rate per 100 person-years, age 18+, 2018; 1 year after first methamphetamine-related contact with health care system



What Do These Results Mean?

Manitobans whose methamphetamine use was documented after they came into contact with the health care system are far more likely to receive a diagnosis for a mental disorder during the five years leading up to and during the year after their first methamphetamine-related health care contact than all other Manitobans. These findings show that Manitobans who have used methamphetamine experience a disproportionate burden of mental disorders in addition to facing considerable socioeconomic disadvantage. They face a powerfully marginalizing set of circumstances as they often live at the intersection of socioeconomic and mental distress. Due to the nature of the data, it is difficult to untangle whether these individuals' methamphetamine use preceded their mental disorder or vice versa. However, in spite of this ambiguity, the findings point to the fact that caring for people who are using methamphetamine is a complex and challenging situation and individuals' mental health and the underlying social and structural determinants of mental health are critical considerations when designing strategies to support this population.

Chapter 5: Health Service Use

This chapter presents analyses focused on understanding the annual rates of health system use among Manitobans whose methamphetamine use has been documented in the administrative data. We looked at four types of services: (1) contacts with the Winnipeg Fire Paramedic Service (WFPS), (2) visits to the emergency department (EDIS), (3) hospitalizations, and (4) physician visits. For each type of service, we considered two broad categories of system use:

- Use of the health care system specifically for methamphetamine use – several members of the cohort had methamphetamine use documented at more than one contact. We quantified the rate of methamphetamine-related service use.
- Any use of the health care system We quantified the cohort's total use of the health care system.

We remind the reader that due to data availability, we had two different cohorts for this part of the study, a Winnipeg cohort and an overall Manitoba cohort. For the Winnipeg cohort, we could use data from WFPS, EDIS, hospitals, medical claims, and DSM data sources, whereas for the Manitoba cohort, we could only use information from hospitals, medical claims, and DSM data sources. Because of this, we have made the following choices:

- When we present contacts with WFPS and visits to emergency departments, we present results from the Winnipeg cohort exclusively.
- When we present visit to hospitals and physicians, we only present results from the Manitoba cohort here in the main body of the report. The Winnipeg cohort results for these two indicators are available to the reader in Appendix 3 in the Online Supplement.

Contacts with the Winnipeg Fire Paramedic Service

In this section, we present rates of contact between individuals in the cohort (people whose methamphetamine use was documented in the administrative data) and the WFPS. We first present rates of contacts where methamphetamine use was documented, and then we present the cohort's total rates of WFPS contact (regardless of the reason). Because WFPS operates primarily in Winnipeg and delivers services to Winnipeg residents, only Winnipeg residents are included in the results for this outcome.

Contacts where Methamphetamine Use was Documented

Winnipeg Cohort

Figure 5.1 shows the rates of individuals in the cohort (who live in Winnipeg) coming into contact with WFPS during the **year following** their first methamphetamine-related contact. In this analysis, we followed individuals from when they entered the cohort either for one year or until they no longer had health care coverage. We counted all contacts with WFPS where methamphetamine use was documented.

The black line in Figure 5.1 represents the cohort's WFPS contact rate and the green band on either side of the line represents the 95% confidence interval for that rate. The figure shows, for example, that people whose methamphetamine use was documented for the first time in 2014 came into contact with WFPS for methamphetamine use, on average, 1.4 times per person-year. People whose methamphetamine use was documented for the first time in 2015 came into contact with WFPS for methamphetamine use, on average, 1.5 times per person-year.

Figure 5.1: Rate of Methamphetamine-Related Winnipeg Fire Paramedic Service (WFPS) Contacts in Winnipeg for Individuals with Documented Methamphetamine Use Per Person-Year, 18 and Older, 2014-2018; by Year Entering Cohort



Figure 5.2 illustrates the rate of WFPS contacts from the year in which an individual's methamphetamine use was **first documented** until the end of the study period, by fiscal year. This illustrates the intensity of WFPS contacts for the cohort. For example, the value for 2015 represents

the WFPS contact rate among individuals who entered the cohort in or before 2015; in 2015, the individuals in the cohort came into contact with WFPS, on average, 0.58 times per person-year.

Figure 5.2: Intensity of Methamphetamine-Related Winnipeg Fire Paramedic Service (WFPS) Contacts in Winnipeg for Individuals with Documented Methamphetamine Use

Per Person-Year, 18 and Older, 2014-2018; by Year



Note: Confidence Intervals for All Other Winnipeggers may not be visible due to small numbers.

All Contacts with the Winnipeg Fire Paramedic Service

In this analysis, we looked at all of the cohort's WFPS contacts regardless of whether methamphetamine use was documented during those contacts or not. As in the analysis above, we calculated rates of all contacts during the year following the first methamphetamine-related contact, and then from when they entered the cohort until the end of the study.

Winnipeg Cohort

In the year following individuals' first methamphetaminerelated contact, the rate of all WFPS contacts was higher than the rate of methamphetamine-related contacts only. During the first year, individuals in the cohort came into contact with WFPS, on average, about 3 times per person-year (Figure 5.3); from the first contact until the end of the study, they came into contact with WFPS, on average, about 1.8 times per person-year (Figure 5.4). As a comparison, the overall WFPS contact rate for Winnipeg residents is shown as a dotted line in each figure (0.09 contacts per person-year).





Figure 5.4: Intensity of All Winnipeg Fire Paramedic Service (WFPS) Contacts in Winnipeg for Individuals with Documented Methamphetamine Use and All Other Winnipeggers Per Person-Year, 18 and Older, 2014-2018; by Year



Visits to the Emergency Department

Here we present the cohort's rate of emergency department visits, first those visits where methamphetamine use was documented and then all visits to the emergency department. Similar to how the previous indicator was presented, we present the visit rate during the year following cohort entry, and then the rate from cohort entry until the end of the study. Because we only have emergency department data for Winnipeg, these results are for Winnipeg residents only.

