AN EXAMINATION OF MENTAL DISORDERS ASSOCIATED WITH SPOUSAL SUICIDE BEREAVEMENT: A LONGITUDINAL POPULATION-BASED STUDY

By

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ABSTRACT

Suicide bereavement is a significant public health problem, with an estimated 48 to 500 million individuals bereaved by suicide every year. Accurate measurements of suicide bereavement related health is an essential component to understanding this public health problem and organizing appropriate resources for prevention and intervention. Spousal suicide bereavement is thought to be associated with poor health outcomes due to its substantial impact on the surviving partner. There are limited theoretical frameworks to better understand the relationship between suicide bereavement and associated health, therefore to address these limitations we proposed an integrative risk framework that is testable using administrative data. The overall goal of this research was to determine if spouses bereaved by suicide have greater rates of mental disorders as compared to spouses bereaved by other sudden deaths. To achieve this goal, 7 manuscripts were written in the areas of theory, methodology, policy, and four related studies using longitudinal population-based administrative data to examine rates of mental disorders among spouses bereaved by suicide, sudden natural death, and unintentional injury. These cohorts were examined both individually as compared to matched non-bereaved spousal samples and then comparatively where suicide bereaved spouses were compared to spouses bereaved by sudden natural death and unintentional injury death using advanced statistical modeling. The overall findings of this research demonstrate that while spousal bereavement seems to be a time of poor mental health, when comparing bereavement cohorts, suicide bereaved spouses appear to be doing more poorly overall. The findings from this body of research support the need for future studies in numerous areas. First, research is needed to examine the impact of the deceased's pre-death health on the surviving spouse to determine if caregiver stress helps explain the elevated pre-bereavement rates of mental disorders found.

Second, the role of guilt and stigma in suicide bereavement and its impact on help seeking is an additional area for future work to determine if reported rates are potential underestimates due to these factors. All of these factors will ultimately inform targeted interventions for spouses bereaved by suicide.

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DEDICATION

I dedicate this thesis to my daughter, Lila Rose Logsetty in hopes that she knows no bounds in her quest for knowledge. May you reach for the stars.

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CHAPTER 1: INTRODUCTION

1.0 Background

Suicide is one of the leading causes of premature death, and is a major public health and social issue worldwide[1]. Research shows that risk factors for suicide are diverse and include young and old age, lower income, having a preexisting mental disorder, and belonging to a minority ethnic group such as being of Aboriginal status. [2,3] In addition to these factors, individuals bereaved by suicide are also at risk for future suicidal behavior and poor mental health outcomes. [4-14]

Widowhood, or spousal bereavement is one of life's most taxing stressors, resulting in the loss of a primary attachment figure, changes to social and economic environments, and disruption of emotional and behavioral processes. [26,30-34] In the case of the suicide death of a spouse, the grief process may become even more complicated due to the nature of death and the stigma that is often associated with a suicide. [13,15-28] Stigma, shame and social isolation accompany suicides[13,15-27 28], which may complicate the bereavement process and contribute to distress and subsequent poor health in the survivors.[13-27,29] Due to these factors, suicide bereavement may place spouses at greater risk for poor health outcomes. [12-14]It has been reported that 7% of individuals experience suicide bereavement yearly, which equates to between 48 and 500 million suicide bereaved individuals every year worldwide. [13]

Although research has investigated the consequences of suicide bereavement, these findings support different conclusions, with some studies finding individuals bereaved by suicide to have worse mental health when compared to individuals bereaved by other types of death. [35]

While research has explored this area, it has typically been limited by small sample sizes and low prevalence. [16]Recently, the use of administrative data has allowed a rigorous examination of suicide bereavement related health and has provided some important insights. Specifically, in population-based samples, spouses bereaved by suicide appear to experience worse mental health, and greater suicide risk. [12,13,36] While the use of administrative data has allowed longitudinal examination of mental health outcomes associated with spousal suicide bereavement [12], there are several limitations with these previous studies, including that data originated from only hospital admissions. While hospitalization data provides an opportunity to examine more severe mental disorders, research has shown that general practitioner visits are the main access point for mental disorder diagnosis and treatment. [37-42] As such, research that relies on hospitalization data has a risk of underestimating the number of individuals with mental disorders following suicide bereavement, as well as not including individuals with milder forms of these mental disorders. An additional limitation in the literature involves inappropriately matched controls and the lack of examination of rate changes from before and after bereavement periods. The grouping of all-cause of death groups as comparators for suicide bereaved spouses results in a cohort that may not be truly comparable. Research has shown that bereavement responses and health outcomes may differ by the nature or cause of death. [43] It is important to distinguish bereavement groups by related causes of death to truly compare and examine health outcomes in order to minimize the effect of bias on health outcomes. Examining mental disorder rates over time is also an important consideration when studying suicide bereavement, as research shows pre-bereavement health may be dissimilar across groups. [11] Examining health outcomes only in the post death period or not examining changes in rates over time may represent an unbalanced view of health associated with bereavement.

The primary focus of the current research is to examine the overall rates of mental disorders among spouses bereaved by suicide and to understand how these rates compare to spouses bereaved by other sudden causes of death. This work fills a major gap in the literature and begins with an examination of suicide bereavement theories and how integrative risk frameworks can be used to advance understanding of suicide bereavement health. While many of the factors presented in the frameworks have theoretical relevance, they are not possible to test using administrative data. Following presentation of a testable integrative risk framework, the strengths and weaknesses of using administrative data to study suicide bereavement related health is discussed, as well as the importance of methodological choices including selection of control groups for health outcome comparisons. Third, a review of suicide policy in Canada is presented highlighting the transition of suicide from a criminal activity with much associated stigma, to a public health concern that needs to be managed in a culturally sensitive manner. Finally, four hypothesis-based manuscripts are presented that address each of the research objectives stated below. The final manuscript presents a statistical comparison of suicide-bereaved spouses to two other sudden death bereaved cohorts, with the fifth, sixth and seventh manuscripts independently analysing each of the bereavement cohorts to gain an understanding of how they each compare to matched general populations. Together, this work expands the evidence base of spousal suicide bereavement related health through utilization of a longitudinal population-based approach; the use of advanced weighting techniques to ensure bereavement cohorts are comparable, and statistical analyses including an examination of mental disorder rate changes over time that take into account many of the weaknesses found in previous studies.

1.1 Research Objectives

The goal of the following dissertation was to determine if spousal suicide bereavement results in different rates of mental disorders as compared to sudden natural death and unintentional injury bereavement. Bereavement controls were carefully selected based on best comparisons and their use in previous research [44] and a biopsychosocial framework was used as a template for the covariates and mental disorders studied. In order to address this goal, there was two study objectives: The first objective was to investigate the rates of mental disorders associated with spousal bereavement. Three types of spousal bereavement were individually examined and compared to a matched non-bereaved married control group from the general population: suicide bereavement, sudden natural death bereavement, and injury bereavement. Age and sex adjusted relative rates of physician diagnosed mental disorders were examined and rates 5 years after the death date were compared to the pre-existing rates 5 years before the death date. A time (pre/post) by group (case/match) interaction term was also used to examine differences in rate changes over time. The second objective of this study was to directly compare rates of mental disorders among suicide-bereaved spouses to spouses bereaved by injury and sudden natural death. The aim of this study was to determine if there were significant differences in mental disorder rates between the bereavement groups while accounting for pre-bereavement mental health and social factors.

1.2 Data Sources

Approvals for this research were obtained from the University of Manitoba's Health Research Ethics Board as well as Manitoba Health's Information Privacy Committee. Administrative data were sourced from the Manitoba Population Research Data Repository,

housed at the Manitoba Centre for Health Policy (MCHP). Physician claims data (physician diagnoses from general practitioners and specialists), hospital discharge abstracts (inpatient admission contacts and diagnoses), the population registry (age, sex, region of residence), vital statistics datasets (cause of death), and Statistics Canada Census data (area-level income quintile) were used. The linkage of these databases allowed for the investigation of a variety of biological, psychological and social factors including cause of death, marital status, income, sex, and region. As a result, a detailed longitudinal examination of social and health information was possible for bereaved spouses.

1.3 Bereavement Cohorts

This thesis examined spouses of individuals who died between January 1, 1998 and December 31, 2008. There were 4 cohorts of interest in the proposed study: 1) spouses who had been bereaved by suicide; 2) spouses who have been bereaved by sudden natural death (MI, cardiac death, stroke, aneurysm); 3) spouses bereaved by non-intentional injury death (MVC, drowning, cold exposure); 4) matched non-bereaved spouses. In order to identify types of bereavement, ICD-9-CM and ICD-10-CA codes were used to obtain cases from the vital statistics database. Spouses were identified by family registration number which is available as part of the individual's Manitoba Health insurance number. Pre-death disorders for the 5 years prior to the suicide (from 1993) were examined, as well as 5 years follow up (until 2013).

1.4 Statistical Analyses

Findings from each research objective are presented in individual manuscripts (Chapters 5, 6, 7 and 8). Overall, unadjusted relative rates (RRs) of mental disorders were calculated for each bereavement cohort for pre and post periods using generalized estimating equation models

(GEE). Adjusted relative rates (ARR) were then calculated for each mental disorder both 5 years pre and post bereavement (post-index date vs. pre-index date). Models were adjusted for age and sex, and time by group interaction terms were calculated to examine differences in rate changes from pre to post periods. When examining the differences between bereavement cohorts (research objective 2), inverse probability treatment weighting (IPTW) was used to ensure suicide bereaved and other bereavement control groups were comparable by equalizing the likelihood of an individual with particular characteristics being in a particular bereavement group. Greater weight is assigned to individuals with a lower probability of being in a particular bereavement group. The calculation of IPTW was based on age, sex and income. Advantages of IPTW are that it allows the bereavement groups to be treated as if they were randomly assigned and as such, it was possible to statistically compare mental disorders between bereavement groups with confidence in group-effect estimates. [45]

1.5 Outcome Variables

i. Mental Disorders

Mental disorders included were defined as follows: depression (ICD-9-CM: 296.2-296.3, 296.5, 300.4, 309, 311; ICD-10-CA: F31.3-F31.5, F32, F33, F341, F380, F381, F432, F438, F530), anxiety (ICD-9-CM: 300.0, 300.2, 300.3; ICD-10-CA: F40, F41.0, F41.1, F41.3, F41.8, F41.9, F42, F431), substance use disorder (ICD-9-CM: 291, 292, 303, 304, 305; ICD-10-CA: F10-F19, F55), and suicide attempts (including accidental poisonings) (ICD 9-CM: E850-E854, E858, E862, E868, E950- E959; ICD-10-CA: X40-X42, X46, X47, X60-X84, Y10-Y12, Y16, Y17, Y870).[11] An 'any mental disorder' variable was also included as an overall measure of depression, anxiety, and substance use disorder.

1.6 Policy Implications

Suicide is a multifaceted problem influenced by many factors. [46,47] With an annual combined total of over $2.442 billion dollars in Canada alone, it is clear that suicide has substantial economic and social costs to both society and individuals. Perhaps the most important of these costs is the health impact on the bereaved. Findings from this doctoral research will help identify the hardships faced by individuals who have had a spouse die by suicide, as well as those bereaved by sudden natural death and unintentional injury, ultimately leading to the development of targeted interventions and treatment for those at risk for poor health. Health care providers have an important role to play as a first point of contact in the diagnosis and treatment of mental disorders among spouses bereaved by suicide.

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CHAPTER 2: AN EXAMINATION OF SUICIDE BEREAVEMENT THEORY: HOW INTEGRATIVE RISK FRAMEWORKS USING ADMINISTRATIVE DATA CAN ADVANCE SUICIDE BEREAVEMENT RESEARCH

2.0 Chapter overview

This manuscript lays a theoretical foundation for the thesis. Reviews of suicide bereavement frameworks are presented as well as suicide bereavement research including studies that utilized administrative data. From these reviews, an integrative risk framework is developed that examines spousal suicide bereavement and related health that is testable using administrative data.

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2.1 Abstract

This manuscript investigates ways to improve suicide bereavement research by incorporating theory and integrative risk frameworks. First a review of theoretical frameworks in bereavement research is conducted, both generally and specific to suicide bereavement. Secondly, a review of suicide bereavement research including studies that utilized administrative data was conducted. From this work, we discuss how a more comprehensive theory could be informed from administrative work and tested using administrative data. An integrative risk framework is developed to improve the identification and measurement of risk factors for poor health outcomes associated with spousal suicide bereavement using administrative data.

2.2 Background

It is well established that suicide is a leading cause of premature death, and that it is a major public health and social issue worldwide.[1-3] In Canada, nearly 4,000 Canadians die every year by suicide.[4] Worldwide, it is estimated that every year between 48 million and 500 million people experience suicide bereavement.[5] What these estimates suggest is that individuals bereaved by suicide represent a substantial portion of the population. Suicide bereavement has been associated with a range of negative outcomes including increased risk for mental disorders, mortality, marital breakdown, and health care use. [6-8] Together these outcomes have a considerable direct and indirect cost to society. In Canada, the costs of each individual suicide is nearly $850 000, with an annual combined national figure of over $2.9 billion dollars.[9] What is missed in this calculation is the impact on individuals bereaved by suicide.

Suicide bereavement differs from other forms of bereavement. There is the survivor's question about their possible role in the deceased's decision to die, which may leave the survivor to question if they could have prevented or stopped the suicide. [10] Suicide bereavement is often accompanied by the experience of stigma, social isolation, and shame. [11-23] These experiences may complicate the grief process by triggering or worsening poor health outcomes following the death of a loved one. In some situations people bereaved by the suicide death of a family member or peer may subsequently die by suicide, a process referred to as "contagion" or the Werther Effect. [24,25] Together, this range of experiences with alarming consequences illustrates the complex nature of suicide and its effect on grieving survivors, and our limited understanding of this process.

Suicide bereavement processes and its health consequences had largely been ignored within public health the discipline of suicidology, until recently.[18] A number of studies have since focused attention on bereavement health outcomes using administrative data.[6-8,26,27] Pitman et al., for example, conducted a systematic review examining the effects of suicide bereavement on mental health and suicide risk and found mixed findings, with increased risk present for some health outcomes dependent on type of kinship.[19,28,29] The authors highlighted the need for future quantitative studies stratified by kinship, using control groups comprised of individuals bereaved by sudden death.[19,28,29] To inform this future work, we however will need more theoretical insight into suicide bereavement. According to Stroebe et al., theoretical-framework adaption to suicide bereavement is a neglected area in suicidology, but not so for general bereavement research.[30] So what can we learn and apply from general bereavement theories to suicide bereavement, particularly around spousal bereavement?

In this paper we examine ways to theoretically improve empirical research into suicide bereavement. First we review theoretical bereavement frameworks both generally and specific to suicide bereavement. Secondly, we reviewed suicide bereavement research that utilized administrative data. From this work, we discuss how a more comprehensive theory can be informed by administrative work and tested using administrative data. Finally, an integrative risk framework is developed to improve the identification and measurement of risk factors for poor health outcomes using administrative data, longitudinally.[31]

2.3 Spousal suicide bereavement: A review of existing studies

Spousal bereavement, generally, is recognized as one of the most stressful events that an individual can experience over their lifetime. [22,32] Spousal bereavement results in the loss of a primary attachment figure, that can lead to functioning difficulties among the bereaved and to subsequent social isolation. [27,48] The death of a spouse has been associated with notable mental and physical health consequences, including depression, anxiety, and even death in the surviving spouse. [22,32-36] Poor health consequences, following spousal bereavement, has also been identified as a major public health problem, with over 1.78 million widowed individuals living in Canada alone[37], and over 2 million individuals becoming widowed in the United States yearly.[38]

Reviewing the scientific literature on spousal suicide bereavement is an important component of further developing the theoretical understanding of this experience. Part of this includes comparing bereavement by suicide to that of other causes, in an effort to clarify unique theoretical aspects. Given this recognition, what is known about the difference between suicide bereavement and bereavement from other causes? Suicide bereavement is the grief process associated with the suicide death of a loved one.[5] In one of the first examinations of the family effect of suicide, Cain and Fast (1972) identified the guilt and shame that follows the suicide of a spouse and the way this death impacts the typical bereavement process.[39] Since then, researchers have argued that spousal suicide bereavement might increase the risk for poor health outcomes, far more than other types of spousal bereavement. [5,11-23,26,40] Many studies have found that individuals bereaved by suicide have experienced worse health outcomes.[12,13,18,19,23,41-45] Other

studies, however, have found inconsistent evidence or a lack of support for differences when death by suicide is compared to death by other traumatic events.[11,12,16,46-50] Similarities or a lack of difference in health outcomes among the suicide bereaved and individuals bereaved by a traumatic death has been noted in the spousal literature, specifically among bereaved widows.[11,19,22,29,40,49,51-55] While there is a chance that bereavement outcomes may not differ, there is a possibility that the course of bereavement may diverge, with individuals bereaved by suicide experiencing a unique grief trajectory.[49,54] For instance, a systematic review conducted recently reported no difference in the risk of depression or other mental disorders when suicide bereaved spouses were compared to spouses bereaved by other violent and non-violent death.[5,11,19,28,29,56,57] While no differences were found in depression, increased risk of suicide among spousal survivors has been documented.[40,58] Such mixed findings have been highlighted, with a call for future research to understand how suicide bereavement may be different, and why spouses bereaved by suicide may be at risk for poor health outcomes.

In perhaps the most methodologically rigorous examinations of spousal suicide bereavement, Agerbo et al.,[40,58] and Erlangsen et al.,[8] examined the risk of suicide and health outcomes using Danish administrative data. Using this administrative data, Agerbo et al identified 3414 married spouses that had their partner die by suicide over a 15-year period and subsequently examined future death by suicide among surviving spouses.[58] The authors found that having a spouse that died by suicide was associated with greater risk of dying by suicide. The authors note that spousal suicide bereavement

may increase the other spouse's awareness of suicide as an option to end grief.[58] In a similar study using Danish administrative data, Agerbo (2005) examined the role of gender and suicide risk among individuals bereaved by spousal and child bereavement.[58] In this study, suicide of a spouse increased suicide risk in both males and females, as compared to death by other causes. Also identified as a risk factor for future suicidal behavior in the remaining spouse was a recent spousal psychiatric admission. If the spouse was admitted to a psychiatric hospital or died by suicide, their spouse was at increased risk for suicide. These studies therefore support the idea that the health and suicide of a partner is associated with future suicide risk in the survivor. Although these studies did not examine other physical or mental health outcomes and relied only on the illness that resulted in the hospital admissions data, the finding of spousal survivor suicide risk provided a valuable and differentiating contribution to the suicide bereavement literature. While the previous studies did not examine mental disorders, a longitudinal study by Erlangsen et al. did. The authors used a nationwide register-based cohort study to examine mental health outcomes among suicide-bereaved spouses that originated from psychiatric hospitalizations. This study found that suicide bereaved spouses were a vulnerable group for mental disorders and suicidal behaviors reinforcing the importance of studying the health of spouses bereaved by suicide.

Limitations identified in suicide bereavement research are as follows. The majority are explorative, with multiple comparisons and small sample sizes. [12] The use of non-validated, non-standardized instruments, and a lack of multivariate approaches have also been cited as weaknesses. [12,59] Sveen and Walby (2008) recommended that future

research should test theoretically driven hypotheses and address the previously mentioned limitations. [12] Recent research has begun this investigation into the health associated with suicide bereavement outcomes. In addition to the studies by Agerbo and Erlangsen, a longitudinal population based study by Bolton et al (2012) compared the physical and mental vulnerabilities of parents (not their spouses) across a suicide bereaved and unintentional injury cohort.[7] The study sample, constructed from a population-based sample matched to the general population, showed that poor physical and mental health outcomes occurred among parents who were bereaved by the suicide of their child, and that suicide bereaved parents were similar to those parents bereaved by motor vehicle collision (MVC). Suicide bereaved parents, however, were more likely to have physician diagnosed depression, physical disorders and lower income prior to the death. The design of this study illustrated the value of using a longitudinal, comparative approach to studying spousal suicide bereavement outcomes. Also longitudinal, comparative approaches are important, along with adequate power and rigor. What is missing is a theoretical framework that has comparative heuristic worth across such groups. Towards formulating such a theory, the next section reviews the major gaps in bereavement theories particularly in relation to suicide bereavement and other comparative cohorts.

2.4 Bereavement Theoretical Frameworks

Although many theories of bereavement exist, only two theoretical models have specifically incorporated suicide into their framework. The first model called the "theory of grief integration" was developed by Sapsford (1998) and is developed from a narrative analysis of a small group of women who had been bereaved by suicide. [41] This theory

views grief as a lifelong process, with a series of non-linear stages. The second model is called the Tripartite Model of Suicide Bereavement (TMSB). This model developed by Sands (2009) focuses on the role of creating meaning throughout the non-linear suicide bereavement process. [60] The TMSB frames the challenges that suicide bereaved individuals face when adapting to their new environment and the importance of understanding, reconstructing and repositioning relationships with the deceased.[61]

The merit of these theories is that they frame some of the important qualitative experiences of individuals who are bereaved by suicide. These experiences help to describe the suicide bereavement process and highlight the meaning-making associated with suicide grief and the bereaved individual's experience. However, the limitations of these theories are three-fold: 1) these frameworks do not account for contextual factors that differentiate suicide bereavement from other forms of sudden or unexpected death, 2) they do not include risk factors for poor mental and physical health across the life span, and 3) they exclude pre-bereavement factors for the bereaved.[36,57]

2.5 Theoretical Differences Between Sudden Death and Suicide Bereavement

Differentiating between suicide death and death by other causes is an important component of suicide bereavement theory and research that investigates health outcomes. Due to the sudden and unexpected nature, sudden death is often used as a comparison for suicide. While sudden and suicide deaths both occur suddenly, many factors differentiate sudden and suicide bereavement experiences. Four key factors, namely the choice to die, social stigma, impact on the family, and the role of expected or anticipated death may

play an important role into why suicide bereavement may differ from sudden death bereavement.[44] These factors are important to consider because they increase the opportunity to identify appropriate bereavement comparison groups. While administrative data systems cases may not include stigma measures, this limitation should not preclude that we exclude concepts of stigma from theory development. As noted, previous suicide bereavement theories have not delineated bereavement differences among survivors of suicide and sudden death. A lack of adequate comparison groups has also been a key limitation, which may account for findings showing a lack of statistical differences between groups.[44] Considering compositional and contextual aspects surrounding types of death and their impact is essential to ensure we appropriately select controls to show how these groups differ. A theoretical framework for suicide bereavement that incorporates these differences is key to guide the design of future studies, and choices of comparison groups with similar bereavement processes. Considerations to inform an integrated theory of suicide bereavement are as follows.

2.6 Thematic Considerations

2.6.1 The choice to die, the guilt, and responsibility

One of the most prominent themes among suicide bereaved is that of guilt and feelings of responsibility for the suicide. [12,15,18,44,55] These themes have been identified in the two suicide bereavement theories, [41,60] and are a major component of the bereavement experience. The deceased actively choses to end their life,[22] and the bereaved individual (spouse) expresses feelings of guilt, blame, or responsibility surrounding the death.[27, 28, 44, 59] Contrasted to sudden unintentional death, it is less likely that a spouse may experience feelings of rejection and guilt because the deceased did not choose to die.

However, there may be feelings of guilt pertaining to any events or interactions prior to the death. For example, if a spouse observed or knew their spouse was consuming alcohol before driving and the alcohol was a factor in their death, the spouse may feel a similar sense of guilt and responsibility. For instance, McNeil (1988) examined contextual differences between spouses bereaved by suicide and accidental death and found that widows of suicide experienced more guilt and blaming than widows of accidents. [62] In a longitudinal case control study among spouses bereaved by motor vehicle collision and suicide, Grad and colleagues (1996) found differences between groups in terms of depression and that the suicide bereaved experienced greater distress immediately after the death, including lack of acceptance of the spouse's choice to die. [11] These studies showed that, regardless of the cause of death, feelings of guilt and responsibility might increase the spousal survivors' vulnerability to future poor health outcomes. Consequently, these factors are important to include in a theoretical framework and for selecting appropriate bereavement control groups.

2.6.2 Social stigma and social isolation

Individuals bereaved by suicide may also feel rejection, anger and stigma as a result of the suicide. [11,15,20,23,29,49,63,64]Stigma, for instance, may impact a survivors support system in that the survivor is ashamed and pulls back from social supports following the suicide, or supporters may feel uncomfortable or awkward causing them to also withdraw from the survivor.[55] Several recent studies have validated suicide stigma scales; one of which aims to examine suicide stigma in suicide-bereaved populations. [65,66]These scales have been proven psychometrically robust, and suggest that stigma can be measured quantitatively. While stigma has been linked with suicide bereavement, Feigleman et al

(2009) found that among bereaved parents, few differences in outcomes existed between suicide deaths and traumatic death cohorts. However, stigma was linked to increased grief difficulties, depression, and strained family relations.[16] This stigma was independent of suicide death, demonstrating the possible role of stigma as a standalone risk factor for poor health following bereavement. Alternatively, in a small case control study, Harwood and colleagues (2002) found that individuals' bereaved by suicide experienced greater stigma and shame compared to survivors of natural death and noted the importance of recognizing stigma in developing outreach interventions for the suicide bereaved. [15] Stigma is therefore an important thematic consideration for a theoretical model of suicide bereavement, as well as being recognized for its possible effect on help seeking, especially in the context of reduced health care utilization. While research demonstrates that suicide bereaved individuals may develop poor health outcomes following bereavement, the experience of stigma may result in these individuals having a lower rate of health care utilization compared to survivors of other causes of death, and may thus influence health and well-being. Lower rates may be expected among the suicide bereaved because of possible social isolation, or fear of judgment and stigma from care providers (provider stigma).

2.6.3 Family Impacts

The third important factor that may distinguish suicide bereavement from other forms of death is the impact that the death has on the family. The loss of a loved one can affect family dynamics, resulting in strain on existing relationships.[18] Although the stress from the death of a spouse can result in family unrest, poor family interaction and

dynamics may have been present before the suicide. [67] In a controlled study, Bolton et al (2012) found that parents who had a child die by suicide had higher rates of both physical and mental disorders prior to bereavement, suggesting that these individuals were less healthy before bereavement. [7] While there are immediate effects on the family following a death, there is some support for sleeper effects, or that intergenerational trauma may pass from family member to family member.[23] Many reasons exist for the intergenerational patterns of suicide, including disruption of attachment, genetic factors, environmental factors and modeling.[68]Among spouses, spousal health concordance (spousal health similarity) and assortative mating (selection of similar partners) may play a role in the transmission of suicidal behavior. Andress (2010) has argued that multiple mechanisms for mental health concordance may exist, including similarity in psychiatric disorders between partners, and poor health in one partner resulting from spousal stress in the other partner.[69] Similarly, the "widowhood effect", or increased risk for mortality and morbidity following spousal bereavement may explain poor post bereavement outcomes and increased health care utilization among bereaved spouses. [70,71]Regardless of the possible health transmission mechanisms, these factors highlight the need for a life course or longitudinal approach and a theoretical assessment of health both pre and post suicide bereavement.

2.6.4 The role of expected or anticipated death

The anticipation of death is a key part of understanding the grief reaction resulting from death from all causes as well as specifically by suicide. Spouses who had been suffering with a partner repeatedly attempting suicide may experience a different grief reaction when compared to survivors of a sudden unanticipated death, such as stroke.

Other pre- factors for suicide can include physical health problems such as cancer,[72] and increased contact with the health care system,[73] all which represent considerable distress and burden on the family prior to the suicide death. Research has shown that nearly 90% of individuals that have died by suicide experienced previous mental illness, [74] suggesting that these individuals may have been troubled or experienced long term suffering prior to the death of their loved one. This anticipated death may therefore impact the survivor's bereavement experience.[28, 46, 51] In this case, the survivor may be filled with feelings of relief, as compared to feelings of shock and despair. This relief effect is similar to that of individuals who have been bereaved by cancer or other long-term illnesses.[11,12] Similar to the relief effect is the idea that marital harmony may also impact post bereavement health outcomes and health care utilization. In a longitudinal study, Prigerson et al (2000) found that widowhood was associated with increased health care use and cost. However, it was individuals with fulfilling marriages that had the highest level of health care use post bereavement.[75] These findings are similar to the longitudinal cohort study by Elwert and Christakis (2008), whereby poor outcomes following bereavement were only present among current spouses, not ex-partners.[70] This finding suggests that marital harmony has a role in poor health outcomes. While recognizing that anticipated death in a marriage also results in grief and sorrow, the ideas of anticipation and relief are vital in creating appropriate comparison groups and creating models of bereavement health outcomes. Future models are needed that consider the role of these factors in the bereavement process.

