



# Sleep and Its Disorders Among Sexual and Gender Minority Populations

# 7

Alexa Martin-Storey, Roxanne Legault, and Kate C. Prickett

## Introduction

In their 2011 report, the Institutes of Medicine suggested that health disparities between cisgender and heterosexual populations and gender and sexual minority populations were a serious and understudied phenomenon [1]. Sexual minorities make up between 2.2% and 4.4% of the population of the United States [2, 3], while gender minorities reflect approximately one out of every 250 people [4]. All told, these numbers suggest that between 5.2 and 9.4 million Americans report sexual minority identities, and between 700,000 and 1,000,000 Americans identify as gender minorities [3]. Despite the marked increase in interest in health outcomes among these vulnerable populations [1], and existing studies that highlight vulnerabilities among sexual and gender minorities for a number of conditions that both contribute to and result from problems with sleep and sleep disorders (e.g., mood disorders, substance disorders, cardiovascular problems, etc.) [1, 5–10], researchers are only beginning to examine sleep and sleep health more explicitly among gender and sexual minority populations.

Although in its infancy, existing research on gender and sexual minorities posits theoretical frameworks to suggest why sexual and gender minority populations may be particularly vulnerable to poor sleep health [11, 12], and initial studies find evidence that sexual and gender minority individuals experience poorer sleep health than their heterosexual and cisgender peers. Moreover, some research is starting to unpack the role of minority stressors for understanding these health disparities.

---

A. Martin-Storey (✉) · R. Legault  
Psychoeducation Department, Université de Sherbrooke, Sherbrooke, QC, Canada  
e-mail: [Alexa.martin@usherbrooke.ca](mailto:Alexa.martin@usherbrooke.ca); [Roxanne.legault@usherbrooke.ca](mailto:Roxanne.legault@usherbrooke.ca)

K. C. Prickett  
Roy McKenzie Centre for the Study of Families and Children, School of Government at  
Victoria University of Wellington, Wellington, New Zealand  
e-mail: [Kate.prickett@vuw.ac.nz](mailto:Kate.prickett@vuw.ac.nz)

The goal of this chapter is to provide context for understanding why sexual and gender minority populations may be particularly vulnerable to sleep problems, to review existing research on sleep among sexual and gender minority populations, to and suggest future directions for research.

---

## Definitions

Prior to discussing sleep and sleep problems among gender and sexual minorities, we will briefly define some terms associated with sexual and gender minority populations. Sexual minority status is a multifaceted “catch-all” terms used to describe individuals who are not heterosexual. Most notably, sexual minority status can reflect patterns of three overlapping constructs being sexual identity, sexual attraction, and sexual behaviour [13]. Sexual minority identities are all identities other than heterosexual identities including: (1) gay or lesbian identities (often indicating sexual or romantic attraction towards individuals with the same gender); (2) bisexual identities (often reflecting sexual or romantic attraction to same and other genders); (3) mostly heterosexual identities (often reflecting patterns of sexual or romantic attraction that are mostly, but not always, towards individuals of a different sex); and, (4) increasingly popular terms such as queer or pansexual (which are often used to describe identities that reflects pattern of attraction that do not conform to a binary notion of gender) [14, 15]. Patterns of attraction indicative of sexual minority status are those where individuals report same-sex sexual or romantic attraction (e.g., report attraction to individuals of the same sex, or of same and other sexes). Asexual individuals, or individuals who report no sexual attraction are also sexual minorities [16], although this population has not been the focus of existing sleep research. Same-sex, or same- and other-sex attraction is often used to establish sexual minority status within adolescent samples, primarily because this marker of sexual minority status is often observable prior to identities or sexual or romantic behaviour [17, 18]. Finally, sexual minority status is also used to describe individuals who report same-sex sexual or romantic behavior (e.g., having sexual or romantic relationships with individuals of the same or other sexes and/or genders) in the presence or absence of having sexual minority identities. Until recently, many large-scale studies that employed government databases have commonly identified sexual minorities based on the gender of the partners with whom the individual cohabitates, as information on sexual minority identity was often not collected [19, 20]. Furthermore, studies focused on sexual health often define sexual minority status based on sex of sexual partner (e.g., men who have sex with men) [21].

While research suggests overlap between sexual minority identities, same-sex romantic and sexual attraction, and same-sex sexual and romantic behaviour [13, 22], it is important to note that these factors have been differentially associated with health behaviors and capture different portions of the sexual minority community [13, 23]. Furthermore, individuals with bisexual identities, attractions, or behaviors (e.g., patterns that reflect attraction to or sexual or romantic behavior with multiple genders such as bisexual, queer, or pansexual) often report more negative health

outcomes compared to monosexuals (e.g., individuals whose identities, attractions, or behaviors reflect attraction towards a single gender such as heterosexual, gay, or lesbian identities) [15, 24, 25]. Indeed, while the processes that explain poorer health outcomes among bisexuals may include vulnerability to bisexual-specific discrimination, bisexual erasure, and lack of support for bisexuals [25], this field of research is very much in development, but underscores the importance of examining differences in sleep health across different sexual minority identities, and not treating sexual minority populations as monolithic.

Gender identity refers to the gender with which people identify, with the majority of individuals (often described as cisgender individuals) having gender identities that correspond with the sex they were assigned at birth (e.g., men who were assigned male at birth, women who were assigned female at birth) [26, 27]. Gender minority populations are generally those for whom the sex (typically male or female) that they were assigned at birth differs from the gender with which they currently identify. These identities can be either binary (e.g., an individual who was assigned male at birth identifies as a woman) or non-binary (e.g., an individual who was assigned male at birth but now identifies using terms such as genderfluid or non-binary) [28]. For instance, the term transgender woman refers to individuals who were assigned male at birth who now identify as women, while the term transgender man refers to individuals who were assigned female at birth but now identify as men [27]. Some gender minority individuals will pursue gender-affirming medical procedures to align their gender identity with their external appearance including masculinising or feminising hormones or surgery to modify primary and secondary sexual characteristics [27], all of which may have implications for sleep health. Additionally, intersex individuals—individuals whose sex at birth or chromosomal make up was outside of male or female categories—are also frequently included as gender minorities [27], although this population is the focus of no sleep research that we were able to identify. Finally, it is important to note that while gender minority populations are more likely to report sexual minority identities compared with cisgender populations, sexual and gender minority status reflects different underlying concepts, and many gender minorities identify as heterosexual [26, 27, 29].

