Preventable mortality among sexual minority Canadians

Travis Salway, Ashleigh J. Rich, Olivier Ferlatte, Dionne Gesink, Lori E. Ross, Richard Brännström, Aida Sadr, Syma Khan, Troy Grennan, Mostafa Shokoohi, David J. Brennan, Mark Gilbert

A population-based retrospective cohort with 442,260 (unweighted N) Canadian adults, ages 18–59 years, was drawn from the Canadian Community Health Survey/Canadian Mortality Database linked database (2003–2017). The Rutstein preventability rating index was used to classify cause-specific mortality (low/high).

Results: SM respondents had higher hazard of all-cause mortality (unadjusted hazard ratio [uHR] 1.28, 95% CI 1.06, 1.55). The uHR increased when the outcome was limited to highly-preventable causes of mortality (uHR 1.43, 95% CI 1.14, 1.80). The uHR further increased in sensitivity analyses using higher thresholds of the Rutstein index. SM respondents had higher hazard of cause-specific mortality for heart disease (uHR 1.53, 95% CI 1.03, 2.29), accidents (uHR 1.97, 95% CI 1.01, 3.86), HIV (uHR 75.69, 95% CI 18.77, 305.20), and suicide (uHR 2.22, 95% CI 0.93, 5.30) but not for cancer (uHR 0.86, 95% CI 0.60, 1.25). The adjusted HR (aHR) for highly-preventable mortality was not attenuated by adjustment for confounders (aHR 1.57, 95% CI 1.20, 2.05) but was reduced by adjustment for hypothesized mediators relating to access to social and material resources (marital status, children, income, education; aHR 1.11, 95% CI 0.78, 1.58).

Conclusions: Preventable mortality was elevated for SM Canadians compared to heterosexuals. Early and broad access to sexual minority-affirming primary and preventive healthcare should be expanded.
or greater risk of inter-personal violence, depression, anxiety, suicide ideation and attempts, sexually transmitted infections, HIV/AIDS, and some forms of substance use (Goldbach et al., 2014; Hottes et al., 2016; Katz-Wise & Hyde, 2012; Purcell et al., 2012; Ross et al., 2018). Evidence for inequities in other health outcomes—particularly those related to chronic physical illnesses (e.g., cancer, cardiovascular disease, asthma, and diabetes)—is scant but emerging (Caceres et al., 2017; Lick et al., 2013; Meads et al., 2018). A small number of international studies have extended these epidemiological inquiries to examine differences in mortality between sexual minority and heterosexual groups, finding elevated all-cause mortality and HIV-related mortality among sexual minority men in one US study (Cochran & Mays, 2011) and elevated suicide mortality among sexual minority adults in the US (Cochran & Mays, 2015), Denmark (Mathy et al., 2011), and Sweden (Bjorkenstam et al., 2016).

A range of structural, social, psychological, physiological, and behavioral causal pathways warrant investigation as explanations for sexual minority health inequities (Krieger, 2020). Many of these pathways start with what has been termed a “minority stress” process (Brooks, 1981; Meyer, 2003). Sexual minority stress theory predicts that an accumulation of enacted and perceived external threats to sexual minorities (e.g., violence, discrimination, social exclusion) as well as internalized notions of shame and sexual identity concealment will lead to psychological, physiological, and behavioral responses that in turn cause disease-specific processes (Hatzenbuehler, 2009). To-date, minority stress causal pathways have predominantly been conceptualized as direct effects of these particular stressors (violence, discrimination, internalized shame, concealment, etc.) on the psychopathology or physiology of disease; in other words, the accumulation of minority stress directly causes production of disease (Hatzenbuehler, 2009; Juster et al., 2015). Brook’s sexual minority stress model (1981), however, additionally includes a socio-economic domain, suggesting that other indirect pathways are important in explaining at least some portion of the elevated burden of multiple diseases in sexual minority populations (Brooks, 1981; Rich et al., 2020).

Fundamental cause theory, which has been used to explain health disparities associated with socioeconomic status (Link & Phelan, 1995), therefore may be complementary to this broader notion of sexual minority stress theory. In their paper introducing stigma as a fundamental cause in its own right, Hatzenbuehler et al. posit that the mediators between sexual minority stigma and poor health will include, not only stress and related psychological and behavioral responses, but also differential access to material and social resources (Hatzenbuehler et al., 2013). These resources include factors that are ‘proximal’ to health outcomes of interest—i.e., those affecting access to preventative healthcare or early diagnosis and treatment—and factors that are ‘distal’ but even more fundamental to the daily lives of sexual minorities—i.e., immediate family supports (spouses/partners, children), employment, income, etc.

In the case of ‘proximal’ resources, because of minority stress, many sexual minorities perceive or anticipate healthcare providers to be stigmatizing with regard to their minority sexual orientation, or have experienced this firsthand, and therefore delay or avoid healthcare encounters (Neville & Henrichson, 2006). Consequently, sexual minorities are more likely than heterosexuals to report unmet health needs or barriers to accessing health services (Tjepkema, 2008). This suggests that an additional pathway between minority stress and poor health includes perceived barriers to access to or utilization of disease prevention interventions through the healthcare system (Bränström et al., 2016).

Differential access to ‘distal’ social (e.g., family members, support networks) and material (e.g., income) resources have been less frequently studied as mediators of sexual orientation and health outcome disparities (Bränström et al., 2019). These factors may be relevant to understanding sexual minority health, given that sexual minorities may experience differences in access to social resources due to lower rates of marriage/partnership (Bränström et al., 2016); lower rates of childrearing (and thus differential access to social networks associated with parenting/schools) (Bränström et al., 2019); differences in size, range, and density of social networks (Erosheva et al., 2016); and, lower levels of community belonging or trust (Bränström et al., 2019). Sexual minorities may additionally experience lower levels of access to material resources owing to their lower levels of income relative to heterosexuals (Badgett et al., 2013). Consistent with fundamental cause theory, a recent Swedish study found that four societal barriers to social integration, including not being married/partnered, not living with children, being unemployed, and lack of societal trust, mediated approximately 30% of the disparity in elevated suicide-related outcomes among sexual minority compared to heterosexual Swedes (Bränström et al., 2019). If these distal factors are important in explaining sexual minority health inequities, then structural solutions—focusing on systemic improvements in social resources, employment/workplace equity, familial/reproductive justice—may be warranted.