2.7 Towards an integrative framework

As this review has shown, suicide bereavement theories are useful, but an integrative risk framework would be a more effective way to identify risk factors for poor health outcomes following spousal suicide bereavement. Integrative theories are multifactorial models that focus on the prediction of bereavement outcomes and include antecedent, concurrent and subsequent factors. [30,31]General bereavement theories, for example, are multifactorial, as illustrated by Parkes, Stroebe and Schut [30], Bonanno and Kaltman, and Van Der Wouwen et al. [31]

The dual process model, proposed by Stroebe and Shut,[76] takes a summative approach to understanding how individuals cope with loss (Figure 2-1). In this model, individuals are shown to move back and forth through loss oriented and restoration oriented behaviors following bereavement. Stroebe et al. extend their model of coping with bereavement by creating an integrative risk factor framework (See Figure 2-2).[30] This framework illustrates the risk factors associated with bereavement outcomes, and accounts for social and environmental processes that may predict bereavement health outcome.[30] The framework includes bereavement related factors, such as the relationship to the deceased and traumatic loss, inter/non-personal risk factors (culture, social supports and religion), intrapersonal risk factors (attachment style, socioeconomic status, gender, mental health disorders), and the appraisal and coping processes. Overall, this framework makes transparent the complex pathways between bereavement and associated health and social outcomes. While not tailored specifically to spouses or suicide, the ideas behind this framework can be applied to an integrative risk framework for individuals who have

lost a spouse to suicide. The work by van der Houwen et al [31] also supports the need for a multivariate examination of fluctuating risk factors in understanding bereavement outcome. The authors longitudinally investigated bereavement related factors, including kinship and cause of death (including suicide), unexpectedness and time since death, and intrapersonal factors (age, gender, education, and religion and other factors) and used longitudinal self-reported grief measures. A limitation of this study was that the time period was limited to 6-months and only 21 individuals bereaved by suicide were included. Furthermore, individuals who experienced severe depression, suicidality and other severe mental health conditions were excluded.[31] While this study demonstrates the viability of an integrative risk framework, future research is required to address these limitations.

2.8 Next steps

While research has been mixed when comparing individuals bereaved by suicide to individuals bereaved by other types of death, a major limitation of these studies is methodological, underscoring the need for more rigorous and representative studies. [19] [12,55,59]Pitman et al (2014) has recently highlighted the advances of linked population registries in overcoming these methodological shortcomings. [6,7,27,40,58,77-79] The use of administrative data, or linked population registries provides an opportunity to test the viability of integrative risk frameworks. While recognizing that the examination of some factors including stigma and family dynamics using administrative data may be challenging, advancing the use of integrative frameworks should meet the following objectives as noted by Stroebe et al: 1) generate empirical research on individual adaptions to bereavement; 2) explore risk variables and processes associated with

bereavement outcomes; 3) examine pathways and interactions; and 4) provide the basis for the testing and refining of theories and improve the ability to predict bereavement health outcomes. [30] To that end, what are the potential variable domains we can glean from administrative data to advance a framework for spousal suicide bereavement?

2.9 Variable domains for consideration

The well-known biomedical or biopsychosocial model proposed by Engel[80] and Stroebe et al.'s [30] integrative risk factor framework provides a guide to variable selection. Suicide bereaved spouses could be compared to spouses bereaved by sudden natural death and unintentional injury as a means to account for the often unexpected nature of suicide. Risk factors related to poor health outcomes could include biological factors (history of physical and mental disorder prior to and after bereavement), psychological factors (history of mental disorder including depression, anxiety, substance use disorder, and suicidal behavior prior to and after bereavement), social factors (socioeconomic status, region), and spousal factors (length of marriage) among suicide bereaved. While the inclusion of age and sex are important parts of a framework, these factors have components that are both biological and social. For example, age and sex are biological in the sense that there is a chronological age and biological sex, however there are also socially constructed components to these factors including the concept of aging and gender. As such, in the proposed frameworks age and sex will be considered as both biological and social in nature.

Suicide is difficult to predict, and tools have been developed to improve the predictability of suicidal behavior.[81,82] While accurately identifying individuals at risk for suicide has proved challenging, some factors have been shown to place individuals at greater risk. Knowledge of risk factors for suicide that are independent of bereavement could facilitate an understanding of the social context in which poor health outcomes occur (Table 2-1 proposed variables list). As such these factors have important theoretical relevance. Risk factors for suicide may include 1) genetic and biological factors[83-88], family history of mental illness and suicide[3,68,89-96], psychiatric disorders including substance abuse, self-harm and comorbidity[1,3,95,97-113], young or old age[3,97,100,114-116], pain and physical illness[3,97,99,114,117-120], and male sex and gender.[3,77,97,100,116,121] In addition to these factors are the social determinants of health, which are related to not only suicide risk but also health in general. Social determinants of health are societal factors that shape the daily life and health of individuals and populations including the conditions to which people live in and grow[122,123] These factors are vast and can include housing, unemployment, low socioeconomic status and low levels of education[3,100], early life experiences and childhood and adult trauma[3,89,124-130], social exclusion or social disconnectedness[122,131-134], ethnic minority status[113,135,136], residential school placement and multigenerational effects of historical colonial trauma [134,137,138], foster care placement[139] and a multitude of other factors.[122] Such factors are thought to influence differences in health status or health inequalities and have important theoretical relevance, however they are difficult to measure. Canada has only just begun to establish databases allowing the investigation into their impact on health over time.[122] To date, consideration of these risk factors for suicide have been absent from the majority of bereavement models and their addition to

an integrative theoretical health risk framework would broaden understanding of the emotional response to suicide and development of suicide bereavement related health (See Figure 2-3 for complete framework). Applying a life-course perspective is an important consideration to aid investigations into complicated processes, such as the contagion of poor health and suicidal behavior between spouses[26], suicide specific factors and other explanations for poor health outcomes following bereavement. For instance, sex as a variable may contribute to the explanation of the development of poor health outcomes following bereavement, as men typically adjust less well to bereavement when compared to women.[140] This difference may be due to gender differences in social support and coping styles. [140]Age at bereavement is also an important factor to determine grief responses associated with bereavement, as individuals may respond to bereavement differently at younger or older ages. Social factors such as socioeconomic status may be another variable that could be important to include, as it is known to correlate with overall health. [141,142] Finally, length of marriage is an important consideration in a model, as the response to bereavement and health outcomes may be affected by the length of the marital union.[143]

Given these considerations, the proposed life course model also has merit as it includes mental, physical and social determinants present in the base biopsychosocial framework, as well as suicide specific factors previously identified as gaps, including feelings of blame, guilt, responsibility, stigma and anticipation. In this model, there are many potential pathways, including interactions between social determinants of health and spousal bereavement related health. The downside is that this framework is

empirically difficult to test due to its comprehensiveness. Stroebe et al., cited the same observation for their integrative risk framework, however, the framework remains useful as a starting point from which research questions can be formulated and investigated. [30]

Given that administrative data has its limitations, the following analytic model has been proposed to investigate the overall rates of mental health disorders associated with spousal suicide bereavement. Figure 2-4 illustrates a longitudinal spousal suicide bereavement integrative risk framework to guide empirical work for administrative data health registries. Population-based health registry data allows for the examination of pre and post bereavement physician diagnosed mental disorders, and when using statistical models, can adjust for the impact of numerous factors, including age at bereavement, sex, region, and income, which is a measure for socioeconomic status. Matching and/or controlling for these factors in statistical models will allow for an examination of overall mental disorder rates among suicide bereaved spouses, thereby accounting for the potential effects of these variables on mental disorder rates.[7] The mental health outcomes selected are based on hypothesized relationships, findings and limitations of previous literature (Table 2-1). Utilizing administrative data may also permit matching a suicide cohort to the general population, or other bereaved spouses who have experienced loss by sudden natural death or other types of injuries. Drawing upon previous theoretical knowledge and concepts [30], the model represents a streamlined approach to compare, for example, overall mental disorder rates across different bereavement groups over time.

2.10 Future Research

To evaluate a more in-depth integrated framework, with the addition of a life course perspective, longitudinal controlled studies are needed to explain the process of and outcomes related to spousal suicide bereavement. Longitudinal studies utilizing large samples and appropriate comparison groups would advance the emerging area of suicide bereavement, which includes follow up required to test various dimensions of suicide and sudden bereavement over time.[49] Future studies must ensure samples are representative of the entire population, not oversampled from one particular group as has been done in past studies that overrepresented females and ethnic minorities.[144] Longitudinal analyses of population level administrative data would enhance our understanding of suicide bereavement, and together these studies would represent a tremendous advancement in the field of suicide bereavement theory and research. Using administrative data is a powerful tool and important next step in understanding trauma related health outcomes. [5-7,145,146] Administrative data can facilitate the longitudinal analyses of the relatively rare event of spousal suicide bereavement, as well as aid in the testing of derived theories, which would be a significant addition to suicide bereavement research. Qualitative studies could compliment this work by clarifying the experience of suicide bereavement while generating new knowledge to advance the theory of suicide bereavement, and inform larger, more generalizable studies.[147]

2.11 Conclusions

Individuals bereaved by suicide are a vulnerable population in need of further study. To date, research on this group has been limited by: 1) the number of theories, with

only two theoretical frameworks identified to explain the suicide bereavement process and 2) the number of studies that have been driven by suicide bereavement theory. Integrative theories that examine bereavement outcomes exist, but have not been specific to suicide death. This review has demonstrated that there is a complex interplay of many interacting factors between spousal suicide bereavement and poor health outcomes. While the life course model may be difficult to test as a whole, components can be tested empirically using a variety of research designs as demonstrated by our integrative risk framework for spousal suicide bereavement. Using administrative data and deriving longitudinal measures of biological, psychological and social factors creates an opportunity to expand our understanding of suicide bereavement outcomes and ultimately provide appropriate responses through informed interventions.

2.12 References

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Table 2-1: Evidence supporting variables included in life-course model

	Biological	**Psychological**	**Social**
Pre-bereavement	-Age[3,42,97,100,114-116] -Sex[3,77,97,100,116,121,144] -Family history of mental disorder or suicidality[3,68,90-96,148] -Previous history of physical disorder[3,97,99,114,117-120,149] -Genes and biology[83-88]	-Previous history of mental disorder[1,3,95,97,98,100-113,150-153] -Family history of mental disorder or suicidality[3,58,68,77,90-96,148] -Previous history of alcohol or drug abuse in spouse [23,52,55]	-Intimate partner violence (IPV)[154] -Length of marriage or union.[143] -Low socioeconomic status (education, income, employment)[3,7,100] -Presence of children[155,156] -Residential school placement[138] -Foster Care placement[139]- -Ethnicity[113,135,136] -Age[3,42,97,100,114-116] -Sex[3,77,97,100,116,121,144]
DEATH OF SPOUSE BY SUICIDE			
Post-bereavement	- Development of physical disorder and subsequent health service use[7,157]-	-Development of mental disorder (depression, anxiety, post-traumatic stress, alcohol and drug use)[33,158] -Suicidal behavior[58]- Complicated grief[159,160] -Sadness, anger, stigma, shame, guilt, abandonment [11-13,15,18,20,22,23,29,44,49,53,55,63,64,161,162]	-Social supports (type of supports, lack of supports (isolation)), lack of seeking supports (withdrawal) -Stigma[11-13,15,20,23,29,49,63,64] (isolation and social disconnectedness) [131-133,163] -Economic impact [143] -Family stress[18]

Table 2-2: Rationale for variables included in analytic model

Variable	Rationale for inclusion
Age at bereavement	Matching for age at bereavement will help account for differences in spousal death cohorts. For example, in a previous study, widows of MVC were on average 14 years younger than widows of suicide. [42]
Sex	Matching and/or controlling for sex will help account for suspected differences in coping styles and health outcomes between men and women.[140]
Income quintile	Examining area level income is a strong indicator of socioeconomic status, which has been correlated with overall health. [141,142] Important to match for this factor to account for differences in income between groups. Bolton (2012), found that suicide bereaved parents were more likely to have lower income prior to the death of their child.[7]
Region	Matching for region helps account for potential issues related to healthcare accessibility, and the role of mental health stigma related to help seeking and suicide in rural regions.[7]
Suicide Attempt	Spousal suicide bereavement may increase the other spouse's awareness of suicide as an option to end grief.[58]
Depression and Anxiety	Previous research shows that bereaved individuals at increased risk for depression and anxiety after death. [33]
Substance Use Disorder	Individuals may use drugs as a coping mechanism to deal with loss of spouse.[158] Widowers may drink to cope with loss of spouse. [158]
Suicide (in surviving spouse)	Family history of suicide can increase the risk of suicide in survivor. [58,77]

Figure 2-1: Dual process model of coping with bereavement

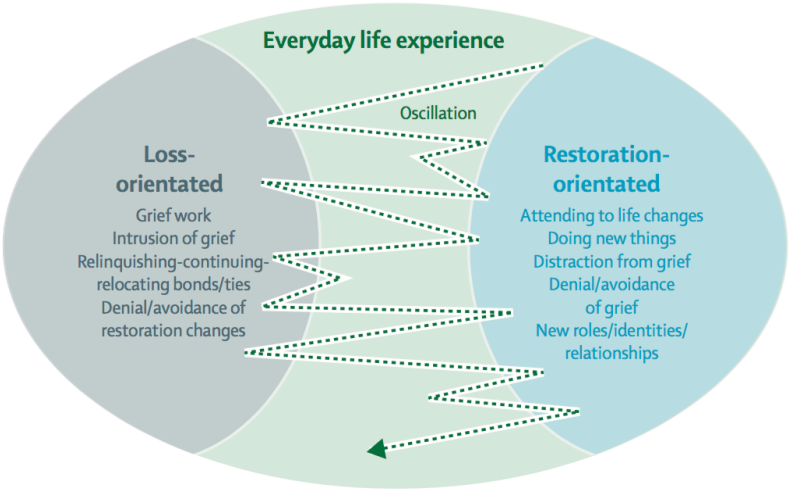


Figure 2-2: Integrative risk factor framework for the prediction of bereavement outcome [30]

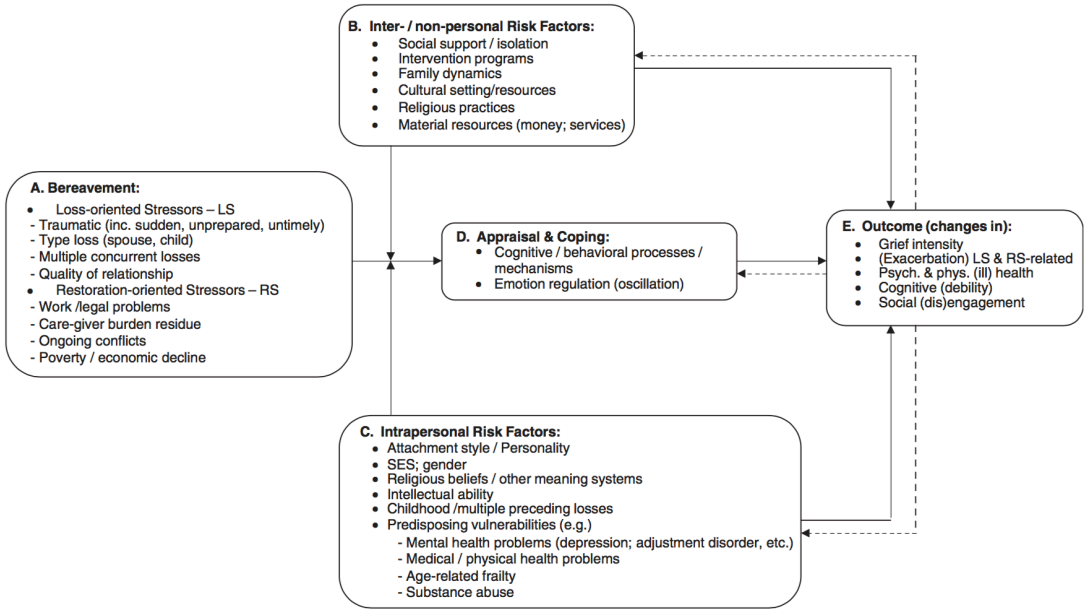


Figure 2-3: Life-course model of spousal suicide bereavement

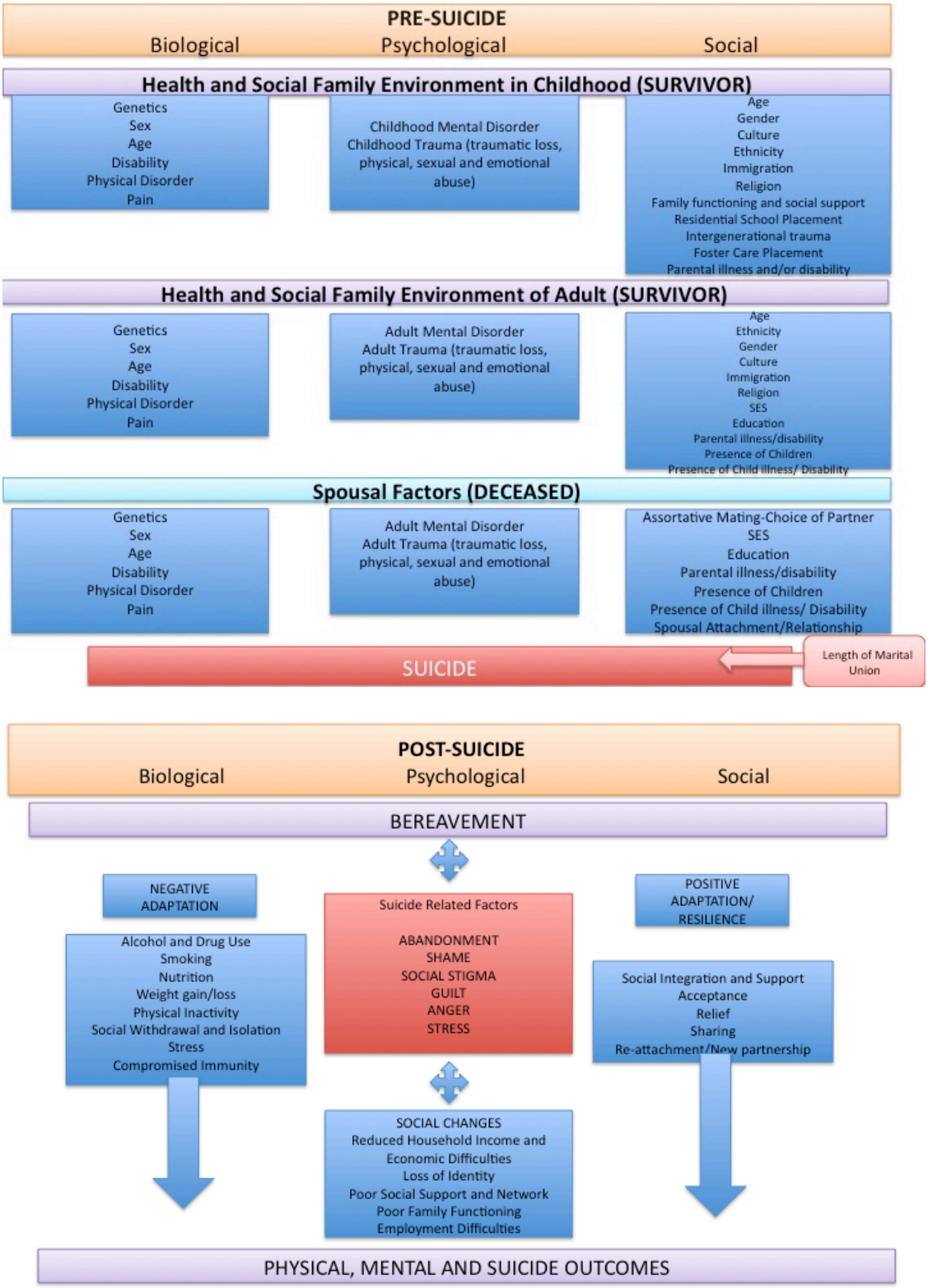
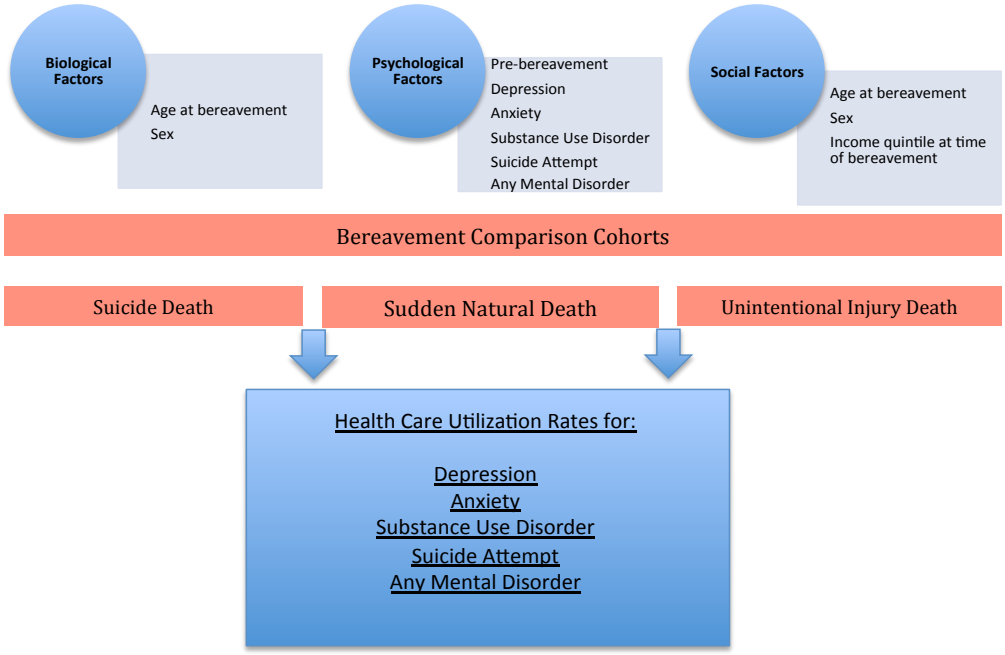


Figure 2-4: Integrative risk framework for spousal suicide bereavement (Analytic Model)



CHAPTER 3: HOW ADMINISTRATIVE DATA CAN BE USED TO ADVANCE THE STUDY OF SUICIDE BEREAVEMENT: AN EXAMINATION OF SPOUSAL SUICIDE

3.0 Chapter overview

This manuscript provides an overview of the factors that were considered when developing the study methodology for this thesis. Overall strengths and limitations of using administrative data to study spousal suicide bereavement health are reviewed and important methodological choices including choice of comparison groups are discussed.

Publication detail:

Spiwak, R., Elias, B., Sareen, J., Chartier, M., Katz, L., Bolton, J.M. How Administrative Data can be used to Advance the Study of Suicide Bereavement: An Examination of Spousal Suicide. To be submitted to the International Journal of Methods in Psychiatric Research.

3.1 Abstract

The study of spousal bereavement following suicide is methodologically challenging for several reasons including small sample sizes, selection bias, loss to follow-up, and difficulties with comparing suicide bereaved individuals to other samples. Administrative data provides tremendous advantages in the study of suicide bereavement outcomes including the ability to: examine large populations without the limitations of recall bias, compare suicide bereaved populations to individuals bereaved by other causes of death, study multiple factors through the use of multilevel statistical models; examine data longitudinally and over the life course, and investigate family linkages. The following paper discusses the strengths and limitations of using administrative data-derived indicators to study spousal suicide bereavement associated health outcomes. This discussion also explores the context of how health indicator choice and methodological limitations affect statistical choices in the study of suicide bereavement health outcomes, as well as directions for future research.

3.2 Background

Research focused on the consequences of suicide on family and friends is limited. [1] Recognizing that between 48 and 500 million individuals are bereaved by suicide every year [2], an accurate measurement of suicide bereavement related health outcomes is essential to understand this public health problem and organize appropriate resources for prevention and interventions. Linked population registries represent tremendous potential and advancement in this field of research.[2] Sveen and Walby (2008) identified methodological shortcomings in the majority of suicide bereavement studies highlighting convenience sampling, low response rate and small sample sizes. [3] Pitman et al (2014) briefly discusses the advances of linked population registries in overcoming these methodological shortcomings. [2] In this context, administrative data can facilitate the longitudinal examination of biological, psychological and social factors to see if health outcomes differ by different types of bereavement. While administrative data can offer tremendous advantages in the study of suicide bereavement outcomes, the choice and use of health indicators derived from this data needs careful attention. These considerations will impact study methodology and direct the choice of analytical strategy used in the conduct of suicide bereavement research.

While spousal bereavement has been associated with negative health outcomes [4-7], the suicide death of a spouse has been thought to increase the risk for poor health outcomes due to the traumatic and complicated nature of suicide on social and family systems.[8,93,5,8,10-22] The majority of studies examining this area have been largely explorative and limited by quality of data and study methodology. [3] These limitations include inappropriate choice of control groups, loss to follow up, small sample sizes, and weak study design. [5,9,21,23-30] The following paper

introduces administrative data as a way of examining the health consequences of spousal suicide bereavement, discusses the strengths and limitations of using administrative data derived indicators to study these health consequences, as well as provides future directions for research in bereavement using administrative data.

3.3 What are administrative data?

Administrative data are comprised of information that is routinely collected from large populations for non-research purposes, and then merged at the individual level using de-identified data to be used in research.[31] In Canada, administrative data is collected for virtually all individuals due to universal health coverage, or a health care system that provides health care to all of its citizens. As such, many populations can be studied, which is not always possible with survey data. Data are diverse and can originate from a variety of sources at multiple levels such as national, provincial and regional levels[32], and can contain information on health service utilization, education, social services or from registration offices such vital statistics.[33] Regardless of the type of administrative data, the use of linked databases enables researchers to investigate complex phenomena that may not be possible with individual or unlinked databases, including the study of rare events, longitudinal studies and inclusion of pre-existing factors such as income or health disorders.

3.4. Administrative Data Derived Health Indicators

Health indicators are measures that can represent a defined component of health including health status, non-medical determinants of health, health system performance and community or health system characteristics. [34] Health indicators may also include a combination

of factors, such as standardized health diagnoses for a grouping of individuals over a period of time. Health indicators can be used to capture information from a variety of areas, which can then be used for many purposes including the assessment of health status for a population, the evaluation of health services received by a certain population, and the cross comparison of groups of individuals with different risk profiles.[34] The scope of health indicators can also be expanded to include risk and protective factors related to certain conditions or health outcomes.[35] For example, indicators can measure social determinants of health, in that non-medical characteristics such as region or household income can be used as social markers of risk or protection, or can be considered as a component of other health indicators[36], such as the case of some social indexes.[31,37]

3.5. How Using Administrative Data can Advance the Area of Suicide Bereavement Research

Administrative data derived health indicators could be used to determine whether individuals bereaved by suicide experience worse health outcomes as compared to non-bereaved individuals, and compared to those bereaved by other sudden deaths. Using various health indicators derived from administrative data, it is possible to examine suicide bereavement-related health outcomes as compared to other bereavement control groups, including those discussed in the literature, specifically sudden natural death and unintentional injury death. [38] Using administrative data, it is possible to link many databases that may help explain why some individuals fair better or worse after suicide bereavement. These databases can include hospital claims, medical claims, physician files, and vital statistics, as well as various other registries and social services data.[39] While access to such vast data provides researchers and policymakers with

many investigational opportunities, it is necessary to use clearly defined, valid, and reliable health indicators. When using health indicators derived from administrative data, it is important to understand that data are collected for non-research purposes, such as health system management and health care provider payment[40] therefore it is important to carefully examine indicators to ensure they are appropriate measures of what you wish to study. Although some sources have cited the lack of data validation as a potential limitation when analyzing administrative data [41], the reliability and validity of some registries including the Manitoba Centre for Health Policy (MCHP) data registry have been examined and recognized. [42-44] These studies provide evidence for the use and validation of such measures related to the study of suicide bereavement related outcomes, including measures of mood and anxiety disorder diagnoses. [39]

Administrative data can be augmented to improve validity, including the use of census and government data, and qualitative approaches including patient interviews, evaluation findings, and other data registries.[45] Although alternate sources of data can be used for augmentation, data may be of varying degrees of validity. For example, national health survey data may be limited in that data are subject to recall bias, individuals may not be aware that they had been diagnosed with a particular disorder, individuals may not report a mental disorder because they are asymptomatic following successful treatment, or individuals simply may not want to disclose personal health information.[46]For example, in a cross validation study between a national health survey and administrative data, mental illness was underreported by the national survey by almost 50%.[39] These findings suggest that data obtained from medical charts or health

care service billing may be more accurate at identifying an individual's actual mental health state, which has significant implications for studying suicide bereavement outcomes.