---

## Minority Stress Theory and Sleep Health

Minority stress theory permits for an understanding of general vulnerability to negative mental health outcomes among sexual and gender minorities [11], and may be useful for understanding vulnerability to poor sleep health, specifically. This theoretical framework suggests that as a consequence of the stigma associated with sexual and gender minority status, sexual or gender minorities are more likely than their peers to experience a number of adverse experiences, including discrimination, harassment, internalized stigma, victimization, and rejection. Their greater likelihood of experiencing these stressors, in turn, increases the likelihood that sexual and gender minorities will experience a number of negative health and mental

health outcomes. The higher likelihood of experiencing victimization and other consequences of stigma among sexual and gender minority populations, starting in childhood and extending across adulthood is well-documented [30], and the consequences of discrimination such as victimization for health problems across the life course are well known [31, 32].

Minority stress theory may be a useful framework for understanding vulnerability to poor sleep health among sexual and gender minorities, because of the growing body of literature linking interpersonal stressors, generally, and discrimination, specifically, to poorer sleep health [12, 33, 34]. A recent systematic review by Slopen and colleagues linked numerous types of discrimination (e.g., discrimination based on race/ethnicity, discrimination based on gender, unfairness at work) to negative sleep outcomes, including self-reported sleep difficulties and sleep length, and showed mixed findings regarding the association between discrimination and objectively measured sleep length and other objective assessments of sleep [12]. The authors suggested that discrimination influences sleep quality because these kinds of aversive experiences increase arousal, vigilance, distress, as well as physiological reactivity. Similar responses to discrimination have also been observed among sexual minority populations, including higher levels of arousal and vigilance [11], greater distress [35, 36], and more physiological reactivity [37, 38]. Likewise, increased vigilance and distress in response to discrimination have also been noted among gender minority populations [39, 40]. If sexual and gender minority populations experience higher levels of discrimination, and higher levels of discrimination are associated with poorer sleep health, then these sexual and gender minority populations should be more likely to experience poor sleep health.

While discrimination is associated with negative health outcomes such as sleep directly, it may also be indirectly associated with poor sleep health via depressive symptoms and substance use [41]. Both depressive symptoms and substance use are associated with vulnerability to poorer sleep outcomes [9, 10]. As a result of discrimination, sexual and gender minority populations both report higher levels of depression and substance use compared to heterosexual and cisgender populations [1, 5, 42]. Ultimately, the well-established links between depression, substance use, and both sleep health and sexual minority status, respectively, provide a plausible causal pathway for linking sexual and gender minority status to poorer sleep health.

Finally, gender minority populations in particular may be more likely to experience poorer sleep health due to gender affirming hormonal therapy. While not all gender minorities can or wish to follow hormone therapy, many gender minorities use hormones such as estrogens, antiandrogens, and/or progestogens for feminizing therapies or testosterone and antiestrogens for masculinizing therapies to acquire desired secondary sex characteristics or minimize undesired secondary sex characteristics [43]. Although the literature examining hormones in relation to gender minority sleep is currently quite limited [44], a much larger literature, focusing primarily on cisgender individuals, suggests that various types of hormone treatment are associated with sleep health [45, 46]. Given the association between hormonal therapies and sleep health, gender minority individuals who are using

hormone therapies may be anticipated to show variations in sleep health compared to cisgender and transgender individuals not using these types of therapies.

---

## Sleep and Sexual Minority Populations

While the theoretical underpinnings that link sexual and gender minority status to poorer sleep health have existed for some time, research examining sleep health among sexual and gender minorities has mostly emerged in the last 4–5 years. Here, we discuss the emerging literature that has examined sleep outcomes among sexual and gender minorities, starting with sexual minorities. Research on sleep among sexual minorities generally fits into a minority stress framework in that it examines how sexual minority status is associated with sleep health disparities, if minority stressors are associated with poor sleep health among sexual minority populations, and if sleep is associated with other health problems among sexual minority populations. We will briefly summarize the findings from these three bodies of literature here, with a particular focus on identifying patterns that may be useful for future research.

### Sleep Disparities Between Sexual Minority and Heterosexual Populations

The ability to understand sleep disparities between sexual minority and heterosexual populations has been facilitated by an increasing number of studies using large scale and, in most cases, nationally-representative datasets [19, 47–59]. The majority of these studies focus on adults [19, 47–55], although some studies have focused on either adolescents [56, 59], young adults [57], or older adults [58]. These studies have used data from well-known health behavior surveys designed to assess health outcomes including the Behavioral Risk Factor Surveillance System [52, 53, 55, 58], the National Longitudinal Study of Adolescent to Adult Health [54, 57], the National Health Interview Survey [47–51], the American Time Use Survey [19], and the Youth Risk Behavior Survey [59]. All but one of these studies focused on participants from the United States [56], suggesting that more work may be needed to understand if findings on sleep health among sexual minorities replicate internationally.

In terms of the association between sexual minority status and sleep health, many more of these studies identified at least some differences between sexual minority and heterosexual participants with regards to sleep health [19, 47, 48, 50–52, 54, 57, 58] than failed to identify differences [49, 53], even after controlling for demographic factors and some relevant mental health variables. It should be noted, however, that only one study (examining sleep among Chinese adolescents) identified significant differences in sleep health across all of the sleep outcomes measured, and examined both sleep duration and sleep quality [56]. In other words, although sleep disparities may exist between heterosexual and sexual minority populations,

the exact nature of these differences may vary depending on how both sexual minority status and sleep outcomes are measured. Several patterns from these findings, however, may provide insight for future research, and will be discussed in greater detail below.