Visits Where Methamphetamine Use was Documented

Winnipeg Cohort

During the year after entering the cohort, individuals who had been documented as consuming methamphetamine had 1.7 to 1.8 visits to the emergency department per person-year (Figure 5.5). From the point of cohort entry until the end of the study, their emergency department visit rate was 0.7 to 0.8 visits per person-year (Figure 5.6).





Figure 5.6: Intensity of Methamphetamine-Related Emergency Department Visits in Winnipeg for Individuals with Documented Methamphetamine Use Per Person-Year, 18 and Older, 2014-2018; by Year



All Visits to the Emergency Department

Here we present the rate of all visits to the emergency department made by people in the cohort, regardless of the reason for the visit. In these graphs, the dotted line represents the all-cause emergency department visit rate for all Winnipeg residents as a means of comparison.

Winnipeg Cohort

We observed a similar pattern in all-cause emergency department visit rates as reported in the section above, except that the all-cause visit rates were higher than the methamphetamine-related visit rates. During the year after first documented methamphetamine use, people in the cohort visited the emergency department between 5.8 and 6.4 times per person-year (Figure 5.7). From the first methamphetamine-related contact until the end of study, the emergency department visit rate was 3.7 to 4.1 visits per person-year (Figure 5.8). The Manitoba average for the same time period was less than 0.35 visits per personyear (shown as a dotted line in each figure). These findings highlight how the people using methamphetamine access acute services at a rate that is disproportionately higher than other Manitobans. Figure 5.7: Rate of All Emergency Department Visits in Winnipeg for Individuals with Documented Methamphetamine Use and All Other Winnipeggers

Per Person-Year, 18 and Older, 2014-2018; by Year Entering Cohort



Note: Confidence Intervals for All Other Winnipeggers may not be visible due to small numbers.

Figure 5.8: Intensity of All Emergency Department Visits in Winnipeg for Individuals with Documented Methamphetamine Use and All Other Winnipeggers

Per Person-Year, 18 and Older, 2014-2018; by Year



Hospitalizations

Similar to the other analyses in this chapter, when we looked at hospitalizations, we first examined the rate of hospitalizations during which methamphetamine use was documented, and then the rate of all-cause hospitalizations. For each of these indicators, we examined the rate in the year after first documentation of methamphetamine use, and also from first documentation of methamphetamine use to the end of the study. The results for the Manitoba cohort are presented here, and the results for the Winnipeg cohort are presented in Appendix 3 in the Online Supplement.

Hospitalizations Where Methamphetamine Use was Documented

Manitoba Cohort

As shown in Figure 5.9, the rate of hospitalizations in the year after first documented methamphetamine use for the Manitoba cohort was around 4 hospitalizations per 10 person-years for most of the study period, but increased in the last year of the study. When we examined the intensity of hospitalization in the years following first documented methamphetamine use, the rate was between 1 and 2 hospitalizations per 10 person-years, and we saw the same increasing trend in 2018 (Figure 5.10).

The rates of hospitalizations for the Manitoba cohort were very similar to what we observed for the Winnipeg cohort (Appendix 3 in the Online Supplement).


Figure 5.9: Rate of Methamphetamine-Related Hospitalizations in Manitoba for Individuals with Documented Methamphetamine Use Per 10 Person-Years, 18 and Older, 2014-2018; by Year Entering Cohort

Figure 5.10: Intensity of Methamphetamine-Related Hospitalizations in Manitoba for Individuals with Documented Methamphetamine Use Per 10 Person-Years, 18 and Older, 2014-2018; by Year



All Hospitalizations

Here we present the rate of all hospitalizations of people in the cohort, regardless of the reason for the hospital stay.

Manitoba Cohort

As shown in Figure 5.11, the rate of hospitalizations in the year after first documented methamphetamine use for the Manitoba cohort was between 8 and 12 hospitalizations per 10 person-years. When we examined the intensity

of hospitalization in the years following first documented methamphetamine use, the rate was between 5 and 6 hospitalizations per 10 person-years (Figure 5.12). As a comparison, the hospitalization rate among all other Manitobans is presented as a dotted line (about 2 hospitalizations per 10 person-years).

The rates of hospitalizations for the Manitoba cohort were very similar to what we observed for the Winnipeg cohort (Appendix 3 in the Online Supplement).

Figure 5.11: Rate of All Hospitalizations in Manitoba for Individuals with Documented Methamphetamine Use and All Other Manitobans Per 10 Person-Years, 18 and Older, 2014-2018; by Year Entering Cohort



Note: Confidence Intervals for All Other Manitobans may not be visible due to small numbers.

Figure 5.12: Intensity of All Hospitalizations in Manitoba for Individuals with Documented Methamphetamine Use and All Other Manitobans

Per 10 Person-Years, 18 and Older, 2014-2018; by Year



Physician Visits

Similar to the other analyses in this chapter, when we looked at physician visits, we first examined the rate of physician visits during which methamphetamine use was documented, and then the rate of all physician visits made by people in the cohort. For each of these indicators, we examined the rate in the year after first documentation of methamphetamine use, and also from first documentation of methamphetamine use to the end of the study. The results for the Manitoba cohort are presented here, and the results for the Winnipeg cohort are presented in Appendix 3 in the Online Supplement.

We remind the reader that we required 5-digit ICD codes in order to identify physician visits where methamphetamine use was documented. These data have only been available since 2015, so we were unable to quantify physician visits where methamphetamine use was documented prior to 2015.

Physician Visits Where Methamphetamine Use was Documented

Manitoba Cohort

As shown in Figure 5.13, in 2018, the rate of physician visits for people in the Manitoba cohort whose methamphetamine use had been documented within the last year was about 4.9 visits per 10 person-years. Also in 2018, the intensity of physician visits following first documented methamphetamine use was about 1.8 visits per 10 person-years (Figure 5.14).

The rates and trends of physician visits for the Manitoba cohort were very similar to what we observed for the Winnipeg cohort (Appendix 3 in the Online Supplement).