The objective of this study is to apply fundamental cause theory (Hatzenbuehler et al., 2013) to sexual minority health by estimating and comparing rates of preventable mortality among sexual minority and heterosexual respondents in a large representative sample of Canadians derived from the Canadian Community Health Survey. We used fundamental cause theory—and methods previously established by Phelan et al. (Phelan et al., 2004)—to test two hypotheses. First, we hypothesized that sexual orientation disparities in mortality would be greater in magnitude for specific causes of death that are preventable “by means of medical treatment or other interventions administered after the disease [has] been detected” or “by preventing the incidence of the disease—for example by good hygiene, diet, other lifestyle factors, vaccines, etc.” (Phelan et al., 2004) This is because highly-preventable causes of death are more amenable to prevention through access to social and material resources, including greater or more timely access to healthcare. Second, we hypothesized that the association between sexual orientation and preventable mortality would be mediated by one or more variables corresponding to social and material resources.

2. Methods

2.1. Data

The Canadian Community Health Survey and Canadian Mortality Database (CCHS-CMDB) is a retrospective cohort of Canadians, sampled from the CCHS between 2000 and 2017 and followed for record of death until December 31, 2017 (Sanmartin et al., 2016). CCHS is a serial cross-sectional study, and nationally representative of approximately 97% of the non-institutionalized Canadian population aged 12 or over. CCHS respondents who consented to share their personal health numbers for the purposes of data linkage (approximately 85% of all survey participants) were probabilistically linked to the Historical Tax Summary File—in order to identify alternative postal codes and names—then to the CMDB, using name, date of birth, sex, and postal code; additional details are reported elsewhere (Sanmartin et al., 2016). Access to the CCHS-CMDB was obtained through the Canadian Research Data Centre Network. Data collection and linkage were approved by Statistics Canada’s Executive Management Board (ref. num. 903–2015); access and privacy standards are governed by Statistics Canada’s Directive on Record Linkage, and ethical standards were met through compliance with the federal Statistics Act (Sanmartin et al., 2016). The CCHS-CMDB is reproduced and distributed on an “as is” basis with the permission of Statistics Canada Canada.

2.2. Variables

Sexual orientation was assessed using a single identity-based measure, “Do you consider yourself to be: heterosexual (sexual relations with people of the opposite sex), homosexual, that is lesbian or gay...
(sexual relations with people of your own sex), bisexual (sexual relations with people of both sexes)?” This question was introduced in 2003 and subsequently asked of adults 18–59 years of age until 2012, after which it was asked of all respondents age 15 years and older.

We updated the Rutstein preventability rating index for the 96 most common causes of death (in the US National Death Index, 1990), and supplemented these with any other causes of death that appeared in ≥5 records in the CCHS-CMDB (Phelan et al., 2004; Rutstein et al., 1976). The Rutstein index has been previously used in numerous epidemiologic analyses of “health events whose occurrence should provide an alarm that something was awry in the delivery of health care,” due to the preventable nature of the outcomes (Phelan et al., 2004; Rutstein et al., 1976), and most recently has been used to analyze preventable causes of hospitalization among sexual minorities in Sweden (Bränström et al., 2016). Three physicians (coauthors: AS, SK, TG) independently rated each cause of death, coded according to the International Classification of Diseases, 10th revision (ICD-10), in 0.5-point increments on a scale from 1 (“virtually impossible to prevent death”) to 5 (“virtually all deaths preventable”). Preventability was defined using two criteria, consistent with the Phelan et al. application of the Rutstein index: 1) “the degree to which that cause of death was preventable by preventing the incidence of the disease—for example, by good hygiene, diet, other lifestyle factors, vaccines, etc.” (i.e., primary preventability), and 2) “the degree to which that cause of death was preventable by means of medical treatment or other interventions administered after the disease had been detected” (i.e., tertiary preventability) (Phelan et al., 2004).

Raters were instructed to consider preventability in the context of the contemporary Canadian medical system. A rating was assigned for each ICD-10 code by considering both criteria in concert (i.e., a cause could be classified as highly preventable either if disease incidence was highly preventable through primary prevention strategies, or if, once diagnosed, disease mortality was highly preventable through treatment).

An intra-rater composite rating was calculated by taking the mean of the intra-rater composite ratings. As defined by Phelan et al. we classified those causes of death with ratings ≥4.0 as “high-preventable” and those with ratings <4.0 as “low-preventable.” We flagged any causes with an inter-rater composite rating between 3.5 and 4.5 for which any two raters provided ratings that differed by ≥0.5. The raters then met with the first author to arrive at a consensus rating for these flagged discrepancies (11/144). Among the analytic sample with any death record in the CMDB, 88.1% were assigned a preventability rating. 84 of the 144 (58%) ICD-10 codes were classified as highly-preventable using the ≥4.0 threshold. The mean (k = 3) intraclass correlation coefficient was 0.90 (95% confidence interval [CI] 0.85, 0.94), indicating good interrater reliability. A full list of the ICD-10 codes and their interrater composite ratings are presented in Appendix A.

We used a directed acyclic graph to identify hypothesized mediators and confounders of the association between sexual minority status and preventable mortality (Fig. 1). Race, gender/sex, age, and urban residence were theorized as unlikely to be affected by sexual minority status but are known to be causes of both sexual minority status disclosure (Ferlatte et al., 2017) and premature mortality (Frohlich et al., 2006; Sanmartin et al., 2016), and therefore constitute confounding variables. We conceived of race and gender/sex, not as biologically deterministic factors, but rather as constructs that reflect pervasive and inequitable social differences in experiences of oppression and access to material resources (Neophytou et al., 2021). Marital status (previously married; single; married/partnered), presence of children (any; none), household income (by quintiles), and educational attainment (less than secondary degree; secondary degree; some postsecondary; postsecondary graduate) were hypothesized to be mediating factors, consistent with fundamental cause theory (Bränström et al., 2019; Link & Phelan, 1995; Tjepkema et al., 2013). These four factors are conceptually distinct from the confounding variables in that that they predominantly occur during adult phases of the life course and hence are more likely to temporally follow the adoption of a sexual minority identity. That is, sexual minority status and its related social conditions were hypothesized to reduce the likelihood of being married/partnered, having children, having a higher household income, and attaining a higher level of education, and these factors, in turn, are fundamental causes of premature mortality (Phelan et al., 2004).