First, in cases where analyses were performed separately for men and women, researchers generally found greater disparities in sleep outcomes between heterosexual and sexual minority women than between heterosexual and sexual minority men [19, 47, 48, 52, 55, 57–59]. In other words, while sexual minority status was associated with poorer sleep outcomes among men, this association was less consistent than the association observed among women. This finding may reflect how stressors may be more strongly associated with sleep outcomes among women than among men [60, 61], and demonstrate the importance of examining the association between sexual minority status and sleep by gender.

Findings also varied according to the sleep outcome being examined. Sexual minority status was more consistently associated with sleep quality indicators (e.g., rested-ness, trouble falling asleep, trouble staying asleep) than with measures of sleep duration in studies in which both were examined [19, 48]. Indeed, one study that failed to find any significant sleep differences by sexual minority status focused exclusively on sleep duration [49]. These findings may reflect the larger literature suggesting that discrimination is more strongly associated with qualitative assessments of sleep quality compared to sleep duration [12]. Moreover, most [50, 52, 57], but not all [55], of the studies on adults that identified differences in sleep duration among sexual minority populations focused on lower sleep duration cut offs (e.g., 5 or 6 hours rather than less than 7 or 8 hours). These findings suggest that sexual minority populations may be more likely to report deficits related to the quality of sleep, rather than the quantity of sleep, and underline the importance of future work examining how the association between sexual minority status and sleep duration may vary as a function of the way in which short sleep duration is defined.

Many of the studies also examined variation in disparities associated with sleep outcomes within sexual minority subgroups (e.g., gay/lesbian individuals compared to bisexual individuals, individuals with same- and other-sex partners compared to individuals with exclusive same-sex partners). Although many of these studies suggested greater vulnerability to poorer health outcomes among individuals with bisexual identities or patterns of attraction and behaviour [50, 51, 57], others did not clearly show differences between individuals with different types of sexual minority identities, attractions, or behaviors [48, 54]. The broader literature generally suggests poorer health outcomes among individuals with non-monosexual identities (e.g., bisexuals), or individuals with histories of same and other gender sexual behavior or attraction [24]. Whether this general vulnerability extends to sleep outcomes is still unclear. These findings suggest the importance of examining the role of shared and unique stressors among different sexual minority populations in association with sleep health as a possible avenue for future research [62, 63].

In line with intersectionality theory [64], race/ethnicity may also be important for understanding variation in sleep health among sexual minorities. Three studies

have examined differences in the association between sexual minority status and sleep outcomes according to race/ethnicity [47, 50, 51], with two finding important racial/ethnic differences, depending on which sexual minority status identities were examined, and what kind of other variables were controlled [47, 51]. These findings suggest how experiences of sexual minority status may vary according to race/ethnicity, and underscore the importance of further research to understand how these identities and statuses influence sleep health in nuanced, and/or potentially compounding, ways.

## Minority Stressors and Sleep among Sexual Minority Populations

Although the research described above suggests that sexual minority populations may be more likely to experience poor sleep health, a second smaller body of literature has addressed how minority stressors are associated with sleep outcomes within sexual minority populations. Put another way, this research can uncover the ways in which discrimination or stress faced by people who identify as sexual minorities causes poorer sleep health. Following from an ecological approach [65], minority stressors can occur at the level proximal to the individual (e.g., at the individual level or within their relationships) or can occur at the distal level (e.g., in their communities) [11, 66]. Starting at the proximal level and moving outward, higher levels of individual-level distress has been shown to partially explain poor sleep outcomes among men who have sex with men [67]. Higher levels of interpersonal stressors also partially explain differences in sleep health between sexual minority and heterosexual populations. Family conflict is an important minority stressor, as sexual minority status increases the likelihood of family rejection [68, 69]. Family conflict partially explained the association between sexual minority status and sleep health in a large-scale study of adults, with family conflict being associated with higher distress and subsequent poorer sleep health [54]. Peer victimization is also a central aspect of minority stress [18, 70]—one which has been shown to mediate the link between sexual minority status and poor sleep health [56].

A limited body of literature has also examined distal stressors with regards to sleep health among sexual minority populations. At the distal level, perceptions of neighborhood are generally more negative among sexual minority populations [71], and reflect an important minority stressor [11]. At least one study has linked less perceived neighborhood safety with poorer sleep health amount men who had sex with men [72], suggesting neighborhood context is an important focus for future work. Finally, previous research suggests that attitudes indicative of greater acceptance of sexual minorities (e.g., support for same sex marriage) are associated with better health outcomes in general among sexual minority populations [73, 74]. Some previous work suggests that more positive broader cultural attitudes towards sexual minorities are related to sleep quality among sexual minority women [19]. These findings underscore the importance of examining distal forms of discrimination in association with sleep health among sexual minority populations.

## Minority Stressors, Sleep, and Other Health Outcomes

While sleep can be understood as a consequence of minority stress, another growing body of research focuses on sleep as a factor that may explain health differences either within sexual minority populations, or between sexual minority and heterosexual populations. To start, at least two studies, focusing on adolescents and young adults, found that sleep health was an important explanatory variable in differences in wellbeing and suicidality between sexual minority and heterosexual populations [75, 76]. Increasingly, research has also begun exploring the associations between sleep, risky sexual behaviors, and HIV/AIDS. While HIV/AIDS is certainly not exclusive to sexual minority populations, men who have sex with men are disproportionately more likely to be living with HIV/AIDS compared to other populations [21]. Although a comprehensive review of HIV/AIDS and sleep health is beyond the scope of the current chapter, a significant body of research associates HIV/AIDS with poorer sleep outcomes [77]. In line with research suggesting a link between being HIV positive and sleep health more generally, sexual minority men who are HIV positive reported poorer sleep quality and greater use of sleep medication compared to men who were not HIV positive, controlling for substance use, antiretroviral therapy, and other health indicators [78]. Finally, two recent studies link poor sleep health with higher levels of risky sexual behavior [79, 80]. Although the directionality on these findings requires further investigation, these results do suggest the importance of future work examining sleep health as being protective with regards to sexual health outcomes.

