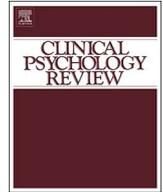




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Review

Examining the role of sex in self-injurious thoughts and behaviors

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HIGHLIGHTS

- Sex differences in self-injurious thoughts and behaviors (SITBs) are extensive.
- However, sex differences in one form of SITB, nonsuicidal self-injury, are less clear.
- Age, race, region, and time moderate, but do not erase, sex differences in SITBs.
- Access to lethal methods, culture, and mental illness may impact sex differences.
- Gender, and particularly non-binary gender, also appear to impact SITB engagement.

A B S T R A C T

Self-injurious thoughts and behaviors (SITBs), including nonsuicidal self-injury, suicidal thoughts, suicide attempts, and suicide death exhibit substantial sex differences. Across most countries, men die by suicide more frequently than women; yet, women think about and attempt suicide more frequently than men. Research on sex differences in nonsuicidal self-injury is less developed; however, nonsuicidal self-injury is historically understood as a primarily female phenomenon. This review describes current research on sex differences across SITBs with a focus on factors that moderate these effects, such as age, race, geographic region, and time. Additionally, this review describes factors that may help to explain why sex differences across SITBs exist, including differences in culture, access to lethal suicide methods, rates of mental illness, and utilization of health care. The role of gender, and particularly non-binary gender, is also discussed. Current understanding of these sex differences is described with an eye toward future research on this topic.

1. Introduction

Suicidal and nonsuicidal self-injury, collectively termed self-injurious thoughts and behaviors (SITBs), are a significant public health problem. Approximately 804,000 people die by suicide each year (World Health Organization [WHO], 2012), making it a leading cause of death worldwide. For every suicide, it is estimated that there are more than 20 non-lethal suicide attempts (WHO, 2014), meaning that there are approximately 16 million suicide attempts each year around the world. Suicide ideation, or thinking about suicide, is even more common, with approximately 2% of people thinking about killing themselves each year (Borges et al., 2010; Borges, Angst, Nock, Ruscio, & Kessler, 2008). In addition to suicidal behaviors, in which people have some intent of dying from a potential action, SITBs also include nonsuicidal self-injury (NSSI), or intentional self-harm enacted *without* the intent to die (Nock, 2010). Global rates of NSSI have not been evaluated rigorously, but it is estimated that 17% of adolescents and 5.5% of adults engage in these behaviors in their lifetimes

(Swannell, Martin, Page, Hasking, & St John, 2014).

Sex differences in the prevalence of SITBs have been consistent for decades. Suicide ideation, plans, and attempts are more common among females; whereas suicide deaths are more common among males (Turecki & Brent, 2016). Among these large and dependable effects, there are several noteworthy caveats. Decade of study, age, race, and geographic region have been shown to alter canonical sex differences for suicidal behaviors (Curtin, Warner, & Hedegaard, 2016; Kochanek, Murphy, Xu, & Tejada-Vera, 2016; Nock, Borges, Bromet, Cha, et al., 2008; WHO, 2014). The association between sex and NSSI has been studied for far less time than suicidal SITBs and is not as well understood. Although NSSI was historically considered a primarily female phenomenon (e.g., Bresin & Schoenleber, 2015; Graff & Mallin, 1967; Laye-Gindhu & Schonert-Reichl, 2005; Rodham, Hawton, & Evans, 2004; Suyemoto, 1998; Whitlock et al., 2011), emerging research suggests that there may not be sex differences in the prevalence of this behavior (e.g., Swannell et al., 2014).

In this review, we describe what is currently known about sex

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differences in the prevalence of SITBs (suicide death, suicidal thoughts and behaviors, and NSSI), highlight factors moderating these differences, and present possible causes for these sex differences. Reported rates of suicide death are age-adjusted rates per 100,000 people unless otherwise stated. Rate ratios of suicide death describe the relative difference in the age-adjusted rates of suicide death among men compared to women. All references to “ratios” or “sex ratios” in the text are rate ratios of suicide death calculated by dividing the age-adjusted rate among men by the age-adjusted rate among women. Thus, ratios greater than 1 indicate a higher male suicide rate whereas ratios less than 1 indicate a higher female suicide rate. Given that the majority of empirical studies on SITBs have been conducted in the United States (U.S.), we examine effects within the U.S. and the rest of world separately within each section, as in previous work (Nock, Borges, Bromet, Cha, et al., 2008). It is important to note that most research described in this review is based on data regarding sex or assuming equivalence between sex and gender. There are critical differences between sex and gender, and having a different biological sex and gender impacts SITB risk. As such, we describe research on gender minority identification and SITB risk at the end of this review.

2. Suicide

2.1. Sex differences in suicide in the U.S.

For over 100 years, as long as data have been collected on suicide within the U.S., males have died by suicide at higher rates than females (CDC, 2014; Linder & Grove, 1943; National Center for Health Statistics, 1979; Nock, Borges, Bromet, Cha, et al., 2008). As of 2015, approximately 3.5 males died by suicide for every female (Web-based Injury Statistics Query and Reporting System [WISQARS], 2017). Although there is a large and consistent difference in the rate of suicide death between sexes, there appear to be several notable moderating factors, such as when the study took place, age, and race.