3.6. Strengths and Limitations of Using Administrative Data Derived Indicators To Study the Consequences of Spousal Suicide Bereavement

3.6.1. Strengths

3.6.1.1 Population-based sampling

The use of health indicators derived from administrative data provide many general and specific advantages in the study of spousal suicide bereavement. Administrative data are rich sources of information, which can be used to answer questions without the methodological constraints present when conducting primary data collection or prospective trials. [47] Specifically, population-based sampling is utilized which ensures that data are representative of the entire population. Self-selection, or selection bias, may result in the recruitment of individuals that may be functioning exceptionally well, therefore able to participate in research, whereas individuals who may be most in need of care and further exploration do not participate in the study. [48] Similarly, the social stigma associated with suicide may prevent some individuals from participating in suicide research, again resulting in a selection of cases that may be quite different from the population.[49]This selection bias may result in an incorrect portrayal of survivor bereavement outcomes, such as findings that underestimate poor health outcomes. While previous studies of suicide bereavement have been limited by selection bias, the use of administrative data is not restrained by this limitation. As all individuals from a population contribute data, selection bias is addressed. As a result, representativeness is ensured, which is important for policy and health system approaches.

3.6.1.2 Longitudinal analyses

The advantages of using administrative data to study suicide bereaved spouses allows the potential to study health outcomes over an extended time period (e.g. 10 years) and allows the analysis of a large sample of individuals, despite suicide being a relatively rare event. This ability increases the power of a study to find differences between bereavement cohorts if they exist. Second, a longer follow up period can be studied. A controlled longitudinal study by Farberow and colleagues reinforced the importance of studying time in the suicide bereavement process [50], and argue that a substantial follow up period is necessary in order to discern differences in mental health outcomes post bereavement.[21]As loss to follow up is an issue with longitudinal studies, it is a further advantage of utilizing administrative data as loss to follow up is greatly reduced. The use of such population-based approaches to study longitudinal outcomes, such as a cohort study where individuals bereaved by suicides are followed up over a lengthy period of time, has demonstrated high external validity. [51]

Secondly, recall bias is also eliminated. Health indicators such as physician diagnosed mental disorders or health care utilization are not limited by survivor recollection bias, because the study does not have to rely on an individual's memory of health conditions. This factor is a key limitation in retrospective and longitudinal studies increasing the likelihood of data validity issues such as recall bias. [52] Although the lack of recall bias is a potential strength of using administrative data, this strength also extends to the ability to identify information about the deceased. Many survivor studies rely on psychological autopsies, or studies that interview individuals bereaved by suicide in order to gain information regarding the deceased following a stressful life event. [53-55] These studies are also impacted by recall bias, particularly because the

survivor is expected to recall and interpret highly personal information regarding the deceased. Having access to the deceased's health information is an important component of understanding suicide bereavement, and represents a significant advantage of using health indicators that are derived from administrative data.

3.6.1.3 Ability to study multiple factors through the use of multilevel statistical models

The ability to examine the overlap in risk factors for poor health and suicide in both bereaved and deceased individuals is another potential advantage of using administrative data to study suicide bereavement. For example, individuals who have low levels of education or previous mental disorders prior to bereavement may be placed at differential risk for poor health following bereavement. [22] Health indicators derived from linked data enable the examination of these potentially overlapping factors[31], which can then be analyzed using complex statistical models.[56]

3.6.1.4 Capture marginalized populations

An additional strength of using administrative data to study spousal suicide bereavement is that it allows investigation into underrepresented groups such as male bereaved spouses. [31,57]Data from suicide-bereaved individuals could also be aggregated or broken down at different geographic or administrative levels enabling the analysis of individuals belonging to different communities. Including factors such as sex, region, and income in analyses, can be used to ensure populations of study are comparable by incorporating various population characteristics that may be related to bereavement outcomes, as well as help determine differences in population health outcomes.[37]

3.6.2 Limitations

3.6.2.1 Underestimation of suicide

A limitation of using administrative data to study spousal suicide bereavement is that while cases derived from administrative data are highly specific at identifying confirmed suicides, they may not be sensitive, and underreporting may occur. Because suicide is an identifiable problem, deaths are accurately reported via the Medical Examiner's office[58], however other factors may impact the accuracy of suicide reporting. While deaths are accurately reported, underreporting may still occur because updated Medical Examiner's Cause of Death reports may not be received.[59] A study by Ajdacic-Gross (2008) investigated suicide reporting and argued that suicide deaths are more likely to be reported if the individual died by a violent method such as hanging, as compared to less violent methods such as poisoning.[60] In this context, a weakness of using suicide as a marker of suicide bereavement is that data are dependent on the accuracy of mortality registries and medical examiner reports. [39] For this reason, deaths that were suicides but not identified as such, would be missing in this indicator, ultimately underestimating the number of individuals and spouses bereaved by suicide. This underestimate may have potential policy implications because of the reduced perception of suicide as a significant public health problem. A recent study by Kapusta and colleges (2011) reinforce this point by suggesting that suicide cases appear to be diminishing in certain countries, however this perceived reduction may actually reflect the reduction in autopsies being conducted.[61] Related to underestimation of suicide and accuracy of mortality registries is the issue of suicide death coding. Unfortunately there are no evidence-based standards or consensus on ICD diagnostic coding for definitions of suicide. [62] While some measures of suicide include expanded definitions that include accidental death measures in an effort to be a more inclusive

and address suspected under-counting of suicides in administrative data [63], others do not. Ultimately the selected definition of suicide and coding is up to the goal of the researcher who may choose to identify all potential suicides (sensitivity is primary concern), or perhaps only the deaths that are determined to be intentional suicides (specificity is primary concern). Suicide rates in certain regions of Manitoba have also been shown to be underestimated as compared to data from the Medical Examiner's Office, signifying potential data quality and completeness issues in some areas.[39] While this is a limitation, validation work using expert review has shown that many accidental deaths are in fact suicides, therefore using an expanded definition of suicide that includes accidental deaths may be advisable especially if sensitivity is a priority. [62]

3.6.2.2 Legalized and Registered Marriage

A notable limitation of administrative data for examining spousal suicide bereavement is that in some jurisdictions data are limited to individuals who are legally married and have registered their marriage. As a result, in some cases individuals that are living in common law unions, or that are legally married but have not registered their marriage would not be included in this health indicator, potentially underestimating the number of individuals who have experienced spousal suicide. There may also be differences between individuals who have married and that are living common law, and also differences between married individuals who have and have not registered their marriages. Therefore findings obtained from registered spouses are only generalizable to married individuals that have registered their marriages. Understanding the differences between individuals who are and are not in registered marriages is a direction for future research.

3.6.2.3 Ascertainment of Mental and Physical Disorders

The use of derived health indicators for both the bereaved and deceased has many advantages, such as the ability to assess both pre and post bereavement health disorders. Unfortunately, measures of mental and physical disorders only represent individuals who sought or received care from a care provider or who were hospitalized for a related event.[39] These health indicators, while physician diagnosed, report treatment or use prevalence, which limits generalization to individuals who did not seek care. [64,65] It has been shown that failure and delays in help seeking for mental disorders is a problem worldwide [66], with older individuals, men, and individuals in developing countries being less likely to seek care. [67] Barriers to help seeking include desires for an individual to manage the problem on their own, lack of awareness or knowledge about where to find care, and unavailability of professional help. [68] As a result, measures of mental disorders are likely underestimates of actual disorders. Although many disease diagnoses are available through the use of administrative data, some important non-diagnostic factors such as measures of complicated grief and suicide ideation are not available. These factors are important to understand in the experience of bereavement, however are not captured in ICD coding. Similarly, in Manitoba some disorders such as posttraumatic stress disorder (PTSD) diagnoses are not available due to limitations in coding diagnoses. PTSD cannot be differentiated from other anxiety conditions in ICD coding, as some jurisdictions do not code all decimal places. Although these factors may be difficult to assess using administrative data, they may be possible to examine using alternate data sources, such as the inclusion of suicidal ideation through examination of Canadian Community Health Survey data.[69]

3.6.2.4 Social Factors

Social measures including information on social supports, including close friendships and relationships, as well as emotional components of bereavement are not commonly available in administrative data, representing a significant limitation in the study of bereavement. Support systems are an incredibly important component of an individual's experience and response to bereavement. [70,71] Research has shown that more social supports are related to positive bereavement outcomes. [71] Additionally, quality of life, work satisfaction, and relationship quality and characteristics are all important social factors that may impact a spouse's adjustment to bereavement. [71-73] Stigma or measures of stigmatization are also important social factors in the study of suicide bereavement as it plays an important role as a barrier to treatment seeking. [66] As stigmatization is a barrier to help-seeking for both suicide related deaths and mental health [74], it is important to understand the role that these social factors play in spousal health following spousal bereavement.

3.7 Defining Bereavement Controls: Spousal Survivors of Traumatic Death

The selection of control group(s) is a vital component of any study in which one group is being compared to another. Several comparability principles exist to guide the choice of study controls, including study base, deconfounding, and comparable accuracy;[75] each of these principles have implications for studying differences in spousal bereavement outcomes. While some bereavement studies have chosen to examine suicide bereavement related health as compared to individuals bereaved by other causes of death as comparison groups, others have chosen to also compare to non-bereaved samples. [22,76-78] Such choices may reflect the research question or goal and can be fuelled by a desire to determine overall impact of bereavement (compared to non-bereaved individuals) or an interest to find differences between selected types

of bereaved individuals. Ultimately, when comparisons are being made, cases and controls should be derived from similar base experiences, have little variability in measurable confounders, and have the same accuracy in measuring the outcome of interest. [75,79] These principles can be used to explain the lack of differences in grief responses post-death between individuals bereaved by suicide and individuals bereaved by other types of death. Choosing individuals with similar base experiences may be difficult in the case of suicide bereavement because of the nature of the death.[15] In this case, the true differences between cases and controls may be diluted due to the inclusion of inappropriate controls. In the case of bereavement studies, one can ensure that when using administrative data that cases are in fact exposed (bereaved by a particular cause of death), however it is less clear if the non-bereaved controls (or controls bereaved by a selected type of death) have experienced other types of bereavement over the study period. However, it is likely that these events would occur at similar frequencies among cases and controls, which would limit any potential bias in this case. This selection bias, or the selection of inappropriate cases or controls [52], is a limitation in previous studies, however can be overcome if appropriate comparisons such as other types of sudden death[15], and statistical approaches, such as inverse probability treatment weights (IPTWs) are chosen. [81] IPTWs will assign more weight to individuals that have lower odds of being in a particular group, therefore helping to equalize the groups enabling comparisons. Using IPTWs is a useful approach that can facilitate control group comparisons in the study of suicide bereavement health outcomes.

3.8. How can health indicator and methodological limitations affect statistical choices in the study of suicide bereavement outcomes?

Although the importance and potential limitations associated with health indicator validity have been discussed, other methodological limitations exist that will drive the choice of statistical tests in suicide bereavement studies. Methodological limitations associated with administrative data and subsequent health indicators are numerous and include factors such as the level of data, repeated measures and correlated data, data coding, incomplete data, and lack of randomization into case and control groups.

3.8.1 Suicide as a Rare Event

Methodological limitations such as the low prevalence of suicide and subsequent bereavement will impact the choice of study design and statistical analysis plan. For example, if a researcher was interested in comparing rates of suicide attempts among individuals bereaved by suicide, poisson regression may be used to predict the rate or number of discrete suicide attempts an individual will have. This type of regression analyzes count data, assuming a poisson distribution. This test is appropriate when count data are available, and you wish to model rare events.[82] In the case of a matched study design, it is possible to use a conditional or matched poisson regression to estimate risk.[83] Similarly, in the case of rare outcomes it may be more appropriate to utilize case control designs versus cohort studies due to the ability to capture all cases of the rare event.[84]

3.8.2 Repeated Measures and Correlated Data

An additional limitation of using derived health indicators are that in some cases such as health care utilization, individuals likely contribute more than one data point or repeated measures, therefore the statistical assumption of independence of observation is violated. [85] Traditional methods for analyzing repeated measures include paired t-tests, multivariate analysis of variance (MANOVA), and mantel-hansel tests, however these methods are limited in their ability to analyze complex data. [86,87] In a longitudinal analysis of individuals bereaved by suicide, these tests are inappropriate because they do not take into account the inter-correlated or dependent nature of the data. Where a paired t-test or MANOVA uses the first and last data points for one individual, another method called generalized estimating equations allows the use of all data points and can accommodate the correlated structure of the data. [87-90] GEE is an extension of generalized linear models, which enable regression analyses on non-normally distributed variables.[86,91] GEE results provide information for a group of observations, therefore explains how much the average response would change given an increase or decrease in a particular covariate. [90] The use of analyses that do not take into consideration the correlated nature of this type of data would provide incorrect inferences concerning regression parameters and inefficient estimators.[92] Correlated data can also be a statistical concern when examining family member data[31], such as in the case of spouses. Incorporating multilevel statistical models that can account for nested data in this case is necessary.[85] Finally, if data are matched to other bereavement groups on factors such as age or sex they may no longer be considered statistically independent, thereby failing the assumption of some statistical tests. In this case, creating strata variables that group cases and matches together and re-analyzing data may be useful to determine if the assumption of independence of observation is being met.

3.8.3 Data Coding

In addition to repeated measures and correlated data, an additional methodological limitation of health indicators is the level of data, or how data are coded. In the case of disease diagnoses, an individual will be coded as either having or not having a particular disease (presence/absence). This dichotomous coding will dictate the choice of analyses, especially when regression or prediction is desired. When data are dichotomous and prediction is desired, logistic regression may be appropriate.[85] Although logistic regression will provide information on the increased odds of experiencing a particular outcome as associated with a particular predictor, the limitation associated with dichotomous coding is that although presence of disease will likely be very accurate, disease severity may not be determined[93], nor can the effect of severity by measured.

3.8.4 Loss to Follow Up and Immeasurable Periods

While administrative data provides vast opportunities to examine health data both prospectively and retrospectively, limitations exist including loss to follow up and immeasurable time bias. While some individuals remain at the same location for the entire study period, others may have moved outside of catchment areas resulting in data that are lost to follow up. [31] Immeasurable time bias exists when an outcome or exposure is immeasurable during a period of time. [94] For example, in the case of hospitalizations in Manitoba, medication use is not captured, as it is only available through outpatient databases. Similarly, if examining health outcomes over a set period of time, some individuals may die over the course of the study period, resulting in unequal periods of follow up for study participants. If a researcher was wishing to examine time

to a particular outcome, such as diagnosis of depression, the use of certain analytical methods such as Cox Proportional Hazards Regression which would allow for the censoring of observations that were incomplete, resulting in the inclusion of data that would be excluded in other statistical tests. [95] Other methods involve the inclusion of an offset using the log of person years to ensure that time at risk for health outcomes are representative of each person's follow up period. Ultimately the methods to address immeasurable time bias will be directed by the study design and research goal.

3.8.5 Lack of Randomization

An additional methodological limitation that can impact statistical considerations in the study of suicide bereavement outcomes reflects the inability to randomize individuals. As a consequence, the benefits of randomization which are the reduction of bias, the equalizing of known and unknown confounding variables, and moderation of the effect of preexisting disease, are not achievable.[96] Although this limitation is important, matching methods including matching on set variables (e.g. age, sex, income), propensity score matching (PSM), or inverse probability of treatment weighting (IPTWs) may be used to allow for the correction of selection biases in making estimates in studies without random selection.[42,81,97-99] In cases where there are large databases, and a large number of confounding and covariates, PSM reduces the number of covariates into one composite score or item allowing for an examination of whether cases and controls overlap significantly in these covariates. If there is significant overlap, the researcher can argue that estimations regarding the differences between cases and controls are reasonable, therefore it may be possible to ask causal questions and achieve reliable results.[96,100] Aiming to reduce bias when a randomized control group is not chosen is of utmost importance, therefore it

may be advisable to include PSM or matching on other factors when using administrative data or any other design where groups are not randomized. Using PSM when examining individuals bereaved by suicide with a small number of covariates should produce similar results to matching, and both methods will not account for biases occurring from unobserved covariates.[96]The use of IPTWs is an additional method that assigns more weight to people that have lower odds of being in particular groups and therefore equalizes groups without matching. Thus, sudden or natural death cohorts or bereavement groups can be compared to suicide-bereaved cohorts when matching may not be possible.

3.9 Future Research and Next Steps

As demonstrated, the use of administrative data derived health indicators can advance the study of spousal suicide bereavement. Although the previously mentioned limitations are present, the use of administrative data tremendously adds to this body of research in its ability to identify spouses bereaved by suicide without the limitations of sampling plagued by other studies, as well as link longitudinal health and social data to analyze the course of bereavement. In order to address the aforementioned limitations, future research should: 1) Utilize consistent methodologies across jurisdictions to ensure studies are generalizable. Creating definitions of suicide that are standardized and providing clarity about choice of control groups are important first steps 2) Consider the effect of treatment of disorders in longitudinal studies. An important role of future research is to examine how treatment for mental disorders impacts overall outcomes following bereavement. It may be that earlier treatment may impact the development of mental disorders over time, and 3) Highlight the benefits of linked databases, including the development of multisite cohorts that incorporate measures of perceived need for care,

stigmatization regarding suicide and mental health help seeking, social supports, and use of non-insured treatments to see how each of these factors can impact health outcomes over time. This knowledge will undoubtedly advance suicide bereavement research and inform the creation of targeted interventions and treatment for those at risk for poor health outcomes following bereavement.[101]

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Appendix 3-A: Selection of statistical tests that could be used to study suicide bereavement

Statistical Test	Key Points	When to Use	Limitations	Applicability to Suicide Bereavement Study
Generalized Estimating Equations	• Method of estimating regression parameters when data are correlated [73-78,93] • Extension of generalized linear models, which enable regression analyses on non-normally, distributed variables[73,78] Must specify the distribution of the dependent variable, link function, and the type of correlation structure[73] • Allows for the violation of the assumption of independence necessary in other regression models[72]	• When you want information for a group of observations or examine population level effects • Explains how much the average response would change given an increase or decrease in a particular covariate [77] • Useful in analyzing longitudinal data where an individual contributes multiple data points • Can use when response variables not normally distributed	• Missing data may bias results if associated with variables in model[73] • Difficult to assess goodness of fit [94] • Does not give predicted values for each level (or cluster) in the hierarchy[72]	• Would allow the analysis of individuals bereaved by suicide's health outcomes, including health care utilization over time, while accounting for the effects of matched pairs, repeated measures, dependent observations and potential correlations
Logistic Regression	• Predicts likelihood of a dichotomous outcome based on independent variables in model [72] • Produces odds ratio	• Use when dependent variable is dichotomous	• Observations must be independent • Requires binomial distribution • Cannot determine disease severity	• Would allow a cross-sectional examination of individuals bereaved by suicides post bereavement and identify correlates of poor health outcomes
Survival Analysis	• When interested in how risk factors impact time to disease • When wanting to examine time to event,	• Dropouts are present. • When you want to compare survival (time to event) curves to see if there are differences	• Can't cope with continuous confounders, such as age at bereavement. • Only compares	• Would allow study of time to development of poor health outcomes for individuals bereaved by suicides, as well as comparison of this time to

	or compare time to event among different groups	between groups	survival curves, does not allow explanatory factors to be taken into account [81]	event to other traumatic loss survivors
Proportional Hazards Regression	• When wanting to examine time to event, and include a range of predictor variables that include continuous variables	• When examining time to event such as depression or suicide attempt	• Assumes hazard ratio (probability of experiencing outcome) is constant over time [81] • More powerful than logistic regression models when examining time to event.	• Allows the study of time to development of poor health outcomes for individuals bereaved by suicides and traumatic loss survivors while including other risk factors in the model
Conditional regression	• Assumes a model that is specific to each cluster • The outcome is binary and observations are not independent, but are matched or grouped[72] • One predictor is declared as a random factor effect	• Based on the maximum likelihood approach used in logistic regression, however takes into consideration matching[72] • Used in case control studies[72] • When interested in between stratum variation [72]	• Results generalized to very similar populations only • Have been criticized for having a mechanistic interpretations [72] • Overestimates the odds ratio when there are matching data and gives a biased estimate [72]	• Allows the study of survivors of suicide who have been matched to survivors of other traumatic death. Matched pairs can be examined to see if risk factors for poor health outcomes are different between groups • Can examine the relationship between spousal factors and deceased's factors to see if spousal health concordance may play a role in poor health outcomes following bereavement. Does suicide contagion exist in couples, or is poor health (including suicide) post bereavement explained by spousal health

				concordance?
Poisson Regression	• Outcome variable is numeric, but in the form of counts • Analyzes count data and the assumptions are that it follows a poisson distribution[69] • Aim is to model the dependent variable Y as the estimate of outcome using some /all of the predictor variables • Assumptions are that the log of odds should be a linear function of the covariates, and each level of the covariates the number of cases has a variance equal to the mean	• Useful if examining rare events (such as suicide) • Both individual and grouped data can be analyzed with the poisson distribution • If matched cohort data are used, conditional or matched poisson regression can be used to estimate risk[70]	• If assumptions violated dispersion exists, a random effects model may need to be used[69]	• If you are interested in comparing counts of outcomes before and following suicide bereavement, poisson regression may be used to predict the rate or number of discrete events survivors will have
Longitudinal Growth Modeling	• Takes into account the hierarchical structure of data [54] • Can look at the relationships among variables at different levels of a hierarchical structure [54] • Allows an examination of an individuals development of an	• HLM is more efficient in parameter estimation and doesn't require data collected at same time points • Does not require equally spaced measurements so individuals can contribute data at any	• Assumes data are missing at random. • Require 3 or more data points per person	• Can examine development of poor health outcomes as a function of time, while examining the sources of variability in the model. • Can examine survivors at the group or individual level

	outcome to be a function of time or age[95,96] • Estimates the parameters representing the growth curves which have created the outcome variable over time[96] • Random effects and hierarchical models (HLM) are essentially other names for LGM[96,97]	time • Missing data is not a problem if random. • Useful for longitudinal and clustered data		

CHAPTER 4: SUICIDE POLICY IN CANADA: LESSONS FROM HISTORY

4.0 Chapter overview

This manuscript provides context for some of the complexities of studying suicide bereavement, including suicide's history as a criminal offense. This background is important in understanding the social attitudes surrounding suicide including feelings of shame and stigma that can arise. As such factors can impact help seeking, recognizing suicide's complex history is an important consideration in suicide-related research.

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4.1 Abstract

In Canada, suicide has transitioned from being a criminal activity with much associated stigma, to being a public health concern that needs to be managed by governments and clinicians in a culturally sensitive manner. In Canada and worldwide, the social attitudes toward and legal interpretation of suicide have been dynamic. Much has been proposed in the development of suicide policy in Canada, however Canada is unique in that it remains one of the only industrialized countries without a national suicide prevention strategy. The current article provides a critical review of the history of suicide in Canada, as well as an appraisal of Canadian suicide prevention policies and key government and political milestones that have impacted suicide policy. Current activity regarding a national suicide prevention strategy in Canada is discussed, as well as potential options for clinician involvement.

4.2 Background

Every year, nearly 4000 Canadians die by suicide[1]. It has been estimated that direct and indirect costs of each suicide total almost $850,000, with a Canadian annual total of over $2.4 billion.[2] After a peak in 1978, suicide rates in Canada have remained relatively stable, decreasing slightly over time.[3] In 2010, the suicide rate in Canada was approximately 12 per 100,000,[4] as compared to 14.8 per 100,000 in 1978.[5] While overall rates appear stable, sex differences exist with younger females dying by suicide at greater rates than in the past, and younger male suicide rates having stabilized.[6] Suicide rates vary among groups, with rates higher in some populations. Suicide rates among First Nations are between 3 and 6 times those of the general population.[7] Suicide is also elevated among youth, and is one of the top 3 causes of death among 15 to 34 year olds.[8,9]

Suicide is acknowledged as a significant public health issue, yet national policies remain largely undeveloped. According to Miljan (2008), health policy occurs in five stages: 1) defining the policy problem, 2) formulating policy, 3) decision making, 4) policy implementation, and 5) policy evaluation.[10] While non-partisan support from all major Canadian political parties exists for a Bill supporting a national suicide prevention strategy (NSPS),[11] Canada is just entering the decision stage, presuming this stage will lead to policy implementation. In the meantime, the Canadian Association for Suicide Prevention (CASP), established in 1985 to represent professionals and non-professionals, has been leading the development of a national strategy. In 2007, CASP released a blueprint for a NSPS.[12] More than 6 years later, government policy is still early in development.

This brief introduction illustrates that evidence-based approaches can inform new suicide policy but new policy can be informed by past initiatives. By engaging a historical review,

policy-makers can learn from past successes and failures, particularly in relation to the stigmatization related to suicide. This paper illustrates the merit of such an approach by 1) documenting the emergence of suicide policy in Canada, and 2) highlighting key milestones as we move closer to realizing a NSPS. To add further context to understanding this approach, the unique features of the Canadian health care system are discussed, as well as the potential role for clinician- informed policymaking as an important future direction.

4.3 The emergence of suicide policy in Canada

In Canada and worldwide, social attitudes toward and legal interpretation of suicide have been dynamic. Prior to 1972, the act of attempting suicide was a criminal activity punishable by law, thereby making suicide policy a federal jurisdictional matter. In 1972, suicide was decriminalized.[13] Subsequently, suicide was described as a health issue, with policy-makers pressuring the national and provincial governments to respond to suicide through prevention and health promotion policies.[14] In 1974, the Lalonde Report (see Figure 4-1), a key health promotion document, acknowledged suicide as a health issue and made transparent the stigma experienced by suicide survivors or individuals bereaved by suicide. Although governments were pressured, the development of a NSPS was hampered by constitutional concerns, including provincial governance over health. As well, the social stigma of suicide as a criminal act remained, as illustrated by the ongoing use of the phrase "committing suicide". Many argue that this term reinforces the view that suicide is still viewed as a heinous activity, implying judgment and further compounding the stigmatization of suicide.[15]

Over the course of the 10 years following the Lalonde Report, Health and Welfare

Canada established the National Task Force on Suicide in Canada and in 1987 produced a national report.[16] This report included such recommendations as the need for 1) epidemiological evidence to identify at-risk groups, 2) evaluations of suicide prevention programs, intervention and postvention (support for individuals bereaved by suicide), and 3) federal, provincial/territorial and regional suicide policy guidelines. Because of lack of action on the report's proposed recommendations for suicide prevention, these recommendations were put forward once again in 1994.[17]

Although federal reports have identified suicide as a health issue, barriers to the development of suicide policy have been constitutional in nature. Provincial governments have jurisdiction over health, which means that health policies and programs must occur at the provincial level, limiting the federal government to leveraging knowledge to influence policy and program uptake at the provincial level. Consequently, a NSPS does not exist. Instead, there is a range of provincial initiatives targeting various aspects of suicide prevention. In Manitoba, there is the Reclaiming Hope provincial youth suicide prevention strategy,[18] and a Suicide Prevention Strategy Network, which makes recommendations for policy change. Within each health authority, there are also regional committees that target suicide risk along the age continuum, with a special emphasis on youth and First Nations populations. Many provinces and territories have also developed excellent strategies and multilevel approaches, each varying in their breadth and scope. These strategies can be found through the Mental Health Commission of Canada Knowledge Exchange Centre.[19] While similarities and differences exist among these strategies, some areas of focus include (and are not limited to): suicide prevention models based on theory and delivered by regional health authorities (New Brunswick);[20] approaches that aim to strengthen the continuum of mental health services, support research on suicide and the

effectiveness of suicide prevention initiatives, as well as improve opportunities for early childhood development (Nunavut);[21] use of population health and health promotion approaches and multi- level supports (Nova Scotia);[22] health promotion and suicide postvention activities that occur largely at the community level (Quebec);[23] as well as strategies that aim to improve suicide-related surveillance systems (Alberta).[24] While this is not a comprehensive list of all provincial/territorial strategies, nor does it imply that the mentioned programs are only available in the province specified, it is clear that a national strategy would allow the integration and consistency of programs across Canada.

While policy and program development rests with the provinces, there are exceptions where both policy formation and implementation are a federal matter. For instance, the federal crown has a fiduciary relationship with and obligation to First Nations peoples, and this relationship and obligation has implications for the development and conduct of government policy in matters that involve First Nations peoples. The scope of obligations, and very nature of associated policy, however, can vary with individual circumstances.[25] For instance, as part of the Royal Commission of Aboriginal Peoples in 1995, the high suicide rates among Aboriginal Peoples were investigated.[26] In 2001, in the wake of this report, a Suicide Prevention Advisory Group was appointed to review research and make recommendations for a National Aboriginal Youth Suicide Prevention Strategy (NAYSPS).[27] In 2005, the federal government committed $65 million over a 5-year period to support the NAYSPS.[28] This strategy focused on suicide prevention, suicide postvention, and cultural considerations for Inuit youth, First Nations youth living on reserve, and Aboriginal youth living off reserve.