## Sleep Problems and Gender Minority Populations

Much less research has focused on sleep outcomes among gender minority populations. The research that does exist, however, generally examines either the association between gender identity and sleep within large-scale population-based samples or the association between gender affirming health services (e.g., hormone use, surgery) and sleep health. Starting with the first category, these studies (which often examine sexual minority status and sleep concurrently) suggest that gender minority individuals report worse sleep outcomes, with some variation according to gender minority identity. Dai and Hao found that transgender non-binary participants were the most likely to report sleep durations of less than 5 hours, followed by transgender women, and transgender men [52]. Cunningham found that transgender women were significantly more likely to have slept less than 7 hours in the last 24 hours, compared to cisgender individuals, as well as compared to transgender men and transgender non-binary participants [55]. These findings, while focusing on different sleep outcomes, suggest greater vulnerability for poor sleep health among gender minority participants. What remains unclear, however, are patterns in the variation of the association between sleep health and gender minority status. More research is required to understand variation in sleep health within gender minority populations.



A second body of work, generally with gender minority populations recruited from clinics specializing in gender minority medicine, focuses on the link between gender affirming medical care and sleep health. For instance, one study with transgender women in Brazil found that while multiple aspects of their functioning improved following gender affirming surgery, sleep and rest remained poor [81]. In many cases, the explicit purpose of these studies was to better understand the effect of certain hormones (e.g., estrogen) on sleep health [44, 82, 83]. These findings generally suggest links between gender affirming medical practices and sleep health, but the samples in all of these studies were limited. These findings require replication before making strong conclusions about the impact various types of gender affirming hormone regimes for sleep health.

---

## Limitations in the Existing Research and Future Directions

### Limitations in the Existing Research

As documented in the previous sections, research suggests there are disparities in sleep health across sexual minority status, and increasingly indicate similar differences in sleep health across gender minority status. Based on the existing literature, we suggest several avenues for future research, as well as some general guidelines for examining sleep health among sexual and gender minority populations.

To start, all of the studies used subjective assessments of sleep quality and sleep duration. Although self-reported sleep quality is important, and may be more strongly tied to health outcomes than other assessments of sleep [84, 85], future research including objective assessments of sleep quality and quantity may supplement our understanding of when and how sexual and gender minority populations experience poor sleep health outcomes. Similarly, all of the identified research relies on observational studies. Future research using natural and quasi-experimental designs to examine how policy initiatives designed to reduce discrimination [86], or psychological interventions that increase an individual's ability to cope with discrimination [87, 88], influence sleep outcomes among sexual and gender minority populations may help address some of these questions. Similarly, understanding how interventions that promote sleep health are associated with an individual's ability to regulate successfully in the context of minority stressors will provide much needed experimental evidence on how sleep health and minority stressors interact over time [89].

In line with these data limitations, the large nationally-representative datasets that are used in these studies to make broader population-level inferences often rely on imprecise measures of sexual minority status. For example, sexual minority status is not typically asked on large U.S. government surveys, therefore, sexual minority status is often 'conferred' upon respondents who note a spouse or partner in the household of the same sex or gender as them [90]. The U.S. Census 2020 will move towards a more accurate measure by asking respondents whether they define their partnership as 'same sex' or 'opposite sex,' however, this approach still limits

analyses to sexual minority respondents who are coupled. Future surveys should include questions that ask respondents about their sexual identity.

Second, more population-based research is needed to assess the role of minority stressors in explaining poor sleep health outcomes among sexual minority populations. Although some studies have focused on potential minority stressors (e.g., neighborhood safety, family acceptance, peer victimization), minority stressors frequently co-occur [18], and informing intervention and prevention requires research that examines multiple minority stressors simultaneously. Additional research is also needed to understand how the classic elements of the minority stress model—that is, experiences of discrimination associated with being a sexual or gender minority, fear of victimization or discrimination, and internalized stigma about sexual or gender minority status—are associated with poorer sleep outcomes among sexual and gender minority populations [11]. Previous work suggests that variation in rates of discrimination explain why individuals with some sexual minority identities are more likely to experience other negative health outcomes (e.g., bisexuals) compared to others (e.g., gay men and lesbians) [91], and may also be useful for understanding variation in sleep health across sexual minority identities.

More research is also needed to better understand how minority stressors shape sleep health among gender minority populations. Previous research has focused on how gender-affirming medical treatments such as hormone therapies and surgery are associated with poorer sleep health [44, 81, 92], but this research has largely overlooked the role of discrimination in shaping sleep outcomes among gender minority populations. As discussed above, discrimination has been repeatedly linked with poor sleep health among other populations [12], and gender minority populations experience very high levels of discrimination [27, 40]. Testing the impact of both minority stressors and gender affirming medical practices on sleep health among gender minority populations will allow for a better understanding of sleep health within this population.