The sex ratio for suicide deaths has shown a curvilinear pattern over the past few decades. Starting from a relatively low point in the early 1980's, the ratio rose to a high point in the mid-1990's, followed by a steady decrease, with the 2015 ratio showing similar levels to those in the early 1980's (see Fig. 1). Curtin et al. (2016) focused on the period from 1999 to 2016 when the sex ratio declined from 4.5 to 3.6, respectively, and concluded that this negative trend reflected a meaningful shift. The reduction of the sex ratio during this time was due to a disproportionate increase in the suicide rate among women under age 74 (rather than a reduction in suicide among men), particularly among women ages 10–14, who showed a 200% increase in suicide since 1999.

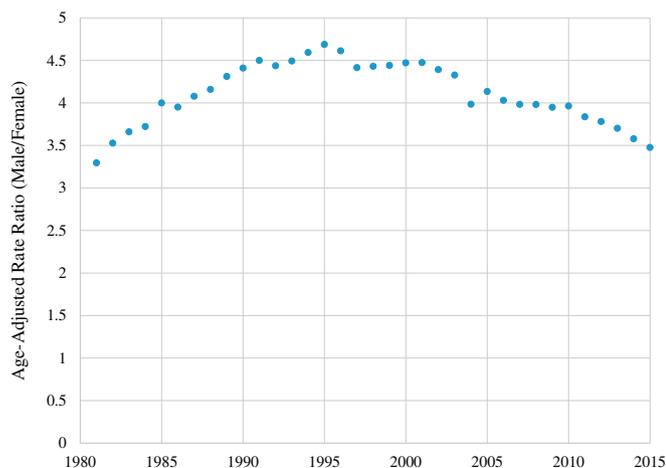


Fig. 1. Age-adjusted rate ratio (Male/Female) of suicide deaths in the U.S. across time, from 1980 to 2015. Data were obtained from WISQARS (2017).

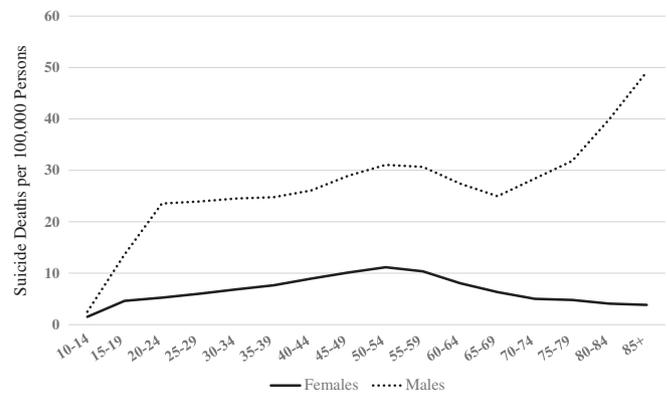


Fig. 2. Suicide deaths in the U.S. from 2014 to 2015 by age group and sex. Data were obtained from WISQARS (2017).

However, given that current ratios are similar to those observed in the 1980s, it is difficult to know whether these shifts reflect meaningful changes in the sex ratio or they reflect complex changes in suicide rates over long periods of time (e.g., McKeown, Cuffe, & Schulz, 2006).

Age is another relevant moderator for sex differences for suicide death (see Fig. 2).¹ There are little to no sex differences in suicide rates for children under 14 years of age (Curtin et al., 2016; Nock, Borges, Bromet, Cha, et al., 2008). This is likely due to the very low suicide rate for this age group (i.e. it is difficult for there to be sex differences when there are so few suicide deaths to begin with). Almost no children under age 10 die by suicide (rate of 0.03; WISQARS, 2017). Although, the suicide death rate increases between the ages of 10–13, it is not until age 14, when the suicide rate increases to approximately 4.42, that sex differences emerge (sex ratio of 1.89; WISQARS, 2017). From age 15 on, sex differences increase but it is not a linear increase over the lifespan; some age ranges are associated with sharp increases, and others with fairly stable sex ratios. For example, the sex ratio sharply increases between ages 15–24 (WISQARS, 2017), but then remains relatively constant until ages 65–74. By ages 75–79 the sex ratio is 6.63 but then it nearly doubles among adults 85+, reaching 12.80 male suicide deaths per female suicide death (WISQARS, 2017). Thus, the main increases in the suicide death sex ratio occur first during adolescence and again during later adulthood.

The stark sex ratio observed among the elderly is particularly important given the high rates of suicide death observed in this group. The ratio is largely explained by the increasing suicide rates among males throughout this period, and particularly after the age of 69. However, there is also a subtle, yet noticeable decrease in the suicide rate among women after the age of 54, suggesting that sex-specific experiences may be important. Contrary to common conception, this ratio is not explained by males experiencing disproportionately higher rates of mental illness, physical illness, financial difficulties, or living alone (Canetto, 2017). Instead, greater difficulty coping with aging, illness, and lack of independence among males, and particularly White males (Canetto, 2017) may explain these increased rates. More research is needed to test this possibility.

Across racial groups in the U.S., men die by suicide at a higher rate than women; however, the magnitude of this sex difference varies by race. From 1999 to 2015, the largest ratio of male-to-female suicide deaths was among Black Americans (ratio of 5.32). The lowest ratio was among Asian Americans (age-adjusted ratio of 2.58; WISQARS, 2017). The sex ratio difference among Black and Asian Americans is driven largely by a particularly low rate of suicide death among Black

¹ We calculated sex ratios across age groups using data from 2014 to 2015 (WISQARS, 2017), the most recent years with data available, given changes in the sex ratio observed across the past decade that are particularly pronounced for certain age groups. Of note, similar patterns emerge regardless of the time-period examined.