In 2006, the federal government commissioned the Kirby Report to examine mental health and the role of the federal and provincial governments in improving outcomes.[29] This

report highlighted suicide as a priority area and the need for federal, provincial/territorial and stakeholder collaboration in the development of a NSPS, including suicide postvention.[30] Also emphasized was the need for a national suicide research agenda and studies on suicide risk and protective factors. The federal government responded and created the Mental Health Commission of Canada (MHCC), which is developing a mental health strategy and reducing stigma associated with mental illness, as illustrated by the Opening Minds campaign.[31] Included in its goals and objectives is suicide prevention.[32]

4.4 Historical lessons

Since 1972, while there has been increased awareness as well as targeted provincial suicide prevention initiatives and action by the federal government, we are still early in policy development. From this review, it is apparent that stigmatization and jurisdictional issues continue to act as barriers to the creation and uptake of policy. While the development of First Nations suicide prevention strategies illustrates growth, it is limited to First Nation communities. Formation of the MHCC was a major milestone, as is political support for a NSPS. Nevertheless, suicide policy in Canada is relatively underdeveloped as compared to countries with a NSPS, such as the USA, Australia, Denmark, England, Estonia, Finland, Germany, Greenland, Japan, Ireland, Northern Ireland, the Netherlands, New Zealand, Norway, Scotland, Sri Lanka and Sweden.[33] Although constitutionally rooted powers have impeded the development of a NSPS in Canada, other nations have transcended jurisdictional barriers. For example, Australia has a federal-national suicide prevention framework with implementation extended to state and territory governments through the Council of Australian Governments.[34] The Council includes representation from the federal government, six state governments, two mainland territories, and

the Australian Local Government Association.[34] The Council, chaired by the Australian Prime Minister, discusses and coordinates government activities across the various government levels. One milestone they achieved was placing suicide bereavement under their national strategy, and developing standards and guidelines for suicide bereavement support groups. Although their survivors support group model is based on down- and midstream approaches (i.e., individuals seeking support are already at risk for poor health outcomes), the model allows for standardization across states and territories, resulting in equal standards of care. In Canada, this approach, which could build out from the First Ministers Conference, could result in discussions and coordinated activities to integrate resources, decrease duplication, and improve efficiency**.** Benefits of a NSPS are likely vast, as demonstrated by a recent link between reduced suicide rates and mental health services associated with "Suicide and Homicide by People with Mental Illness", a strategy that monitored suicide in the United Kingdom.[35]

In Canada, there is potential to act on such innovations, given recent national political activity supporting a NSPS.[36,37] A national policy, at multiple levels and across jurisdictions, could address suicide and associated structural barriers. Indeed, a NSPS could result in the integration of redundant provincial suicide prevention frameworks, consistency and equality in postvention approaches, and uniform guidelines and regulations for suicide supports. In Manitoba, for instance, there are several suicide prevention frameworks, each addressing similar areas, which could be integrated.[38] Implementing a NSPS is therefore an opportunity for provincial and federal governments to jointly and uniformly address suicide prevention and postvention, and other recommendations in the *Report of the National Task Force on Suicide in Canada*.[16]

4.5 Clinician advocacy in policy

The engagement of clinicians as advocates illustrates the various ways clinical knowledge can impact and inform suicide policies. For instance, support for a NSPS has come from special interest groups such as the Canadian Psychiatric Association (CPA) and CASP, as noted. CPA has advocated for the creation of media guidelines for suicide reporting aimed at reducing suicide contagion and associated stigma.[39] CASP has advocated for policy development at all government levels, as well as producing and sharing information on suicide interventions and research.[40] In 2004, CASP President Dr. Paul Links called again for federal leadership in developing a NSPS, and argued that all levels of government be involved to reduce suicide rates.[41]

Clinicians engaged in research and/or incorporating evidence in their daily practice can impact policy. For example, in Australia, clinicians have informed health policies in the area of nursing and midwifery, resulting in not only the creation of clinician-informed policy, but also the maximization of clinician investment in the final policy.[42] Clinical expertise can help generate patient risk profiles, identifying individuals at risk for suicide, or poor health outcomes following suicide bereavement. Clinical involvement can also encourage clinicians' investment in the suicide policy well after its development, leading to improved uptake at multiple levels. An example of a clinician-informed care protocol is the addition of complicated grief- and bereavement-related depression diagnoses in the upcoming Diagnostic and Statistical Manual of Mental Disorders (DSM-V).[43]

4.6 Emerging areas requiring guidance

Emerging areas of suicide policy requiring further investigation include: benefits and limitations of a NSPS within constituted roles; guidelines and regulation of suicide postvention activities; role of help-seeking barriers to suicide prevention and postvention care; policy-making role of clinicians; and investigations into effective suicide prevention approaches, as well as who should have input into the design and testing of these interventions. Ongoing evaluation is also required to refine policy and identify effective interventions. While clinical input is important in determining effective interventions for at-risk populations, finding ways to expand clinician involvement is essential for implementation and uptake of suicide policy.

In summary, suicide has transitioned from being a criminal activity in Canada with much associated stigma, to being a public health concern with some movement to address stigma. Informing the development of a NSPS using a reflective approach has merit in that it makes transparent the history of policy creation, implementation and uptake. From this review, it is clear that more research is required in suicide prevention and postvention programs and to refine appropriate care for all individuals impacted by suicide. As well, clinical advocacy and input has been and is critical in developing and implementing a national suicide policy.

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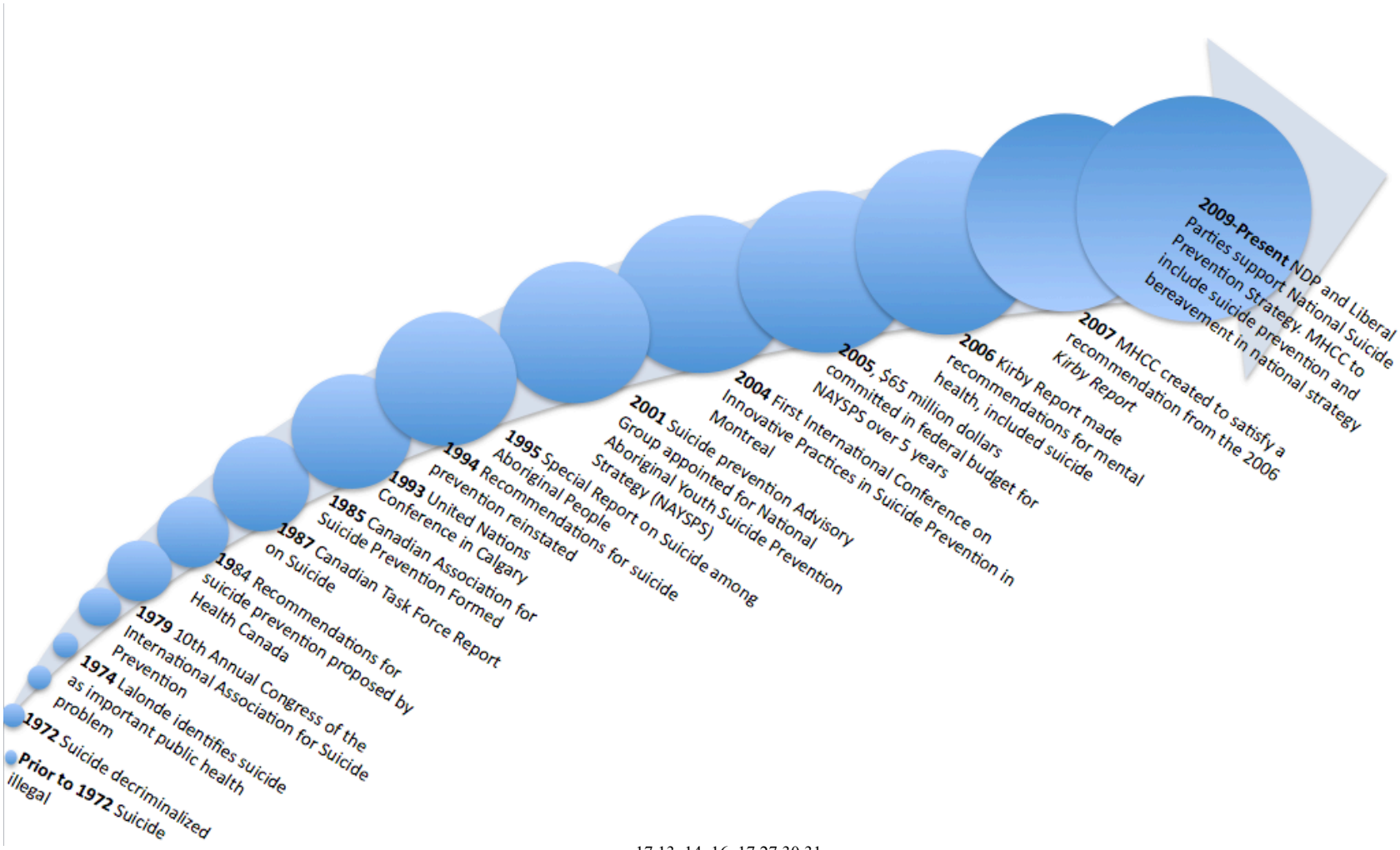
Figure 4-1: Historical Timeline of Suicide Policy in Canada*



*Data abstracted from various Canadian policy documents [17,13, 14, 16, 17,27,30,31.]

CHAPTER 5: BEREAVEMENT AFTER THE SUICIDE DEATH OF A SPOUSE: A POPULATION-BASED LONGITUDINAL INVESTIGATION OF MENTAL HEALTH OUTCOMES

5.0 Chapter overview

This manuscript investigates spouses bereaved by suicide as compared to a matched non-bereaved spousal cohort. It is important because it highlights the high rates of mental disorders both before and after spousal bereavement. Such findings have important implications for the creation of interventions for spouses bereaved by suicide.

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5.1 Abstract

Background: Spousal suicide bereavement has been associated with poor health, however an examination of physician-diagnosed health outcomes is needed. Aims: To examine physician-diagnosed mental disorders among spouses bereaved by suicide (SBS) in the general population. Method: Married individuals whose spouse died by suicide between 1998 and 2008 (n=373) were matched on age, sex, income quintile and region, 1:3, to control non-bereaved spouses (n=1119). Generalized estimating equation models were used to compare rates of mental disorders 5 years before and after spousal death. Results: SBS had greater rates of all mental disorders prior to and following bereavement. Significant time by group interactions suggest absolute rates change for depression, anxiety and any mental disorder were greater among SBS (19.30, 6.44, 15.55) than controls (0.98, -1.16, -0.53) over time. Discussion: SBS have poor mental health overall. Future studies are needed to examine caregiver burden prior to bereavement as a possible point of intervention.

5.2 Background

Worldwide, every year, between 48 and 500 million people experience suicide bereavement due to the suicide death of a loved one.[1] Suicide bereavement tends to differ from other forms of bereavement. Shame, stigma and social isolation may accompany a suicide[1-4], which in turn may impact the bereavement process and contribute to survivor distress and subsequent poor health.[1-8] Given this potential outcome, suicide bereavement related health is a significant public health concern requiring greater understanding and interventions.

While all forms of bereavement are traumatic, spousal bereavement has been noted as one of the most stressful events that an individual will experience over their lifetime. [4,9] Spousal bereavement involves the loss of a primary attachment figure, which can impact survivor functioning and result in social isolation. [4,9] A large literature has identified the risk of mortality associated with spousal death, including poor health associated with spousal bereavement. [10-13] Suicide death, however, is seldom examined as an area of focus. Pitman et al's (2014) narrative synthesis of 57 studies summarized the heath consequences of suicide bereavement, and highlighted the increased risk of suicide among marital partners, as recorded in Danish registries. [1] The authors further examined differences in health outcomes between suicide and other causes of death, and acknowledged a lack of adjustment for pre-bereavement psychopathology that is typically seen when studying the suicide bereaved. [1]

To date, investigations into health outcomes associated with suicide bereavement have been criticized for being explorative, cross-sectional, using small sample sizes, and lacking control groups. [2] Also, the true impact of suicide bereavement, while hypothesized, is not well

defined. Several studies have attempted to address these limitations using administrative data to longitudinally examine health outcomes of the suicide bereaved. [14-17] Administrative data provides a tremendous advantage. Data are not limited by survivor recollection bias, such as an individual's memory of previous health conditions. Longer follow-up periods can be studied using statistical models to account for the effect of time and confounding factors, such as socioeconomic status or sex. Data from suicide-bereaved individuals can be aggregated at different geographic or administrative levels, enabling the analysis of individuals from diverse regions. Area level matching can ensure study populations are comparable by incorporating population characteristics that may be related to bereavement outcomes, helping to understand differences in bereavement related health outcomes.[18]Administrative data allows for the study of a large number of individuals at the population level, thus making it possible to examine rare events such as suicide.

While administrative data has been used to study suicide bereavement related health while accounting for pre-bereavement psychopathology among siblings and other relatives, such data has been rarely used for spousal bereavement studies. [6,19-22] In the largest examination of suicide bereaved spouses to date, Erlangsen et al.,[17] followed 15,607 spouses 5 years after the suicide death of their spouse and reported incident rate ratios of mental, physical and social outcomes. This study compared suicide-bereaved spouses to a general population-based sample (regardless of marital status), as well as spouses bereaved by a wide variety of death causes. This was a nationwide register-based cohort study. The most important limitation of this study is the definition of mental disorders; mental health outcomes originated from psychiatric hospitalizations, and as such would typically only capture the most severe psychiatric disorders.

[23] Due to the fact that the majority of mental disorders are typically diagnosed and treated by family physicians/general practitioners, [23-27] and private mental health specialists not registered in the Danish Psychiatric Central Research Register[23] , they were not captured in the definition of mental disorders in this study. While visits for general psychological or psychiatric therapy was investigated as a separate outcome, it was not disorder specific and relied on records of supplemental payments for therapy. There is a risk that this study underestimates not only the proportion of individuals with mental disorders following suicide bereavement, but also vastly underestimates individuals with both mild and moderate forms of mental health disorders. A second limitation of this study includes lack of appropriately matched controls, and methods to assess changes in disorder rates over pre and post study periods between cases and comparison groups. While previous mental disorder was adjusted for in multivariate analyses, this consisted of previous psychiatric hospitalization, which was not clearly defined in terms of amount of time. Previous psychiatric hospitalization is also subject to the above-mentioned limitation on underestimation. Regardless, this study reinforced the idea that spouses bereaved by suicide are a vulnerable group for mental disorders following spousal loss and thus highlights the importance of investigation into this important public health issue. In addition to the study by Erlangsen, Agerbo et al. longitudinally investigated spouses and children bereaved by suicide over a 15-year period using administrative data. [16] The authors studied 3414 married spouses that had a marital partner die by suicide and found that survivors were at increased risk of suicide, suggesting suicide contagion may be present between couples. While this study addressed some of the limitations previously cited, it focused on suicide death as an outcome. Other mental health outcomes were not investigated. A major limitation of Agerbo's study was that it also originated

from inpatient hospital visits, thus limiting its ability to measure health contacts in outpatient settings, which are far more numerous than hospitalizations.

To address these limitations and extend published longitudinal studies of suicide-bereaved health, in spouses, offspring, and siblings, [14,15,17] we undertook a matched longitudinal population based sample of spouses who experienced the death of a spouse by suicide. The first study objective was to investigate the rate of mental disorders associated with spousal suicide bereavement. Whereby, we compared the relative rate of physician diagnosed mental disorders of surviving spouses 5 years before and after the suicide to a matched non-bereaved married control group. The second objective was to examine rates of mental disorders associated with spousal suicide bereavement while adjusting for the effects of age and sex and using a time by group interaction term to assess differences over time. Both objectives defined outcomes based on both outpatient general practitioner and specialists' visits and hospitalizations for physician-diagnosed depression, anxiety, substance use, suicide, and any mental disorder. This work expands on the work of Erlangsen et al., and will broaden the evidence base of spousal suicide and mental health outcomes through the inclusion of general practitioner visits, which has been demonstrated to be the main access point for mental disorder diagnosis and treatment. [23-27] We hypothesized, based on previous studies, that suicide bereaved spouses would have elevated rates of mental disorders [1,5,8], within 5 years following the death of their marital partner when compared to non-bereaved controls and pre-bereavement rates.

5.3 Methods

5.3.1 Data Sources

Approvals for this study were obtained from the University of Manitoba's Health Research Ethics Board as well as Manitoba Health's Information Privacy Committee. Administrative data were sourced from the Manitoba Population Research Data Repository, housed at the Manitoba Centre for Health Policy (MCHP) located at the University of Manitoba in Canada. The Repository contains individual-level data containing scrambled Personal Health Information Number (PHIN) enabling de-identified data linkage across the datasets for almost all residents of the province of Manitoba (1.2 million). [28,29] Because Manitoba provides free medical care to all residents and administratively records the care provided, data linkage enabled a longitudinal record of health diagnoses and health care use for all persons in the province of Manitoba. While care is provided to military personnel and incarcerated individuals under federal jurisdiction, their claims however are not tracked. [15] This study utilized physician claims data (physician diagnoses from general practitioners and specialists), hospital discharge abstracts (inpatient admission contacts and diagnoses), the population registry (age, sex, region of residence), vital statistics datasets (cause of death), and Statistics Canada Census data (area-level income quintile). Cause of death is determined by medical examiners and is integrated into the registry yearly by Manitoba Health. [30] Linking these databases allowed for the examination of cause of death, marital status, income quintile, sex, and region, which are necessary to create the detailed longitudinal history of social and health information for bereaved spouses and their deceased partners.

5.3.2 Cohort Formation

The cohorts developed for this study are spouses bereaved by suicide, and matched non-bereaved controls from the general population (See Figure 5-1). Vital Statistics data were used to identify spouses who died by suicide (including accidental poisonings) between January 1, 1998 and December 31, 2008 (using ICD 9-CM codes: E850-E854, E858, E862, E868, E950- E959; ICD-10-CA: X40-X42, X46, X47, X60-X84, Y10-Y12, Y16, Y17, Y870). The bereaved cohort was comprised of 373 individuals (registered marital partner) who had a spouse die by suicide death, which were matched to 1119 non-bereaved controls. Marital status was obtained from the Manitoba Health Registry Data, and was available for spouses with a common family registration number. Adults in this database were classified as married, single, and widowed[31]. Non-bereaved spouses were married at the start of the study period, and their spouse was alive at the end of the study period. For the non-bereaved cohort, the date of death in the matched cohort was used as the index date to allow for pre and post comparisons. Only individuals who had one marriage over the 10-year period were included. These criteria ensured that remarriage would not influence future health outcomes. Non-bereaved controls were matched on: age at bereavement (+/- 5 years), health authority region (11 categories), sex (male or female), and income quintile (average household income was divided into 5 quintiles). Income was derived from Census data and reflects the average household income in the area in which the spouse resided. Methods of identifying income quintile were used for individuals living in rural and urban environments.[32]

5.3.3 Social Factors and Mental Health Outcomes

Age at bereavement was broken down into 5 categories, with the youngest age range and male sex used as reference categories. Mental disorders included were defined as follows:

depression (ICD-9-CM: 296.2-296.3, 296.5, 300.4, 309, 311; ICD-10-CA: F31.3-F31.5, F32, F33, F341, F380, F381, F432, F438, F530), anxiety (ICD-9-CM: 300.0, 300.2, 300.3; ICD-10-CA: F40, F41.0, F41.1, F41.3, F41.8, F41.9, F42, F431), substance use disorder (ICD-9-CM: 291, 292, 303, 304, 305; ICD-10-CA: F10-F19, F55), and suicide attempts (including accidental poisonings) (ICD 9-CM: E850-E854, E858, E862, E868, E950- E959; ICD-10-CA: X40-X42, X46, X47, X60-X84, Y10-Y12, Y16, Y17, Y870).[14] An 'any mental disorder' variable was also created to include individuals who have depression, anxiety, or substance use disorder over the selected time period. The mental health disorders identified were based on previous literature as well as their hypothesized relationship with bereavement related stress. [14,33] A 10-year total bereavement period was used, and pre-death disorders for the 5 years prior to the suicide (from 1993) were examined, as well as a minimum of 5-year follow up from 2008 (until 2013). Five-year bereavement periods allowed for a broader examination of bereavement health and has been previously used to study spousal bereavement.[34] Disorders were identified by physician-generated diagnoses from both outpatient physician visits and hospitalizations (defined as spending more than one day in hospital). Diagnoses were treated as dichotomous variables (yes/no), and were based on a spouse receiving a physician diagnosis at least once over the study period.

5.3.4 Statistical Analyses

Analyses were conducted using SAS version 9.4. Chi-square tests were used to examine the demographic and social factors of cases and controls. As some individuals died over the course of the study period, individuals were not followed for the same amount of time post-bereavement. To address this issue, an offset using the log of person years was calculated and

applied to all models, thus ensuring that time at risk for mental disorders varied for each person according to their follow up period or time at risk. Unadjusted relative rates (RRs) were calculated for each disorder for pre and post periods using generalized estimating equation models (GEE). GEE was used to account for correlated observations. [35-37] Poisson or negative binomial distributions were used depending on model fit. Models with the smallest QIC statistics were used. Second, adjusted relative rates (ARR) were calculated for each mental disorder both 5 years before and after bereavement (post-index date vs. pre-index date). Each model was adjusted for age (<=50 years, >=51 years), and sex (male, female). Time (pre/post) by case (case/match) interaction terms were calculated to see if there were differences in rate changes from the pre to post period between cases and matches. To account for the non-independent nature of cases and matches in this study design, a variable was created to represent grouped cases and associated matches as a means to test the assumption of independence of observation. Statistical analyses were run with both variables and results were virtually identical, therefore this statistical assumption was considered met.

5.4 Results

From Table 5-1, the average age of spousal death was approximately 50 years of age, the median age of marriage was 22 years, and the majority of bereaved individuals were women. The majority lived in the Province's most populated city. Table 5-2 presents the unadjusted relative rates for mental disorders both 5 years before and 5 years after bereavement as compared to non-bereaved spouses. Prior to bereavement, suicide bereaved spouses compared to matched control, had increased risk of physician diagnosed depression (RR=1.89; 95% CI=1.54-2.30, P<.0001), physician diagnosed anxiety (RR=1.39; 95% CI=1.16-1.66, P<.001), physician

diagnosed substance use disorder (RR=2.41; 95% CI=1.55-3.75, P<.0001), and physician diagnosed any mental disorder (RR=1.46; 95% CI=1.28-1.67, P<.0001). Following bereavement, unadjusted relative rates of all physician diagnosed mental disorders were significantly greater than matched controls. Table 5-3 displays results for the final model, which have been adjusted for age and sex. Rates of all disorders were significantly higher in the suicide cohort both before and after bereavement. Time by case interaction term P values are presented as well as pre and post bereavement adjusted rates. Significant interactions signify that the rate change for depression, anxiety and any mental disorder from the pre and post period was significantly different between cases and matches. In other words, changes in depression, anxiety and any mental disorder rates were greater for bereaved spouses than non-bereaved matches (P<0.0001, P=.0305, P<.0001). In both cases and control groups, women were more likely to be diagnosed with depression, anxiety, and any mental disorder over the study period (not presented in tables). Older individuals were more likely to experience anxiety, and less likely to experience substance use disorder (not presented in tables).

5.5 Discussion

The current study provides important findings on physician diagnosed mental disorders both 5 years prior to and following spousal suicide bereavement in the general population. The study findings show the health effects of suicide on the living survivors and reveal the time before and after suicide bereavement as periods of vulnerability and potential opportunities for intervention. Our main finding is that spouses bereaved by suicide experience greater rates of physician-diagnosed depression, anxiety, substance use disorder and any mental disorder both prior to and following suicide bereavement. These findings reflect the elevated mental disorder

incident rate ratios found by Erlangsen et al, and in tandem provide a stronger argument that spouses bereaved by suicide require follow-up by care providers. While suicide bereaved spouses had higher rates of disorders prior to bereavement, significant time by group interactions suggest that absolute rate change for depression, anxiety and any mental disorder were greater among bereaved spouses (19.3, 6.44, 15.55) than non-bereaved controls (0.98, -1.16, -0.53) over time. Unfortunately, small sample sizes for suicide attempt prohibited investigation into this outcome as a consequence of suicide bereavement. Adjusted rates suggest that suicide bereavement is a time of vulnerability to all mental disorders investigated, most notably with individuals experiencing nearly 3 times the rate of physician diagnosed depression after bereavement. While elevated rates for mental disorders were present, these rates may underrepresent these disorders due to the associated stigma and shame, which may influence help seeking to medical providers. [38] Given the traumatic and stigmatized nature of suicide death, there is a possibility that reduced help seeking and social isolation may have affected rates.

While the study utilized area-based income quintiles with equal income representation, it remains unclear as to what occurred at the individual level. For spouses that occupied the lowest income quintiles, there is a likelihood that income may have dropped following the death of their marital partner. As poor health has been associated with low socioeconomic status, we can only speculate that this group may be at greater risk for poor health following the death of their spouse. That being said, as more than 90% of individuals that die by suicide have a diagnosable mental disorder [39], spouses may have experienced caregiver stress and related mental disorders, such as depression prior to the suicide of their spouse. The caregiving effect has been proposed as a way to understand the chronic stress that a caregiver experiences, and our population rates

prior to bereavement support this idea. [40-42] While suicide may have been sudden it may not have been a random event, and in fact may have been preceded by periods of poor mental health and suicide attempts on behalf of the deceased. In this case, the health of the deceased may have impacted caregiver mental health prior to the suicide. This fact presents a unique opportunity for intervention, in that individuals are at increased risk for poor mental health before the suicide. Inquiring about spousal health may help clinicians identify and prevent subsequent poor health in these individuals.

Nevertheless, several limitations may have influenced our findings. First, study outcomes were dependent on treatment seeking, and as such do not represent all cases of mental disorders in this population. While examining mental health disorders using administrative data has tremendous advantages due to it's ability to examine a large sample of suicide bereaved individuals, despite suicide being a relatively rare event, measures of mental and physical disorders only represent individuals that sought or received care from a care provider or who were hospitalized for a related event. [43]As a result, these data may underestimate actual mental disorders. Second, data are limited to individuals who are legally married and have registered their marriage. Individuals that are living in common law unions, or that are legally married but have not registered their marriage would not be included in this health indicator, potentially underestimating the number of individuals who have experienced spousal suicide in our population. Findings from this study are therefore generalizable only to married individuals that registered their marriages. While marital status has limited sensitivity, it has excellent specificity, which ensures that only married individuals were included in this study. An additional limitation includes the inclusion of accidental poisonings in our measure of suicide death. Due to the fact

that suicide deaths derived from administrative data are highly specific at identifying confirmed suicides, they may not be sensitive, and underreporting may occur. In this context, a weakness of using suicide as a marker of suicide bereavement is that data are dependent on the accuracy of Vital Statistics and medical examiner reports. [43]For this reason, accidental poisonings were included to help offset the underreporting of suicides that has been thought to occur when using administrative data. While it is recognized that accidental poisonings may not always imply suicide death, selected poisoning codes were used where it was expected that poisonings were intentional, as reflected in previous research. [44] A third limitation is that individual level measures of income were not used because they were not available. [45] As such, area level income was used as approximate measures of socioeconomic status. Fourth, although administrative data poses many advantages in the study of suicide bereavement outcomes, it cannot assess complicated grief or other emotional responses to suicide bereavement that are tremendously important. Suicide bereavement has been associated with stigma and shame, and these factors cannot be assessed using administrative data. A final limitation involves the comparison of suicide-bereaved spouses to matched non-bereaved spouses. While a strength of this study is that bereaved spouses were matched to other spouses from the general population allowing comparability to a similar age, sex, region and income demographic, a weakness is that some uncertainty exists about whether findings reflect the impact of bereavement in general, or bereavement specific to suicide deaths as spouses were only compared to the non-bereaved.

In summary, suicide bereavement has an impact on the surviving spouse and has been associated with subsequent risk for mental disorders. Spousal bereavement has been noted as one of the most traumatic life events experienced, and one can suspect that spousal suicide

bereavement results in even further disruption and trauma. Health care providers must be made aware of the health consequences of spousal suicide bereavement and consider supports that can identify and facilitate the care of these individuals in the pre and post-bereavement periods. Future prospective studies are necessary to measure factors such as stigma and it's relationship with help seeking and to determine the degree of underestimation present when using administrative data to examine suicide bereavement related health. Finally, suicide prevention efforts are needed that will prevent suicide and ultimately prevent suicide bereavement and it's associated outcomes.