## Future Research Considerations

The existing literature, while limited, provides useful instruction for future research. The findings of the current review strongly suggest the importance of future research examining sleep outcomes separately among sexual minority men and women. The existing literature on sleep outcomes and the link between sexual minority status and sleep outcomes shows clear differences between men and women [19, 47, 48, 52, 55, 57–59]. Although some previous research has compared sleep between sexual minority men and women, the differences in sleep health among men and women, generally, strongly limit the utility of this way of presenting findings. While sexual minority men and women experience some similar minority stressors, they differ in terms of a number of important health and demographic variables that may shape the ways in which they are vulnerable to poor sleep health [1]. We strongly recommend that future research, whenever possible, examine the association

between sexual minority status and sleep health by gender (e.g., comparing sexual minority women to heterosexual women). Finally, while existing research suggests that differences are observed in sleep health within gender minority populations, the different stressors experienced by transgender men and transgender women, and among binary compared to non-binary gender minorities [93, 94], suggest that more research is needed to understand variation in sleep health within this population.

Moreover, closer attention should be paid to the intersectionality of statuses associated with minority stress, such as race/ethnicity and immigration status. Research strongly suggests differences in access to resources, and daily stressors within sexual and gender minority populations differ across race/ethnicity, immigration status, and socioeconomic status [1, 51], all of which may be anticipated to shape sleep health. Scant research has documented how these intersecting statuses may compound consequences for—or be protective of—sleep health, and should be the focus of future research.

Finally, both sleep health and the consequences of sexual and gender minority status for sleep health may change across the life course [95, 96]. We strongly suggest the importance of evaluating the link between sexual and gender minority status and sleep health over time, as well as examining the association between these statuses and sleep health concurrently among participants of different ages. It is unlikely that the association between sleep health and sexual and gender minority status is static, and both longitudinal and cross-sectional approaches may help to identify both the development of sleep problems among sexual and gender minorities, as well as cohort effects among these populations regarding sleep health.

---

## Conclusion

Both the rapidly expanding number of studies examining disparities in sleep health across sexual and gender minority status, and the growing body of research linking sleep health with minority stressors indicates the increasing realization of potential vulnerabilities for poor sleep health among sexual and gender minority populations. Better understanding sleep health among sexual and gender minority populations, and the factors that are associated with risk for poor sleep health has implications for both the fields of sleep and sexual and gender minority research. Understanding vulnerability for poor sleep health among sexual and gender minorities can inform our understanding of how discrimination is associated with sleep outcomes. Moreover, given the importance of sleep health to health and wellbeing more broadly, focusing on sleep health may be a useful way of unpacking other health disparities observed among gender and sexual minority populations. More research is needed to understand the nature and direction of the links between sexual and gender identity and sleep health, how sexual and gender identities intersect with other marginalized identities in relation to sleep health, as well as to identify the most effective methods for improving sleep health among sexual and gender minority populations.

## References

1. Institute of Medicine. The health of lesbian, gay, bisexual, and transgender people: building a foundation for better understanding. Washington DC: National Academies Press; 2011.
2. Gates GJ. LGBT demographics: comparisons among population-based surveys. 2014 [cited 2019 Jan 18]; Available from: <https://escholarship.org/uc/item/0kr784fx>.
3. Gates GJ. How many people are lesbian, gay, bisexual and transgender? 2011 [cited 2019 Jan 18]; Available from: <https://escholarship.org/uc/item/09h684X2>.
4. Meerwijk EL, Sevelius JM. Transgender population size in the United States: a meta-regression of population-based probability samples. *Am J Public Health*. 2017;107(2):e1–8.
5. Marshal MP, Friedman MS, Stall R, King KM, Miles J, Gold MA, et al. Sexual orientation and adolescent substance use: a meta-analysis and methodological review. *Addiction*. 2008;103:546–56.
6. Marshal MP, Dietz LJ, Friedman MS, Stall R, Smith HA, McGinley J, et al. Suicidality and depression disparities between sexual minority and heterosexual youth: a meta-analytic review. *J Adolesc Health*. 2011;49(2):115–23.
7. Caceres BA, Brody A, Luscombe RE, Primiano JE, Marusca P, Sitts EM, et al. A systematic review of cardiovascular disease in sexual minorities. *Am J Public Health*. 2017;107(4):e13–21.
8. Hoeveraar-Blom MP, Spijkerman AMW, Kromhout D, van den Berg JF, Verschuren WMM. Sleep duration and sleep quality in relation to 12-year cardiovascular disease incidence: the MORGEN study. *Sleep*. 2011;34(11):1487–92.
9. MD MDS, Peter D, Friedmann MDM. Disturbed sleep and its relationship to alcohol use. *Subst Abuse*. 2006;26(1):1–13.
10. Alvaro PK, Roberts RM, Harris JK. A systematic review assessing bidirectionality between sleep disturbances, anxiety, and depression. *Sleep*. 2013;36(7):1059–68.
11. Meyer IH. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. *Psychol Bull*. 2003;129(5):674–97.
12. Slopen N, Lewis TT, Williams DR. Discrimination and sleep: a systematic review. *Sleep Med*. 2016;18:88–95.
13. Chandra A, Copen CE, Mosher WD. Sexual behavior, sexual attraction, and sexual identity in the United States: data from the 2006–2010 national survey of family growth. In: Baumie AK, editor. *International handbook on the demography of sexuality*: New York: Springer; 2013. p. 45–66.
14. Mereish EH, Katz-Wise SL, Woulfe J. We're here and we're queer: sexual orientation and sexual fluidity differences between bisexual and queer women. *J Bisex*. 2017;17(1):125–39.
15. Martin-Storey A. Gender, sexuality, and gender nonconformity: understanding variation in functioning. *Child Dev Perspect*. 2016;10(4):257–62.
16. Bogaert AF. Asexuality: what it is and why it matters. *J Sex Res*. 2015;52(4):362–79.
17. Pearson J, Muller C, Wilkinson L. Adolescent same-sex attraction and academic outcomes: the role of school attachment and engagement. *Soc Probl*. 2007;54(4):523–42.
18. Martin-Storey A, Crosnoe R. Sexual minority status, peer harassment, and adolescent depression. *J Adolesc*. 2012;35(4):1001–11.
19. Martin-Storey A, Prickett KC, Crosnoe R. Disparities in sleep duration and restedness among same and different sex couples: findings from the American time use survey. *Sleep*. 2018;41(8).
20. Thomeer MB. Sexual minority status and self-rated health: the importance of socioeconomic status, age, and sex. *Am J Public Health*. 2013;103(5):881–8.
21. Beyrer C, Baral SD, van Griensven F, Goodreau SM, Chariyalertsak S, Wirtz AL, et al. Global epidemiology of HIV infection in men who have sex with men. *Lancet*. 2012;380(9839):367–77.
22. Igartua K, Thombs BD, Burgos G, Montoro R. Concordance and discrepancy in sexual identity, attraction, and behavior among adolescents. *J Adolesc Health*. 2009;45:602–8.
23. Martin-Storey A, Fromme K. Trajectories of dating violence: differences by sexual minority status and gender. *J Adolesc*. 2016;49:28–37.
24. Ferguson A, Gilmour M. Non-monosex research publication in U.S.-based social work journals between 2008–2016. *J Evid Inf Soc Work*. 2018;15(1):23–37.