American women (i.e., suicide rate of 1.80) compared to Asian American women (i.e., rate of 3.37). Black and Asian men, on the other hand, show comparable rates (i.e., 9.47 versus 8.64 respectively). The low rate of suicide death among Black women is not well understood. A small body of research on this topic suggests that these lower suicide death rates may relate to stronger reasons for living (e.g., family and peer relationships, future expectations, positive self-evaluation) among Black compared to White Americans (Morrison & Downey, 2000), which are associated with fewer SITBs, particularly among Black women (Lizardi et al., 2007; Wang, Lightsey, Tran, & Bonaparte, 2013). There is a possibility that suicide death is more likely to be classified as accidental among Black Americans given that there are high rates of psychiatric misdiagnosis (e.g., Neighbors, Jackson, Campbell, & Williams, 1989; Neighbors, Trierweiler, Ford, & Muroff, 2003; Schwartz & Blankenship, 2014). However, suicide rates are similar among Black men and men of other races, making the misclassification explanation unlikely. More research is needed to determine the exact causes of the low suicide rate among Black women.

2.2. Patterns of suicide by sex cross-nationally

Looking cross-nationally, sex difference in suicide mortality show a similar, although attenuated, pattern to the U.S. Globally, men die by suicide at a higher rate than women. As of 2015, there were approximately 1.78 male suicides per every female suicide (Global Health Estimates, 2015). As with the U.S., this pronounced sex difference has some relevant moderators.

Globally, geographic region greatly impacts the sex ratio. As of 2015, using World Health Organization defined geographic regions, the sex ratio was highest among countries in the Americas and Europe, reaching 3.36 and 3.47, respectively (Global Health Estimates, 2015). In contrast, the ratio was lowest among countries part of the South East Asia Region (e.g., ratio of 1.36) and the Western Pacific Region (e.g., ratio of 1.11; Global Health Estimates, 2015).

The Western Pacific region is the only region wherein males and females show a near-equal likelihood of suicide death. Importantly, this effect is primarily driven by the reversed sex ratio in China (i.e., approximately 0.76 in 2015; Global Health Estimates, 2015). Other than China, Bangladesh (ratio of 0.72) is the only other country wherein women die by suicide more than men (ratio of 0.70) with nearly equal rates among men and women in the Democratic People's Republic of Korea (ratio of 1.02) and Nepal (ratio of 1.11; Global Health Estimates, 2015). Given the large population in China and the high rate of suicide reported in the country, it is estimated that suicide in China accounts for a quarter of suicides worldwide (Weiyuan, 2009), meaning that the sex ratio shift plays a big role in dampening the global sex ratio as well as the ratio in the Western Pacific Region.

Several sociocultural factors have been put forth to explain why this sex ratio shift occurs in these regions, and particularly in China and Bangladesh. One hypothesis proposes that the low status and power of women, resulting in particularly limited access to education, employment and money, lead to higher suicide rates among women (e.g., Canetto, 2008). However, the relatively low rate of female suicide death in other countries wherein women have relatively low status and power suggests that this factor on its own is not sufficient to explain the sex ratio shift (e.g., Zhang, Jia, Wiczorek, & Jiang, 2002). Another hypothesis involves the possibility that some of the deaths recorded as suicides are actually misclassified. For example, in several of these low-to-middle income countries (e.g. India) there are large numbers of young women who die as the result of familial or financial disputes; it is hypothesized that many of these deaths are actually homicides documented as suicides (Canetto, 2008; Sanghavi, Bhalla, & Das, 2009). Comparably, cultural factors may affect the labeling of fatal injury as suicide, even when the injury is coerced or not even self-inflicted. For example, there are cases of ritual killings of widows after the death of their spouses that are labeled suicide (e.g., in Kaliai district of Papua

New Guinea; Canetto, 2008). Similarly, in traditional Hindu communities, it is honorable for widows to climb on the funeral pyre of her husband to be burned with him (Canetto, 2008). Although, technically voluntary, a widow faced punishments, such as severe restrictions, if she did not burn with her husband. These types of practices may reduce the sex ratio as women are pressured by cultural tradition to die by suicide.