Figure 5.13: Rate of Methamphetamine-Related Ambulatory Physician Visits in Manitoba for Individuals with Documented Methamphetamine Use Per 10 Person-Years, 18 and Older, 2014-2018; by Year Entering Cohort



Note: Data not available for methamphetamine use documented in physician visits for 2014.

Figure 5.14: Inensity of Methamphetamine-Related Ambulatory Physician Visits in Manitoba for Individuals with Documented Methamphetamine Use Per 10 Person-Years, 18 and Older, 2014-2018; by Year



All Physician Visits

Here we present the rate of all physician visits made by the Manitoba cohort, regardless of the reason. We provide the visit rate for all other Manitobans as a comparison.

When we previously reported methamphetamine-related physician visits, the visit rates were shown as 'per 10 person-years'. For this section, we present rates as 'per person-year'.

Manitoba Cohort

As shown in Figure 5.15, the rate of all physician visits for people in the Manitoba cohort whose methamphetamine use had been documented within the last year was 8.7 to 10.4 visits per person-year, whereas for all other Manitobans, the rate was about 5 visits per person-year. The intensity of physician visits following first documented methamphetamine use was lower, but still significantly higher than the rate among all other Manitobans (Figure 5.16).

The rates of physician visits for the Manitoba cohort were very similar to what we observed for the Winnipeg cohort (Appendix 3 in the Online Supplement).

Figure 5.15: Rate of All Ambulatory Physician Visits in Manitoba for Individuals with Documented Methamphetamine Use and All Other Manitobans

Per Person-Year, 18 and Older, 2014-2018; by Year Entering Cohort



Note: Confidence Intervals for All Other Manitobans may not be visible due to small numbers.

Figure 5.16: Intensity of All Ambulatory Physician Visits in Manitoba for Individuals with Documented Methamphetamine Use and All Other Manitobans

Per Person-Year, 18 and Older, 2014-2018; by Year



What Do These Results Mean?

Across the four health services we examined - care from WFPS, the emergency department, hospitals and physicians - we saw that individuals whose methamphetamine use had been documented in the administrative data had higher rates of health system use compared with all other Manitobans. In many cases, the rates were highest in the year people entered the cohort (that is, in the year after their methamphetamine use was first documented); this was true in all calendar years of the study. This suggests that during the first year after coming to the attention of the health care system, individuals who use methamphetamine also use significantly more health services than the general population of Manitoba. Though it is impossible to uncover the precise reasons for this trend using the administrative data, the increase could be due to the higher acuity of distress experienced by individuals early in their methamphetamine use trajectory,

or it could be due to the health care system suddenly being able to document an already-worsening trajectory that the individual was on prior to their first contact.

It is also important to note that a health care contact does not typically occur in isolation. For example, someone who comes into contact with WFPS is likely to then be admitted to the emergency department for further care. Use of the health care system by a population of people who use methamphetamine includes more than a single type of health care contact, and these contacts are to some degree additive. The types of services that these individuals require also has an impact on the economic costs borne by the province.

For a more descriptive assessment of health service use among people who use methamphetamine, deeper explorations into the reasons for and the intensity of health system use will need to be pursued in future studies.

Chapter 6: Conclusions

This study used multiple sources of administrative health data to provide a better understanding of the developing picture of methamphetamine use in Manitoba. It was conducted by a multidisciplinary team comprising physicians, population health and mental health scientists, health policy scholars and experts in data linkage and analysis. The study was supported by a diverse advisory group that included mental health practitioners and clinician scientists as well as policy makers and analysts at the local, provincial and federal levels.

This chapter provides a brief overview of the study findings and the strengths and limitations of the study design that have implications for the conclusions that we drew from the results. We then situate these findings within the broader literature on methamphetamine use.

Summary of Results

Four important findings emerged from this study:

1. Methamphetamine-related contacts with the health care system increased between 2013 and 2018, and we saw these new contacts recorded across multiple data sources.

The incidence rates of methamphetamine-related health care contacts increased each year from 2013-2017 across multiple data sources. In the area-based analyses, both the dot plots and the heat maps illustrated the spread of methamphetamine use from downtown Winnipeg to other areas of the city. These findings point to the conclusion that methamphetamine use is a growing challenge in Manitoba.

2. Manitobans whose methamphetamine use has been documented by the health care system have higher rates of comorbid mental disorders compared with all other Manitobans.

The study cohort of people who had used methamphetamine had a disproportionately high risk of having a diagnosed mental disorder during the five years leading up to their first methamphetamine-related contact and in the year after their first contact compared with all other Manitobans.

3. Manitobans whose methamphetamine use has been documented by the health care system access health services at a higher rate than other Manitobans. This is most pronounced during the year after their first methamphetamine-related contact, but continues well beyond that year.

Manitobans who have used methamphetamines had more contacts with WFPS and used more emergency department, hospital and physician services compared with all other Manitobans. Although the health services use rates fluctuated over time, the number of people in the cohort who used these services trended upward over the course of the study.

4. Manitobans who have used methamphetamines face a myriad of marginalizing socioeconomic factors that predispose them to an increased risk of further methamphetamine use.

In our study, as many as half of Manitobans who used methamphetamines were young adults living in low-income neighbourhoods. However, it is notable that the other half of the people in the cohort lived in higher income neighbourhoods across all regions of the province. The fact that many people who use methamphetamine are relatively young adults (age 18-34) may make it difficult for them to obtain the financial means to access timely mental health and addictions services to prevent and/or treat methamphetamine use. The diversity in socioeconomic circumstances among people who use methamphetamine means that solutions and supports for this population must take into consideration the lived experiences of Manitobans from a wide variety of backgrounds.

Strengths and Limitations

This study has several important strengths and limitations. One notable strength is the fact that in Manitoba we have the ability to link whole-population administrative health datasets to document methamphetamine-related health care contacts. This means that we were able to capture nearly every contact associated with methamphetamine use in Winnipeg using data from WFPS, EDIS, the hospital system, physician claims and lab services. Using data on diagnosed mental disorders and sociodemographic characteristics, we were thus able to construct a holistic picture not only of Winnipeg residents' methamphetaminerelated health care contacts, but also of their sociodemographic and mental health characteristics.