25. Ross LE, Salway T, Tarasoff LA, MacKay JM, Hawkins BW, Fehr CP. Prevalence of depression and anxiety among bisexual people compared to gay, lesbian, and heterosexual individuals: a systematic review and meta-analysis. *J Sex Res.* 2018;55(4–5):435–56.
26. American Psychological Association. Guidelines for psychological practice with transgender and gender nonconforming people. *Am Psychol.* 2015;70(9):832–64.
27. Winter S, Diamond M, Green J, Karasic D, Reed T, Whittle S, et al. Transgender people: health at the margins of society. *Lancet.* 2016;388(10042):390–400.
28. Grossman AH, D’Augelli AR. Transgender youth. *J Homosex.* 2006;51(1):111–28.
29. Katz-Wise SL, Reisner SL, Hughto JW, Keo-Meier CL. Differences in sexual orientation diversity and sexual fluidity in attractions among gender minority adults in Massachusetts. *J Sex Res.* 2016;53(1):74–84.
30. Katz-Wise S, Hyde J. Victimization experiences of lesbian, gay and bisexual individuals: a meta-analysis. *J Sex Res.* 2012;49:142–67.
31. Schwartz D, Lansford JE, Dodge KA, Pettit GS, Bates JE. Peer victimization during middle childhood as a lead indicator of internalizing problems and diagnostic outcomes in late adolescence. *J Clin Child Adolesc Psychol.* 2015;44(3):393–404.
32. Wolke D, Copeland WE, Angold A, Costello EJ. Impact of bullying in childhood on adult health, wealth, crime, and social outcomes. *Psychol Sci.* 2013;24(10):1958–70.
33. Åkerstedt T, Orsini N, Petersen H, Axelsson J, Lekander M, Kecklund G. Predicting sleep quality from stress and prior sleep—a study of day-to-day covariation across six weeks. *Sleep Med.* 2012;13(6):674–9.
34. Hall MH, Casement MD, Troxel WM, Matthews KA, Bromberger JT, Kravitz HM, et al. Chronic stress is prospectively associated with sleep in midlife women: the SWAN sleep study. *Sleep.* 2015;38(10):1645–54.
35. Liao KY-H, Kashubeck-West S, Weng C-Y, Deitz C. Testing a mediation framework for the link between perceived discrimination and psychological distress among sexual minority individuals. *J Couns Psychol.* 2015;62(2):226–41.
36. Timmins L, Rimes KA, Rahman Q. Minority stressors, rumination, and psychological distress in monozygotic twins discordant for sexual minority status. *Psychol Med.* 2018;48(10):1705–12.
37. Juster R-P, Hatzenbuehler ML, Mendrek A, Pfaus JG, Smith NG, Johnson PJ, et al. Sexual orientation modulates endocrine stress reactivity. *Biol Psychiatry.* 2015;77(7):668–76.
38. Austin SB, Rosario M, McLaughlin KA, Roberts AL, Sarda V, Yu K, et al. Sexual orientation and salivary alpha-amylase diurnal rhythms in a cohort of U.S. young adults. *Psychoneuroendocrinology.* 2018;97:78–85.
39. Bauerband LA, Teti M, Velicer WF. Measuring minority stress: invariance of a discrimination and vigilance scale across transgender and cisgender LGBQ individuals. *Psychol Sex.* 2019;10(1):17–30.
40. Timmins L, Rimes KA, Rahman Q. Minority stressors and psychological distress in transgender individuals. *Psychol Sex Orientat Gend Divers.* 2017;4(3):328–40.
41. Pascoe EA, Smart Richman L. Perceived discrimination and health: a meta-analytic review. *Psychol Bull.* 2009;135(4):531–54.
42. Reisner SL, Greytak EA, Parsons JT, Ybarra ML. Gender minority social stress in adolescence: disparities in adolescent bullying and substance use by gender identity. *J Sex Res.* 2015;52(3):243–56.
43. Coleman E, Bockting W, Botzer M, Cohen-Kettenis P, DeCuypere G, Feldman J, et al. Standards of care for the health of transsexual, transgender, and gender-nonconforming people, version 7. *Int J Transgenderism.* 2012;13(4):165–232.
44. Auer MK, Liedl A, Fuss J, Nieder T, Briken P, Stalla GK, et al. High impact of sleeping problems on quality of life in transgender individuals: a cross-sectional multicenter study. *PLoS One.* 2017;12(2):e0171640.
45. Manber R, Armitage R. Sex, steroids, and sleep: a review. *Sleep J Sleep Res Sleep Med.* 1999;22(5):540–55.