Finally, women's increased access to lethal suicide methods may play a role in more women dying by suicide. In China, most households, especially in rural regions, have access to highly lethal means of suicide death: pesticides (e.g., Dewan, 2014; Phillips, Yang, et al., 2002; Phillips, Li, & Zhang, 2002; Zhang et al., 2002). Although larger quantities of pesticides are sold in industrialized countries, highly toxic pesticides are more widespread and readily available in China, in part due to the large proportion of the population employed in agriculture and less regulation around pesticide use and storage (e.g., Eddleston, 2000; Gunnell, Eddleston, Phillips, & Konradsen, 2007). There are similar patterns in the other country where more women die by suicide, Bangladesh, where approximately three-quarters of the population live in rural regions (Mashreky, Rahman, & Rahman, 2013; Sultana et al., 2011) and there are few regulations around pesticide use and education (e.g., Sultana et al., 2011). Higher availability of these toxic pesticides, paired with lower availability of medical services, may lead to higher rates of suicide mortality from pesticide poisoning (e.g., Eddleston, 2000; Gunnell et al., 2007; Phillips, Yang, et al., 2002). In fact, the proportions of suicide mortality from pesticide poisoning in China and Bangladesh are among the highest in the world (e.g., Eddleston, 2000; Gunnell et al., 2007; Phillips, Yang, et al., 2002). Given that women tend to attempt suicide more frequently than men (discussed in more detail below), increased access to these lethal pesticides may explain the greater proportion of female suicide attempts in these regions resulting in death (e.g., Phillips, Li, et al., 2002; Zhang et al., 2002). Although speculative, this could be a cause of the sex ratio shift. This possibility is corroborated by research showing that, compared to urban regions, the overall suicide death rate and sex ratio are *both* higher in rural regions of China and Bangladesh, where farming and therefore pesticide availability tends to be higher (e.g., Hirsch, 2006; Mashreky et al., 2013; Phillips, Li, et al., 2002; Phillips, Yang, et al., 2002; Zhang et al., 2002). Although each of these factors are intriguing, it is likely that interactions among each of the sociocultural factors discussed, as well as others, cause more women to die by suicide in these regions.

As in the U.S., age also moderates suicide sex differences in other regions. We cannot directly compare U.S. and global age effects on the sex ratio because the WHO provides statistics on age groups. Nevertheless, within regions with sex ratios similar to the U.S. (i.e., the Americas, Europe), sex ratios across age groups are largely comparable to those in the U.S. Sex ratios are quite low, though already favoring males, among those 5–14 years of age. The ratio then increases dramatically, doubling among those ages 15–29 (Global Health Estimates, 2015). However, unlike in the U.S., there is a less dramatic increase in the sex ratio among older adults, and particularly the elderly, in the Americas and Europe. Countries with markedly different sex ratios than the U.S. also display quite different sex ratios over the life span. For example, in South-East Asia, sex differences below one begin to emerge among those 5–14 years of age (ratio of 0.75), and remain below one through those ages 15–29 (ratio of 0.84). The ratio then flips, such that males are about two times more likely to die by suicide among those ages 30 and above, with some fluctuation. In the Western Pacific Region, suicide death rates are approximately equal through 49 years of age (i.e., ratio of 1.09–1.10), then increasing such that males die by suicide more frequently than females 50+ (i.e., ratio of 1.10–1.18; Global Health Estimates, 2015).² In other words, in the South East Asia

² High-quality, accurate data on suicide death are not available in all countries for a variety of reasons, and lower and middle income countries tend to have lower quality

and Western Pacific Regions, younger women drive the lower overall sex ratios observed across these regions.

Taken together, this research shows that, overall, men exhibit a higher rate of suicide death both in the U.S. and globally. However, decade, age, race, income, and global region affect these differences, decreasing and even reversing the sex ratio in some cases.

2.3. Suicidal behaviors

Federal governments in the U.S. and cross-nationally sometimes maintain surveillance data regarding the annual number of hospitalizations due to non-fatal SITBs (e.g., Web-based Injury Statistics Query and Reporting System in the U.S., CDC; National Ambulatory Care Reporting System in Canada, Canadian Institute for Health Information; Ministry of Health's National Non-Admitted Patient Collection in New Zealand, New Zealand Ministry of Health). However, such data: (a) omit information about SITBs not resulting in hospitalization, and (b) do not distinguish between suicidal and nonsuicidal SITBs (e.g., Nock, Borges, Bromet, Alonso, et al., 2008). Therefore, we do not discuss these data and instead draw on dozens of large, nationally-representative surveys of these behaviors that provide a more accurate picture of the rates of non-fatal suicidal behaviors in the U.S. and cross-nationally.

2.3.1. Suicidal behaviors in the U.S.

Nock, Borges, Bromet, Cha, et al. (2008) conducted a systematic review of all large-scale epidemiological and prevalence research on suicidal behaviors among teens and adults (i.e., suicide ideation, plans, attempts) through 2007. This review indicated that in the U.S., females are more likely than males to report lifetime engagement in suicide ideation, suicide plans, and suicide attempts. More recent, large-scale epidemiological studies assessing lifetime history of suicidal behaviors show similar patterns among teens (Nock et al., 2013). This stands in contrast to the patterns observed for suicide death, wherein males die by suicide at a higher rate than females starting in adolescence.

2.3.2. Suicidal behaviors cross-nationally

The World Mental Health Surveys assessed suicidal thoughts, plans and attempts among 84,850 adults in 17 countries. Results showed that, compared with men, women reported higher lifetime rates of each suicidal outcome measured (Nock, Borges, Bromet, Cha, et al., 2008). Rates of these outcomes are somewhat different when measured only within past year. Compared with males, females report higher rates of suicide ideation in the past year across developed and developing countries. However, whereas women report more past year suicide plans than males in developing countries, no sex differences are observed suicide plans in developed countries. Interestingly, rates of past year suicide attempts also were similar for men and women in both developed and developing countries (Borges et al., 2010).