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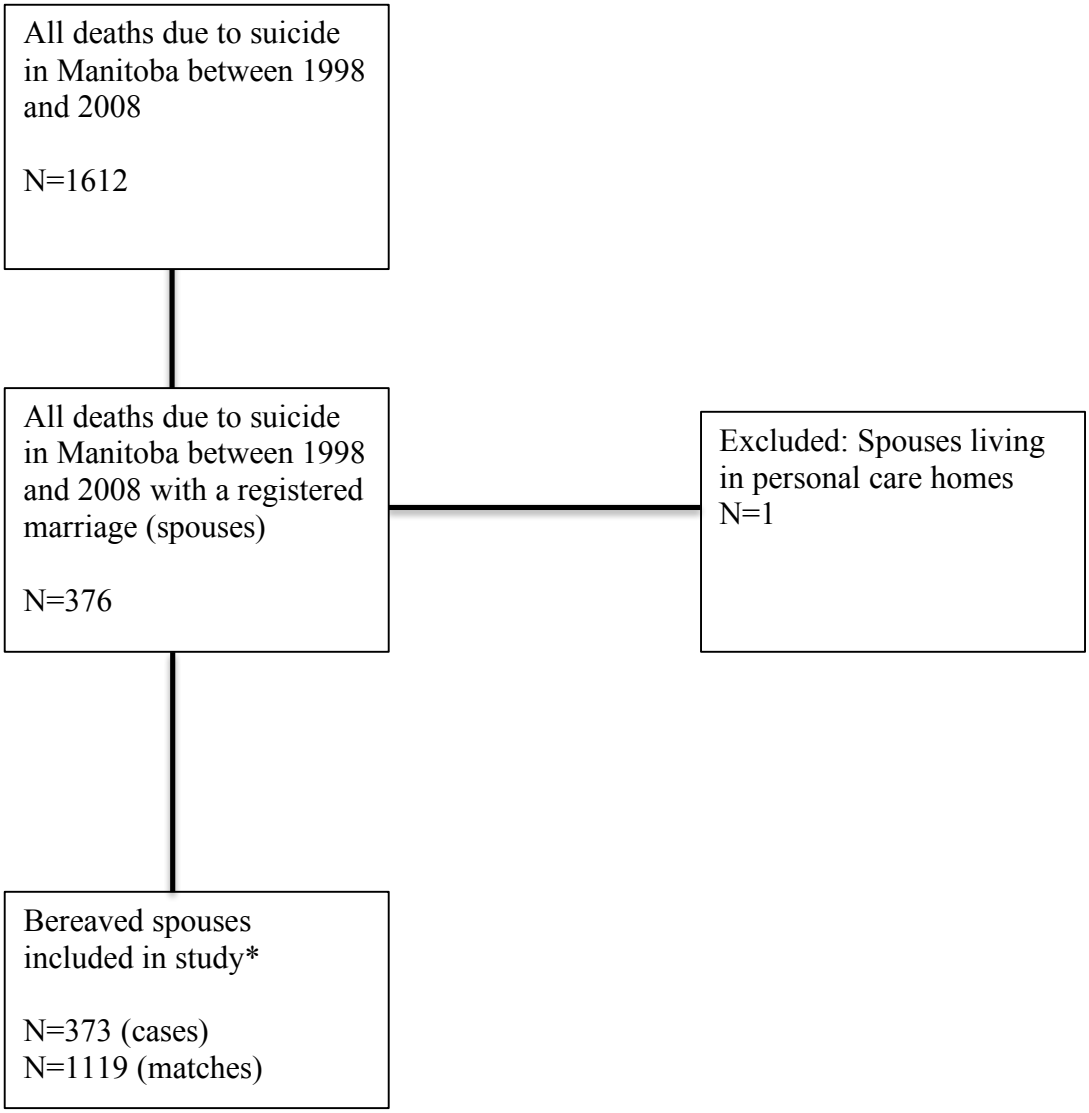
Figure 5-1: Cohort formation



*successfully matched on age at bereavement (+/- 5 years), health authority region (11 categories), sex (male or female), and income quintile.

Table 5-1: Study cohort characteristics

Characteristic	Spouses bereaved by suicide death (n=373)	Non-Bereaved Controls (n=1119)
	n(%)	n(%)
Age at bereavement		
Mean (SD)	53.16 (14.1)	51.49 (13.7)
Median	51.0	50.00
<=35	43(11.5)	129 (11.5)
36-45	94 (25.2)	281 (25.1)
46-55	111 (29.8)	313 (28.0)
56-65	60 (16.1)	199 (17.8)
66-75	42 (11.3)	130 (11.6)
76-85	22 (5.9)	61 (5.5)
86+	ss	6 (0.5)
Years married		
Mean (SD)	19.85 (9.9)	22.24 (11.8)
Median	22.0	22.0
Sex		
Male	79 (21.2)	237 (21.2)
Female	294 (78.8)	882 (78.8)
Income at time of spouses death (index date)		
Lowest quintile	71 (19.0)	213 (19.0)
Second lowest quintile	65 (17.4)	195 (17.4)
Middle quintile	82 (22.0)	246 (22.0)
Second highest quintile	79 (21.2)	237 (21.2)
Highest quintile	76 (20.4)	228 (20.4)
Region		
South Eastman	15 (4.0)	45 (4.0)
Central	35 (9.4)	105 (9.4)
Assiniboine	31 (8.3)	93 (8.3)
Brandon	12 (3.2)	36 (3.2)
Winnipeg City	186 (49.9)	558 (49.9)
Interlake	22 (5.9)	66 (5.9)
North Eastman	28 (7.5)	84 (7.5)
Parkland	15 (4.0)	45 (4.0)
Churchill	ss	ss
Nor-Man	ss	15 (1.3)
Burntwood	24 (6.4)	72 (6.4)

ss-suppressed due to cell size of 5 or less.

Table 5-2. Mental disorders and hospitalizations for suicide among bereaved spouses (n=373) compared to non-bereaved spouses (n=1119), before and after death of spouse/index date

Outcomes	5-Year Prevalence Prior to Death (Cases) n (%)	5-Year Prevalence Prior to Death (Matches) n (%)	Pre-bereavement Relative Rate (95% Confidence Interval)	5-Year Prevalence After Death (Cases) n (%)	5-Year Prevalence After Death (Matches) n (%)	Post-bereavement Relative Rate (95% Confidence Interval)
Mental disorders						
Depression	116 (31.10)	208 (18.59)	1.89 (1.56-2.30)***	188 (50.40)	219 (19.57)	2.91 (2.48-3.41)***
Anxiety	125 (33.51)	310 (27.70)	1.37 (1.14-1.63)***	149 (39.95)	297 (26.54)	1.70 (1.45-2.00)***
Substance use disorder	32 (8.58)	46 (4.11)	2.36 (1.52-3.66)***	38 (10.19)	50 (4.47)	2.58 (1.71-3.88)***
Suicide Attempt	ss	ss	ss	ss	ss	ss
Any mental disorder	187 (50.13)	438 (39.14)	1.28 (1.13-1.45)***	245 (65.68)	432 (38.61)	1.70 (1.53-1.89)***

*p<0.05; **p<.01,***p<0.001

GEE used in RR calculation.
ss- cell size less than 5. Data suppressed.
Any mental disorder comprised of depression, anxiety and any substance use disorder.

Table 5-3. Before (5 years prior spouses death) and after bereavement (5 years after spouses death) rate comparisons of suicide death bereaved spouses and non-bereaved spouses controls

Outcomes	5 Year Pre-Bereavement Adjusted Relative Rate	Time X Group Interaction (P-value)	5 Year Post-Bereavement Adjusted Relative Rate
Mental disorders			
Depression	1.89 (1.54-2.30)***	<.0001	2.93 (2.50-3.43)***
Anxiety	1.39 (1.16-1.66)***	.0305	1.73 (1.48-2.03)***
Substance Use Disorder	2.41 (1.55-3.75)***	0.7341	2.63 (1.75-3.95)***
Suicide Attempt	ss	ss	ss
Any mental disorder	1.46 (1.28-1.67)***	<.0001	1.95 (1.75-2.16)***

*p<0.05; **p<0.01; ***p<0.001

[1]Model covariates: Time period (pre/post), group (case/match), sex (female/male), age (<=35, 36-45, 46-55, 56-65, 66+). GEE used in ARR calculation.

ss- cell size less than 5. Data suppressed.

Any mental disorder comprised of depression, anxiety and any substance use disorder.

CHAPTER 6: SPOUSES BEREAVED BY SUDDEN NATURAL DEATH: A POPULATION-BASED LONGITUDINAL STUDY OF MENTAL HEALTH OUTCOMES

6.0 Chapter overview

This manuscript is an investigation of rates of mental disorders among spouses bereaved by sudden natural death. The cohort of comparison in this study is non-bereaved matched spouses. The importance of this study is that it highlights elevated rates of mental disorders surrounding the time of bereavement, suggesting spouses bereaved by sudden natural death may benefit from intervention. This chapter investigates spouses bereaved by sudden natural death in order to more completely understand the cohort that will be used as a comparison to suicide-bereaved spouses in Chapter 8. Investigating predictors of poor health in the pre-bereavement period may be an important area of consideration for future research.

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6.1 Abstract

Objective: To examine mental disorders among spouses in the general population who experienced the sudden natural death of their spouse. Married spouses whose spouse died from sudden natural death between 1998 and 2008 (n=7988) were matched 1:3 to control spouses (21,563) who were not bereaved during the study period. Adjusted relative rates of physician diagnosed mental disorders 5 years before and after bereavement were generated by generalized estimating equation models and adjusted for age and sex. Time by group interaction terms were used to examine differences in disorder rates between cases and matches over time. Results: Bereaved spouses had greater rates of diagnosed depression, anxiety, substance use disorder, suicide attempt and any mental disorder compared to matches prior to bereavement. Following bereavement, bereaved spouses had greater rates of depression (ARR=2.42; 95% CI=2.32-2.54; P<0.001), anxiety (ARR=1.33; 95% CI=1.28-1.39; P<0.001), substance use (ARR=1.75; 95% CI=1.51-2.03; P<0.001), and any mental disorder (ARR=1.63; 95% CI=1.58-1.68; P<0.001), as compared to non-bereaved matches. Depression and any mental disorder rate changes were greater for bereaved spouses (16.14% and 5.52%, respectively) compared with non-bereaved spouses (1.25%, and 1.22%, respectively) (P<0.001). Conclusion: Sudden natural death bereavement is associated with poor mental health outcomes. Due to elevated rates of poor mental health surrounding the time of bereavement, spouses bereaved by sudden natural death may benefit from interventions aimed at the time of bereavement, with future work investigating predictors of poor health in the pre-bereavement period.

6.2 Background

Spousal death is one of the most traumatic common life events experienced. Widowhood is traumatic for many reasons, largely due to the social, physical, cognitive and spiritual effect on the bereaved. [1-4] In 2015, there were over 1.83 million widowed individuals in Canada[5], and nearly 1.5 million spouses became bereaved in the United States in 2009 alone. [3,4,6-8]While spousal bereavement later in life may be considered a normative life event, the negative effects on health and well-being are well documented. [3,9-12] Sudden death bereavement, due to its unexpected nature, has been associated with complicated grief and disorders such as major depressive disorder. [1] In a population-based cohort study examining hospitalization and specialized psychiatric care, Moller et al found that spousal bereavement increased the risk for overall outpatient psychiatric visits and prescription of psychotropic medications. [13] While Moller's study supports the idea that widowed individuals are at risk for mental disorders, outpatient visits to primary care physicians were not included, therefore the true impact of bereavement on mental health services may be underestimated. While research largely supports health consequences associated with spousal bereavement, the literature has been limited for a number of reasons: reliance on cross-sectional studies, longitudinal designs with few time points, young age of widowers, and limited ability to examine bereavement related health in the context of mental health history. [4,15] It remains unclear whether an individual's mental health history prior to bereavement impacts their mental health following spousal bereavement. Given the large number of widowers and that unexpected spousal death is one of the most frequently reported traumatic life experiences, understanding associated mental health outcomes has significant public health implications. [18]

The present study utilizes a matched longitudinal population-based sample of spouses who have experienced the sudden natural death of their marital partner to examine bereavement associated mental disorders. There were two study objectives. The first was to investigate the rate of mental disorders experienced both before and after the sudden natural death of a spouse. The second objective was to examine mental disorders while controlling for the effects of age and sex, and including time by group interactions to assess differences in rate changes over time between cases and matched controls. By examining spouses bereaved by sudden natural death in a population based sample, comparing them to matched spousal controls, using a time by group interaction to account for pre-bereavement disorder rates, and adjusting for age and sex, the current study builds on previous studies and provides understanding for the role of pre-bereavement health in the experience of spousal bereavement associated mental disorders.

6.3 Methods

6.3.1 Data Sources

University of Manitoba research ethics board approval was obtained for this study. Data for this study come from the Manitoba Population Research Data Repository, which is housed at the Manitoba Centre for Health Policy (MCHP). The Repository contains de-identified health information that is linkable between multiple datasets for the 1.2 million individual residents of the province of Manitoba, Canada. [19,20] Datasets used in this study included physician claims, hospital discharge abstracts, the population registry, and vital statistics. Vital statistics data contain information on cause of death, and is determined by medical examiners. At MCHP, vital statistics are incorporated into the registry annually by Manitoba Health [21] giving high confidence concerning the accuracy of data sources. Individual-level data containing scrambled

Personal Health Information Number (PHIN) enable data linkage across the datasets. This linkage enables a longitudinal record of health diagnoses and health care use for virtually all persons in the province of Manitoba. The linkage allowed the examination of cause of death (Vital Statistics Data), marital status (Population Registry), income quintile (Statistics Canada Census Data), sex (Population Registry), and region (Population Registry), which are necessary in order to create the detailed longitudinal history of social and health information for bereaved spouses and their deceased partners.

6.3.2 Cohort Formation

The cohorts of interest in this study are a) spouses of individuals who died a sudden natural death, and b) non-bereaved spousal controls. In this study, cause of sudden natural death was defined as a death that was not injury related and occurred in an otherwise unpredictable manner, and included myocardial infarction (MI), cardiac death, stroke, or aneurysm (Appendix 6-A). Marital status is contained in the Manitoba Health Registry Data, and is available for spouses with a common family registration number. Adults are classified as married, single, and widowed. [22] Non-bereaved spouses were married at the start of the study period, and their spouse was alive at the end of the study period. For the non-bereaved spousal cohort, the date of death in the matched bereaved cohort was used as the index date for before and after death comparisons. Individuals with multiple marriages over the 10-year period were excluded from the study. This exclusion prevented the possibility that remarriage would influence subsequent health. Vital Statistics data were used to identify spouses who died by sudden natural death between January 1,1998 and December 31, 2008. There were 7988 individuals who had a spouse die by sudden natural death with a registered marital partner (Figure 6-1). Matching criteria included age at

bereavement (+/- 5 years), health authority region (11 categories), sex (male or female), and income quintile. Income was derived from Census data and reflects the average household income in the area in which the spouse lived. This measure has been highly correlated with individual family income.[23] Average household income was divided into 5 quintiles, with the lowest quintile representing 20% of the population with the lowest average household income. Methods of identifying income quintile were used for individuals living in rural and urban environments.[24] The lowest income quintile was used as the outcome of interest, with the remaining quintiles (2 through 5) creating the reference or comparison group.

6.3.3 Mental Health Outcomes

ICD-9-CM and ICD-10-CA codes were used to identify the presence or absence of mental disorder as well as rates of mental disorders (Appendix 6-A). Mental disorder definitions have been validated in other studies and were used due to their potential association with bereavement related stress. [25,26] The following mental disorders were included in this study: depression, anxiety, substance use disorder and suicide attempts (including accidental poisonings).[26] In addition, an 'any mental disorder' variable was created to include individuals who had any one of the previously mentioned disorders. A 10-year total bereavement period was used. Pre-bereavement disorders for the 5 years prior to the sudden death (from 1993) were examined, as well as a minimum of 5-year follow up from 2008 (until 2013). Five-year bereavement periods have been used in the past in the study of spousal bereavement.[27] Disorders were identified based on physician generated diagnoses from both outpatient physician visits and hospitalizations. Hospitalizations are based on spending more than one day in hospital.

Diagnoses were treated as dichotomous variables (yes/no), and were based on a spouse receiving a diagnosis of the disorder at least once during the study period.

6.3.4 Social Factors

Age at bereavement and sex were used as social factors in this study. Age at bereavement was dichotomized based on median age of the bereaved cohort (median age=73)
Lower age (age<=73) and male sex were used as the reference groups.

6.3.5 Statistical Analyses

SAS version 9.4 was used for all analyses. Cross-tabulations and chi-square tests were used to examine the social and demographic factors for both cases and controls. Because some bereaved individuals died before the end of the study period, some individuals did not have the same amount of follow up time post-spousal death. An offset using the log of person years was calculated and applied to all models to ensure time at risk for mental disorders varied for each person according to their follow up period or time at risk. Unadjusted relative rates (RR) were calculated for each disorder using generalized estimating equations (GEE) to account for correlated observations. Poisson distributions were used. Second, multivariate models were run using each mental disorder as the outcome. Adjusted relative rates (ARR) were calculated. Each model included bereavement period (pre, post), group (case, match), age (<=73 years, >=74 years), and sex (male, female). A time by group interaction term was also calculated to see if significant rate differences existed from the pre to post period for each disorder between cases and matches.

6.4 Results

Cohort characteristics are presented in Table 6-1. The majority of the sample was bereaved at an older age, 73 years and older. The median duration of marriage for spouses were between 30 years (cases) and 35 years (matches), and 75% of the bereaved spouses were female. Table 6-2 presents unadjusted rates of experiencing each of the mental disorders in the 5 years before and 5 years after the death of their spouse/index date. Bereaved spouses experienced greater rates of depression, anxiety, substance use disorder, and any mental disorder as compared to their non-bereaved matches, both before and after bereavement. Spouses also had higher rates for suicide attempt prior to bereavement but not after. Following bereavement, individuals' rates for physician diagnosed depression were almost two and a half times greater (RR=2.45; 95% CI=2.34-2.56, P<.0001), and were over 1.3 times greater for anxiety (RR=1.34; 95% CI=1.28-1.40, P<.0001). Rates for substance abuse (RR=1.71; 95% CI=1.48-1.98; P<.0001) and any mental disorder were also elevated (RR=1.64; 95% CI=1.59-1.69; P<.0001). Table 6-3 displays age and sex ARR for the pre and post periods and time by group interaction term significance values. ARR were significant for all outcomes in the pre-bereavement period, and all outcomes with the exception of suicide attempt in the post period, signifying that bereaved spouses had elevated rates of diagnosed mental disorders when compared to non-bereaved spouses. While some rates were significantly higher for time periods, the difference between cases and matches became more prominent after bereavement. The time by group interactions demonstrate bereaved spouses had a significantly higher absolute increase in depression from pre- to post-bereavement periods (16%) compared to the increase observed in matches (1%). (P<0.001). While both cases and matched controls had elevated rates of diagnosed mental disorder, cases had an absolute increase of 6% as compared to an increase of 1% in matched controls (P<0.001). Overall study

period rates of mental disorders for males and females are presented in Figure 6-2. Both bereaved and non-bereaved females have greater rates of depression, anxiety and any mental disorder overall.

6.5 Discussion

This study examined the mental health consequences associated with the sudden natural death of a spouse. Findings reveal that overall spouses bereaved by sudden natural death have substantially poorer mental health when compared to matched non-bereaved spouses, suggesting opportunities for interventions targeting this vulnerable group. Findings are consistent with previous literature on widowhood as a time of poor health. [18] When examining rates of depression, anxiety, substance use disorder, suicide attempt and any mental disorder, cases had significantly higher pre-bereavement rates as compared to controls. This striking pre-event morbidity suggests a complex relationship between the health of spouses, perhaps reflecting shared environmental factors that contribute to poor health, or possible assortative mating. Nevertheless, interaction analyses showed that this higher morbidity among spouses who are soon to be bereaved does not fully account for the higher rates of mental disorders they experience after the death of their spouse. Care providers should be aware of these health needs and could potentially offer intervention around the time of the death of their spouse. While sudden natural death occurs without warning, if the deceased spouse experienced poor health prior to their death, it may result in more caregiver distress and deterioration for the survivor. The caregiving effect has been noted in other studies [28], supporting the idea that poor health among spouses may be a gateway to intervention.

After adjusting for age and sex, bereaved spouses rates of physician-diagnosed depression were still almost 2.5 times higher than non-bereaved spouses, demonstrating the detrimental effect of a sudden death on the surviving spouse. Similar findings have previously been found with respect to mood and anxiety disorders. [3] In this study, individuals were older in age and married for approximately 30 years, which helps provide context for the notable change of lifestyle and impact of bereavement on health. The poor health outcomes found in this study are not surprising given older individuals experience a decline in physical and social resources as they age, increasing the risk for poor adaptation to bereavement. [2,14] Based on these findings, health care providers who are involved in the management of patients experiencing sudden death can play a role in alerting patients to increased risks of depression following bereavement and provide them with information on support services or follow-up.

This study is unique in that 29,551 individuals were followed for a 10-year period, allowing the longitudinal examination of physician-diagnosed health between bereaved spouses and non-bereaved controls using a matched population-based sample. Outpatient visits were used, providing an important addition to the literature, as primary care physicians are often the first point of contact for health care. While suicide attempts were not significant for the post death period, the relatively high rates prior to the death suggests other markers of poor health may explain this increased risk including other mental and physical disorders, and sociodemographic factors including low income. Income quintile is a marker of socioeconomic status, which has been correlated with overall health. [29,30]

The findings from this research also highlight that while bereaved spouses appear to exhibit poorer mental health, in both cases and matches females had higher rates of depression and anxiety, as compared to males (Figure 6-2). These findings reflect what we would expect from the general population [31,32]. As expected, males in this study had greater rates of substance use disorder.[33] Of concern is the relatively high rate of suicide attempts among cases prior to bereavement. While over 75% of cases in this study were female, the trend was for males to be more likely to have attempted suicide prior to the death of their spouse. This finding reflects the literature that males have greater rates of death by suicide as compared to women. [34] Follow up for male widows is needed, as they are likely a vulnerable group for poor health.

Findings from this study should be interpreted with consideration for the following limitations. First, physician diagnosed mental disorders originated from physician billing claims and hospitalizations and are therefore dependent on treatment seeking. As such, if some individuals did not seek help from their health care provider they would not be represented. While it could be expected that both bereaved and non-bereaved individuals were affected by this limitation equally, it may be that bereaved spouses may be less likely to seek help if they are going through a period of mourning or social isolation. Therefore, rates of disorders among bereaved spouses may be underrepresented. Second, these are physician billing derived diagnoses, and not derived from a structured interview. While appropriate for comparison of changes in rates between groups over time and as estimates of rates of mental disorders, it is not advisable to use these as actual rates of these disorders. A strength of this study is that because claims and hospitalization data are used, measures of health are not subject to recall bias, and as such are an accurate representation of contact with health care providers. An additional limitation

of this study is that data are limited to individuals who are legally married and have registered their marriage. As a result, individuals that are living in common law unions, or that are legally married but have not registered their marriage would not be included in this study, potentially underestimating the number of individuals who have experienced spousal bereavement. It may be that a cohort effect is present where individuals that have registered their marriages are different than ones that have not, thus findings from the current study are generalizable only to married individuals that have registered their marriages. Also, individuals that were bereaved and then re-married were not included in this study, as re-marriage may impact the survivor's health. Data directly measuring individual income was not available therefore matching on this variable was based on neighbourhood residence. An additional limitation involves the lack of information on spousal harmony [35] and interpersonal factors such as attachment style [36], which has been shown to impact the bereavement process. A final limitation is that bereaved spouses were compared to matched non-bereaved spouses. A strength of this comparison is that by comparing to the general population, the effect of bereavement was examined as compared to a non-bereaved group. The weakness of this comparison is that uncertainty remains regarding whether study findings reflect the impact of general bereavement, or bereavement specific to sudden natural deaths.

The present study provides important health information related to spousal bereavement caused by sudden natural death. Using a longitudinal population-based sample matched on age, sex, income, region, as well as data based on physician diagnoses, the study addresses limitations of previous work. Findings highlight the need for interventions for widows and widowers both prior to and following the loss of their spouse. While widowhood may be considered a normative

event, survivors may be vulnerable to poor mental health and as such are in need of specialized care and post bereavement follow up. Future research should examine predictors of poor health in the pre-bereavement period including the deceased's health in order to determine if poor health rates prior to bereavement can be explained by caregiving distress. Future work should also examine the role of the survivor's pre-bereavement physical health in an effort to explore how it might influence an older spouse's ability to deal with the trauma of losing a spouse.

6.6 References

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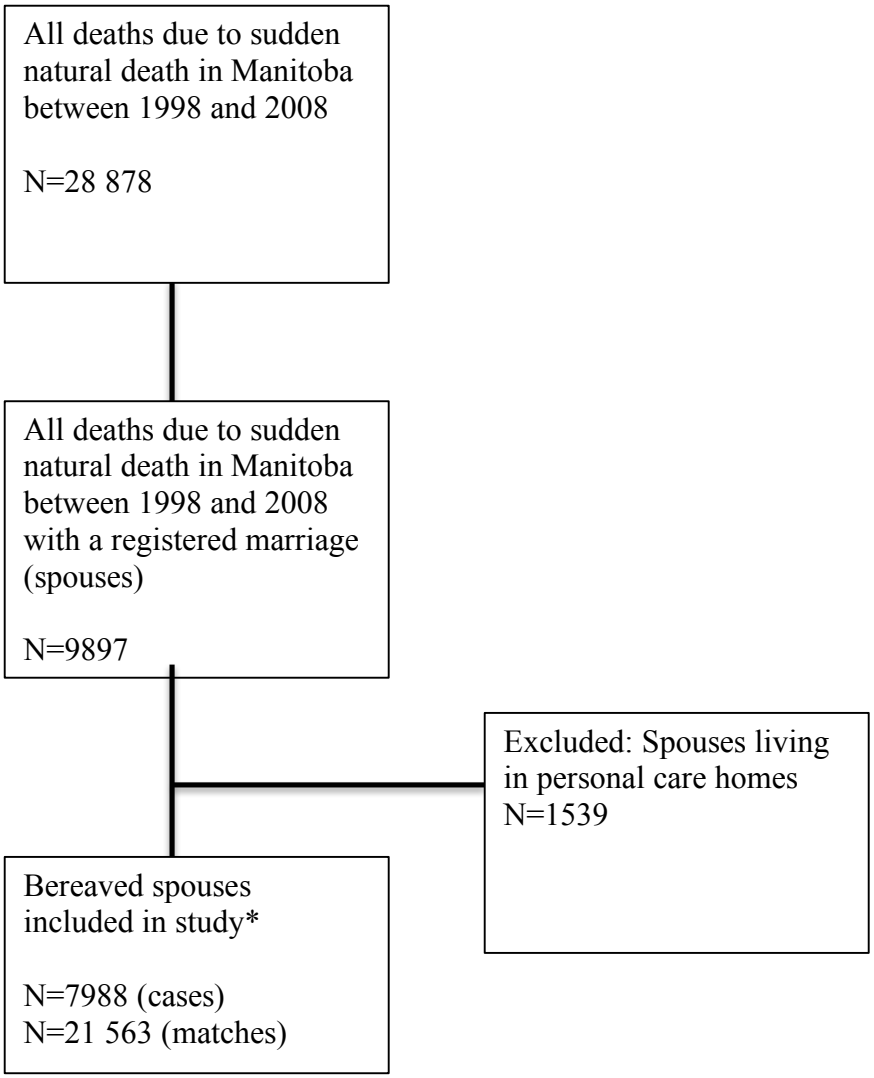
Figure 6-1: Cohort formation



*successfully matched on age at bereavement (+/- 5 years), health authority region (11 categories), sex (male or female), and income quintile.

Figure 6-2: Mental disorder rates for all spouses over study period, by sex.