46. Cintron D, Lipford M, Larrea-Mantilla L, Spencer-Bonilla G, Lloyd R, Gionfriddo MR, et al. Efficacy of menopausal hormone therapy on sleep quality: systematic review and meta-analysis. *Endocrine*. 2017;55(3):702–11.
47. Trinh M-H, Agénor M, Austin SB, Jackson CL. Health and healthcare disparities among U.S. women and men at the intersection of sexual orientation and race/ethnicity: a nationally representative cross-sectional study. *BMC Public Health*. 2017;17(1):964.
48. Galinsky AM, Ward BW, Joestl SS, Dahlhamer JM. Sleep duration, sleep quality, and sexual orientation: findings from the 2013–2015 National Health Interview Survey. *Sleep Health*. 2018;4(1):56–62.
49. Jackson CL, Agénor M, Johnson DA, Austin SB, Kawachi I. Sexual orientation identity disparities in health behaviors, outcomes, and services use among men and women in the United States: a cross-sectional study. *BMC Public Health*. 2016;16(1):807.
50. Chen J-H, Shiu C-S. Sexual orientation and sleep in the U.S.: a national profile. *Am J Prev Med*. 2017;52(4):433–42.
51. Hsieh N, Ruther M. Sexual minority health and health risk factors: intersection effects of gender, race, and sexual identity. *Am J Prev Med*. 2016;50(6):746–55.
52. Dai H, Hao J. Sleep deprivation and chronic health conditions among sexual minority adults. *Behav Sleep Med*. 2017;17:254–68.
53. Blossnich JR, Farmer GW, Lee JGL, Silenzio VMB, Bowen DJ. Health inequalities among sexual minority adults: evidence from ten U.S. states, 2010. *Am J Prev Med*. 2014;46(4):337–49.
54. Patterson CJ, Tate DP, Sumontha J, Xu R. Sleep difficulties among sexual minority adults: associations with family relationship problems. *Psychol Sex Orientat Gen Divers*. 2018;5(1):109–16.
55. Cunningham TJ, Xu F, Town M. Prevalence of five health-related behaviors for chronic disease prevention among sexual and gender minority adults — 25 U.S. States and Guam, 2016. *Morb Mortal Wkly Rep*. 2018;67(32):888–93.
56. Li P, Huang Y, Guo L, Wang W, Xi C, Lei Y, et al. Is sexual minority status associated with poor sleep quality among adolescents? Analysis of a national cross-sectional survey in Chinese adolescents. *BMJ Open*. 2017;7(12):e017067.
57. Fricke J, Sironi M. Dimensions of sexual orientation and sleep disturbance among young adults. *Prev Med Rep*. 2017;8:18–24.
58. Fredriksen-Goldsen KI, Kim H-J, Shui C, Bryan AEB. Chronic health conditions and key health indicators among lesbian, gay, and bisexual older US adults, 2013–2014. *Am J Public Health*. 2017;107(8):1332–8.
59. Kann L, Olsen EO, McManus T, Harris WA, Shanklin SL, Flint KH, et al. Sexual identity, sex of sexual contacts, and health-related behaviors among students in grades 9–12 – United States and selected sites, 2015. *Morb Mortal Wkly Rep Surveill Summ (Wash, DC 2002)*. 2016;65(9):1–202.
60. Nordin M, Knutsson A, Sundbom E, Stegmayr B. Psychosocial factors, gender, and sleep. *J Occup Health Psychol*. 2005;10(1):54–63.
61. Bassett E, Moore S. Neighbourhood disadvantage, network capital and restless sleep: is the association moderated by gender in urban-dwelling adults? *Soc Sci Med (1982)*. 2014;108:185–93.
62. Mereish EH, Katz-Wise SL, Woulfe J. Bisexual-specific minority stressors, psychological distress, and suicidality in bisexual individuals: the mediating role of loneliness. *Prev Sci*. 2017;18(6):716–25.
63. Martin-Storey A, Paquette G, Bergeron M, Dion J, Daigneault I, Hébert M, et al. Sexual violence on campus: differences across gender and sexual minority status. *J Adolesc Health*. 2018;62:701–7.
64. Crenshaw K. Demarginalizing the intersection of race and sex: a black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. *Univ Chic Leg Forum*. 1989;1989:139–68.
65. Bronfenbrenner U. *The ecology of human development: experiments by nature and design*. Harvard University Press; 1979.