Discrepancies between past year and lifetime SITBs may be due, at least in part, to self-report biases. For example, when Nock, Borges, Bromet, Cha, et al. (2008) reported a puzzling finding that adults had a lower prevalence of lifetime SITBs than adolescents, they noted that since the rates of SITB among adolescents had remained unchanged, it was more likely that adults are simply less likely to report suicidal ideation experienced during adolescence if they are no longer suicidal as adults. Similarly, Goldney, Smith, Winefield, et al. (1991) showed that 40% of people reporting suicide ideation during adolescence deny any lifetime history of these thoughts just four years later. Thus, one explanation for the discrepancies between lifetime and past year SITB engagement is that females are more likely than males to either

remember or report prior SITB engagement. In addition, memory biases may decrease reporting of stigmatized behaviors (e.g., Swannell et al., 2014) and to the extent that non-fatal SITBs are more stigmatized among males than females, males may be more motivated to forget or underreport their earlier SITBs. Future research is needed to test whether females are more likely than males to recall and report lifetime SITBs than males, which might explain larger lifetime compared to past year discrepancies in reports of these thoughts and behaviors.

2.4. Nonsuicidal Self-Injury (NSSI)

2.4.1. Patterns of NSSI by sex

Compared to suicidal behaviors, far less research has focused on NSSI. Relatively few large-scale research studies make it difficult to compare sex differences across different global regions. As such, it is more appropriate to discuss sex differences in NSSI globally. However, it should be noted that focusing on a global scale will likely obscure important cultural factors that may impact sex differences in NSSI. Further research on this topic is needed to adequately assess how NSSI varies between the sexes and how important factors such as age, race, and culture might moderate this gap.

Although most early studies in the area reported much higher rates of NSSI among females, two recent meta-analyses examining sex differences report that such differences are relatively modest, if present at all. Swannell et al. (2014) analyzed community studies exclusively and found a surprisingly small effect of greater NSSI prevalence in females than males (female-to-male NSSI ratio: 1.35) that failed to reach statistical significance after controlling for methodological factors influencing NSSI rates (e.g., response format, anonymity, incentives for participation). They concluded that there likely are no sex differences in NSSI prevalence. In a comparably large meta-analysis, Bresin and Schoenleber (2015) found that women were approximately 1.5 times more likely than men to report NSSI engagement. This effect persisted after accounting for methodological factors and sample age (which, contrary to research on other SITBs, did not actually impact sex differences in NSSI).

One possible explanation for these different conclusions is that Swannell et al. (2014) only examined community samples, whereas Bresin and Schoenleber (2015) also included clinical samples. Given that Bresin & Schoenleber observed significantly larger sex differences among clinical compared to community or college samples, sex differences in clinical samples may have accounted for overall higher rates of NSSI observed in females. Correspondingly, methodological factors may have accounted for sex differences in Swannell and colleagues because they only included studies with community samples, which have smaller effects. Future studies should examine sex ratios in clinical and community samples separately to test this possibility. Nonetheless, prevalence of NSSI appears higher in females than males in at least clinical populations.

Aside from sex differences in the prevalence of NSSI, there also is evidence for sex differences in NSSI characteristics across large-scale research studies. First, men and women may engage in different NSSI methods. Females are more likely to report engaging in cutting, biting, scratching, hair pulling, and interfering with wound healing, whereas men are more likely to report burning, hitting, and head banging than females (Bresin & Schoenleber, 2015). Second, and relatedly, women are more likely to injure their arms and legs, whereas males are more likely to injure their face, chest, or genitals (Sornberger, Heath, Toste, & McLouth, 2012). Third, men and women may engage in NSSI for different reasons. For example, among university populations, women are more likely to report NSSI engagement for affect regulation, self-control, and because of a strong urge, whereas males are more likely to report engaging in NSSI to get a "rush" (Whitlock et al., 2011). Looking at clinical populations, similar differences in NSSI motivations are observed. Specifically, female participants are more likely to engage in NSSI to avoid negative emotions and to self-punish than males,

(footnote continued)

data on suicide death. Data on suicide deaths are determined through modeling methods based on available data, and thus data from lower and middle income regions may be less accurate (WHO, 2014).

although both males and females report NSSI engagement to relieve tension (Claes, Vandereycken, & Vertommen, 2007). Fourth, males are more likely to report engaging in NSSI in the presence of others and after drinking alcohol (Whitlock et al., 2011). Together, this work suggests that there may be important differences in NSSI engagement across males and females. However, more large-scale research is needed on this topic to better differentiate male and female NSSI patterns.

Together, existing research suggests that NSSI occurs among both males and females; if sex differences do exist, they are largest in clinical samples where females tend to report greater NSSI engagement than males, and smallest in community samples. Additionally, there appear to be some differences in characteristics of NSSI engagement across males and females. However, more large-scale, representative epidemiological research is needed on this topic. Research on sex differences in NSSI, as well as NSSI more generally, are especially needed in countries outside the U.S., to better understand how culture and socioeconomic factors may impact NSSI engagement and sex differences in this engagement.

2.5. Why do SITB sex differences exist?

Given that sex differences are robust for suicide death and present across most SITBs, the next major question is: *why* do these sex differences exist? Here we describe how the access and use of certain suicide methods may help explain why males tend to die by suicide more than females. We then discuss how sex differences in several psychological factors (e.g., the prevalence of depression and anxiety) may help to explain why females think about suicide more frequently than males.