2.3. Analyses

The dataset was restricted to adults 18–59 years of age who provided a valid answer to the sexual orientation question (2003–2017; unweighted N = 442,260). Analyses were conducted in five steps. First, we described the distributions of hypothesized mediators and confounders between sexual minorities and heterosexuals. We additionally examined the distributions of self-rated mental and physical health between sexual

Fig. 1. Conceptual and analytical model of hypothesized causal pathways between sexual minority status and preventable mortality, based on fundamental cause theory (Link and Phelan, 1995); o explanatory variable; o outcome; m mediator; c confounder.
minorities and heterosexuals—not as explanatory variables, but rather as secondary outcomes of potential interest (and representing convergent validity with mortality outcomes). Second, we used Cox proportional hazards regression to generate hazard ratios, with 95% confidence intervals (CI), comparing sexual minorities to heterosexuals for the following outcomes: a) the three most common causes of death in the general population (cancer, heart disease, accidents), b) two common causes of premature mortality among sexual minorities (suicide, HIV) (Hottes et al., 2015), c) preventable mortality (Rutstein rating ≥4.0), and d) all-cause mortality. Third, we conducted sensitivity analyses, varying the cut point defining high-preventability between 3.5 and 5.0. Fourth, we evaluated the degree to which any observed association between sexual minority status and preventable mortality was explained by hypothesized confounders (multivariable model 1) and mediators (multivariable models 2–6), by entering these variables sequentially into Cox proportional hazards models. Evidence of confounding or mediation was determined by changes in the magnitude and statistical significance of the hazard ratio (HR) comparing sexual minorities to heterosexuals. Fifth, we conducted additional unadjusted Cox proportional hazards models to estimate HRs for preventable mortality (Rutstein rating ≥4.0), stratified by gender/sex, and comparing bisexual and lesbian/gay groups to heterosexuals, separately (sample size did not support analyses further stratified by sexual orientation identity and gender/sex). All analyses used weights to account for the complex survey design and were conducted in R version 4.0.2.

3. Results

Ninety-seven percent (97.6%) of the CCHS-CMD cohort identified as heterosexual, 1.1% as bisexual, and 1.3% as lesbian/gay. As compared with heterosexuals, a greater proportion of sexual minorities lived in urban areas, were <30 years of age, were women, were un-married/partnered, had no children in the household, and had a household income in the lowest quintile. Fair/poor mental health and physical health were more frequent among sexual minorities (Table 1).

Sexual minorities had significantly greater hazard of all-cause mortality (unadjusted HR [uHR] 1.28, 95% CI 1.06, 1.55), compared with heterosexuals. Statistically significant differences in cause-specific mortality were observed for HIV (uHR 75.69, 95% CI 18.77, 305.20), accidents (uHR 1.97, 95% CI 1.01, 3.86), and heart disease (uHR 1.53, 95% CI 1.03, 2.29). Sexual minorities also had greater hazard of death by suicide, however, the association was not statistically significant (uHR 2.22, 95% CI 0.93, 5.30). No statistically significant difference was observed for cancer mortality (uHR 0.86, 95% CI 0.60, 1.25). (Table 2).

In primary analyses of high-preventable mortality (≥4.0), the uHR for sexual minority status was 1.43 (95% CI 1.14, 1.80), while for low-preventable mortality (<4.0), the uHR was closer to the null and not statistically significant (1.02, 95% CI 0.69, 1.52). In sensitivity analyses, the uHR for high-preventable mortality increased with higher thresholds of the Rutstein rating (i.e., uHR = 1.39 at threshold of ≥3.5, 1.43 at ≥4.0, 1.55 at ≥4.5, and 1.68 at ≥5.0) (Appendix B). Kaplan-Meier survival curves stratified by sexual orientation and preventability of death were overlapping between sexual minority and heterosexual groups in the case of highly preventable deaths but divergent in the case of low-preventable deaths (Fig. 2).

The highly-preventable mortality HR for sexual minority status increased with adjustment for confounders to 1.57 (95% CI 1.20, 2.05). Individual adjustment for two of the mediators (marital status and income) resulted in reductions in the highly-preventable adjusted mortality HR (aHR) such that they were no longer statistically significant (aHR 1.20, 95% CI 0.94, 1.54 for marital status; aHR 1.21, 95% CI 0.89, 1.65 for income). Individual adjustment for the other two mediators (children and educational attainment) did not reduce the highly-preventable aHR. Adjustment for all four mediators (and confounders) further reduced the highly-preventable aHR to 1.11 (95% CI 0.78, 1.58). (Table 3).

Table 1

| Characteristic                  | Level          | Sexual minorities | Heterosexuals |
|--------------------------------|----------------|------------------|---------------|
| Socio-demographics             |                |                  |               |
| Area of residence              | Urban          | 82.6%            | 73.9%         |
|                               | Rural          | 17.4%            |               |
| Age                            | 18–30          | 34.2%            | 23.7%         |
|                               | 30–39          | 21.0%            | 23.9%         |
|                               | 40–49          | 22.8%            | 22.9%         |
|                               | 50–59          | 22.4%            | 29.5%         |
| Gender/sex                     | Women          | 58.4%            | 41.6%         |
|                               | Men            | 41.6%            | 58.4%         |
| Race or cultural group         | Indigenous     | 7.8%             | 5.5%          |
|                               | White/European | 84.5%            | 85.7%         |
|                               | Other racialized minority | 7.3% | 8.8% |
| Educational attainment         | ≤ Secondary    | 8.2%             | 8.7%          |
|                               | Secondary      | 16.4%            | 16.1%         |
|                               | Some postsecondary | 21.5% | 16.6% |
|                               | Postsecondary grad | 53.4% | 58.6% |
| Marital status                 | Married or common-law | 31.5% | 59.4% |
|                               | Previously married | 10.5% | 12.6% |
|                               | Single         | 58.0%            | 28.0%         |
| Children in household          | None           | 78.1%            | 61.8%         |
|                               | Any            | 21.5%            | 38.2%         |
| Household income               | Lowest quintile | 26.0%            | 16.2%         |
|                               | Second-lowest quintile | 18.3% | 16.1% |
|                               | Middle quintile | 19.6%            | 19.4%         |
|                               | Second-highest quintile | 20.1% | 22.3% |
|                               | Highest quintile | 21.5%            | 25.9%         |
| Health outcomes                | Self-rated physical health | Fair/poor | 16.0% | 10.5% |
|                               | Self-rated mental health | Fair/poor | 16.0% | 6.7% |
| Person-years of follow-up      | Median          | 6.65             | 8.33          |

Note. All percentages are calculated using weighted estimates. * assessed in the last 12 months. † a sexual orientation question only asked of respondents 18–59 years of age in some survey cycles. ‡ persons living on-reserve are not sampled in CCHS.