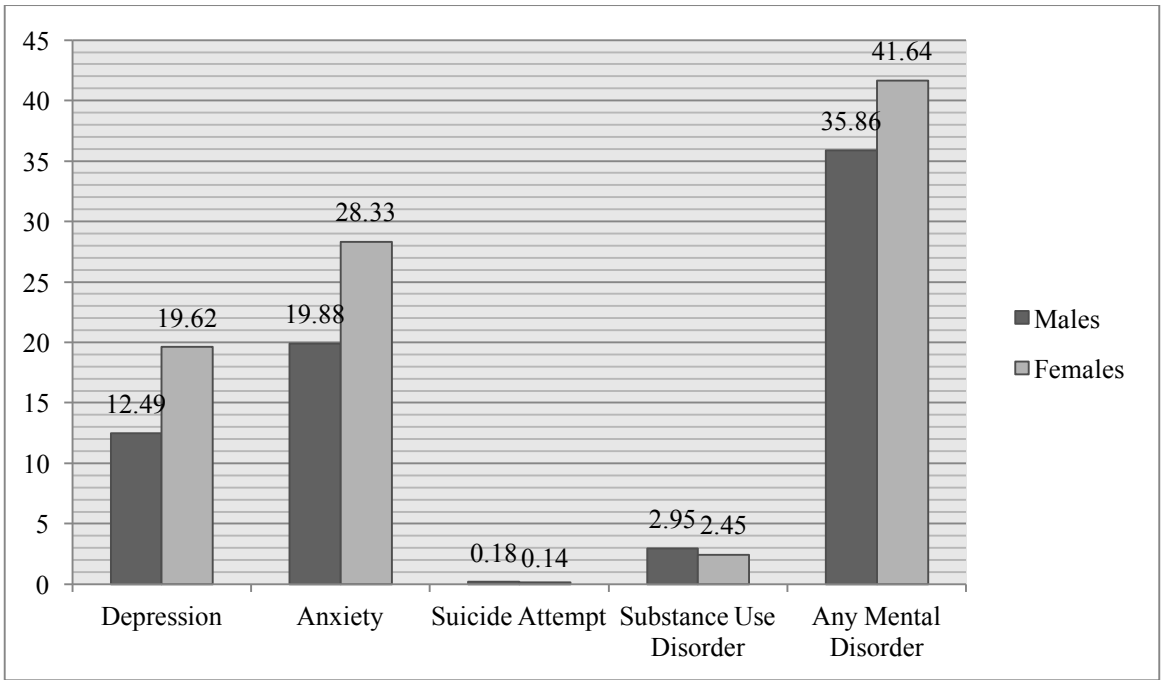


Table 6-1: Cohort characteristics

Characteristic	Spouses bereaved by sudden natural death (n=7988)	Non-bereaved controls (n=21 563)
	n(%)	n(%)
Age at bereavement		
Mean (SD)	71.10 (11.4)	69.98 (11.3)
Median	73.0	72.0
<=35	26(0.3)	85(0.4)
36-45	180(2.3)	573(2.7)
46-55	663(8.3)	1976(9.2)
56-65	1351(16.9)	3992(18.5)
66-75	2524(31.6)	7117(33.0)
76-85	2729(34.2)	6781(31.5)
86+	515(6.5)	1039 (4.8)
Years married		
Mean (SD)	27.40 (6.3)	31.94 (9.1)
Median	30.00	35.00
Sex		
Male	1992 (24.9)	5572 (25.8)
Female	5996 (75.1)	15991 (74.2)
Income at time of spouses death (index date)		
Lowest quintile+	1551 (19.4)	4113 (19.1)
Second lowest quintile	1843 (23.1)	4954 (23.0)
Middle quintile	1861 (23.3)	5027 (23.2)
Second highest quintile	1539 (19.3)	4206 (19.5)
Highest quintile	1179 (14.8)	3257 (15.1)
Not Found	15 (0.2)	36 (0.2)

Region		
South Eastman	328 (4.1)	890 (4.1)
Central	727 (9.1)	1960 (9.1)
Assiniboine	753 (9.4)	1985 (9.2)
Brandon	320 (4.0)	860 (4.0)
Winnipeg City	4188 (52.4)	11 376 (52.8)
Interlake	661 (8.3)	1786 (8.3)
North Eastman	296 (3.7)	804 (3.7)
Parkland	461 (5.8)	1218 (5.7)
Churchill	ss	11 (0.1)
Nor-Man	110 (1.4)	290 (1.3)
Burntwood	140 (1.8)	383 (1.8)

Table 6-2: Mental disorders and hospitalizations for suicide attempts among bereaved spouses (n=7988) compared to non-bereaved spouses (n=21 563), before and after death of spouse/index date

Outcomes	5-Year Prevalence Prior to Death n (%)	5-Year Prevalence Prior to Death (Matches) n (%)	Pre-index date Relative Rate (95% Confidence Interval)	5-Year Prevalence After Death n (%)	5-Year Prevalence After Death (Matches) n (%)	Post-index date Relative Rate (95% Confidence Interval)
Mental disorders						
Depression	1363 (17.06)	3115 (14.45)	1.37 (1.29-1.45)***	2652 (33.20)	3386 (15.7)	2.45 (2.34-2.56)***
Anxiety	2320 (29.04)	5221 (24.21)	1.39 (1.33-1.45)***	2378 (29.77)	5548 (25.73)	1.34 (1.28-1.40)***
Substance use disorder	264 (3.30)	504 (2.34)	1.64 (1.41-1.90)***	267 (3.34)	487 (2.26)	1.71 (1.48-1.98)***
Suicide Attempt	19 (0.24)	18 (.08)	3.30 (1.73-6.28)***	18 (0.23)	34 (0.16)	1.65 (0.93-2.93)
Any mental disorder	3067 (38.4)	6986 (32.4)	1.37 (1.32-1.42)***	7017 (43.92)	14 500 (33.62)	1.64 (1.59-1.69)***

*p<0.05; **p<.01, ***p<0.001.
GEE used.
Any mental disorder comprised of depression, anxiety and any substance use disorder.

Table 6-3: Pre- (5 years prior spouses death) and post-bereavement (5 years after spouses death) adjusted relative rate comparisons of mental disorders among sudden death bereaved spouses (n=7988) and non-bereaved spouses controls (n=21 563[a]).

Outcomes	5 year Pre-index date adjusted relative rate comparing bereaved spouses to matched controls (95% confidence interval)	Time X Group Interaction (P-value)	5 year Post- index date adjusted relative rate comparing bereaved spouses to matched controls (95% confidence interval)
Mental disorders			
Depression	1.35 (1.28-1.44)***	<.0001	2.42 (2.32-2.54)***
Anxiety	1.38 (1.32-1.44)***	0.1530	1.33 (1.28-1.39)***
Substance Use Disorder	1.67 (1.45-1.94)***	0.6280	1.75 (1.51-2.03)***
Suicide Attempt	3.31 (1.74-6.31)***	0.1150	1.66 (0.94-2.95)
Any mental disorder	1.36 (1.32-1.41)***	<.0001	1.63 (1.58-1.68)***

*p<0.05; **p<0.01; ***p<0.001

[1]Model covariates: Period (pre/post), group (case/match), sex (male/female), age (<=73 years/ >=74 years)

[a] 17 matches had a follow up period of less than one year, therefore the log could not be calculated for the offset. These individuals were not included in this analysis.

Appendix 6-A. ICD-9-CM and ICD-10-CA codes

Sudden natural death codes	(ICD-9-CM code 410; ICD-10-CA code I21. Cardiac Death (includes MI)-ICD-9-CM codes of 390-398, 402, 404-429, and 745-746. (ICD-10-CA codes I00-I09, I11, I13, and I20-I51) Stroke Death- (ICD-9-CM codes 431, 434, 436; ICD-10-CA codes I61, I63, I64). Cerebral Aneurysm Death-(ICD-9-CM codes 437.3; ICD-10-CA codes I67.1).
Mental disorder codes	Depression (ICD-9-CM: 296.2-296.3, 296.5, 300.4, 309, 311; ICD-10-CA: F31.3-F31.5, F32, F33, F341, F380, F381, F432, F438, F530), anxiety (ICD-9-CM: 300.0, 300.2, 300.3; ICD-10-CA: F40, F41.0, F41.1, F41.3, F41.8, F41.9, F42, F431), substance use disorder (ICD-9-CM: 291, 292, 303, 304, 305; ICD-10-CA: F10-F19, F55), and suicide attempts (including accidental poisonings) (ICD-9-CM: E850-E854, E858, E862, E868, E950- E959; ICD-10-CA: X40-X42, X46-X47, X60-X84,Y10-Y12, Y16, Y17, Y870).

CHAPTER 7: SPOUSES BEREAVED BY SUDDEN UNINTENTIONAL INJURY: A POPULATION-BASED LONGITUDINAL INVESTIGATION OF BEREAVEMENT ASSOCIATED MENTAL DISORDERS.

7.0 Chapter overview

This manuscript investigates rates of mental disorders among spouses bereaved by unintentional injury and a matched non-bereaved spousal cohort. This chapter investigates spouses bereaved by unintentional injury in order to more completely understand the cohort that will be used as a comparison to suicide-bereaved spouses in Chapter 8. This study is important as it highlights the increased rates of mental disorders among spouses bereaved by unintentional injury in both the pre and post-death periods. This finding has important implications for intervention surrounding the time of bereavement.

Publication details:

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7.1 Abstract

Objective: To examine physician-diagnosed mental disorders among spouses in the general population who were bereaved by sudden unintentional injury death (SUI). Methods: Married individuals whose spouse died by motor vehicle collision, drowning, or excessive cold exposure between 1998 and 2008 (n=287) were matched on age, sex, income-quintile and health region, 1:3, to control spouses who were not bereaved (n=859) during the study period. Generalized linear modeling and generalized estimating equations were used to compare rates of physician-diagnosed mental disorders five years before and after spousal death while adjusting for age and sex. Results: Unadjusted analyses found that spouses bereaved by SUI experienced greater rates of depression, anxiety and any mental disorder both pre and post-bereavement. Significant time–by- group interactions were found for depression (P=0.0002) suggesting that the crude rate increases in depression of 20% among bereaved spouses (compared to 2% among non-bereaved controls) were the consequence of bereavement. Conclusion: The SUI death of a spouse is associated with poor mental health. Interventions are needed to target this vulnerable group. Prospective studies are needed to examine the role of caregiving, the deceased's pre-death health, and the role of guilt and stigma on bereavement related health.

7.2 Background

Death by unintentional injury is the 3rd leading cause of death among males and the 5th leading cause of death among Canadians. [1] In 2009, over 10,000 individuals died by unintentional injury, and rates appear to be increasing over time. [1] Injuries are the leading cause of death among individuals 60 years and younger and these deaths represent a significant economic burden; over 26 billion dollars in 2010 alone. [2]

One of the most stressful life events, associated with the vulnerability for developing poor health, is spousal bereavement. [3-7] Widowhood is a powerful stressor that disrupts the emotional, behavioural, social and economic linkages once shared with the deceased partner. [8] The negative effect of spousal loss on health has been well documented. That being said, there is still large variability in bereavement outcomes and psychological adaption, which suggests more research is needed.[6,8-14] A reliance on retrospective self-report and longitudinal health assessments without considering pre-loss health has created a potential interpretative bias. [9] Some recent studies, as listed, have addressed such shortcomings by using population-based data to examine spousal bereavement-associated health.

Using a population-based design, Galatzer-Levy and Bonanno examined grief trajectories associated with spousal loss and demonstrated heterogeneity of depression outcomes.[11] Similarly, Maccallum et al. applied latent class growth modeling to a population-based sample in order to longitudinally examine trajectories of bereavement following spousal and child bereavement. [9] The authors examined trajectories of depression in response to both spousal and child bereavement and compared outcomes for these two groups. Approximately 20% of

individuals reported high levels of chronic distress post-bereavement. However, half of individuals experienced depression prior to the death. The authors argue that future prospective studies should examine bereavement related health in the context of pre-loss distress in order to further understand facets of depression following bereavement.

While all spousal death is traumatic, the cause of death may play a role in the survivors' psychological adaption to bereavement and subsequent poor health. [15] Unexpected deaths such as loss by motor vehicle collision may be particularly difficult given its unpredictable and violent nature, resulting in a different bereavement trajectory and experience of grief. [16] Some studies have found elevated rates of mood disorders among those bereaved by such deaths.[17-20] Research on spouses have also shown similar findings of increased risk for depression, anxiety, post traumatic stress disorder symptoms, and other psychiatric symptoms following a violent death. [15,17,21,22] The assessment of mental health and the study methodology applied, however, has been variable across such studies. As well, the majority of studies have relied on self-report measures to assess mental disorders resulting in inaccurate estimates of mental disorder prevalence. [16,18] Additionally, assessments of mental disorders prior to bereavement are not commonly considered. Similar limitations exist when investigating sudden, violent spousal deaths. For instance, there is a predominance of cross-sectional or retrospective designs, few data collection time periods, and a lack of investigation into pre-bereavement health and its relationship with post-bereavement outcomes.

To understand more about the sequelae of sudden injury-related spousal bereavement, we conducted a controlled, longitudinal, population-based study using administrative data. This

study examined the effect of the unintentional injury death of a spouse on mental disorder rates. First we investigated rates of physician diagnosed mental disorders, both five years prior to and following the unintentional injury death of a spouse. Relative rates of diagnosed mental disorders were calculated comparing non-bereaved and bereaved spouses both five years before and after spousal death. Next we examined mental disorders while controlling for the effects of age and sex, and calculated time by group interactions to assess differences in rate changes over time between cases and matched controls. Study outcomes included outpatient visits and hospitalizations for physician-diagnosed depression, anxiety, substance use, suicide, and any mental disorder. This study is a significant contribution to the bereavement literature by: 1) utilizing a longitudinal population-based sample, 2) comparing a bereaved cohort to non-bereaved spousal controls matched on age, sex, income quintile and region 3) examining pre and post bereavement mental disorders including anxiety disorders and substance use disorders which has been highlighted as a limitation in the literature [23], and 4) adjusting for social factors including age and sex, and ultimately allowing for the longitudinal investigation of mental disorders.

7.3 Methods

7.3.1 Data Sources

Approvals for this study were obtained from the University of Manitoba's Health Research Ethics Board as well as Manitoba Health's Information Privacy Committee. Administrative data are from the Manitoba Population Research Data Repository, housed at the Manitoba Centre for Health Policy (MCHP) located at the University of Manitoba in Canada. The Repository contains de-identified individual-level data for the population of Manitoba (1.2

million[24,25]), and is linkable via anonymous patient health information number enabling data linkage across a variety of datasets. Specifically, this study utilized physician claims data (physician diagnoses from general practitioners and specialists), hospital discharge abstracts (inpatient hospital admission contacts and diagnoses), Vital Statistics datasets (cause of death), the population registry (age, sex, region of residence), and Statistics Canada Census data (area-level income quintile). This data linkage allowed the examination of cause of death, marital status, income quintile, sex, and region, allowing the longitudinal investigation of social and health information for living spouses and their deceased partners.

7.3.2 Cohort Formation

Two cohorts were created for this study. One cohort represented spouses bereaved by sudden unintentional injury (SUI) (spouses whose partner died by Motor Vehicle Collision (MVC), drowning or excessive cold exposure) between 1998 and 2008 and the other was matched non-bereaved spousal controls from the general population (See Figure 7-1). The closing date for deaths (December 31, 2008) reflects a five-year follow up (until December 31, 2013). Vital Statistics data were used to identify spouses who died by SUI between 1998-2008 (MVC Death- ICD-9-CM: E810-E819, E822-E825; ICD-10-CA: V02.0-V09.9, V12.0, V14.9, V19.0-V19.2, V19.4-V19.6, V20.0-V79.9, V80.3-V80.5, V81.0-V82.1, V83.0-V83.3, V84.0, V85.3, V86.00-V86.38, V87.0-V87.8, V88.0-V88.8, V89.0-V89.2, V99; Drowning: ICD-9-CM: E830, E832, E910; ICD-10-CA: V90-V94, W65-W74; Excessive Cold Exposure: ICD-9-CM: E901; ICD-10-CA: X31). To minimize the likelihood that suicide death was included, no overdose or undetermined deaths were included in the SUI cohort. There were 287 individuals who were a registered marital partner that had a spouse die by SUI and 859 non-bereaved spousal controls. Marital status was obtained via the Manitoba Health Registry Data, by common

family registration number. Adults are classified as married, single, and widowed.[26] Non-bereaved spouses were married at the start of the study period, and their spouse was alive at the end of the study period. The date of death in the bereaved cohort was used as the index date in the non-bereaved cohort to allow for comparisons pre and post death. Only individuals who had one marriage over the 10-year period were included, ensuring remarriage did not influence or impact future health. Controls were matched on: age at bereavement (+/- 5 years), sex (male or female), health authority region (11 categories), and income quintile (average household income was divided into five quintiles, ranging from low to high). Matching criteria was selected to increase the likelihood that the cases and matches were comparable on these measures, increasing the likelihood that any differences found were not due to these social factors.

7.3.3 Mental Health Outcomes

The following mental disorders were included in this study: depression (ICD-9-CM: 296.2-296.3, 296.5, 300.4, 309, 311; ICD-10-CA: F31.3-F31.5, F32, F33, F341, F380, F381, F432, F438, F530), anxiety (ICD-9-CM: 300.0, 300.2, 300.3; ICD-10-CA: F40, F41.0, F41.1, F41.3, F41.8, F41.9, F42, F431), substance use disorder (ICD-9-CM: 291, 292, 303, 304, 305; ICD-10-CA: F10-F19, F55), and suicide attempts (including accidental poisonings) (ICD 9-CM: E850-E854, E858, E862, E868, E950- E959; ICD-10-CA: X40-X42, X46, X47, X60-X84, Y10-Y12, Y16, Y17, Y870). [27] An 'any mental disorder' variable was also created and it represented individuals who had depression, anxiety or substance use disorder over the study period. The mental disorders included in this study were based on their hypothesized relationship with bereavement related stress, as well as their use in other related studies. [27,28] Five-year bereavement periods were used to allow for an examination of bereavement health five years

before (From 1993) and after spousal death (ending in 2013), which resulted in a 10-year total bereavement study period. This approach allowed for a longer investigation of health, which is supported by a previous study of conjugal bereavement.[29] Disorders were physician identified, from outpatient physician visits and hospitalizations (defined as spending more than one day in hospital). These diagnoses were treated as dichotomous variables (yes/no), and were based on the bereaved spouse receiving a physician diagnosis at least once over the 10-year study period.

7.3.4 Social Factors

Age at bereavement was dichotomized based on a median age of 54 years. Younger age (<=53 years) and male sex were used as reference categories. Methods of identifying income quintile were used for individuals living in rural and urban environments. Derived income measures reflect the average household income in the area in which the spouse lived, ranked low (1) to high (5).

7.3.5 Statistical Analyses

Analyses were conducted using SAS version 9.4. Descriptive statistics and chi-square tests were used to examine study factors among cases and controls. Some bereaved individuals died by the end of the study period, therefore follow up times varied post-spousal death. An offset using the log of person years was calculated and applied to all models to confirm time at risk for mental disorders, which varied for each person according to their time at risk (follow-up period). Unadjusted relative rates (RRs) were calculated for each disorder for the pre and post periods using generalized estimating equations (GEE). GEE is an extension of generalized linear models which enable regression analyses on non-normally distributed variables or when data are

correlated.[30-33] Other types of analyses would not have accounted for the correlated nature of these data and would have provided incorrect inferences concerning regression parameters and inefficient estimators.[34] Correlated data can be a statistical concern when using family member data[35], such as in the case of spouses. Among spouses, health concordance (spousal health similarity) may have existed, including similarity in psychiatric disorders between partners, and poor health in one partner resulting from spousal stress in the other partner.[36] Poisson or negative distributions were used depending on the distribution and model fit. Models with the smallest QIC statistics were chosen. Second, adjusted relative rates (ARR) were calculated. Each model included bereavement period (pre, post), group (case, match), age (<=53 years, >=54 years), and sex (male, female). A time- by- group interaction term was also calculated to examine differences in rates of each disorder between cases and matches for pre and post time periods.

7.4 Results

In this study (Table 7-1), there were 287 spouses bereaved by unintentional injury and 859 matches. The median age at bereavement was 54 and the median length of marriage was 26 years. Over 66% of individuals were female. The largest group of individuals lived in Winnipeg (31.36%), the most populous city in Manitoba. Over 93% of the sample was bereaved by a MVC death (Figure 7-2). Table 7-2 presents unadjusted rates of having each of the specified mental disorders in the five-year period prior to and after spousal death. When compared to non-bereaved spouses, individuals who had a spouse die by SUI had higher rates of depression (RR=1.64; 95% CI=1.21-2.23, P=<0.001), anxiety (RR=1.35; 95% CI=1.06-1.72, P=<0.05) and any mental disorder (RR=1.37; 95% CI=1.13-1.66, P=<0.01) prior to the death of their spouse. Following the death, bereaved spouses had rates of depression that were nearly three times

higher, and 1.67 times higher for anxiety as compared to non-bereaved matched controls. Rates for any mental disorder was also higher for bereaved spouses following bereavement (RR=1.91 95% CI=1.65-2.20, P=<0.001). In the post period, nearly 40% of injury-bereaved spouses had depression, more than 36% had anxiety, and almost two-thirds had any mental disorder. Absolute increases in mental disorder rates among bereaved spouses were observed from pre-death to the post-death period for depression (20.55%), anxiety (10.81%), and any mental disorder (20.2%), whereas increases of 1.98%, 3.03% and 3.26%, respectively, were seen for controls. Table 7-3 displays the final adjusted model, showing age and sex adjusted relative rates for both the pre and post bereavement periods. Time- by- group interactions for each disorder are also presented. Post-bereavement rates for bereaved spouses were significantly higher for depression (ARR=2.98; 95% CI=2.39-3.71, P=<0.001), anxiety (ARR=1.67; 95% CI=1.37-2.03, P=<0.001), and any mental disorder (ARR=1.90; 95% CI=1.65-2.19, P=<0.001). SUI bereaved spouses had significant increases in rates of depression (P=0.0002) and any mental disorder (p=0.0007) between pre and post periods as compared to matches. Unfortunately small sample sizes for suicide attempt did not allow investigation into this outcome as a consequence of bereavement.

7.5 Discussion

This study longitudinally investigated rates of mental disorders associated with the SUI death of a spouse. Findings suggest that SUI bereaved spouses have greater rates of mental disorders when compared to a matched non-bereaved sample. Findings reflect the bereavement literature[15,17-22]and the relationship between spousal death and mental health. Our main finding is that spouses bereaved by SUI experience poor mental health bereavement following the sudden unintentional death of their partner. Bereaved spouses experienced significantly greater rate

increases in depression and any mental disorder from the pre- to post-death periods as compared to matched controls, providing empirical evidence underscoring spousal death as a very distressing event.

Although SUI bereaved spouses had depression and any mental disorder rates that were significantly higher than matches before and after bereavement, the difference between groups became more prominent after spousal bereavement. Nevertheless, these higher rates of mental disorders prior to bereavement may suggest that SUI death may not necessarily be unanticipated. Individuals who have died unintentionally have been found to be at greater risk for bipolar disorder, substance use, and personality disorder prior to their death. [19] Other research has identified risk factors for motor vehicle collisions and found overrepresentation of substance use and personality types which are impulsive and sensation seeking. [19,37] As well, it may be that some spouses who have lost a spouse to SUI experienced greater caregiver distress before bereavement due to their partners pre-bereavement mental health, which is why rates of depression and anxiety are elevated in pre-death periods. Caregiver distress has been noted in the literature as an important area of intervention due to its mental and physical health consequences. [38-40]

Findings from this study should be interpreted in the context of study limitations. First, only individuals with registered marriages were included. While many individuals live in common-law unions as well as legal marriages without registering their marriage, study findings can only be generalized to the cohort of individuals who have registered their marriage. While this is a limitation, it increased confidence that these individuals were actually married. Next, our

definition of unintentional injury included deaths by MVC, drowning and excessive cold exposure, however deaths due to burns were not included. While deaths due to other causes of unintentional injury such as electrocution and burns can be considered under the umbrella of unintentional injury, for the purpose of this study they were not included due to the diverse nature of these injuries as shown by clinical care (burns and trauma are typically treated in different centers or specialty units) as well as the support systems available for burn injury survivors (Canadian Burn Survivors Communities, Provincial Firefighters Burn support groups, Mamingwey Burn Survivor Society, and the Canadian Burn Network) which may have impacted rates of mental disorders in the province of Manitoba. As over 93% of the bereaved sample was bereaved by MVC, the findings from this research are largely generalizable to this group. Another limitation is measures of mental disorders are dependent on treatment seeking, and therefore do not represent all cases of mental disorders in this population. Through the use of administrative data it is possible to examine a large cohort of bereaved spouses longitudinally without self-selection bias. That being said, our findings only reflect individuals who visited health care providers, therefore underrepresentation of disorder rates may have occurred. An additional limitation involves the possibility that some intentional deaths may have been included in the unintentional injury cohort. While deaths due to the intentional crash of a vehicle were excluded (suicide), the cause of death would ultimately reflect the decision of the medical examiner and what were documented in Vital Statistics data. The likelihood of this limitation is small. An additional limitation is that measures of individual-level income were not used because they were not available. [35] Instead, area level income was used as approximate measures of socioeconomic status. Furthermore, due to the nature of administrative data, stigma or shame and its impact on bereavement cannot be examined. Some research has shown that individuals

bereaved by accidental death experience similar or greater levels of guilt and stigma as suicide bereaved individuals due to the nature of their loved one's death.[41] While the phenomenology of bereavement is a tremendously important area, it ability to be measured using administrative data is questionable. A final limitation of this study is that unintentional injury bereaved spouses were compared to non-bereaved spouses. While comparing to a matched spousal sample from the general population allowed the effect of bereavement on spousal health to be examined, a weakness is that some ambiguity remains regarding whether study findings signify the impact of general bereavement, or bereavement specific to unintentional injury.

Bereavement by SUI has a considerable impact on rates of mental disorders in the surviving spouse. Findings from this study highlight the need to consider pre-bereavement factors among bereaved spouses, as well as the deceased, in order to understand the full impact of bereavement on spousal health. Future research, including latent class modeling, is needed to expand our understanding of the trajectories of grief, the role of caregiving, the health of the deceased prior to bereavement, and the interaction of these factors with spousal bereavement related health outcomes. Such information would help provide direction in the support of bereaved individuals who are in need of follow-up after SUI bereavement. Health providers should be aware of the periods of poor health that exist both prior to and following bereavement in order to provide support around widowhood. Both upstream and downstream interventions are necessary to ensure spouses are not only comfortable seeking support due to stigma sometimes associated with SUI death, but also that such supports are available and accessible to them at this vulnerable time.