66. Watson LB, Varjas K, Meyers J, Graybill EC. Gay–straight alliance advisors: negotiating multiple ecological systems when advocating for LGBTQ youth. *J LGBT Youth*. 2010;7(2):100–28.
67. Mountcastle HD, Park SH, Al-Ajlouni YA, Goedel WC, Cook S, Lupien S, et al. Stress levels are associated with poor sleep health among sexual minority men in Paris, France. *Sleep Health*. 2018;4(5):436–41.
68. Ryan C, Russell ST, Huebner D, Diaz RM, Sanchez J. Family acceptance in adolescence and the health of LGBT young adults. *J Child Adolesc Psychiatr Nurs*. 2010;23:205–13.
69. Ryan C, Huebner D, Diaz RM, Sanchez J. Family rejection as a predictor of negative health outcomes in White and Latino lesbian, gay, and bisexual young adults. *Pediatrics*. 2009;123:346–52.
70. van Beusekom G, Baams L, Bos HMW, Overbeek G, Sandfort TGM. Gender nonconformity, homophobic peer victimization, and mental health: how same-sex attraction and biological sex matter. *J Sex Res*. 2016;53(1):98–108.
71. Tran AGTT. In these spaces: perceived neighborhood quality as a protective factor against discrimination for lesbian, gay, and bisexual (LGB) adults. *Psychol Sex Orientat Gend Divers*. 2015;2(3):345–52.
72. Duncan DT, Park SH, Goedel WC, Kreski NT, Morganstein JG, Hambrick HR, et al. Perceived neighborhood safety is associated with poor sleep health among gay, bisexual, and other men who have sex with men in Paris, France. *J Urban Health Bull N Y Acad Med*. 2017;94(3):399–407.
73. Hatzenbuehler ML, Flores AR, Gates GJ. Social attitudes regarding same-sex marriage and LGBT health disparities: results from a national probability sample. *J Soc Issues*. 2017;73(3):508–28.
74. Hatzenbuehler ML, Bellatorre A, Lee Y, Finch BK, Muennig P, Fiscella K. Structural stigma and all-cause mortality in sexual minority populations. *Soc Sci Med (1982)*. 2014;103:33–41.
75. Crawford TN, Ridner SL. Differences in well-being between sexual minority and heterosexual college students. *J LGBT Youth*. 2018;15:243–55.
76. Huang Y, Li P, Lai Z, Jia X, Xiao D, Wang T, et al. Role of sleep quality in mediating the relationship between sexual minority status and suicidal behavior among Chinese adolescents. *Psychol Res Behav Manag*. 2018;11:607–15.
77. Uchôa LRA, Silva AD, Veras VS, Sousa DFD, De VEC, Freire S. Poor sleep quality in persons living with HIV: a systematic review and meta-analysis. *J Nurs Health Sci*. 2018;4(2):8.
78. Downing MJ, Houang ST, Scheinmann R, Yoon IS, Chiasson MA, Hirshfield S. Engagement in care, psychological distress, and resilience are associated with sleep quality among HIV-positive gay, bisexual, and other men who have sex with men. *Sleep Health*. 2016;2(4):322–9.
79. Millar BM, Parsons JT, Redline S, Duncan DT. What’s sleep got to do with it?: sleep health and sexual risk-taking among men who have sex with men. *AIDS Behav [Internet]*. 2018 [cited 2019 Jan 6]; Available from: <https://doi.org/10.1007/s10461-018-2288-x>.
80. Duncan DT, Goedel WC, Mayer KH, Safren SA, Palamar JJ, Hagen D, et al. Poor sleep health and its association with mental health, substance use, and condomless anal intercourse among gay, bisexual, and other men who have sex with men. *Sleep Health*. 2016;2(4):316–21.
81. Cardoso da Silva D, Schwarz K, Fontanari AMV, Costa AB, Massuda R, Henriques AA, et al. WHOQOL-100 before and after sex reassignment surgery in Brazilian male-to-female transsexual individuals. *J Sex Med*. 2016;13(6):988–93.
82. Barrón-Velázquez E, Santana D, Espinosa P, Salin-Pascual RJ. Estrogens administration in female transsexuals augmented delta and rem sleep stages after six months of treatment. *Open Sleep J*. 2015;8(1):1–8.
83. Künzel HE, Murck H, Stalla GK, Steiger A. Changes in the sleep electroencephalogram (EEG) during male to female transgender therapy. *Psychoneuroendocrinology*. 2011;36(7):1005–9.
84. Chandola T, Ferrie JE, Perski A, Akbaraly T, Marmot MG. The effect of short sleep duration on coronary heart disease risk is greatest among those with sleep disturbance: a prospective study from the Whitehall II cohort. *Sleep*. 2010;33(6):739–44.

85. Kumari M, Badrick E, Ferrie J, Perski A, Marmot M, Chandola T. Self-reported sleep duration and sleep disturbance are independently associated with cortisol secretion in the Whitehall II study. *J Clin Endocrinol Metab.* 2009;94(12):4801–9.
86. Burk J, Park M, Saewyc EM. A media-based school intervention to reduce sexual orientation prejudice and its relationship to discrimination, bullying, and the mental health of lesbian, gay, and bisexual adolescents in Western Canada: a population-based evaluation. *Int J Environ Res Public Health.* 2018;15(11):2447.
87. Austin A, Craig SL, Alessi EJ. Affirmative cognitive behavior therapy with transgender and gender nonconforming adults. *Psychiatr Clin.* 2017;40(1):141–56.
88. Hobaica S, Alman A, Jackowich S, Kwon P. Empirically based psychological interventions with sexual minority youth: a systematic review. *Psychol Sex Orientat Gen Divers.* 2018;5(3):313–23.
89. Irish LA, Kline CE, Gunn HE, Buysse DJ, Hall MH. The role of sleep hygiene in promoting public health: a review of empirical evidence. *Sleep Med Rev.* 2015;22:23–36.
90. DiBennardo R, Gates GJ. Research note: US census same-sex couple data: adjustments to reduce measurement error and empirical implications. *Popul Res Policy Rev.* 2014;33(4):603–14.
91. Martin-Storey A, Fromme K. Mediating factors explaining the association between sexual minority status and dating violence. *J Interpers Violence.* 2017;886260517726971.
92. Kuhn A, Bodmer C, Stadlmayr W, Kuhn P, Mueller MD, Birkhäuser M. Quality of life 15 years after sex reassignment surgery for transsexualism. *Fertil Steril.* 2009;92(5):1685–9.
93. Frohard-Dourlent H, Dobson S, Clark BA, Doull M, Saewyc EM. “I would have preferred more options”: accounting for non-binary youth in health research. *Nurs Inq.* 2017;24(1):e12150.
94. Rider GN, McMorris BJ, Gower AL, Coleman E, Eisenberg ME. Health and care utilization of transgender and gender nonconforming youth: a population-based study. *Pediatrics.* 2018;141(3):e20171683.
95. Gradisar M, Gardner G, Dohnt H. Recent worldwide sleep patterns and problems during adolescence: a review and meta-analysis of age, region, and sleep. *Sleep Med.* 2011;12(2):110–8.
96. Lichstein KL, Durrence HH, Riedel BW, Taylor DJ, Bush AJ, Durrence HH, et al. *Epidemiology of sleep: age, gender, and ethnicity* [Internet]. Psychology Press; 2013 [cited 2019 Feb 1]. Available from: <https://www.taylorfrancis.com/books/9781135639471>.