2.5.1. Suicide

One reason men are more likely to die by suicide even though more women attempt suicide is that men tend to use more lethal methods than do women. Specifically, suicide via firearms and hanging is more common among males, whereas suicide via self-poisoning or drowning is more common among women (Ajdacic-Gross et al., 2008). Notably, firearms and hanging are the most lethal suicide methods, with lethality rates between 83 and 92% (Chapdelaine, Samson, Kimberley, & Viau, 1991; Elnour & Harrison, 2008; Spicer & Miller, 2000), whereas self-poisoning tends to be less fatal, with lethality rates of closer to 2% for self-poisoning with drugs or non-gaseous poisons (Elnour & Harrison, 2008). Moreover, even when comparing men and women that use the same suicide method (e.g. self-poisoning), men tend to inflict more bodily damage than women (Mergl et al., 2015).

But *why* do males and females tend to choose different suicide methods? One hypothesis is that men tend to gravitate toward more lethal methods than females because they tend to have higher suicide intent. Consistent with this, several studies have found that males report greater suicidal intent from their suicidal behaviors (Harriss, Hawton, & Zahl, 2005; Haw, Hawton, Houston, & Townsend, 2003; Nock & Kessler, 2006; Townsend, Hawton, Harriss, Bale, & Bond, 2001). However, other studies have failed to find such an association (Bancroft et al., 1979; Casey, 1989; Denning, Conwell, King, & Cox, 2000; Hawton, Bergen, Casey, & Simkin, 2008). More work is needed to better understand potential sex differences in suicidal intent.

Sex differences in method availability also may help to explain why men and women tend to choose different suicide methods. For example, the Pew Research Center American Trends Survey conducted among a nationally representative panel of adults in the U.S. in 2013, found that males are more likely than females to have a gun in their home (45% males, 30% females) and to personally own a gun (37% males, 12% females). Given that access to guns is associated with suicide death by firearm and suicide death more generally (e.g., Anestis & Anestis, 2015; Kaplan & Geling, 1999), and males have greater access to guns, this discrepancy may be associated with sex differences in rates of firearm suicides and the overall rates of suicide death.

Culture and societal expectations may also impact these sex

differences through willingness to seek mental health care. Men are less likely than women to use health care services for routine, yearly visits and preventative services, even controlling for age, and pregnancy-related visits (Garfield, Isacco, & Rogers, 2008) as well as less likely to seek and utilize mental health care services for things like stressful life events, depression, and substance use (e.g., Courtenay, 2003; Garfield et al., 2008; Möller-Leimkühler, 2002). Men who do seek services tend to delay service-seeking, to be less likely to disclose their health concerns, and tend to be less likely to comply with medical recommendations (Garfield et al., 2008). These effects seem to be strongest among men who hold traditional beliefs about male gender roles and masculinity; these men tend to have more negative attitudes toward help-seeking behaviors, and they tend to have lower intention to seek help (e.g., Blazina & Marks, 2001; Good, Dell, & Mintz, 1989; Lane & Addis, 2005). In fact, a review of health care contact prior to suicide deaths showed that even within groups of people who die by suicide, women were more likely than males to have had lifetime and past year contact with mental health care treatment (Luoma, Martin, & Pearson, 2002).

2.5.2. Suicidal behaviors

To understand why women tend to think about and engage in suicidal behaviors more often than males, it is helpful to consider sex differences in mental illness. First, women are approximately twice as likely as males to experience depression (e.g., Nolen-Hoeksema, 1990; Weissman & Klerman, 1977; Weissman, Leaf, Holzer, Myers, & Tischler, 1984) and most affective and anxiety disorders than males (Kessler et al., 1994; Kessler, Berglund, Borges, Nock, & Wang, 2005). Second, just as sex differences in SITBs tend to arise during adolescence, so too do sex differences in depression and mood disorders. Whereas pre-adolescent boys actually tend to have higher rates of depression than females, during adolescence, this sex difference starts to switch, and females begin to report more depression than males (e.g., Hankin et al., 1998). Third, although SITBs are associated with all disorders (Kessler, Borges, & Walters, 1999), self-reporting a history of mood disorder, which is more common among women, is most strongly associated with self-reporting a history of suicidal thoughts and behaviors (Kessler et al., 1999). Together, this work starts to suggest that higher rates of affective disorders among women may help to explain higher rates of suicide ideation, plans, and attempts.

Recall bias may also contribute to sex differences in rates of suicide ideation, plans, and attempts, which generally are self-reported. As described earlier in this review, discrepancies in the female to male prevalence rates of SITBs are larger when considering lifetime compared to past year behaviors, and reports of lifetime SITBs are higher in adolescence than in adulthood (Goldney et al., 1991; Nock, Borges, Bromet, Cha, et al., 2008). This research suggests that people tend to underreport past suicidal thoughts and behaviors due to recall bias. Importantly, however, this underreporting may be greater among males. A small but growing body of research indicates that males tend to hold more stigmatizing beliefs toward suicidal thoughts and behaviors than do females both in and outside the U.S. (e.g., Batterham, Calear, & Christensen, 2013; Oliffe et al., 2016; Reavley & Jorm, 2011), and that both males and females hold more stigmatizing attitudes toward men with depression and suicidal tendencies than toward females with those symptoms (e.g., Oliffe et al., 2016; Reavley & Jorm, 2011). This higher level of stigma may be associated with a decreased likelihood to report any prior suicidal thoughts or behaviors, and this may also contribute to larger recall bias when considering less recent suicidal thoughts and behaviors (Swannell et al., 2014). More research on this possibility is needed.