For Manitoba overall, the picture was somewhat less complete because we lacked comprehensive emergency department and paramedic services data on people living outside Winnipeg. This is an important weakness of our study, as our findings are limited with respect to conclusions that can be drawn for the province as a whole.

Another strength of our study is that we relied on administrative data in our analyses. This means that we were not subject to recall and social desirability bias as we would have been in a study dependent on self-reported methamphetamine use and self-reported mental health. However, using administrative data means that we are certainly undercounting the number of individuals in the province who use methamphetamine and we are unable to identify when they first began to use methamphetamine. We also likely underestimated the prevalence of comorbid mental disorders, since the estimates rely on diagnoses obtained when a person comes into contact with the health care system. Given that our population of study has most likely experienced marginalizing circumstances, it is likely that some people in the cohort have undiagnosed mental disorders that we could not detect.

Situating the Findings in the Literature

The literature highlights a variety of structural factors that predispose certain individuals to methamphetamine use. These factors include the consequences of colonialism, such as intergenerational trauma and institutionalized and systemic racism, as well as socioeconomic factors and histories of abuse [11,18,22,30–32,40–42,76]. Because we used administrative data in this study, we were not able to fully examine these factors in our analyses. We want to caution the reader against focusing solely on individual-level factors when considering how best to care for people who use methamphetamine and to look to broader upstream solutions to this complex mental health challenge.

References

- 1. Benning K. Price of Meth as low as \$3 in Saskatoon. *Global News*. https://globalnews.ca/news/6176405/price-meth-low-3-saskatoon/. Published November 18, 2019.
- 2. Health Canada. *Canadian Tobacco Alcohol and Drugs Survey (CTADS) 2013*. Ottawa, ON; 2014. https://www.canada. ca/en/health-canada/services/canadian-tobacco-alcohol-drugs-survey.html.
- 3. Health Canada. *Canadian Tobacco Alcohol and Drugs Survey (CTADS) 2015*. Ottawa, ON; 2016. https://www.canada. ca/en/health-canada/services/canadian-tobacco-alcohol-drugs-survey.html.
- 4. Health Canada. Canadian *Tobacco, Alcohol and Drugs Survey (CTADS) 2017*. Ottawa, ON; 2018. https://www.canada. ca/en/health-canada/services/canadian-tobacco-alcohol-drugs-survey.html.
- 5. Johnson D, Poulin G, Fandrey S. A Strategic and Evidenced Based Approach to Methamphetamine and Opioid Use Disorders in Manitoba. Winnipeg, Manitoba; 2018.
- 6. Marshall S, Reimer J. *Crystal Methamphetamine Use in Winnipeg: Drug Consumption and Context*. Winnipeg, Manitoba; 2018.
- 7. Illicit Drug Task Force. *Recommendations to Reduce the Use and Effects of Illicit Drugs within Manitoba's Communities.* Winnipeg, Manitoba; 2019.
- 8. Ilieva IP, Hook CJ, Farah MJ. Prescription Stimulants' Effects on Healthy Inhibitory Control, Working Memory, and Episodic Memory: A Meta-analysis. *J Cogn Neurosci*. 2015;27(6):1069-1089.
- 9. Franke AG, Bagusat C, Rust S, Engel A, Lieb K. Substances used and prevalence rates of pharmacological cognitive enhancement among healthy subjects. *Eur Arch Psychiatry Clin Neurosci.* 2014;264 Suppl:S83-S90.
- 10. Huang Y-S, Tsai M-H. Long-term outcomes with medications for attention-deficit hyperactivity disorder: current status of knowledge. *CNS Drugs*. 2011;25(7):539-554.
- 11. Buxton JA, Dove NA. The burden and management of crystal meth use. CMAJ. 2008;178(12):1537-1539.
- 12. Canadian Centre on Substance Use and Addiction. Methamphetamine Drug Summary. https://www.ccsa.ca/ methamphetamine-canadian-drug-summary. Accessed December 14, 2019.
- 13. Anglin MD, Burke C, Perrochet B, Stamper E, Dawud-Noursi S. History of the methamphetamine problem. *J Psychoactive Drugs*. 2000;32(2):137-141.
- 14. Jufer RA, Wstadik A, Walsh SL, Levine BS, Cone EJ. Elimination of cocaine and metabolites in plasma, saliva, and urine following repeated oral administration to human volunteers. *J Anal Toxicol.* 2000;24(7):467-477.
- 15. Harris DS, Boxenbaum H, Everhart ET, Sequeira G, Mendelson JE, Jones RT. The bioavailability of intranasal and smoked methamphetamine. *Clin Pharmacol Ther*. 2003;74(5):475-486.
- 16. National Institute on Drug Abuse. Methamphetamine. https://www.drugabuse.gov/sites/default/files/drugfactsmethamphetamine.pdf. Published 2019.
- 17. Glasner-Edwards S, Mooney LJ. Methamphetamine Psychosis: Epidemiology and Management. *CNS Drugs*. 2014;28(12):1115-1126.
- 18. Maxwell JC, Rutkowski BA. The prevalence of methamphetamine and amphetamine abuse in North America: a review of the indicators, 1992-2007. *Drug Alcohol Rev.* 2008;27(3):229-235.
- 19. SAMHSA. *Summary of the National Household Survey on Drug Abuse (NHSADA) for 1998.*; 1999. https://www. datafiles.samhsa.gov/study/national-household-survey-drug-abuse-nhsda-1998-nid13630.