4. Discussion

Using a large retrospective cohort, we identified an elevated rate of preventable mortality among sexual minority Canadians, relative to heterosexual Canadians (Table 3). This association was specific to causes of death classified as highly preventable, increased with greater specificity of outcome (i.e., higher preventability rating), and did not attenuate with adjustment for hypothesized confounders. These observations strengthen our inference that the effect is not distorted by confounding or misclassification of the outcome. The observed sexual orientation disparity in preventable mortality occurred in the context of a publicly funded medical system in Canada—an iteration of what has been described elsewhere as the inequality paradox associated with whole-population approaches to healthcare (Frohlich & Potvin, 2008). This suggests that additional tailored policy and practice interventions are needed to enable equitable preventive care for sexual minorities.

Consistent with a recent study from Sweden (Brännström et al., 2019)—and informed by fundamental cause theory—we found evidence that the association between sexual minority status and preventable mortality is at least partially mediated by two variables that can be conceived as barriers to access to social and material resources: being un-married/unpartnered and having lower levels of household income. Partnership affords access to social resources that may be beneficial in...
Income is a fundamental driver of multiple health outcomes. Relational accountability and reciprocity with partners act as conduits to increase the size of social networks, offering intimate bonds that have health-promoting effects of their own; as a result, partners may be needed to mitigate inequities in fundamental cause-related mediators. We suggest that social and material resources should be expanded. Ultimately, the healthcare system should be broadened to include sexual minority-affirming primary and preventive healthcare needs, possibly signaling a deficit in opportunities for receiving preventative medical care early in the course of disease (Brooks, 1981; Rich et al., 2020). With regard to practice, early and broad access to sexual minority-affirming primary and preventive healthcare should be expanded. Ultimately, the healthcare system should be supported by evidence-based measures to ensure that healthcare encounters affirm the experiences of sexual minorities and thus encourage and support access (Neville & Henrickson, 2006). In the meantime, a tailored approach may be required, which supports low-barrier and affirming clinics that specialize in healthcare delivery for sexual minority populations (Mayer et al., 2012).

Finally, our results suggest that higher level structural interventions may be needed to mitigate inequities in fundamental cause-related mediating factors; historically, these have included non-discrimination preventing both the onset of some illnesses and ensuring early access to diagnosis and treatment for diseases with preventable mortality (Kim et al., 2017). Relational accountability and reciprocity with partners offer intimate bonds that have health-promoting effects of their own; moreover, partners act as conduits to increase the size of social networks (e.g., through a partner’s group of friends, family, or coworkers, or through other parents at a child’s school). (Berkman et al., 2000).

Sexual minorities have lower levels of individual income than heterosexuals, and women partnered with women have lower levels of household income than women partnered with men (Badgett et al., 2013). Income is a fundamental driver of multiple health outcomes—determining where one lives, access to prevention tools (healthy diet, exercise), social connections that enable early/timely healthcare—and those living in poverty are less likely to have resources (money, time, power, privilege, control) “that can then be used to avoid risks or minimize the consequences of disease once it occurs.” (Link & Phelan, 1995) Particularly relevant to the second criterion of preventable mortality—i.e., preventable through early medical intervention—Canadians living in poverty are more likely to report unmet healthcare needs, possibly signaling a deficit in opportunities for receiving preventative medical care early in the course of disease (Sibley & Glazier, 2009).

These analyses are limited by several methodological problems inherent to the CCHS dataset. First, sexual orientation was only assessed for Canadians under 60 years of age until recent cycles of the CCHS; thus, we are unable to derive estimates of preventable mortality for older adults. Second, sexual orientation is assessed through an interviewer (in person or by phone), and thus is susceptible to misclassification (underreporting) by up to 33%, due to the stigma attached to sexual minority status (Ferlatti et al., 2017). Assuming nondifferential misclassification, this error likely attenuated the associations in this study by misclassifying sexual minority respondents (with higher mortality) as heterosexuals. In addition, our analyses lacked the specificity to understand the precise pathways between sexual orientation and premature and preventable mortality. We have assumed that some mediators—partnership, children, income, education—are drivers of access to social and material resources; however, further research is needed to explore these pathways in more detail. This is particularly important given that the pathways may be different for sexual minorities relative to what we know based on research with predominantly heterosexuals. For example, while more education may provide access to resources, it may also be associated with exposure to discrimination. Access to these resources also may differ by specific sexual orientations (gay/lesbian, bisexual, etc.) and by gender. Unfortunately, we did not have sufficient sample size to test for moderation of observed associations by sexual orientation (disaggregating bisexual and monosexual identities) and gender using multivariable adjustment of confounders and mediators; however, these sub-group multivariable analyses will be feasible with future updates to the CCHS-CMDB, enlarging the available sample size. Likewise, because Statistics Canada has only recently begun to include gender identity ascertainment measures, we are unable to stratify by gender modality (trans, cis). We included all forms of cancer in the estimate of cancer mortality; however, some types of cancer are more preventable than others. This lack of specificity in the outcome may explain our failure to detect a difference between groups. While we used multiple raters to arrive at our preventability ratings, we encourage further validation and refinements of the categorization scheme we present. Finally, we lacked the sample size to estimate rates of cause-specific mortality with precision for the sexual minority sub-cohort of the CCHS (e.g., for suicide mortality, Table 2). As the CCHS-CMDB cohort is updated with more recent CCHS cycles, more precise estimates may be derived.

Our study offers important implications for public health research and practice. With regard to research on the causes of ill health among sexual minorities, we suggest that social and material resources should be considered alongside minority stress as potential pathways contributing to ongoing sexual orientation inequities in health. Indeed, constrained economic opportunities was included as an important factor in Brooks’s, 1981 articulation of minority stress theory, and this socio-structural category of mediators should be evaluated alongside the psychological mediators in future sexual minority epidemiologic studies (Brooks, 1981; Rich et al., 2020). With regard to practice, early and broad access to sexual minority-affirming primary and preventive healthcare should be expanded. Ultimately, the healthcare system should be supported by evidence-based measures to ensure that healthcare encounters affirm the experiences of sexual minorities and thus encourage and support access (Neville & Henrickson, 2006). In the meantime, a tailored approach may be required, which supports low-barrier and affirming clinics that specialize in healthcare delivery for sexual minority populations (Mayer et al., 2012).

| Cause of death | Sexual minorities Rate per 100,000 person-years | Heterosexuals Rate per 100,000 person-years | UHR (95% CI) |
|---------------|-----------------------------------------------|---------------------------------------------|--------------|
| Common causes of death, general population | | | |
| Cancer | 129.62 | 142.97 | 0.86 (0.60, 1.25) |
| Heart disease | 64.81 | 48.58 | 1.53 (1.03, 2.29) |
| Accidents | 64.81 | 18.05 | 3.68 (1.01, 12.50) |
| Common causes of death, sexual minorities | | | |
| Suicide | 64.81 | 15.27 | 2.22 (0.93, 5.30) |
| HIV* | – | – | 75.69 (18.77, 305.20) |
| All-cause mortality | 388.85 | 317.87 | 1.28 (1.06, 1.55) |

Note. UHR = unadjusted hazard ratio (unadjusted), comparing rate in sexual minorities to rate in heterosexuals.