Additionally, cultural acceptance may impact the willingness of females to report SITBs. Although research on this topic is limited, there is some evidence that non-fatal suicide attempts are considered more “feminine,” and are more acceptable for women than for men (e.g., Linehan, 1973). Additionally, research suggests that young women receive more sympathy and empathy for suicidal behaviors than men

(Stillion, White, Edwards, & McDowell, 1989) and that, among adolescents, males report greater concern regarding social disapproval for suicidal thoughts (Rich, Kaufmann, & Levy, 1992). More research on how these gendered beliefs about SITBs may or may not impact these behaviors is needed.

2.6. Non-Binary Gender and SITBs

Gender minority identification refers to a range of gender expressions, wherein people identify with a gender that is different than their sex at birth. Some people identify with traditional gender categories (e.g., trans women, trans men) and others identify as gender non-binary or genderqueer (e.g., agender, bigender, or genderfluid; e.g., James et al., 2016). Global prevalence estimates of those that identify with a gender other than their assigned sex at birth are approximately 0.4–1.3% of birth-assigned males and females (Winter et al., 2016).

Gender minority identification is associated with numerous adversities worldwide (e.g., high rates of being murdered, experiencing physical and sexual violence, being excluded from the workplace, being unemployed or underemployed; Winter et al., 2016). Perhaps as a consequence, cross-nationally, gender minorities report higher rates of psychopathology (Reisner et al., 2016) and SITBs, including NSSI, suicide ideation, suicide plans, suicide attempts, and even suicide death, although more, large-scale research is needed to confirm higher rates of suicide death (Marshall, Claes, Bouman, Witcomb, & Arcelus, 2016). Despite numerous studies indexing high rates of mental illness and SITBs, very few studies have assessed mechanisms of this effect (Reisner et al., 2016).

Preliminary research seeking to understand why people who identify as gender minorities are at higher risk of SITBs has identified a few possible explanations. First, as stated previously, mental illness and especially affective disorders are associated with higher risk of SITBs (Kessler et al., 2005). People identifying as gender minorities tend to report higher rates of mental illnesses, including affective disorders (Reisner et al., 2016); as such, higher rates of SITBs may, at least in part, be due to higher rates of mental illness in this population. Second, disclosure of one's gender minority status is associated with numerous stressors. A recent large-scale study found that, among over 6000 adults identifying as gender minorities, disclosing one's gender identity was associated with greater incidence of social isolation, homelessness, discrimination, victimization, and rejection both in and outside of friends and family (Haas, Rodgers, & Herman, 2014). Perhaps relatedly, people who disclosed their gender minority identification with others and people who reported that others can typically tell that they are a gender minority were more likely to report suicide attempts compared to gender minorities where neither of these were the case. Consistent with this research, several other studies have found that reporting gender identity-based victimization is associated with a greater likelihood and frequency of suicide attempts (e.g., Clements-Nolle, Marx, & Katz, 2006; Goldblum et al., 2012).

Moreover, recent research found that transgender, prepubescent children who are supported by their family and peers in their gender identity show similar rates of depression, self-worth, and only slightly elevated anxiety compared to their typical, non-gender minority peers (Durwood, McLaughlin, & Olson, 2017; Olson, Durwood, DeMeules, & McLaughlin, 2016). These findings are in stark contrast to children who have not socially transitioned, who show highly elevated rates of internalizing disorders (Cohen-Kettenis, Owen, Kaijser, Bradley, & Zucker, 2003; Wallien, Van Goozen, & Cohen-Kettenis, 2007). More research is needed to identify social factors related to risk and resilience among gender minority children and to evaluate whether the effects of these factors persist through puberty and into adulthood.

2.7. Conclusion and future directions

2.7.1. Summary of findings

SITBs are complex, multi-determined phenomena that are difficult to understand. Although much about suicide remains unknown, one effect that persists across research on this topic is that men are more likely to die by suicide than women. There are several important moderators of this canonical effect, such as age, race, global region, age, and decade. However, regardless of these moderators, male suicide deaths outnumber those of women across the globe with a few notable exceptions (e.g., in China). Paradoxically, females think about and attempt suicide more frequently than males. Again, there are factors that appear to moderate these effects, including age group and period of time (e.g., past year, lifetime) studied, but this sex effect tends to persist regardless. Sex differences in NSSI are less clear, although emerging evidence indicates that men and women in the general population engage in NSSI at similar rates, with sex differences only emerging among clinical populations.

Reasons for these sex differences are largely unclear; however, several factors likely play a role. Men tend to use higher lethality methods (e.g., firearms, hanging) than do women. Greater availability of lethal suicide methods, cultural factors, and higher suicide intent among males (though research on this topic is mixed) may help explain use of more lethal suicide methods among men. In contrast, higher rates of suicide ideation and attempts among women may relate to greater prevalence of mental illness, particularly affective disorders, among women compared to men. Recall bias and cultural acceptance factors may also play an important role. In addition to these sex differences, gender identity also impacts SITBs. Globally, gender minorities report higher rates of all SITBs. These higher rates may relate to higher rates of psychopathology reported among gender minorities and greater experiences with discrimination, victimization, and rejection from friends, family, and peers.