- 20. SAMHSA. *National Admissions to Substance Abuse Treatment Services: The Treatment Episode Data Set (TEDS)* 1992-1996.; 1998. https://datafiles.samhsa.gov/study/treatment-episode-data-set-admissions-teds-1998-nid13615.
- 21. SAMHSA. Results from the 2005 National Survey on Drug Use and Health: National Findings. Rockville, MD; 2006.
- Adlaf E, Begin P, Sawka E. Canadian Addictions Survey: A National Survey of Canadians' Use of Alcohol and Other Drugs: Substance Use by Canadian Youth. Ottawa, ON; 2007. https://www.publicsafety.gc.ca/lbrr/archives/cn4943eng.pdf.
- 23. Adlaf EM, Paglia-Boak A. *Drug Use among Ontario Students* 1977-2005. Toronto, ON; 2005. https://collections.ola.org/ ser/191553/1977-2005.pdf.
- 24. Health Canada. *Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS) 2014-2015*. Ottawa, ON; 2016. https://www.canada.ca/en/health-canada/services/canadian-student-tobacco-alcohol-drugs-survey.html.
- 25. Health Canada. *Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS) 2016-2017*. Ottawa, ON; 2018. https://www.canada.ca/en/health-canada/services/canadian-student-tobacco-alcohol-drugs-survey.html.
- 26. Wood E, Stoltz J-A, Zhang R, Strathdee SA, Montaner JSG, Kerr T. Circumstances of first crystal methamphetamine use and initiation of injection drug use among high-risk youth. *Drug Alcohol Rev.* 2008;27(3):270-276.
- 27. Martin I, Lampinen TM, McGhee D. Methamphetamine use among marginalized youth in British Columbia. *Can J Public Health*. 2006;97(4):320-324.
- 28. Tanner Z, Matsukura M, Ivkov V, Amlani A, Buxton J. *British Columbia Drug Overdose and Alert Partnership Report.*; 2014.
- 29. Marshall BDL, Wood E, Shoveller JA, Buxton JA, Montaner JSG, Kerr T. Individual, social, and environmental factors associated with initiating methamphetamine injection: implications for drug use and HIV prevention strategies. *Prev Sci.* 2011;12(2):173-180.
- 30. Lampinen TM, McGhee D, Martin I. Increased risk of "club" drug use among gay and bisexual high school students in British Columbia. *J Adolesc Health*. 2006;38(4):458-461.
- 31. Russell K, Dryden DM, Liang Y, Friesen C, O'Gorman K, Durec T, Wild TC, Klassen TP. Risk factors for methamphetamine use in youth: a systematic review. *BMC Pediatr.* 2008;8:48.
- 32. Scheim AI, Bauer GR, Shokoohi M. Drug use among transgender people in Ontario, Canada: Disparities and associations with social exclusion. *Addict Behav*. 2017;72:151-158.
- 33. Trussler T, Marchand R, Gilbert M. *Numbers Rising: Challenges for Gay Men's Health*. Vancouver, BC; 2006. https://www.cbrc.net/sex_now_numbers_rising_challenges_for_gay_mens_health.
- 34. Mattison AM, Ross MW, Wolfson T, Franklin D, Group SDHIVNRC. Circuit party attendance, club drug use, and unsafe sex in gay men. *J Subst Abuse*. 2001;13(1-2):119-126.
- 35. Semple SJ, Patterson TL, Grant I. The context of sexual risk behavior among heterosexual methamphetamine users. *Addict Behav*. 2004;29(4):807-810.
- Martino SC, Tucker JS, Ryan G, Wenzel SL, Golinelli D, Munjas B. Increased substance use and risky sexual behavior among migratory homeless youth: exploring the role of social network composition. *J Youth Adolesc.* 2011;40(12):1634-1648.
- 37. Buxton J. Vancouver Drug Use Epidemiology. Vancouver, BC; 2005.
- Vearrier D, Greenberg MI, Miller SN, Okaneku JT, Haggerty DA. Methamphetamine: history, pathophysiology, adverse health effects, current trends, and hazards associated with the clandestine manufacture of methamphetamine. *Dis Mon.* 2012;58(2):38-89.
- Fries A, Anthony RW, Cseko Jr. A, Gaither CC, Schulman E. *The Price and Purity of Illicit Drugs: 1981-2007.* Alexandria, Virginia; 2008. https://obamawhitehouse.archives.gov/sites/default/files/ondcp/policy-and-research/ bullet_1.pdf.