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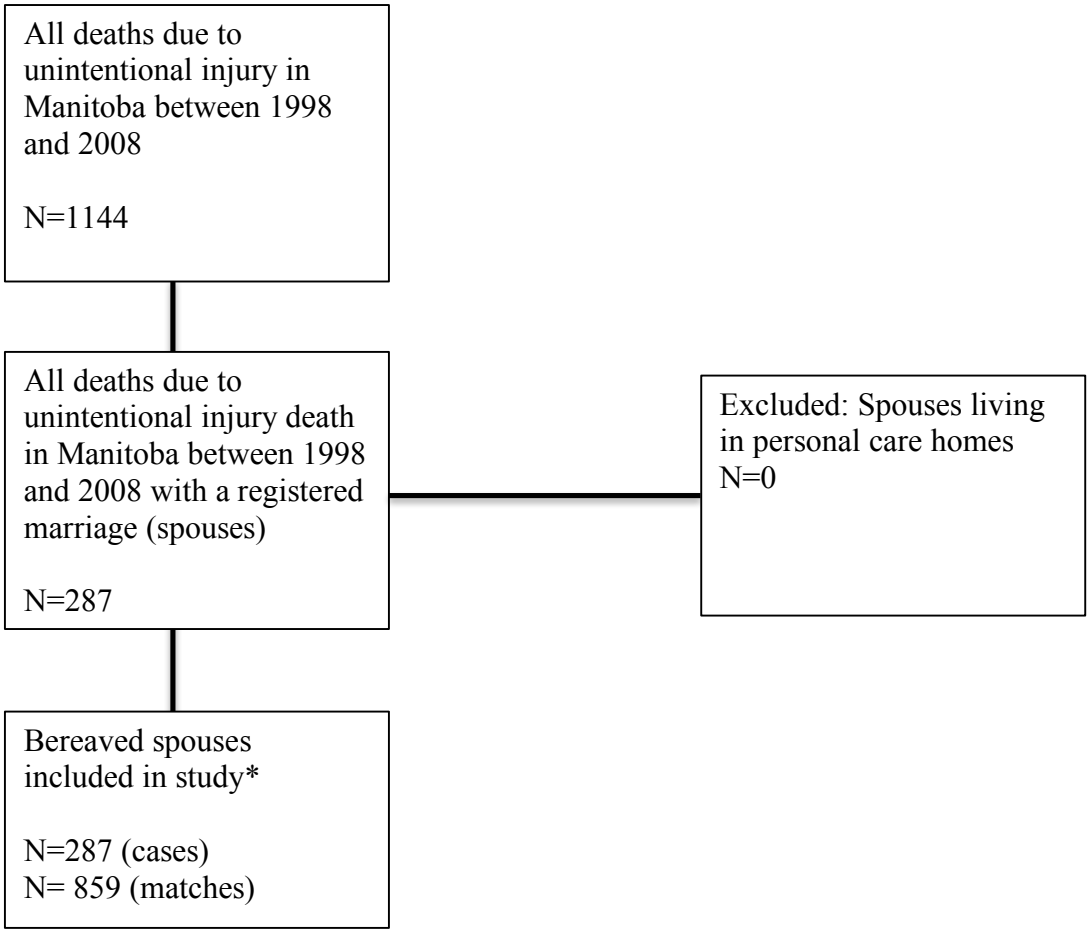
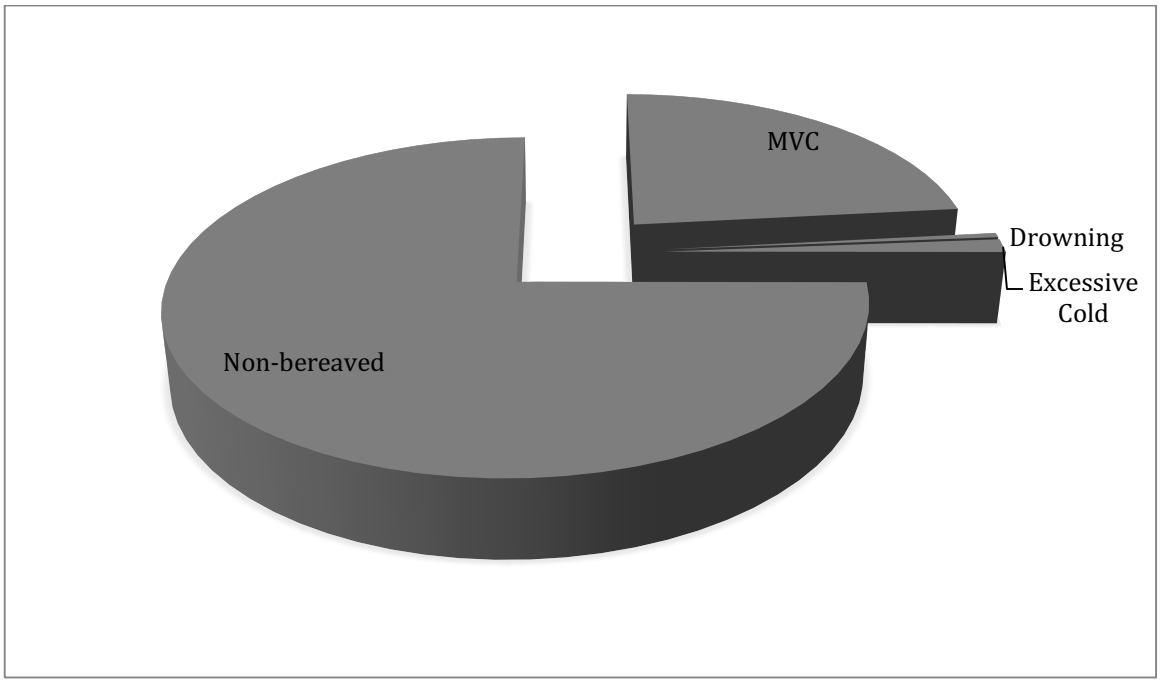
Figure 7-1: Cohort formation



*Successfully matched on age at bereavement (+/- 5 years), health authority region (11 categories), sex (male or female), and income quintile.

Figure 7-2: Cohort breakdown



Bereavement due to MVC (93%), and drowning and excessive cold exposure (7%).
Cell size for some causes of death less than 5. Data suppressed.

Table 7-1: Unintentional injury and matched cohort characteristics

Characteristic	Spouses bereaved by unintentional injury death (n=287)	Non-Bereaved Controls (n=859)
	n(%)	n(%)
Age at bereavement		
Mean (SD)	54.09 (16.7)	53.93 (16.8)
Median	54.0	54.0
<=35	42 (14.6)	130 (15.1)
36-45	52 (18.1)	156 (18.2)
46-55	55 (19.2)	173 (20.1)
56-65	59 (20.6)	163 (19.0)
66-75	43 (15.0)	131 (15.3)
76-85	30 (10.5)	89 (10.4)
86+	6 (2.1)	17 (2.0)
Years married		
Mean	20.91 (10.4)	23.63 (13.1)
Median	26.0	26.0
Sex		
Male	95 (33.1)	284 (33.1)
Female	192 (66.9)	575 (66.9)
Income at time of spouses death (index date)		
Lowest quintile	60 (20.9)	180 (21.0)
Second lowest quintile	56 (19.5)	168 (19.6)
Middle quintile	58 (20.2)	173 (20.1)
Second highest quintile	51 (17.8)	152 (17.7)
Highest quintile	60 (21.6)	186 (21.7)
Region		
South Eastman	22 (7.7)	65 (7.6)
Central	45 (15.0)	129 (15.0)
Assiniboine	32 (11.2)	96 (11.2)
Brandon	ss	9 (1.1)
Winnipeg City	90 (31.4)	270 (31.4)
Interlake	36 (12.5)	108 (12.6)
North Eastman	19 (6.6)	57 (6.6)
Parkland	19 (6.6)	57 (6.6)
Churchill	0 (0)	ss
Nor-Man	9 (3.1)	26 (3.0)
Burntwood	13 (4.5)	39 (4.5)

ss- cell size less than 5. Data suppressed.

Table 7-2: Mental disorders and hospitalizations for suicide among bereaved spouses (n=287) compared to non-bereaved spouses (n=859), before and after death of spouse/index date

Outcomes	5-Year Prevalence Prior to Death (Cases) n (%)	5-Year Prevalence Prior to Index Date (Matches) n (%)	Pre-bereavement Relative Rate (95% Confidence Interval)	5-Year Prevalence After Death (Cases) n (%)	5-Year Prevalence After Index Date (Matches) n (%)	Post-bereavement Relative Rate (95% Confidence Interval)
Mental disorders						
Depression	53 (18.5)	106 (12.3)	1.64 (1.21-2.23)***	112 (39.0)	123 (14.3)	2.99 (2.40-3.72)***
Anxiety	74 (25.8)	180 (21.0)	1.35 (1.06-1.72)*	105 (36.6)	206 (24.0)	1.67 (1.37-2.04)***
Substance use disorder	13 (4.5)	30 (3.5)	1.42 (0.75-2.70)	14(4.9)	34 (4.0)	1.35(0.73-2.48)
Suicide Attempt	ss	ss	ss	ss	ss	ss
Any mental disorder	107 (37.3)	256 (29.8)	1.37 (1.13-1.66)**	165 (57.5)	284 (33.1)	1.91 (1.65-2.20)***

*p<0.05; **p<.01,***p<0.001
GEE used in RR calculation
ss- cell size less than 5. Data suppressed.
Any mental disorder comprised of depression, anxiety and any substance use disorder.

Table 7-3: Before (5 years prior spouses death) and after bereavement (5 years after spouses death) comparisons of unintentional injury death bereaved spouses and non-bereaved spouses controls

Outcomes	5 Year Pre-bereavement Adjusted Relative Rate	Time X Group Interaction (P-value)	5 Year Post-bereavement Adjusted Relative Rate
Mental disorders			
Depression	1.63 (1.21-2.22)**	0.0002	2.98 (2.39-3.71)***
Anxiety	1.34 (1.06-1.71)*	0.1132	1.67(1.37-2.03)***
Substance Use Disorder	1.43 (0.75-2.72)	0.8992	1.36 (0.74 -2.50)
Suicide Attempt	ss	ss	ss
Any mental disorder	1.37(1.13-1.65)**	0.0007	1.90(1.65-2.19)***

*p<0.05; **p<0.01; ***p<0.001

[1]Model covariates: Time period (pre/post), group (case/match), sex (male (reference)/female), age (<=53 years/>=54 years). GEE used in ARR calculation.

ss- cell size less than 5. Data suppressed.

Any mental disorder comprised of depression, anxiety and any substance use disorder.

CHAPTER 8: SPOUSES BEREAVED BY SUICIDE: A POPULATION-BASED LONGITUDINAL INVESTIGATION OF MENTAL DISORDERS

8.0 Chapter overview

The following manuscript statistically compares mental disorder rates among spouses bereaved by suicide, sudden natural death, and unintentional injury. Several important findings were found in this study. When examining cohorts individually, it appears that cause of death does not distinguish response to bereavement: sudden spousal bereavement is a time of vulnerability for depression in all causes of death examined. Spouses bereaved by suicide had the greatest proportion of depression post bereavement as compared to sudden natural death and unintentional injury bereaved spouses. However, while all groups suffer in the wake of the death, suicide bereaved spouses had higher absolute rates of depression given their higher pre-bereavement rates. Findings highlight the impact of spousal suicide bereavement, and the idea that spouses bereaved by suicide may experience a unique grief trajectory given their higher pre-bereavement rates of mental disorders.

Publication details:

Spiwak, R., Elias, B., Sareen, J., Chartier, M., Katz, L., Bolton, J.M. Spouses bereaved by suicide: A population-based longitudinal investigation of mental disorders. To be submitted to Psychological Medicine.

8.1 Abstract

Objective: This study compares a longitudinal population based sample of spouses bereaved by suicide and those bereaved by sudden death to determine if rates of physician-diagnosed mental disorders differ for individuals bereaved by suicide, sudden natural death (SND), and sudden unintentional injury (UI). Methods: Married individuals whose spouse died between 1998 and 2008 by suicide (n=365) were compared to spouses bereaved by SND (n=1000) and UI (n=270) over the same time period. Inverse probability treatment weights were calculated using age, sex, and income to minimize bias and ensure comparable bereavement cohorts. Generalized estimating equations were used with a poisson distribution to calculate relative rates comparing mental disorders 5 years before and after spousal death. A group by time interaction term was used to determine if bereavement groups had significantly different rate changes for disorders from the pre to post periods. Results: Spouses bereaved by suicide had the greatest rate of depression post bereavement (50.96%), as compared to SND (33.70%) and UI (38.52%) spouses. A significant group-by-time interaction (P=0.047) revealed that the rate change in depression in the pre to post period was significantly different between suicide and UI bereaved spouses. Suicide bereaved spouses had increased rates of any mental disorder both pre (ARR=1.35, 95% CI=1.03-1.18, P<.05) and post death (ARR=1.24, 95% CI=1.03-1.45, P<.05) when compared to UI spouses signifying their poorer mental health overall. Post-bereavement, adjusted models showed that suicide bereaved spouses had greater rates of depression only when compared to spouses bereaved by SND (ARR=1.31, 95% CI=1.10-1.55, P<.01). No differences were found in rates of mental disorders between UI and SND groups in any time period. Conclusion: Sudden spousal bereavement is a time of vulnerability for depression in all causes of death examined. Suicide bereaved spouses have greater rates of depression and any mental

disorder in the period before bereavement. Prospective studies are needed to examine the role of caregiving, the deceased's pre-death health, and the role of guilt and stigma on bereavement related health to inform targeted interventions.

8.2 Background

The death of a spouse is noted to be one of the most difficult experiences in life. In addition to changes in the behavioural, social and economic environments of the surviving spouse, the grief that accompanies bereavement is associated with poor health, increased mortality and psychological maladaptation. [1-5] While all types of spousal bereavement are traumatic, the health consequences associated with suicide bereavement have been hypothesized to be increasingly difficult due to the guilt, stigma and caregiver burden of 'suicide watch'. [6,7]

While a death by suicide may result in a unique bereavement experience, research findings are mixed. Some studies have shown that individuals bereaved by suicide have worse health outcomes when compared to individuals bereaved by other causes of death[8-18], while other studies have found no difference.[15,19-24] Such variable findings may have been due to methodological limitations, including small sample sizes, bias from loss to follow up, and inappropriate choice of control groups.[4,22,23,25-32] A systematic review of 41 studies conducted by Sveen and Walby (2008) found that while there were few differences between individuals bereaved by suicide and other types of death with respect to psychiatric disorders and suicide, stigma, blame and rejection were more common among the suicide bereaved. [11] The authors highlighted the significant methodological limitations in these studies, and recommended the use of sufficient sample sizes, multivariate statistical approaches, and control groups comprised of bereaved individuals from other forms of sudden death. To understand the association between suicide bereavement and mental health, Pitman et al. (2014) conducted a systematic review of 57 studies and found that suicide bereavement was associated with some negative health outcomes dependant on the relation to the deceased. [6] The authors suggest that advances in data quality and

study methodology including the analysis of linked population registries have addressed the many limitations of previous research. Studies in Canada [33,34], Denmark [18,35-41] and Sweden [42-46] have examined entire populations and have included adjustment for pre-bereavement factors, demonstrating an important research advancement.

While studies utilizing administrative data and linked population registries have focused on diverse relationships, including sibling and offspring suicide bereavement, only a few have focused on the spousal relationship. [18,35,36,38] Danish registry studies have found increased suicide risk among spouses, and increased risk for hospital admission for mental disorders related to spousal suicide bereavement. [18,38] For example, Agerbo et al. longitudinally investigated over 3400 married spouses that had a spouse die by suicide and found that survivors were at increased risk of suicide. [35] Erlangsen et al (2017) conducted a nationwide cohort study of 15,607 suicide bereaved spouses and found that they had higher risks of developing mental disorders, suicidal behaviors, increased mortality, and requiring increased municipal support within 5 years of bereavement when compared to the general population and with spouses bereaved by other causes of death. Both studies relied on inpatient hospital visits to build their definition of mental disorders, which may have only captured the most severe cases of mental disorders. Individuals with minor and moderate forms of mental disorders may not have been represented since the majority are usually diagnosed and treated by general practitioners. [47-52]Other limitations of Erlangsen's study involved the inability to examine differences in rate changes over time between case and control groups, and the lack of appropriately matched controls. While control groups included both the general population (regardless of marital status), and other causes of death, the authors did not distinguish between death types such as those associated with chronic

processes or sudden causes such as violent death. Bereavement responses and health outcomes may be quite different depending on the nature of the death.[53]Nevertheless, this study provided compelling evidence to support suicide bereaved spouses as an at risk group following spousal death, and reinforced the need for further investigation in other jurisdictions.

Thus far, suicide bereavement research based on population-based registries has been deemed the most rigorous studies available, however the inability to assess relationship quality and social function has been cited as limitations. [6] Despite these drawbacks, the use of administrative data has many advantages in advancing spousal suicide bereavement research. Specifically, it is not limited by recall bias and facilitates longer follow up periods with the use of statistical modelling to account for the effect of time and other confounders such as age, income and sex. Importantly, pre-bereavement health can be considered and more advanced methodology applied to examine the effects of time on rates, specifically pre-post comparisons between groups. Appropriate comparison groups can also be chosen, and by drawing on larger sample sizes at the population level a study of rare events such as suicide is more feasible.

To address the stated limitations we investigated the rate of mental disorders associated with spousal suicide, sudden natural death (SND), and unintentional injury (UI) bereavements and compared the relative rates of physician diagnosed mental disorders of surviving spouses five years before and after the death. This work was framed by a biopsychosocial model (as shown in Figure 8-1). For this study, we hypothesized that suicide bereaved spouses would have elevated rates of mental disorders during the post-bereavement period, when compared to spouses bereaved by SND and UI.

8.3 Methods

8.3.1 Data Sources

Study approvals were obtained from the University of Manitoba's Health Research Ethics Board and Manitoba Health's Health Information Privacy Committee. Administrative data were obtained from the Manitoba Population Research Data Repository, which is housed at the Manitoba Centre for Health Policy (MCHP) at the University of Manitoba (Canada). Manitoba provides universal medical care, and the Repository therefore contains de-identified individual-level data for the population of Manitoba (1.2 million) and is linkable across datasets by scrambled Personal Health Information Number (PHIN). [54,55] A data linkage approach enabled a longitudinal record of health diagnoses and health care use for all persons in the province (with the exception of military personnel and incarcerated individuals). [33] Datasets utilized included physician claims (physician diagnoses from general practitioners and specialists), hospital discharge abstracts (inpatient admission contacts and diagnoses), the population registry (age, sex), vital statistics datasets (cause of death), and Statistics Canada Census data (for an area-level income quintile). This data linkage allowed for the examination of cause of death, marital status, income quintile, and sex, all which are necessary to establish the detailed longitudinal history of health diagnoses for bereaved spouses and their deceased partners. Cause of death was determined by medical examiners which is annually updated by Manitoba Health. [56]

8.3.2 Cohort Formation

Administrative data was used to construct a longitudinal population based sample of spouses bereaved by suicide and selected sudden death control groups. Bereavement controls were carefully selected based on best fit for a range of sudden death comparisons and their use in

previous studies. [15,57-59] The cohorts were spouses bereaved by suicide, spouses bereaved by SND, and spouses bereaved by UI (See Figure 8-1). Vital Statistics data were used to identify spouses who died between January 1, 1998 and December 31, 2008 by suicide (including accidental poisonings, where poisonings were deemed to be intentional) [60], sudden natural death (MI death, cardiac death, stroke death, cerebral aneurysm death) and unintentional injury death (Motor vehicle collision death, drowning, excessive cold exposure (See for Appendix 8-A for ICD 9-CM and ICD-10-CA codes). No overdose or undetermined deaths were included in the UI cohort to minimize the likelihood that suicide death was included in this cohort. Bereaved spouses were identified through common family registration number obtained from the Manitoba Health Registry Data. Marital status information was contained in this database (married, single, and widowed). [61] Only individuals who had one marriage over the 10-year period were included to ensure remarriage did not influence health outcomes. Sex (male or female), income quintile (average household income divided into 5 quintiles) and age were used to create the Inverse Probability Treatment Weighting (IPTWs). Income was derived from Census data and signified the average household income in the area (rural or urban) in which the spouse resided.[62] Since there were large differences in sizes and age differences between the original cohorts, we removed individuals over the age of 80 and selected a random sample of 1000 from the SND cohort to ensure weights were more representative and cohorts had greater comparability. The constructed cohorts are as follows: 365 individuals had a spouse die by suicide death (original cohort size=373), 1000 individuals had a spouse die by SND (original cohort size=7988) and 270 individuals had a spouse die by UI (original cohort size=287).

8.3.3 Mental Health Outcomes

The mental disorders investigated are: depression (ICD-9-CM: 296.2-296.3, 296.5, 300.4, 309, 311; ICD-10-CA: F31.3-F31.5, F32, F33, F341, F380, F381, F432, F438, F530), anxiety (ICD-9-CM: 300.0, 300.2, 300.3; ICD-10-CA: F40, F41.0, F41.1, F41.3, F41.8, F41.9, F42, F431), substance use disorder (ICD-9-CM: 291, 292, 303, 304, 305; ICD-10-CA: F10-F19, F55), and suicide attempts (including accidental poisonings) (ICD 9-CM: E850-E854, E858, E862, E868, E950- E959; ICD-10-CA: X40-X42, X46, X47, X60-X84, Y10-Y12, Y16, Y17, Y870). An 'any mental disorder' measure, based on previous literature and its hypothesized relationship with bereavement related stress, [34,63] was created to represent individuals who have depression, anxiety, or a substance use disorder over the selected time period. A 10-year bereavement period was selected to examine pre-death disorders for the 5 years prior to the death (from 1993) and then a 5-year follow up from 2008 (until 2013). As supported by the literature, 5-year bereavement periods allowed for a broader examination of spousal bereavement related health. [18,64] Physician-generated diagnoses from both outpatient physician visits and hospitalizations (defined as spending more than one day in hospital) were used. Diagnoses were treated as dichotomous variables (yes/no), and were based on a spouse receiving a physician diagnosis at least once over the 10-year study period.

8.3.4 Social and Demographic Variables

Age at bereavement (age at death of spouse), sex, and income were included in the calculation of IPTWs. However, due to the large discrepancy of age and sex in the cohorts, these variables were also used as control variables in the model to ensure the accuracy of estimates.

Age at bereavement was broken down into median splits for each cohort and the lowest age and male sex was used as reference categories.

8.3.5 Statistical Analyses

SAS version 9.4 was used for all analyses. Bereavement groups were weighted using inverse probability treatment weights (IPTW) to ensure cases and control groups were comparable. In randomized clinical trials, randomization is used to minimize bias. [65]In observational studies, this is not possible so IPTW is used to minimize bias by equalizing the likelihood of an individual being in a particular bereavement group. More weight is assigned to individuals that have lower probability of being in a particular group. The advantage of this approach is that the weighting allows the bereavement groups to be treated as if they were randomly assigned. Therefore, it is possible to statistically compare mental disorders between bereavement groups with confidence in group-effect estimates. [65] Chi-square tests were used to examine differences between groups on age, sex, region and income quintile. Since not all individuals lived until the end of the study period, not all spouses were followed for the same amount of time post-bereavement. To address this issue, an offset using the log of person years was calculated and applied to all models ensuring that time at risk for mental disorders represented each person's follow up period. Generalized estimating equations were used with a poisson distribution to calculate unadjusted relative rates for the five years before and after the spousal death period for each bereavement group. Then, suicide bereaved spouses were compared with spouses bereaved by SND and UI to determine if rates of mental disorders were different. SND bereaved spouses were also compared to UI bereaved spouses. Generalized estimating equations were used with a poisson distribution to calculate relative rates comparing

mental disorders five years before and after spousal death. A group-by-time interaction term determined if bereavement groups had significantly different rate changes for disorders from the pre to post periods. Goals of this analysis were to determine if there were significant differences in mental disorder rates between the bereavement groups while accounting for pre-bereavement mental health and social factors. Age by sex interactions were also calculated to determine the impact on mental disorder rates.

8.4 Results

The characteristics of the three bereavement groups are presented in Table 8-1. The median age of spouses bereaved by suicide was 49 years, and over 78% were women. All cohorts were statistically different from one another on age and region of residence, with SND bereaved spouses being the oldest (median=70). Suicide bereaved spouses had smaller rates of low income when compared to sudden natural death bereaved spouses. Sex differences were found between suicide and UI cohorts, as well as between SND and UI cohorts. Across all cohorts, however, the majority of spouses were female. Table 8-2 presents unadjusted relative rates (RRs) of mental disorders for each of the three bereavement groups for pre and post periods. In unadjusted models, spouses bereaved by suicide had the greatest proportion of depression post bereavement (50.96%), as compared to SND (33.70%) and UI (38.52%) spouses. Spouses bereaved by suicide and UI had significantly higher rates of depression, anxiety, and any mental disorder as compared to their pre bereavement rates. However, spouses bereaved by suicide had the highest rates of these disorders prior to the loss of their spouse. Spouses bereaved by SND had significantly higher rates of depression and any mental disorder compared to their pre bereavement rates. Table 8-3 displays comparisons between bereavement groups, for the pre

and post death periods. When compared to spouses bereaved by UI, a significant group by time interaction term was found signifying that the relative rate changes in depression for the pre to post period were significantly different between suicide and UI bereaved spouses. UI bereaved spouses had lower rates of depression before bereavement (Figure 8-2: 18.52% vs. 31.59%), and their absolute rate increases were similar to suicide-bereaved spouses post-bereavement (absolute rate increase of 20.0% vs. 19.4%). Absolute rate increases were 14.7% in the SND cohort (Figure 8-2). Compared to UI bereaved spouses, suicide bereaved spouses had increased rates of any mental disorder both pre (ARR=1.34, 95% CI=1.03-1.18, P<.05) and post death (ARR=1.24, 95% CI=1.03-1.45, P<.05). No group by time interaction terms were significant in the comparison of suicide bereaved and SND spouses, highlighting no differences between these bereavement groups in how rates for outcomes changed over time. In the suicide cohort, however, rates for depression, substance use and any mental disorder were significantly higher for both pre and post bereavement periods. Higher rates of anxiety were also found in the post period (ARR=1.22, 95% CI=1.03-1.45, P<.05). No differences were found in rates of mental disorders between UI and SND groups in pre and post periods, and all group by period interaction terms were non-significant. No age by sex interactions were significant for any comparison or model.

8.5 Discussion

This study compared suicide bereaved spouses to their counterparts bereaved by two other types of sudden death, using a study methodology that determined whether mental disorder rates were influenced by the type of death, and whether they were explained by pre-bereavement mental disorder history. As such, it provides novel information that extends our understanding of

bereavement consequences. Findings highlight the impact of sudden spousal bereavement as a time of vulnerability to depression and any mental disorder for all cohorts investigated.

When examining cohorts individually, it appears that cause of death does not distinguish response to bereavement. However, while all groups suffer in the wake of the death, suicide bereaved spouses have higher absolute rates of depression given their higher pre-bereavement rates of depression. While adjusted models found UI and suicide bereaved spouses to have significantly different increases in rates of depression post bereavement, their higher rate before the death suggests that while the suicide death was sudden, it may not have been entirely unexpected. It also suggests that SND and UI deaths may be preceded by less documented stress and mental health burden, suggesting these forms of bereavement may in fact be more unexpected in nature. Caregiver stress and associated mental disorders may have played a role in increased pre-bereavement mental disorder rates in the suicide cohort. Research finds that over 90% of individuals that die by suicide have a diagnosable mental disorder [66], therefore caregiver stress and related mental disorders may have impacted rates. Bolton et al. also did not find statistical differences in depression, anxiety, or substance use disorder rates between parents bereaved by motor vehicle collision and suicide. Similarly, elevated pre-bereavement rates of depression were observed among suicide bereaved parents when compared to parents bereaved by motor vehicle collision signifying that caregiver burden may be playing a role in these pre-bereavement periods. As UI death was likely without warning, spouses bereaved by suicide may have experienced caregiver stress or had otherwise been alerted to an increased risk for suicide such as previous mental disorder or suicide attempts.[34]

With regard to suicide and SND bereaved spouses, differences were present in both pre and post periods, with suicide bereaved spouses experiencing greater rates of depression, substance use, anxiety (post period only) and any mental disorder.. The elevated mental disorder rates found among suicide bereaved spouses in this study also reflect the conclusions of Erlangsen et al., who also found increased incidence of mental disorders among suicide-bereaved spouses when compared to the general population and other death control groups. Together with Bolton et al., these findings can provide direction for interventions aimed at individuals who have lost a spouse or loved one by not just suicide but sudden death. It is clear that spouses bereaved by suicide, UI and SND are all vulnerable to mental disorders following bereavement, which represents a significant opportunity for clinical intervention. Psychosocial support and screening methods may be important tools to identify and provide treatment for individuals who have lost a spouse suddenly. [67] While it is clear that all bereaved spouses in this study require support, poor health among the suicide cohort prior to bereavement suggests that there may be opportunities for intervention prior to or at the time of death of their spouse. Clinicians need to be aware of the increased rates of depression in the pre-period and aim to screen individuals and inquire about the health of their partner. These elevated rates suggest that suicide may not really be a random event in these cases, therefore identifying individuals that may be at risk for poor health before or at the time of the loss of their partner may be a key intervention component. Finally, this study highlights the lack of substance use disorders associated with unintentional injury and sudden natural death bereavement, suggesting that spouses do not appear to cope by drinking. When comparing substance use disorder rates in the suicide to unintentional injury cohort they were not significant. However, suicide bereaved spouses did have elevated substance use disorder rates both prior to and following bereavement as compared to the sudden natural

death cohort. Further research is needed to investigate this relationship, however as diagnoses are dependent on treatment seeking, rates may suggest spouses may not be reporting substance use to their care providers. A similar finding has been found in the investigation of motor vehicle collision bereaved parents. [34]

The findings from this study should be considered given the following limitations. First, study outcomes were dependent on treatment seeking, therefore the mental disorders reported only represent spouses who sought or received care from a care provider or who were hospitalized for a related event. [68] Therefore, rates may be underestimated as compared to actual mental disorders experienced. A second limitation involves the definition of suicide death, which includes measures of accidental poisonings. As suicide deaths derived from administrative data are highly specific at identifying confirmed suicides, they may not be sensitive and underreporting may occur. Suicide data are dependent on the accuracy of Vital Statistics and medical examiner reports.[68] Accidental poisonings were included in our definition of suicide to help offset the underreporting of suicides that may have occurred. Selected poisoning codes were used where it was expected that poisonings were intentional, as reflected in previous research. [60] Third, study findings are only generalizable to individuals who have registered their marriages. Individuals living in common law unions, or that are legally married but have not registered their marriage were not included. This definition potentially underestimates the number of suicide-bereaved spouses in the province of Manitoba. Fourth, area level income was used as an approximate measure of socioeconomic status because individual level data were not available.[69] An additional limitation is that suicide bereaved spouses were compared to spouses bereaved by other causes of sudden death. While a strength of this comparison is that suicide bereaved

spouses were compared to two unique types of sudden deaths, a limitation is that pre-death health of the deceased was not examined therefore it is difficult to determine if all deaths were truly sudden in nature. For example, individuals that died by suicide may have experienced poor mental health prior to their death thereby impacting the health of the bereaved and their course of bereavement. While the goal of this research was to study the health of the bereaved and not the deceased, given the elevated rates of pre-bereavement mental disorders found in this study, future research should examine pre-death health and consider inclusion of other long-term types of death (cancer, degenerative disease) as comparison groups for spouses bereaved by suicide. Sixth, bereavement responses including complicated grief, stigma, shame and other factors cannot be examined using administrative data. Although higher pre-bereavement mental disorder rates were found among the suicide bereaved, post-bereavement rates may still be an underestimation due to the effect of stigma and shame on help seeking. [70] While small sample sizes prohibited the examination of suicide attempt as an outcome in this study, evidence supports the relationship between stigmatization and increased risk for suicidal thoughts and behaviors. Future research should explore this link using longitudinal studies in order to address barriers related to help seeking and design interventions to mitigate this risk.