* Mortality estimates do not meet Statistics Canada requirements for data release.

**Table 2**

Unadjusted mortality rates and Cox proportional hazard ratios (HR) for all-cause and cause-specific mortality by sexual minority status, Canadian Community Health Survey-Canadian Mortality Database cohort, Canada, 2003–2017.
## Table 3
Cox proportional hazard ratios (HR) for high-preventable mortality (≥4.0) by sexual minority status, Canadian Community Health Survey-Canadian Mortality Database cohort, Canada, 2003–2017

| Sexual orientation | UHR (95% CI) | AHR1 | AHR2 | AHR3 | AHR4 | AHR5 | AHR6 |
|--------------------|-------------|------|------|------|------|------|------|
| Sexual minorities (ref: heterosexuals) | 1.43 (1.14, 1.80) | 1.57 (1.20, 2.05) | 1.20 (0.94, 1.54) | 1.45 (1.11, 1.91) | 1.21 (0.89, 1.65) | 1.62 (1.26, 2.09) | 1.11 (0.78, 1.58) |
| Underlying social characteristics | | | | | | | |
| Age (continuous) | 1.10 (1.09, 1.10) | 1.10 (1.09, 1.10) | 1.10 (1.08, 1.11) | 1.10 (1.09, 1.11) | 1.10 (1.09, 1.11) | 1.10 (1.09, 1.11) | 1.10 (1.09, 1.11) |
| Urban residence (ref: non-urban) | 0.82 (0.74, 0.90) | 0.99 (0.89, 1.09) | 0.91 (0.83, 1.01) | 0.99 (0.89, 1.09) | 0.93 (0.82, 1.04) | 0.91 (0.80, 1.05) | 1.04 (1.00, 1.08) |
| Women (ref: men) | 0.52 (0.48, 0.57) | 0.53 (0.48, 0.58) | 0.52 (0.48, 0.58) | 0.53 (0.48, 0.58) | 0.47 (0.41, 0.53) | 0.53 (0.49, 0.58) | 0.47 (0.42, 0.53) |
| Race (ref: white) | 1.33 (1.09, 1.62) | 1.81 (1.48, 2.21) | 1.68 (1.38, 2.05) | 1.78 (1.48, 2.13) | 1.32 (1.08, 1.62) | 1.63 (1.38, 1.92) | 1.26 (1.07, 1.49) |
| Other racialized minority | 0.40 (0.32, 0.49) | 0.56 (0.45, 0.70) | 0.60 (0.47, 0.76) | 0.58 (0.46, 0.73) | 0.41 (0.30, 0.55) | 0.57 (0.45, 0.73) | 0.47 (0.33, 0.67) |
| Fundamental cause-related mediators | | | | | | | |
| Educational attainment (ref: secondary) | | | | | | | |
| Previously married | 2.87 (2.56, 3.22) | – | 2.14 (1.92, 2.39) | – | – | – | – |
| Single | 1.09 (0.98, 1.21) | – | 2.25 (2.01, 2.52) | – | – | – | – |
| Children (ref: none) | 0.31 (0.28, 0.35) | – | 0.65 (0.58, 0.73) | – | – | – | – |
| Income (ref: lowest quintile) | | | | | | | |
| Second-lowest quintile | 0.46 (0.39, 0.55) | – | – | 0.45 (0.37, 0.53) | – | – | 0.50 (0.42, 0.59) |
| Middle quintile | 0.42 (0.35, 0.50) | – | – | 0.37 (0.31, 0.43) | – | – | 0.45 (0.37, 0.53) |
| Second-highest quintile | 0.35 (0.30, 0.42) | – | – | 0.29 (0.25, 0.34) | – | – | 0.38 (0.32, 0.45) |
| Highest quintile | 0.29 (0.25, 0.35) | – | – | 0.20 (0.17, 0.24) | – | – | 0.27 (0.22, 0.33) |
| Educational attainment (ref: <secondary) | | | | | | | |
| Secondary | 0.48 (0.42, 0.55) | – | – | – | 0.64 (0.56, 0.73) | 0.85 (0.69, 1.04) |
| Some postsecondary | 0.39 (0.32, 0.47) | – | – | – | 0.60 (0.51, 0.71) | 0.80 (0.63, 1.02) |
| Postsecondary grad | 0.34 (0.31, 0.38) | – | – | – | 0.46 (0.41, 0.51) | 0.73 (0.61, 0.88) |

Note. UHR = unadjusted hazard ratio; AHR = adjusted hazard ratio; ref = referent category.
* adjusted for underlying social characteristics.
† adjusted for one mediator (and underlying social characteristics).
* full model, adjusted for all mediators (and underlying social characteristics).

in the workplace legislation, access to marriage equality, etc., however, these laws and policies are clearly not sufficient in and of themselves (Krieger, 2020). More work is needed to evaluate other social policies and legislation that can improve access to life-affirming social and material resources (Carpenter et al., 2021). Long follow-up periods will be needed to examine the benefits of these kinds of structural interventions; however, ultimately these mediators—and associated structural interventions—may account for more of the relationship between sexual minority status and health outcomes (including mortality) than minority stress factors alone.

### Author Statement

**Travis Salway:** Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Writing-Original Draft, Writing-Review & Editing, Visualization.  
**Ashleigh J. Rich:** Conceptualization, Methodology, Investigation, Writing-Review & Editing.  
**Olivier Ferlatte:** Conceptualization, Methodology, Investigation, Writing-Review & Editing.  
**Dionne Gesink:** Conceptualization, Methodology, Investigation, Writing-Review & Editing.  
**Lori E. Ross:** Conceptualization, Writing-Review & Editing.  
**Richard Bränstrom:** Conceptualization, Writing-Review & Editing.  
**Aida Sadr:** Formal Analysis, Data Curation, Writing-Review & Editing.  
**Syma Khan:** Formal Analysis, Data Curation, Writing-Review & Editing.  
**Troy Brennan:** Formal Analysis, Data Curation, Writing-Review & Editing.  
**Mostafa Shokoohi:** Conceptualization, Writing-Review & Editing.  
**David J. Brennan:** Conceptualization, Writing-Review & Editing.  