- 40. Hobkirk AL, Watt MH, Myers B, Skinner D, Meade CS. A qualitative study of methamphetamine initiation in Cape Town, South Africa. Int J Drug Policy. 2016;30:99-106.
- 41. Von Mayrhauser C, Brecht M-L, Anglin MD. Use ecology and drug use motivations of methamphetamine users admitted to substance abuse treatment facilities in Los Angeles: an emerging profile. *J Addict Dis*. 2002;21(1):45-60.
- 42. Bungay V, Malchy L, Buxton JA, Johnson J, MacPherson D, Rosenfeld T. Life with jib: A snapshot of street youth's use of crystal methamphetamine. Addict Res Theory. 2006;14(3):235-251.
- 43. Kerr T, Wood E, Grafstein E, Ishida T, Shannon K, Lai C, Montaner J, Tyndall MW. High rates of primary care and emergency department use among injection drug users in Vancouver. *J Public Health (Oxf)*. 2005;27(1):62-66.
- 44. McKetin R. Why methamphetamine-related deaths need more attention. Addiction. 2017;112(12):2203-2204.
- 45. Darke S, Kaye S, Duflou J. Methamphetamine-related death is an under-addressed public health problem. *Addiction*. 2017;112(12):2204-2205.
- 46. Marshall BDL, Werb D. Health outcomes associated with methamphetamine use among young people: a systematic review. *Addiction*. 2010;105(6):991-1002.
- 47. Kalant H, Kalant OJ. Death in amphetamine users: causes and rates. Can Med Assoc J. 1975;112(3):299-304.
- 48. Åhman A, Jerkeman A, Blomé MA, Björkman P, Håkansson A. Mortality and causes of death among people who inject amphetamine: A long-term follow-up cohort study from a needle exchange program in Sweden. *Drug Alcohol Depend*. 2018;188:274-280.
- Callaghan RC, Cunningham JK, Verdichevski M, Sykes J, Jaffer SR, Kish SJ. All-cause mortality among individuals with disorders related to the use of methamphetamine: a comparative cohort study. *Drug Alcohol Depend*. 2012;125(3):290-294.
- 50. Herbeck DM, Brecht M-L, Lovinger K. Mortality, causes of death, and health status among methamphetamine users. *J Addict Dis.* 2015;34(1):88-100.
- 51. Lappin JM, Darke S, Farrell M. Stroke and methamphetamine use in young adults: a review. *J Neurol Neurosurg Psychiatry.* 2017;88(12):1079-1091.
- 52. Darke S, Duflou J, Kaye S. Prevalence and nature of cardiovascular disease in methamphetamine-related death: A national study. *Drug Alcohol Depend.* 2017;179:174-179.
- 53. Kaye S, McKetin R, Duflou J, Darke S. Methamphetamine and cardiovascular pathology: a review of the evidence. *Addiction*. 2007;102(8):1204-1211.
- 54. Copeland AL, Sorensen JL. Differences between methamphetamine users and cocaine users in treatment. *Drug Alcohol Depend.* 2001;62(1):91-95.
- 55. Darke S, Kaye S, McKetin R, Duflou J. Major physical and psychological harms of methamphetamine use. *Drug Alcohol Rev.* 2008;27(3):253-262.
- 56. Werb D, Kerr T, Lai C, Montaner J, Wood E. Nonfatal overdose among a cohort of street-involved youth. *J Adolesc Health*. 2008;42(3):303-306.
- 57. Callor WB, Petersen E, Gray D, Grey T, Lamoreaux T, Bennett PJ. Preliminary findings of noncompliance with psychotropic medication and prevalence of methamphetamine intoxication associated with suicide completion. *Crisis*. 2005;26(2):78-84.
- 58. Marshall BDL, Galea S, Wood E, Kerr T. Injection methamphetamine use is associated with an increased risk of attempted suicide: a prospective cohort study. *Drug Alcohol Depend.* 2011;119(1-2):134-137.
- 59. Darke S, Kaye S, Duflou J, Lappin J. Completed Suicide Among Methamphetamine Users: A National Study. *Suicide Life Threat Behav.* 2019;49(1):328-337.

- 60. American Dental Association. Methamphetamine Use (Meth Mouth). http://www.ada.org/prof/resources/topics/ methmouth.asp. Accessed December 17, 2019.
- 61. Klasser GD, Epstein J. Methamphetamine and its impact on dental care. *J Can Dent Assoc*. 2005;71(10):759-762.
- 62. Froese I. Winnipeg's syphilis outbreak getting worse, health authority says. *CBC News2*. https://www.cbc.ca/news/ canada/manitoba/winnipeg-syphilis-outbreak-rising-wrha-worsening-1.5137687. Published May 15, 2019.
- 63. Froese I. Meth use in Winnipeg causing outbreak of blood-borne illnesses, new documents say. *CBC News*. https://www.cbc.ca/news/canada/manitoba/prairie-police-meth-health-disease-1.4941110. Published December 11, 2018.
- 64. Halkitis PN, Mukherjee PP, Palamar JJ. Longitudinal modeling of methamphetamine use and sexual risk behaviors in gay and bisexual men. *AIDS Behav*. 2009;13(4):783-791.
- 65. Hittner JB. Meta-analysis of the association between methamphetamine use and high-risk sexual behavior among heterosexuals. *Psychol Addict Behav.* 2016;30(2):147-157.
- 66. Shoptaw S, Reback CJ. Methamphetamine use and infectious disease-related behaviors in men who have sex with men: implications for interventions. *Addiction*. 2007;102 Suppl:130-135.
- 67. Degenhardt L, Mathers B, Guarinieri M, Panda S, Phillips B, Strathdee SA, Tyndall M, Wiessing L, Wodak A, Howard J, et al. Meth/amphetamine use and associated HIV: Implications for global policy and public health. *Int J Drug Policy*. 2010;21(5):347-358.
- 68. Kalaitzopoulos D-R, Chatzistergiou K, Amylidi A-L, Kokkinidis DG, Goulis DG. Effect of Methamphetamine Hydrochloride on Pregnancy Outcome: A Systematic Review and Meta-analysis. *J Addict Med.* 2018;12(3):220-226.
- 69. Behnke M, Smith VC, Abuse C on S, Newborn C on F and. Prenatal substance abuse: short- and long-term effects on the exposed fetus. *Pediatrics*. 2013;131(3):e1009-e1024.
- 70. CBC News. 10 infants infected with syphilis as outbreak worsens. *CBC News*. https://www.cbc.ca/news/canada/ manitoba/syphilis-manitoba-outbreak-infants-1.5032422. Published February 25, 2019.
- 71. Manitoba Health Seniors and Active Living. Syphilis (Treponema pallidum). https://www.gov.mb.ca/health/publichealth/ diseases/syphilis.html. Accessed December 19, 2019.
- 72. Lewer D, Freer J, King E, Larney S, Degenhardt L, Tweed EJ, Hope VD, Harris M, Millar T, Hayward A, et al. Frequency of healthcare utilisation by adults who use illicit drugs: a systematic review and meta-analysis. *Addiction*. Published online November 9, 2019:10. https://doi.org/10.1111/add.14892
- 73. Marshall BDL, Grafstein E, Buxton JA, Qi J, Wood E, Shoveller JA, Kerr T. Frequent methamphetamine injection predicts emergency department utilization among street-involved youth. *Public Health*. 2012;126(1):47-53.
- 74. Callaghan RC, Cunningham JK, Victor JC, Liu L-M. Impact of Canadian federal methamphetamine precursor and essential chemical regulations on methamphetamine-related acute-care hospital admissions. *Drug Alcohol Depend.* 2009;105(3):185-193.
- Chartier M, Bolton J, Mota N, MacWilliam L, Ekuma O, Nie Y, McDougall C, Srisakuldee W, McCulloch S. *Mental Illness Among Adult Manitobans*. Winnipeg; 2018. http://mchp-appserv.cpe.umanitoba.ca/reference/mh2015_Report_web.pdf.
- 76. Marshall BDL, Wood E, Shoveller JA, Patterson TL, Montaner JSG, Kerr T. Pathways to HIV risk and vulnerability among lesbian, gay, bisexual, and transgendered methamphetamine users: a multi-cohort gender-based analysis. *BMC Public Health*. 2011;11:20.