To conclude, this study presents important findings on the health outcomes related to spousal suicide bereavement in the general population. By using IPTWs, two bereavement comparison groups, and physician diagnosed mental disorders obtained from both health care visits and hospitalizations, this work adds to the field of suicide bereavement research. Findings suggest that spousal suicide bereavement is associated with depression, anxiety and any mental disorder. Health care providers should be aware of the vulnerabilities of spouses bereaved by

suicide, and aim to identify any red flags for spousal health related stress in the pre-bereavement period. Identifying poor mental health prior to the suicide death may possibly mitigate the risk of poor health following bereavement for the survivor, as well as possibly prevent suicide [34] through the identification of at risk individuals through spousal follow up. Future research should investigate the role of health care providers as a first point of contact in the identification of spouses at risk for suicide as well as the role of guilt and stigma in help-seeking related to suicide bereavement.

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Figure 8-1: Biopsychosocial framework including bereavement cohorts, study variables and mental disorders.

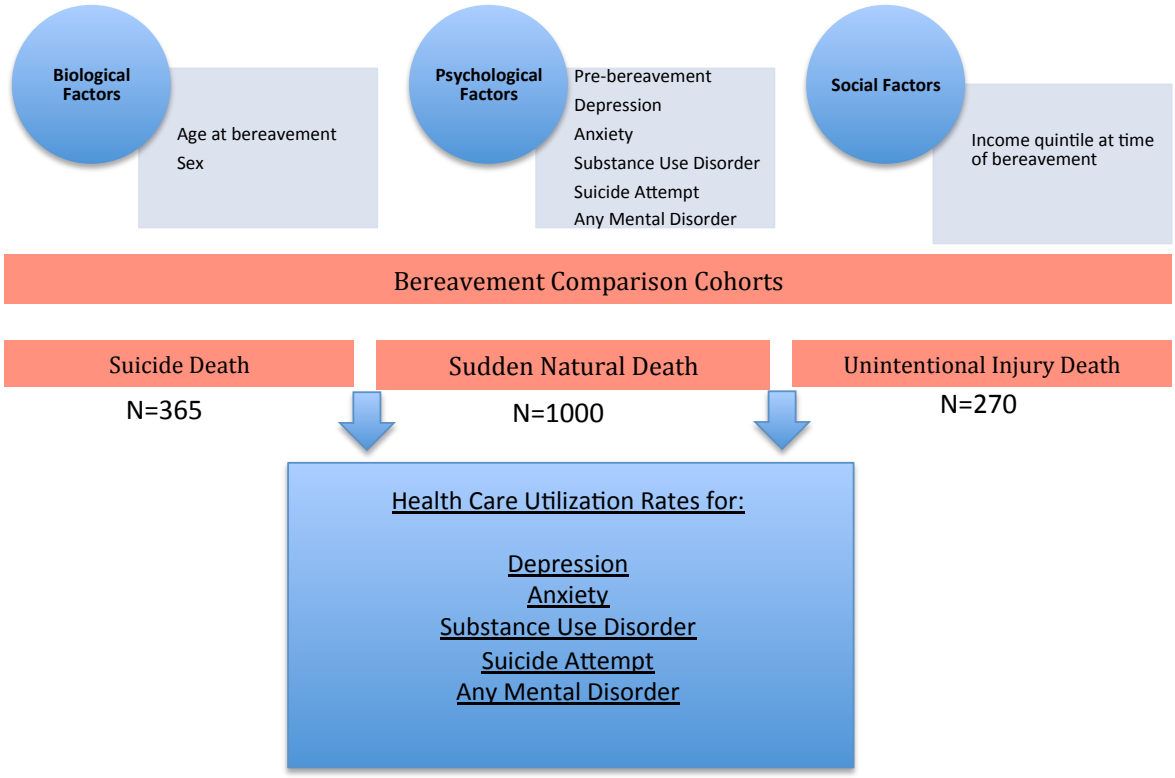
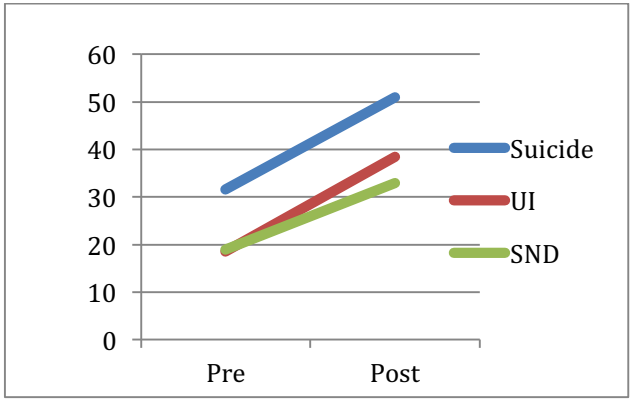
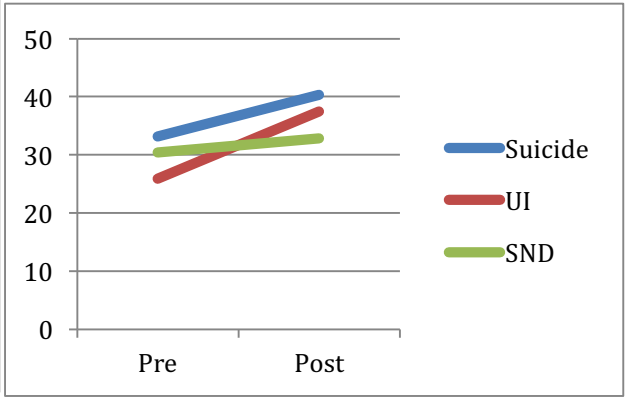


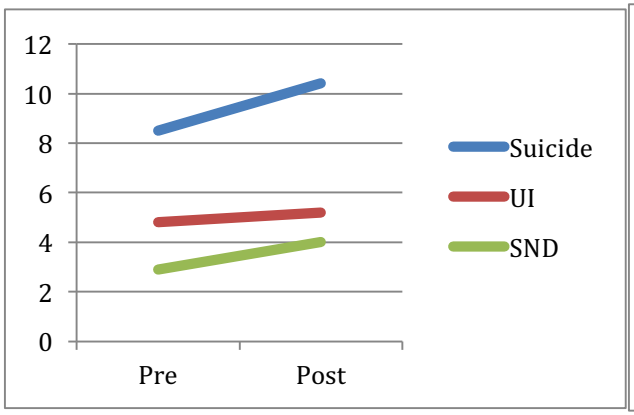
Figure 8-2: Mental disorders and bereavement group absolute rate changes (pre and post bereavement)



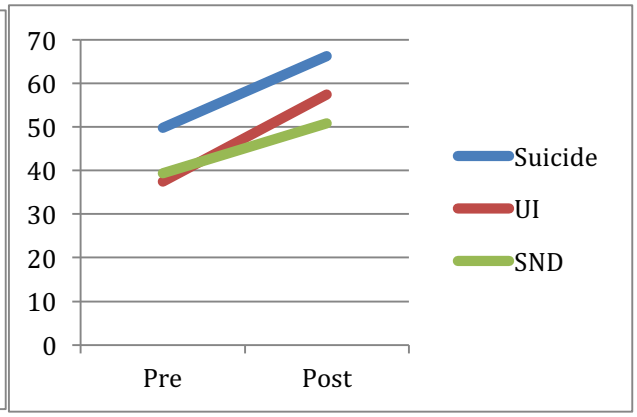
Rates of Depression



Rates of Anxiety



Rates of Substance Use Disorder



Rates of Any Mental Disorder

Table 8-1: Characteristics of spousal bereavement groups

Characteristic	Spouses bereaved by suicide (n= 365)	Spouses bereaved by sudden unintentional injury (n=270)	Spouses bereaved by sudden natural death (n=1000)			
	n(%)[a]	n(%)[a]	n(%)[a]	χ^{2b}	χ^{2c}	χ^{2d}
Age at bereavement						
Mean (SD)	50.9 (13.0)	52.2 (15.3)	67.5 (10.0)			
Median	49.0	52.5	70.0			
35-44	186 (25.5)	112 (20.7)	32 (1.6)	21.87***	824.72***	568.11***
45-54	208 (28.5)	114 (21.1)	218 (10.9)			
55-64	142 (19.5)	112 (20.7)	398 (19.9)			
65 and older	114 (15.6)	124 (23.0)	1304 (65.2)			
Sex						
Male	154 (21.1)	172 (31.9)	368 (18.4)	18.82***	2.51	45.96***
Female	576 (78.9)	368 (68.2)	1632 (81.6)			
Income at time of spouses death						
Lowest two quintiles	266 (36.4)	224 (41.5)	816 (40.9)	3.33	4.41*	0.063
Highest three quintiles	464 (63.6)	316 (58.5)	1180 (59.1)			
Region (11 RHAs)						
Winnipeg	364 (49.9)	168 (31.1)	1016 (50.8)	80.31***	50.38***	103.55***
Brandon	24 (3.3)	6 (1.1)	86 (4.3)			
South Eastman,	30 (4.1)	40 (7.4)	78 (3.9)			
Assiniboine	58 (8.0)	58 (10.7)	180 (9.0)			
Central	68 (9.3)	78 (14.4)	182 (9.1)			
Parkland	30 (4.1)	36 (6.7)	120 (6.0)			

North Eastman	56 (7.7)	38 (7.0)	82 (4.1)			
Interlake	42 (5.8)	72 (13.3)	172 (8.6)			
Burntwood	48 (6.6)	26 (4.8)	50 (2.5)			
NOR-MAN	10 (1.4)	16 (3.0)	32 (1.6)			
Churchill.	ss	ss	ss			

*p<0.05; **p<0.01; ***p<0.001

[a]values represent pre and post time periods and add up to double the number of observations per bereavement group. Percentages rounded to first decimal place therefore may not add up to 100.

[b]Suicide bereaved as compared to UI bereaved.

[c] Suicide bereaved as compared to SND bereaved.

[d] SND bereaved as compared to UI bereaved.

ss-small cell size, data suppressed.

Table 8-2: Mental disorders and hospitalization for suicide attempts among bereaved spouses before and after the death of their spouse

Suicide-Bereaved (n=365)			
Characteristics	5 year Prevalence Before Death	5 year Prevalence After Death	Relative Rate (95% CI)
Mental disorders	No. (%)	No. (%)	
Depression	115(31.59)	186(50.96)	1.62 (1.40-1.87)***
Anxiety	121(33.15)	147(40.27)	1.22(1.03-1.44)*
Substance Use Disorder	31(8.49)	38 (10.41)	1.23(0.84-1.78)
Suicide Attempt	ss	ss	ss
Any Mental Disorder	182(49.86)	242(66.30)	1.33(1.20-1.47)***
Sudden Natural Death (n=1000)			
Characteristics	5 year Prevalence Before Death	5 year Prevalence After Death	Relative Rate (95% CI)
Mental disorders	No. (%)	No. (%)	
Depression	190(19.00)	337(33.70)	1.77(1.56-2.02)***
Anxiety	304(30.40)	328(32.80)	1.09(0.97-1.21)
Substance Use Disorder	29(2.90)	40(4.0)	1.38(0.90-2.11)
Suicide Attempt	ss	ss	ss
Any Mental Disorder	394(39.40)	508(50.80)	1.29(1.19-1.40)***
Unintentional Injury Bereaved (n=270)			
Characteristics	5 year Prevalence Before Death	5 year Prevalence After Death	Relative Rate (95% CI)
Mental disorders	No. (%)	No. (%)	
Depression	50(18.52)	104(38.52)	2.08(1.61-2.69)***

Anxiety	70(25.93)	101 (37.41)	1.44(1.15-1.81)**
Substance Use Disorder	13(4.81)	14(5.19)	1.08(0.55-2.10)
Suicide Attempt	ss	ss	ss
Any Mental Disorder	101(37.41)	155(57.41)	1.54(1.30-1.81)***

*p<0.05; **p<.01,***p<0.001
With log per year offset.
GEE used.

Table 8-3: Before (5 years prior to spouses death) and after bereavement (5 years after spouses death) comparisons between bereavement cohorts

	Suicide-Bereaved vs. Unintentional Injury Bereaved (reference) N=1270			
Outcomes	Pre-Bereavement Adjusted Relative Rate[1] (95% CI)	Group X Bereavement Period Interaction (p-value)	Age X Sex Interaction (p-value)	Post-Bereavement Adjusted Relative Rate (95% CI)
Mental disorders				
Depression	1.99(1.31-3.03)**	0.0470	0.8187	1.28(0.98-1.67)
Anxiety	1.23(0.86-1.76)	0.787	0.2705	1.29(0.98-1.71)
Substance Use Disorder	2.10(0.89-5.00)	0.886	0.2058	1.99(0.88-4.51)
Suicide Attempt	ss	ss	ss	ss
Any Mental Disorder	1.35(1.03-1.18)*	0.5176	0.5025	1.24(1.03-1.45)*
	Suicide-Bereaved vs. Sudden natural death Bereaved (reference) (n=2726) [a]			
Outcomes	Pre-Bereavement Adjusted Relative Rate[1] (95% CI)	Group X Bereavement Period Interaction (p-value)	Age X Sex Interaction (p-value)	Post-Bereavement Adjusted Relative Rate (95% CI)
Mental disorders				
Depression	1.67(1.30-2.14)***	0.0759	0.4648	1.31(1.10-1.55)**
Anxiety	1.02 (0.82-1.27)	0.2138	0.9743	1.20(1.00-1.43)**
Substance Use Disorder	3.01(1.55-5.86)**	0.1767	0.4564	2.03(1.17-3.52)*
Suicide Attempt	ss	ss	ss	ss
Any Mental Disorder	1.22 (1.03-1.45)*	0.8534	0.7298	1.21(1.07-1.36)**

	Unintentional Injury Bereaved vs. Sudden Natural Death Bereaved (reference) (n=2536) [a]			
Outcomes	Pre-Bereavement Adjusted Relative Rate[1] (95% CI)	Group X Bereavement Period Interaction (p-value)	Age X Sex Interaction (p-value)	Post-Bereavement Adjusted Relative Rate (95% CI)
Mental disorders				
Depression	0.86(0.60-1.28)	0.3401	0.4361	1.05(0.86-1.30)
Anxiety	0.87(0.66-1.16)	0.5508	0.8558	0.97(0.78-1.21)
Substance Use Disorder	1.32(0.61-2.89)	0.3899	0.9023	0.94(0.49-1.80)
Suicide Attempt	ss	ss	ss	ss
Any Mental Disorder	1.07(0.85-1.33)	0.5653	0.7645	0.99(0.85-1.15)

*p<0.05; **p<.01,***p<0.001
Weighted with IPTW
Adjusted for age (median split used for each cohort) and sex (male/female).
[a]4 cases were not included from the SND cohort due to missing information on income.
GEE used.
ss-small cell size, data suppressed.

Appendix 8-A: ICD 9-CM and ICD-10-CA coding by bereavement group

	ICD 9-CM and ICD-10-CA codes
Suicide group	ICD 9-CM: E850-E854, E858, E862, E868, E950- E959; ICD-10-CA: X40-X42, X46, X47, X60-X84, Y10-Y12, Y16, Y17, Y870
Sudden natural death group	MI Death- (ICD-9-CM code 410; ICD-10-CA code I21) Cardiac Death (includes MI)-ICD-9-CM codes of 390-398, 402, 404-429, and 745-746. (ICD-10-CA codes I00-I09, I11, I13, and I20-I51) Stroke Death (ICD-9-CM codes 431, 434, 436; ICD-10-CA codes I61, I63, I64). Cerebral Aneurysm Death (ICD-9-CM codes 437.3; ICD-10-CA codes I67.1)
Unintentional injury group	MVC Death- (ICD-9-CM: E810-E819, E822-E825; ICD-10-CA: V02.0-V09.9,V12.0, V14.9,V19.0-V19.2,V19.4-V19.6,V20.0-V79.9, V80.3-V80.5, V81.0-V82.1,V83.0-V83.3,V84.0, V85.3,V86.00-V86.38,V87.0-V87.8,V88.0-V88.8,V89.0-V89.2,V99.) Drowning: ICD-9-CM: E830, E832, E910; ICD-10-CA: V90-V94, W65-W74. Excessive Cold Exposure: ICD-9-CM: E901; ICD-10-CA: X31.)

CHAPTER 9: SUMMARY

9.0 Summary of findings

Every year between 48 and 500 million individuals are bereaved by suicide, with evidence supporting poor health and increased suicide risk among the bereaved. [1] While many studies have found that individuals bereaved by suicide have poor health [2-11], some studies have found inconsistent evidence or lack of support for differences when suicide bereavement is compared to death by other traumatic events.[5,12-18] One of the reasons suicide bereavement may result in worse health is the caregiver burden that may precede the suicide, as well as feelings of rejection, stigma and shame that is associated with suicide. This shame may stem from the historical classification of suicide as an illegal activity and its fairly recent decriminalization in 1972. [19]

While the impact of suicide bereavement on health has been studied, including several theoretical frameworks to help examine suicide bereavement processes and meaning, a theoretical gap was present with more complex models needed that could empirically test overall rates of bereavement-associated mental disorders. The following doctoral research presented a longitudinal spousal suicide bereavement integrative risk framework that was tested using administrative data health registries. Using administrative data allowed for a rigorous examination of suicide bereavement related health while accounting for the impact of factors such as age, sex, region, and household income. [20-22] The ability to match a suicide cohort to the general population, and then statistically compare mental disorder rates of spouses who have experienced loss by suicide, sudden natural death and unintentional injury is an advantage of using administrative data. Defining mental disorders using both hospitalizations and medical

provider visits provides a more inclusive measure of treatment seeking as compared to studies which have relied on hospitalization data alone.[23]While the adapted framework utilized in this research is built on existing theoretical knowledge and concepts [24], it is a streamlined approach to examining one component of a larger framework in order to answer the question of overall, do spouses bereaved by suicide experience greater rates of mental disorders than spouses bereaved by other sudden causes of death?

Overall, the findings from this body of research has two clear messages: 1) spousal bereavement by suicide, sudden natural death and unintentional injury is associated with increased rates of mental disorders as compared to matched non-bereaved spouses, and 2) spouses bereaved by suicide do in fact experience different rates of mental disorders as compared to spouses bereaved by other types of sudden deaths. These findings support the hypothesis that bereavement trajectories may be different for suicide bereaved spouses. When examining the cohorts independently, spouses bereaved by suicide, injury and sudden natural death all have increased rates of depression, anxiety and any mental disorder when compared to the general population. This is largely consistent for both pre and post bereavement periods, suggesting the time surrounding bereavement is a period of increased risk for poor mental health. Spouses bereaved by suicide and sudden natural death had elevated rates of substance use disorder both prior to and following bereavement.

While individual examinations of bereavement cohorts found that all bereaved spouses experience poor mental health when compared to the non-bereaved, when statistically comparing the cohorts to one another, differences emerged. It is this comparison of cohorts that is

interesting and provides opportunities for intervention. Through this comparison, it is clear that suicide bereaved spouses had the poorest pre-existing overall health. Over 30% of suicide bereaved spouses had depression prior to bereavement, as compared to 19% of sudden natural death and 18.5% of injury cohorts. When comparing suicide bereaved to unintentional injury bereaved spouses, depression rates were highest among the suicide bereaved prior to the loss of their partner, however significant differences between groups were not found following the death. If only looking at the post-bereavement period, one could argue that these types of bereavement result in similar outcomes. However, the lack of differences found is due to the increased rates among suicide-bereaved spouses that existed prior to the death. Including pre-bereavement rates enabled an examination of the entire grief trajectory, and suggests each bereavement type has a unique trajectory and associated health. Pre-bereavement rates may be elevated in the suicide cohort because the death may not have been entirely unexpected, in that the spouse's health presented difficulties for the caregiver prior to the death. Increased rates among caregivers five years before the suicide suggests there may be opportunities for intervention prior to or at the time of death of the spouse. Given the higher pre-bereavement rates found in this study, opportunities for intervention are present which can hopefully result in a reduction of mental disorder rates and even the suicide death through possible early identification and treatment. As suicide is typically an unexpected and unpredictable event, it may or may not be possible to provide spousal intervention prior to the suicide. It is however possible to offer support to individuals who have a partner with mental disorders or previous suicide attempts. This intervention has the potential to impact not only caregivers in need of support but also the spouse who may be at risk for suicide. Providing mental health intervention at the time of the suicide death is also another possible strategy, as is being done in the United

States to help prevent poor health outcomes among suicide-bereaved individuals. [25,26] When examining rates of substance use for pre and post periods, rates are only elevated when comparing suicide bereaved spouses to spouses bereaved by sudden natural death. This is an important clinical finding in that overall sudden natural death and unintentional injury bereaved spouses do not appear to use substances to cope with the loss. However, data are dependent on treatment seeking, therefore it is possible that these individuals simply are not seeing health care providers for substance use whether or not a need is present. Among suicide-bereaved spouses, while rates are elevated in the pre and post death periods, rates appear to decrease in the post-death period. This finding suggests that future investigation may be warranted in understanding overall substance use among suicide-bereaved spouses.

9.1 Overall Limitations

In addition to study outcomes being dependent on treatment seeking which would potentially underestimate disorder rates, overall limitations of the following research includes findings are generalizable only to individuals that have registered their marriage, resulting in a potential underestimation of the number of suicide-bereaved spouses in Manitoba. While it is likely that common-law or unregistered partnerships would result in similar bereavement related health as spouses, it is not possible to extend our findings to these populations. Additionally, the effects of stigma on treatment seeking could not be examined due to its difficulty in measurement when using administrative data. For this reason, rates of mental disorders related to suicide and injury deaths may be further underestimated due to the effect of stigma and shame on help seeking. [27] Fourth, for the purpose of this research, the definition of suicide death included measures of accidental poisonings. [28] This inclusion was done to help offset the suspected

underreporting of suicides that can occur when using administrative data. [28] While this is a limitation, the number of suicide deaths due to accidental poisonings in this study was low (9.7%). A final limitation involves the use of area level income to approximate measure of socioeconomic status. As individual-level income data were not available,[29] this measure was used as matching criteria to approximate individual socioeconomic status and account for its impact on overall mental disorder rates. While this measure represents socioeconomic status at the time of death, economic changes that may have occurred in the years following bereavement were not examined in this study.

9.2 Future research and Next Steps

Based on the overall findings and limitations of this thesis, future research should aim to explore the relationship between stigma associated with suicide as a barrier to help-seeking, as well as investigate common-law and unregistered partnerships in order to determine if similar mental disorder rates are found surrounding the time of bereavement. Most importantly, interventions are needed that can help mitigate the risk of mental disorders associated with bereavement.

In order to address the increased need for care of suicide bereaved spouses as well as create innovative strategies that both prevent and treat poor health outcomes, a multifaceted approach consisting of a balanced distribution of upstream, midstream and downstream approaches is necessary (See Figure 9-1). The identification of individuals at risk can be used to target suicide-bereaved spouses via downstream approaches, which aim at responding to the effects of suicide bereavement. Active postvention, or direct contact for prevention or intervention among the surviving spouse is an example of a downstream intervention effort.

Follow up services can be as simple as a card sent to the spousal address with information on social supports following bereavement. Such support is available for individuals who have lost loved ones at Riverview, a palliative care facility in Winnipeg, Manitoba. More active approaches could include mandatory follow up and post-death screening by public health nurses, 24 hour suicide bereaved response unit, and linkage with social support/bereavement groups. Such mandatory following up could include screening by a mental health professional and follow up to ensure suicide bereaved spouses have access to the care they need. Specifically, a public health nurse or physician specializing in mental health and bereavement could be appointed for assessment and follow up of these individuals. Accountability would thereby lie with the Medical Examiner and the Regional Health Authorities to ensure identification and follow up has taken place and that survivors in need of support are offered care. Support exists for the benefits of an active postvention model in the suicide bereaved[30-32] and these models may prove useful because bereaved spouses may be severely depressed or traumatized early in their grief. These individuals may not be able to seek out and locate care because of the difficulty in mobilizing themselves. [30] New models of proactive outreach are currently being developed to facilitate care. Specifically, outreach services such as LOSS[25,26], an innovative program in which suicide bereaved individuals are contacted by a mental health professional and a trained suicide bereaved volunteer on the day of the suicide death may help to support the suicide bereaved, and reduce the isolation that can occur with suicide bereavement.

Despite the well-known impact of suicide bereavement, suicide bereavement interventions have been largely understudied. [25,33,34] Those who have studied suicide bereavement postvention have found findings to be mixed in terms of efficacy and benefit to survivors. [25,35,36] While the majority of studies have found small positive effects, the majority of

research has been plagued by methodological weaknesses. [25] While limited evidence is available on how to best support those bereaved by suicide, interventions are essential. In order to improve the identification and intervention for at risk spouses, general bereavement literature argues for the inclusion of interventions that support both the physical and psychological impact of widowhood. Recent guidelines on suicide postvention highlight that although the suicide bereavement experience is unique, suicide bereaved individuals are still bereaved individuals.[36] It may be that generalized bereavement approaches can offer guidance for suicide bereaved spousal postvention. Specifically, a focus on self-care and health promotion in addition to clinical care, research supports linkages between poor physical health at bereavement and increased risk for major depression and poor adjustment to bereavement following spousal loss.[37] Generalized bereavement approaches also confirm the importance of pre-bereavement (when possible) and early bereavement interventions. The unique trajectory of suicide bereavement may require a similar approach due to the greater burden of pre-bereavement mental disorders. Ultimately, future research is needed to determine if such types of postvention programs reduce the impact of suicide bereavement. [26] It is clear that developing effective suicide postvention and clinical interventions are a priority area for suicide research. [36]

Conversely, midstream and upstream approaches can also be developed that focus on healthy public policy, including the promotion of mental health via various mechanisms such as education incentives for post-secondary education, which has shown to be protective against suicide.[38,39] Midstream approaches offer a variety of innovative opportunities to help prevent poor health outcomes among the suicide bereaved. For example, in the United States there is a national survivors of suicide day that occurs every year before thanksgiving. [40] The goal of this

day is to bring awareness to suicide bereavement as well as allow the bereaved the opportunity to create social networks with others. While this approach may be viewed as downstream in that the approach supports the suicide bereaved, it is also midstream in that it directly influences behavior through increased social support, which has been shown to be protective.[41] Regardless of the choice of approach, policy and interventions in this area must focus on the promotion of mental health and reduction of stigma associated with mental disorders and suicide, target the modification of risk levels for the suicide bereaved, and regulate and test effective treatments and supports for individuals who have been bereaved by suicide.

To conclude, suicide bereaved spouses are a unique cohort who are in need of support and intervention. The effect of stigma on help seeking, as well as its role in bereavement related health is worth further investigation as it was not possible to measure using administrative data in this work. Future research should examine the role of stigma, shame and its relation to help seeking for mental disorders among spouses bereaved by suicide and other causes of death such as unintentional injury. Finally, downstream supports should be available for not just suicide bereaved spouses but spouses bereaved by the forms of sudden death discussed in this research, as it is clear that they are also in need of care. Creating an intervention as simple as a mail out following the sudden death may provide the bereaved with awareness and access to the supports they need to help reduce their risk of experiencing poor mental health. Given that spousal bereavement is considered to be one of life's most normal traumatic events, putting resources into reducing the health outcomes associated with it would reduce the tremendous burden on both the surviving individual and society as whole.

9.3 References

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Figure 9-1: Potential upstream, midstream and downstream approaches for spousal suicide bereavement.