### Data availability

The authors do not have permission to share data.

### Acknowledgment

This research was supported by funds to the Canadian Research Data Centre Network (CRDCN) from the Social Sciences and Humanities Research Council (SSHRC), the Canadian Institute for Health Research (CIHR), the Canadian Foundation for Innovation (CFI), and Statistics Canada. Although the research and analysis are based on data from Statistics Canada, the opinions expressed do not represent the views of Statistics Canada.
Appendix A. Causes of death by preventability ratings, based on Phelan et al. (Erosheva et al., 2016), updated for Canadian context, 2000–2017

| Preventability rating | ICD-10 code | Cause of death |
|-----------------------|-------------|----------------|
| 1.0                   | C23         | Malignant neoplasm of gallbladder |
|                       | C24.9       | Malignant neoplasm of biliary tract, unspecified |
|                       | C24.0       | Malignant neoplasm of extrahepatic bile ducts |
|                       | C25         | Malignant neoplasm of pancreas |
|                       | C73         | Malignant neoplasm of thyroid gland |
|                       | C81.9       | Hodgkin lymphoma, unspecified |
|                       | C85.1       | Unspecified B-cell lymphoma |
|                       | D43.2       | Neoplasm of uncertain behavior of brain, unspecified |
|                       | D47.1       | Chronic myeloproliferative disease |
|                       | G12.2       | Anterior horn cell disease |
|                       | G35         | Multiple sclerosis |
|                       | G70/G71/G72 | Myoneural disorders, muscular dystrophies, and other myopathies |
|                       | M34.8       | Other forms of systemic sclerosis |
| 2.0                   | C37/C38     | Malignant neoplasm of thymus, heart and mediastinium |
|                       | C55/C56/C57.4 | Malignant neoplasm of ovary and other uterine adnexa |
|                       | C71         | Malignant neoplasm of brain |
|                       | C82.9/C83/C85.9/ | Lymphosarcoma and reticulosarcoma |
|                       | C91.9       | Multiple myeloma and immunoproliferative neoplasms |
|                       | C92         | Myeloid leukemia |
|                       | C95         | Leukemia of unspecified cell type |
| 3.0                   | C15         | Malignant neoplasm of esophagus |
|                       | C16         | Malignant neoplasm of stomach |
|                       | C51.9       | Malignant neoplasm of vulva, unspecified |
|                       | C54         | Malignant neoplasm of body of uterus |
|                       | C64         | Malignant neoplasm of kidney, except renal pelvis |
|                       | C64.9       | Myelodysplastic syndrome, unspecified |
|                       | D61         | Aplastic anemia |
|                       | D64.9       | Anemia, unspecified |
|                       | D86         | Sarcoidosis |
|                       | E88.0       | Disorders of lipid and plasma protein metabolism |
|                       | F19         | Other psychoactive substance related disorders |
|                       | F03         | Senile and presenile organic psychotic conditions |
|                       | G30.0       | Alzheimer’s disease with early onset |
|                       | G30.1       | Alzheimer’s disease with late onset |
|                       | G30.9       | Alzheimer’s disease, unspecified |
|                       | I42         | Cardiomyopathy |
|                       | M30         | Polyanarteritis nodosa and allied conditions |
|                       | Q60-64      | Congenital anomalies of urinary system |
|                       | X70, X80    | Suicide and self-inflicted injury by hanging, strangulation, suffocation and jumping from high place |
| 3.5                   | C22         | Malignant neoplasm of liver and intrahepatic bile ducts |
|                       | C50         | Malignant neoplasm of female breast |
|                       | C61         | Malignant neoplasm of prostate |
|                       | C91         | Lymphoid leukemia |
|                       | D33         | Benign neoplasm of brain and other parts of nervous system |
|                       | D65-69      | Coagulation defects |
|                       | G20         | Parkinson’s disease |
|                       | G40         | Epilepsy |
|                       | I26.0       | Acute pulmonary heart disease |
|                       | I27.9       | Chronic pulmonary heart disease |
|                       | I3.50       | Nonrheumatic aortic (valve) stenosis |
|                       | I38         | Valvar heart disease, excluding that of rheumatic origin |
|                       | J49.9       | Arrhythmias |
|                       | J71         | Aortic aneurysm |
|                       | J80.2       | Pilethritis and thrombophlebitis of other and unspecified deep vessels of lower extremities |
|                       | J84.1       | Other interstitial pulmonary diseases with fibrosis |
|                       | N00-N08     | Acute glomerulonephritis, nephrotic syndrome, chronic glomerulonephritis, and nephritis and nephropathy, not specified as acute or chronic |
|                       | R54         | Age-related physical debility |
|                       | X30-X39     | Accidents due to natural and environmental factors |
|                       | X71         | Intentional self-harm by drowning and submersion |
|                       | X78         | Intentional self-harm by sharp object |
| 4.0                   | A40-41      | Septicemia |
|                       | A64.7       | Enterocolitis due to Clostridium difficile |
|                       | A99         | Unspecified viral hemorrhagic fever |
|                       | C10,11,13   | Malignant neoplasm of oropharynx, nasopharynx, hypopharynx |
|                       | C14.0       | Malignant neoplasm of pharynx, unspecified |
|                       | C18         | Malignant neoplasm of colon |
|                       | C19-21      | Malignant neoplasm of rectum, rectosigmoid junction, and anus |
|                       | C26.0       | Malignant neoplasm of intestinal tract, part unspecified |
|                       | C43-44      | Malignant neoplasm of skin |
|                       | C67         | Malignant neoplasm of bladder |