Appendix 1: Technical Definitions and Search Terms

Appendix Table 1.1: Codes Used to Identify People who Used Methamphetamine

Issue	ICD-10	ICD-9
Methamphetamine abuse		
Methamphetamine use		
Episodic methamphetamine abuse		
Methamphetamine abuse, episodic		
Methamphetamine abuse in remission		
Amphetamine abuse		
Amphetamine user		
Amphetamine and psychostimulant abuse	E15 1	305.7
Mild amphetamine-type substance abuse	1 10.1	505.7
Amphetamine-type substance use disorder, mild, abuse		
Intravenous amphetamine abuse without dependence		
Mild amphetamine-type substance use disorder		
Nondependent amphetamine or related acting sympathomimetic abuse		
Nondependent intraveous(sic) amphetamine abuse		
Drug abuse using speed		
Drug abuse, amphetamine type		
Continuous amphetamine abuse		
Amphetamine abuse, continuous		
Amphetamine of related acting sympathomimetic abuse, continuous use		
Amphetamine or stimulant drug abuse	F15.1	305.71
Nondependent Amphetamine and psychostimulant abuse, continuous		
Amphetamine and psychostimulant abuse, daily use		
Nondependent amphetamine or psychostimulant abuse, continuous		
Episodic amphetamine abuse		
Amphetamine abuse-episodic		
Amphetamine and psychostimulant abuse, episodic abuse		
Amphetamine and psychostimulant abuse, binge pattern	F15.1	305.72
Amphetamine or related acting sympathomimetic abuse, episodic use		
Nondependent amphetamine abuse, episodic		
Episodic methamphetamine abuse		
Methamphetamine abuse, episodic		
Amphetamine abuse in remission		
Amphetamine or related acting sympathomimetic abuse, in remission		
Amphetamine or stimulant drug abuse, in remission	F15.1	305.73
Nondependent amphetamine abuse in remission		
Methamphetamine abuse in remission		

Issue	ICD-10	ICD-9
Caffeine abuse		
Caffeinism	F15.1	305.9
Stimulant abuse		
Excessive caffeine abuse, continuous	F15.1	305.91
Caffeine abuse in remission	F15.1	305.93
Caffeinism in remission		
Moderate amphetamine substance use disorder		
Amphetamine use disorder, moderate		
Severe amphetamine substance use disorder	F15.2	305.7
Amphetamine use disorder, severe		
Moderate mixed dextroamphetamine-amphetamine use disorder		
Adderall use disorder, moderate		
Methamphetamine addiction		
Methamphetamine dependence		
Ampnetamine dependence		
Ampnetamine and psychostimulant dependence		
Amphetamine and psychostimulant dependence with physiological dependence		
Amphetamine and psychostimulant dependence, physiological dependence		
Moderate ampnetamine substance dependence		
Amphetamine use disorder, moderate, dependence		
Severe ampnetamine substance dependence	E15 0	204.4
Amphetamine use disorder, severe, dependence	F15.2	304.4
Amphetamine and psychostimulant dependence without physiological dependence		
Amphetamine and psychostimulant dependence no physiological dependence		
Estimulant dependence		
Sumulani dependence		
Adderell use disorder, moderete, dependence		
Caffeine addiction		
Mathylphanidate dependence		
Phenmetrazine dependence		

Issue	ICD-10	ICD-9
Continuous amphetamine dependence		
Amphetamine dependence, continuous	F15.2	304 41
Amphetamine and other psychostimulant dependence, continuous	1 10.2	304.41
Amphetamine and psychostimulant dependence, continuous abuse		
Episodic amphetamine dependence		
Amphetamine dependence, episodic		
Amphetamine and other psychostimulant dependence, episodic	F15.2	304.42
Stimulant dependence, episodic		
Amphetamine and psychostimulant dependence, binge pattern		
Amphetamine dependence, in remission	F15.2	304 43
Amphetamine and other psychostimulant dependence, in remission	110.2	504.45
Overdose of psychostimulant		
Psychostimulants overdose	T43.6	969 7
Accidental poisoning by psychostimulants	145.0	303.7
Poisoning by psychostimulant		
Poisoning by caffeine		
Caffeine overdose		
Accidental caffeine poisoning	T43.6	969 71
Caffeien overdose of undetermined intent	143.0	303.71
Caffeine toxicity		
Intentional caffeine overdose		

Issue ICD-		ICD-9
Poisoning by methamphetamine		
Amphetamine overdose		
Poisoning by amphetamine		
Amphetamine poisoning		
Amphetamine overdose of undetermined intent		
Amphetamine poisoning of undetermined intent		
Accidental amphetamine overdose		
Accidental amphetamine poisoning		
Intentional amphetamine overdose		
Intentional amphetamine poisoning	T43.6	969.72
Poisoning by amphetamine sulfate		
Poisoning by speed		
Desoxyephedrine poisoning		
Dexamphetamine poisoning		
Dexedrine poisoning		
Dextroamphetamine poisoning		
MDMA poisoning		
Ecstasy poisoning		
Methedrine poisoning		
Poisoning by methylphenidate	T43.6	969 73
Ritalin poisoning	140.0	303.73
Poisoning by other psychostimulants	isoning by other psychostimulants T43.6 969	
Poisoning by khat		
Poisoning by qat		
Poisoning by fencamfamine	T43.6	970.89
Poisoning by pipradrol		
Poisoning by Catha edulis		
Overdose of bath salts	T43.6	970.9
History of methamphetamine abuse		
History of amphetamine abuse	Z86.48	305.73
H/O amphetamine abuse		
Amphetamine intoxication	F15.0	292.89
Amphetamine and psychostimulant intoxication		202.00
Amphetamine withdrawal		
Amphetamine and psychostimulant withdrawal	F15.3	292
Caffeine withdrawal	1 1010	
Stimulant withdrawal		