Prior research indicates that SITBs are highly comorbid (Hamza, Stewart, & Willoughby, 2012) and prior SITBs, suicidal and nonsuicidal, tend to be associated with future suicidal behaviors, though individual associations are not particularly strong (Ribeiro et al., 2016). Moreover, although nonsuicidal and suicidal SITBs are typically distinguished through one's self-reported intent to die, sometimes intent to die is difficult to determine due to factors such as ambivalence, stigma, or a desire not to be hospitalized (e.g., Fox et al., 2016). Because of these issues, many researchers group all non-fatal self-injurious behavior into one category and consider only suicide death as a truly distinct form of self-harm (e.g., Kapur, Cooper, O'Connor, & Hawton, 2013). However, as described in this review, there appear to be important differences in the role of sex on different forms of non-fatal SITBs. Whereas women tend to report more suicide attempts than men, sex differences in NSSI are less clear and perhaps only exist in clinical populations. As such, research on sex differences in SITBs add to other research highlighting important distinctions (e.g., prevalence, function) across suicidal and nonsuicidal behaviors (e.g., Nock, 2009).

3. Future directions

Although the impact of sex on SITBs has been studied since the beginning of research on suicide, there are still several areas of research that need to be developed. First, the majority of epidemiological research on suicide and sex differences focuses simply on sex. Including questions assessing the broad range of gender identification, especially in large-scale, population based study of health, could provide more reliable estimates on how gender minority identification of different types relates to SITBs. Relatedly, additional empirical studies assessing how identification with “feminine” and “masculine” ideals impacts willingness to disclose SITB histories and mental illness more generally may shed light on how gender norms impact self-reporting. For example, testing whether males who are primed with words or attributes

related to traditional masculinity and male gender roles (e.g., Mast, Sieverding, Esslen, Graber, & Jäncke, 2008) compared to males who receive neutral primes report different SITB rates could provide insights into the impact of male gender roles on SITB reporting.

Second, higher rates of mental illness among women appear to play a role in higher rates of thinking about and engaging in non-fatal suicidal behaviors; yet, these experiences do not then translate to higher rates of suicide deaths. Instead, despite lower rates of most mental illnesses, and primarily lower rates of non-fatal suicidal thoughts and behaviors, men die by suicide *more* than women. More research is needed to better understand why higher rates of most affective and anxiety disorders, and higher rates of non-fatal suicidal thoughts and behaviors, do not then translate into higher rates of suicide death. One possibility for this effect is that, internalizing disorders, and even prior SITBs, are not particularly strong risk factors for suicide death when considered in isolation (Franklin et al., 2016; Ribeiro et al., 2016). Instead, complex associations across numerous factors, rather than individual factors like affective disorders in isolation, confer meaningful risk for SITBs (e.g., Nock, 2016). Providing support for this possibility, recent research employing machine learning algorithm has resulted in improved prediction of suicide death (Kessler et al., 2015; Ribeiro, Franklin, & Walsh, 2017). More research using machine learning methods are needed to continue to test this possibility.

Third, more research is needed to understand why certain groups of people, for example Black women in the U.S., experience relatively low rates of suicide death. Better understanding this resilience, especially in the face of double minority status, could provide important insight into potential prevention targets. For example, if additional research suggests that Black women endorse more reasons for living than other groups, then programs seeking to foster greater reasons for living (e.g., promoting greater involvement in community) could lead to subsequent decreases in suicide deaths across other groups. However, large-scale studies should first be conducted to better identify what factors, if any, are related to these suicide lower rates to determine the most impactful prevention targets.

Fourth, rates of suicide among people in China, and particularly women in rural China, are disproportionately high. As described above, this may relate to the availability of highly lethal pesticides. Given research demonstrating that decreasing access to highly lethal suicide methods is associated with subsequent decreases in suicide deaths (e.g., Yip et al., 2012) across suicide methods, and specifically in regards to limiting access to lethal pesticides (e.g., Gunnell et al., 2007), decreasing access to lethal pesticides in China could play an important role in decreasing suicide deaths in that region. It would be interesting to see if such a change impacted the rate of male to female suicide deaths.

Fifth, research on differences in suicide intent across suicide attempts in males and females is mixed, with some studies showing that males report higher suicide intent (e.g., Harriss et al., 2005; Haw et al., 2003; Nock & Kessler, 2006; Townsend et al., 2001), and others not showing a significant difference (e.g., Bancroft et al., 1979; Casey, 1989; Denning et al., 2000; Hawton et al., 2008). Additional large-scale studies or meta-analyses on this topic could shed light on whether men typically attempt suicide with a higher suicidal intent than women.

Finally, more research on sex differences in NSSI is needed. Available research suggests that there may be sex differences in clinical but not community samples. Research seeking to uncover why these sex differences might exist in clinical samples but not elsewhere may be important. Additionally, more large-scale, population based prevalence studies of NSSI outside of the U.S. and other high-income countries are needed. Such research could shed light on whether sex differences in NSSI are similar across cultures or whether there are distinct patterns of NSSI that emerge in different groups or countries.

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KRF conducted literature searches and wrote the manuscript. AJM, CEM, and MKN contributed novel ideas to and provided critical revisions for the final manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

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