(continued on next page)
| Preventability rating | ICD-10 code | Cause of death |
|-----------------------|-------------|----------------|
|                       | E10-14      | Diabetes mellitus |
|                       | E785        | Hyperlipidemia, unspecified |
|                       | F10.2       | Dependence syndrome |
|                       | I20-25      | Ischemic heart disease |
|                       | I26         | Pulmonary embolism |
|                       | I27.2       | Other secondary pulmonary hypertension |
|                       | I33         | Acute and subacute endocarditis |
|                       | I34.0       | Carcinoid syndrome |
|                       | I50         | Congestive heart failure |
|                       | I51.7       | Cardiomegaly |
|                       | I60-69      | Cerebrovascular diseases |
|                       | J60-65      | Pneumoconiosis due to external agents |
|                       | K56.6       | Other and unspecified intestinal obstruction |
|                       | K63.1       | Perforation of intestine (nontraumatic) |
|                       | K70-77      | Liver abscess and sequelae of chronic liver disease |
|                       | L92.2       | Gastrointestinal hemorrhage |
|                       | N18         | Chronic renal failure |
|                       | Q20-28      | Bulbus cordis anomalies and anomalies of cardiac septal closure, other congenital anomalies of heart and circulatory system |
|                       | V95         | Accident to powered aircraft |
|                       | Y85-86      | Late effects of accidental injury |
| 4.5                   | C00-04,07,08 | Malignant neoplasm of lip, tongue, major salivary glands, gum, floor of mouth |
|                       | C09.9       | Malignant neoplasm of intestinal tract, part unspecified |
|                       | E65-68      | Obesity and other hyperalimentation |
|                       | E86         | Volume depletion |
|                       | F10.1       | Alcohol abuse |
|                       | F10.2       | Alcohol dependency syndrome |
|                       | G00         | Bacterial meningitis |
|                       | H05-09      | Rheumatic heart disease |
|                       | I10         | Essential (primary) hypertension |
|                       | I11         | Hypertensive heart disease |
|                       | I12         | Hypertensive renal disease |
|                       | I13         | Hypertensive heart and renal disease |
|                       | I14         | Atrial fibrillation and flutter |
|                       | J70         | Atherosclerosis |
|                       | J9-18       | Pneumonia and influenza |
|                       | J43         | Emphysema |
|                       | J47         | Bronchiectasis |
|                       | K35.0       | Acute vascular disorders of intestine |
|                       | K35.9       | Anemia due to enzyme disorder, unspecified |
|                       | K70, K73-74 | Chronic liver disease and cirrhosis |
|                       | N10,11,15,9 | Infections of kidney |
|                       | V01-99      | Motor vehicle traffic accidents |
|                       | W00-19      | Accidental falls |
|                       | W65-84      | Accidents caused by submersion, suffocation, and foreign bodies |
|                       | X60-69      | Suicide and self-inflicted poisoning by liquid, solid, gas or vapor |
|                       | X73-75      | Suicide and self-inflicted injury by firearms and explosives |
|                       | X85-Y09     | Homicide |
| 5.0                   | A15-19      | Tuberculosis |
|                       | B15-19      | Viral hepatitis |
|                       | B20-24      | Human immunodeficiency virus (HIV) disease |
|                       | C22         | Malignant neoplasm of larynx |
|                       | C33.34      | Malignant neoplasm of trachea, bronchus, and lung |
|                       | C45.9       | Mesothelioma, unspecified |
|                       | C51         | Malignant neoplasm of cervix uteri |
|                       | E1,2,3,2.3,3,8,3,9 | Acquired hypothyroidism |
|                       | J04, J06, J20, J21 | Acute laryngitis and tracheitis, acute upper respiratory infections of multiple or unspecified sites, acute bronchitis and bronchiolitis |
|                       | J44         | Chronic obstructive pulmonary disease |
|                       | J69.0       | Pneumonitis due to inhalation of food and vomit |
|                       | J80         | Acute respiratory distress syndrome |
|                       | K25,27,28   | Peptic ulcer |
|                       | K29         | Gastritis and duodenitis |
|                       | K35         | Acute appendicitis |
|                       | K45         | Hernia of abdominal cavity |
|                       | K57         | Diverticula of intestine |
|                       | K80         | Cholelithiasis |
|                       | K83.0       | Cholangitis |
|                       | N20         | Calculus of the kidney and ureter |
|                       | N39.0       | Urinary tract infection, site not specified |
|                       | V90-94      | Water transport accidents |
|                       | X00-09      | Accidents caused by fire and flames |
|                       | X40-49      | Accidental poisoning |
|                       | Y10-34      | Injury undetermined whether accidentally or purposely inflicted |
|                       | Y40-84      | Misadventures during surgical and medical care and medical procedures as the cause of abnormal reaction or later complication |
|                       | Y86         | Other accidents |
Appendix B. Sensitivity analyses of Cox proportional hazard ratios (HR) for high and low preventable mortality by sexual minority status, at varying preventability thresholds, Canadian Community Health Survey-Canadian Mortality Database cohort, Canada, 2003–2017

| Cause of death | UHR (95% CI) |
|----------------|--------------|
| By preventability category | |
| High preventable (5.0) | 1.68 (1.16, 2.45) |
| Low preventable (<5.0) | 1.19 (0.94, 1.51) |
| High preventable (≥4.5) | 1.55 (1.13, 2.13) |
| Low preventable (<4.5) | 1.16 (0.89, 1.50) |
| High preventable (≥4.0) * | 1.43 (1.14, 1.80) |
| Low preventable (<4.0) * | 1.02 (0.69, 1.52) |
| High preventable (≥3.5) | 1.39 (1.12, 1.74) |
| Low preventable (<3.5) | 0.96 (0.58, 1.58) |

Note. UHR = unadjusted hazard ratio comparing hazard of mortality for sexual minority as compared to heterosexual respondents.

*prior primary analysis, per Phelan et al. (Eroshova et al., 2016).

References

Badgett, M. L., Dueso, L. E., & Schneebeaum, A. (2013). New patterns of poverty in the lesbian, gay, and bisexual community—williams Institute/Williams institute. https://williamsinstitute.law.ucla.edu/research/census-lgbt-demographics-studies/lgbt-poverty-update-june-2013/.

Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. Social Science & Medicine, 51, 843–857.

Bjørkensan, C., Andersson, G., Dalman, C., Cochran, S., & Kioso, K. (2016). Suicide in married couples in Sweden: Is the risk greater in same-sex couples? European Journal of Epidemiology, 31(7), 685–690.

Brosnich, R., Hatzenbuehler, M. L., Pachankis, J. E., & Link, B. G. (2016). Sexual orientation disparities in preventable disease: A fundamental cause perspective. American Journal of Public Health, 106(6), 1109–1115. https://doi.org/10.2105/AJPJH.2016.303051

Brosnich, R., van der Staa, A., & Pachankis, J. E. (2019). Untethered lives: Barriers to social integration as predictors of the sexual orientation disparity in suicidality. Social Psychiatry and Psychiatric Epidemiology. https://doi.org/10.1007/s00222-019-01743-6

Brooks, V. R. (1981). Minority stress and lesbian women. Lanham, MD: Lexington Books.