Issue	ICD-10	ICD-9
Adverse effect of amphetamine	Y49 7	F939 7
Amphetamine adverse reaction	140.7	2000.7
Amphetamine-induced organic mental disorder		
Amphetamine-related disorder		
Amphetamine-related mental disorder	E15.9	292.9
Caffeine-induced mental disorder	1 10.0	202.0
Caffeine-induced disorder		
Stimulant use disorder		
Amphetamine-induced anxiety disorder		
Amphetamine-induced sexual dysfunction		
Amphetamine and psychostimulant-induced anxiety disorder	F15.8	292.89
Amphetamine and psychostimulant-induced sexual disorder		
Caffeine-induced anxiety disorder		
Amphetamine-induced mood disorder	F15.8	292 84
Amphetamine and psychostimulant-induced mood disorder	1 10.0	232.04
Amphetamine-induced sleep disorder		
Amphetamine and psychostimulant-induced sleep disorder	F15.8	292.85
Caffeine-induced sleep disorder (mild, mod or severe)		
Amphetamine and psychostimulant-induced psychotic disorder with delusions	F15 5	292 11
Amphetamine and psychostimulant-induced psychosis with delusions	1 10.0	202.11
Amphetamine and psychostimulant-induced psychotic disorder with hallucinations	E15.5	292 12
Amphetamine and psychostimulant-induced psychosis with hallucinations	1 10.0	202.12
Underdosing of amphetamine		E873.8
Poisoning	T65.9	
History of poisoning	Z91.8	V15.6
Drug overdose		
Overdose		
Accidental overdose		
Polysubstance overdose	T50 9	977 9
Suicidal Overdose	100.0	077.0
Medication overdose		
Overdose of medication		
Suicide attempt by drug ingestion		
Dietetic overdose	T50 Q	977
Overdose of dietetic	100.9	511
Central nervous system stimulant overdose	T50 9	970 9
CNS stimulant overdose	100.0	570.5

Appendix Table 1.2: List of Search Terms

	List of Words
	'amphetamine'
	'amphetamines'
	'amphetimine'
	'amphetimens'
	'cristalmeth'
	'crystalmeth'
	'ivmeth'
	'meth'
	'nmeth'
	'methamhetamine'
Words Searched	'methampetamine'
	'methamphetamine'
	'methamphetaminee'
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Appendix Table 1.3: Technical Definitions

Indicator	Definition
Mood or Anxiety Disorders	 One or more hospitalizations with a diagnosis for depressive disorder, affective psychoses, neurotic depression, adjustment reaction or bipolar disorder (ICD-10-CA codes: F30, F31, F32, F33, F34, F38, F41.2, F43, F53.0) OR; One or more hospitalizations with a diagnosis for an anxiety state, phobic disorders or obsessive-compulsive disorders (ICD-10-CA codes F40, F41.0, F41.1, F41.3, F41.8, F41.9, F42) Two or more physician visits with a diagnosis for adjustment reaction: ICD-9-CM code: 309. OR; Two or more physician visits with a diagnosis for anxiety disorders (including dissociative and somatoform disorders)*: ICD-9-CM code: 300.
Psychotic Disorders	 One or more hospitalizations with a diagnosis of psychotic disorders: Schizophrenia and schizophrenic disorders (ICD-9-CM 295; ICD-10 F20) Delusional Disorders (ICD-9-CM 297; ICD-10 F22, F24) Acute and Transient Psychotic Disorders (ICD-10 F23) Schizoaffective Disorders (ICD-10 F25) Other or unspecified nonorganic Psychoses (ICD-9-CM 298; ICD-10 F28, F29) Psychotic disorders due to opioids, cannabinoids, etc. (ICD-10 F11.5, F12.5, F13.5, F14.5, F15.5, F16.5, F18.5, F19.5) One or more physician visits with a diagnosis of psychotic disorders: Schizophrenic disorders (ICD-9-CM 295) Delusional Disorders (ICD-9-CM 297) Other nonorganic Psychoses (ICD-9-CM 298)
Personality Disorders	 One or more hospitalizations with a diagnosis for personality disorders (ICD-10-CA codes: F21, F60, F62, F69) One or more physician visits with a diagnosis of personality disorders (ICD-9-CM code: 301)
Substance Use Disorder	 One or more hospitalization with a diagnosis for alcohol or drug psychoses, alcohol or drug dependence, or nondependent abuse of drugs: Alcoholic Psychoses (ICD-9-CM 291; ICD-10 F10) Drug Psychoses (ICD-9-CM 292; ICD-10 F11-F19) Alcohol Dependence (ICD-9-CM 303, ICD-10 F10.2) Drug Dependence (ICD-9-CM 304; ICD-10 F11.2, F12.2, F13.2, F14.2, F15.2, F16.2, F17.2, F18.2, F19.2) Nondependent Abuse of Drugs (ICD-9-CM 305; ICD-10 F55) Alcohol rehabilitation (ICD-10 Z50.2) Drug rehabilitation (ICD-10 Z50.3) One or more physician visits with a diagnosis for alcohol or drug psychoses, alcohol or drug dependence, or nondependent abuse of drugs: Alcoholic Psychoses (ICD-9-CM 291) Drug Psychoses (ICD-9-CM 292) Alcohol Dependence (ICD-9-CM 303) Drug Psychoses (ICD-9-CM 303) Drug Psychoses (ICD-9-CM 303) Drug Psychoses (ICD-9-CM 303) Drug Dependence (ICD-9-CM 303) Drug Dependence (ICD-9-CM 303) Drug Dependence (ICD-9-CM 304) Nondependent Abuse of Drugs (ICD-9-CM 305)





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