Caceres, B. A., Brody, A., Luscombe, R. E., Primiano, J. E., Marusca, P., Sitts, E. M., & Chuyan, D. (2017). A systematic review of cardiovascular disease in sexual minorities. American Journal of Public Health, 107(4), e13–e20. https://doi.org/10.2105/AJPJH.2016.303630

Carpenter, C. S., Eppink, S. T., Gonzales, G., & McKay, T. (2021). Effects of access to legal same-sex marriage on marriage and health. Journal of Policy Analysis and Management, 40(2), 376–411. https://doi.org/10.1002/PMAM.22286

Cochran, S. D., & Mays, V. M. (2015). Mortality risks among persons reporting same-sex orientation by gay and bisexual men in government-administered probability surveys. American Journal of Public Health, 105(2), 258–264.

Eroshova, E. A., Kim, H. J., Emlet, C., & Fredriksen-Goldsen, K. I. (2016). Social networks for lesbian, gay, bisexual, and transgender older adults. The Gerontologist, 57, 584–594. https://doi.org/10.1093/geront/gnw069

Ferlatte, O., Hottes, T. S., Transier, T., & Marchand, R. (2017). Disclosure of sexual orientation by gay and bisexual men in government-administered probability surveys. LGBT Health, 4(3), 216–221. https://doi.org/10.1093/lgbthealth/lwx021

Hatzenbuehler, M. L. (2009). How does sexual minority stigma influence health and well-being? Psychological Bulletin, 135(5), 707–730. https://doi.org/10.1037/a0016441

Hatzenbuehler, M. L., & Link, B. G. (2013). Sexual orientation modulates endocrine stress reactivity. Biological Psychiatry, 77(7), 668–676. https://doi.org/10.1016/j.biopsych.2014.08.013

Katz-Wise, S. L., & Hyde, J. S. (2012). Vicimization experiences of lesbian, gay, and bisexual individuals: A meta-analysis. The Journal of Sex Research, 49, 142–167. https://doi.org/10.1080/00224491.2011.637247

Kim, H. J., Fredriksson-Goldsen, K. I., Bryan, A. E. B., & Muraco, A. (2017). Social network types and mental health among LGBT older adults. The Gerontologist, 57, 584–594. https://doi.org/10.1093/geront/gnx169

Krieger, N. (2020). Measures of racism, sexism, heterosexism, and gender binarism for health equity research: From structural injustice to embodied harm—an ecosalud analysis. Annual Review of Public Health, 41(1). https://doi.org/10.1146/annurev-publhealth-040119-094017.

Lick, D. J., Durso, L. E., & Johnson, K. L. (2013). Minority stress and physical health among sexual minorities. Perspectives on Psychological Science, 8(5), 521–548. https://doi.org/10.1177/1745691613497965

Link, B. G., & Phelan, J. (1995). Social conditions as fundamental causes of disease. Spec No Journal of Health and Social Behavior, 80–94.

Mathy, R. M., Cochran, S. D., Olsen, J., & Mays, V. M. (2011). The association between relationship markers of sexual orientation and suicide: Denmark, 1990-2001. Social Psychiatry, 46(2), 111–117. https://doi.org/10.1007/s00224-009-0177-3

Mayer, K. H., Bekker, L.-G., Stall, R., Grulich, A. E., Colfax, G., & Lama, J. R. (2012). Comprehensive clinical care for men who have sex with men: An integrated approach. Lancet, 380(9837), 379–387.

Meads, C., Martin, A., Grierson, J., & Varney, J. (2018). Systematic review and meta-analysis of diabetes mellitus, cardiovascular and respiratory condition epidemiology in sexual minority women. BMJ Open, 8(4). https://doi.org/10.1136/BMJOPEN-2017-020775

Meyer, I. H. (2003). Prejudice, social stress, and mental health in lesbian, gay, and bisexual men and women: A fundamental causes analysis. Annual Review of Public Health, 24(1). https://doi.org/10.1146/annurev.publhealth.24.100302.124321

Noé, G., & Dery, D. (2017). Educational note: Addressing special cases of bias that frequently occur in perinatal epidemiology. International Journal of Epidemiology, 50(1). https://doi.org/10.1093/ije/dyx252

Neville, R., & Henriksson, M. (2006). Perceptions of lesbian, gay and bisexual people of primary healthcare services. Journal of Advanced Nursing, 55(4), 407–415.

Phelan, J. C., Link, B. G., Diez-Roux, A., Kawachi, I., & Levlin, B. (2004). Fundamental causes of social inequalities in mortality: A test of the theory. Journal of Health and Social Behavior, 45(3), 265–285. https://doi.org/10.1177/002215650400300303

Purcell, D. W., Johnson, C. H., Lansky, A., Prejean, J., Stein, R., Denning, P., … Crepaz, N. (2012). Estimating the population size of men who have sex with men in the United States to obtain HIV and syphilis rates. The Open AIDS Journal, 6, 98–107. https://doi.org/10.2174/1874613601206010098

Rich, A. J., Salway, T., Scheim, A., & Poteat, T. (2020). Sexual minority stress theory: Remembering and honoring the work of Virginia Brooks. LGBT Health, 7(3), 139–145. https://doi.org/10.1097/MLH.0000000000000252

Ross, L. E., Salway, T., Tarasoff, L. A., MacKay, J. M., Hawkins, B. W., & Fehr, C. P. (2018). Prevalence of depression and anxiety among bisexual people compared to gay, lesbian, and heterosexual individuals: A systematic review and meta-analysis. The Journal of Sex Research, 55(5). https://doi.org/10.1080/00224499.2017.1387755

Rutstein, D. D., Berenberg, W., Chalmers, T. C., Child, C. C., Fishman, A. P., & Perrin, E. B. (1976). Measuring the quality of medical care: A clinical method. New England Journal of Medicine, 294, 582–588.
Sanmartín, C., Decady, Y., Trudeau, R., Dasylva, A., Tjepkema, M., Finès, P., … Manuel, D. G. (2016). Linking the Canadian community health survey and the Canadian mortality database: An enhanced data source for the study of mortality. *Health Reports, 27*(12), 10–18. http://www.statcan.gc.ca/pub/82-003-x/2016012/article/14687-eng.htm.

Sibley, L. M., & Glazier, R. H. (2009). Reasons for self-reported unmet healthcare needs in Canada: A population-based provincial comparison. *Healthcare Policy, 5*(1), 87–101. https://doi.org/10.12927/hcpol.2009.20934

Tjepkema, M. (2008). Health care use among gay, lesbian and bisexual Canadians. *Health Reports, 19*(1), 53–64. http://www.statcan.gc.ca/pub/82-003-x/2008001/article/10532-eng.htm.

Tjepkema, M., Wilkins, R., & Long, A. (2013). Cause-specific mortality by income adequacy in Canada: A 16-year follow-up study. *Health Reports, 24*(7), 14–22.