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The role of sleep duration in suicide risk among sexual and gender minority adolescents

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ABSTRACT

Background: Short sleep duration is linked with suicide risk in adolescence. Sexual and gender minority (SGM) adolescents experience substantially increased risk for suicide compared to their non-SGM peers.
Methods: We investigated the role of sleep duration in SGM adolescent suicide risk using population-based, cross-sectional data from the 2022 Minnesota Student Survey (MSS; $N = 85{,}610$, $M_{age} = 14.8$). Adolescents reported average school-night sleep duration; those reporting <6 h were classified as having very short sleep duration. The MSS additionally assessed past-year suicidal ideation and suicide attempt. Mediation analyses assessed the role of sleep duration in explaining associations between SGM identity and suicide risk. Further, to examine intervention mechanisms, among SGM adolescents ($n = 20{,}171$, 23.6%), a logistic regression model assessed associations among demographic factors, perceived parental care, and very short sleep duration.
Results: As compared to non-SGM adolescents, SGM adolescents reported substantially higher prevalence of past-year suicidal ideation and suicide attempt and 2.6× higher prevalence of very short sleep duration (all $p < 0.001$). Mediation analyses demonstrated that very short sleep duration partially mediated the pathway between SGM identity and past-year suicidal ideation (15.5% mediated) and suicide attempt (17.2% mediated). Among SGM adolescents, a striking positive dose-response relationship was observed between level of perceived parental care and very short sleep duration. As perceived parental care decreased, so too did hours of sleep.
Discussion: Sleep duration is a crucial and understudied mechanism underlying suicide risk disparities affecting SGM adolescents. Family-based interventions may improve SGM adolescent sleep and reduce suicide risk.

1. Introduction

Sleep duration is increasingly documented as an important contributor to suicide risk, especially during the developmentally sensitive period of adolescence. A recent meta-analysis investigating the relationship between sleep duration and suicide risk pooled data from >500,000 adolescents and indicated a curvilinear pattern such that adolescents who endorsed fewer hours of sleep (<8 h) and those who endorsed excessive hours of sleep (10 or more hours) were more likely to also report suicidal ideation and suicide attempts compared with adolescents who endorsed adequate sleep (8–9 h) (Chiu et al., 2018). Very short sleep duration (VSSD; <6 h on average per night) in particular was a significant contributor to adolescent suicide risk with adolescents reporting VSSD at the highest risk for suicidal ideation and suicide attempt (Chiu et al., 2018). Sleep duration is a modifiable risk factor and therefore considered a prime candidate for adolescent suicide prevention efforts. Emerging evidence from clinical trials documents promising results from cognitive-behavioral sleep interventions that improve adolescent mental health by targeting sleep (Blake and Allen, 2020).

Sexual and gender minority (SGM) people experience shorter sleep duration and poorer quality sleep compared to their non-SGM peers, including in studies of adolescents (Patterson and Potter, 2019; Butler et al., 2020). For example, in one cross-sectional sample of >1700 adolescents, researchers found that gender minority (e.g., transgender, non-binary) adolescents were more likely to report shorter sleep duration and poorer sleep quality (e.g., more wakefulness in bed) than their cisgender counterparts (Levenson et al., 2021). Similarly, results from multiple states participating in the Youth Risk Behavioral Survey (YRBS)

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optional sexual orientation module found that girls who were bisexual or unsure of their sexual orientation were more likely to report VSSD compared to heterosexual girls, and that boys who were gay or unsure of their sexual orientation were more likely to report VSSD compared to heterosexual boys (Dai et al., 2020).

SGM adolescents, compared to their non-SGM peers, experience markedly increased risk for suicide. Population-based data from the YRBS documents that SGM adolescents report three-to-five times increased risk of past-year suicidal ideation and suicide attempt compared with non-SGM adolescents (Johns et al., 2019; Johns et al., 2020). Yet despite the promise of sleep as a modifiable suicide prevention mechanism, very few studies have investigated the role of sleep in SGM population suicide risk with a recent review of the sleep-suicide literature in SGM populations declaring that the field is "still in its infancy (Dolsen et al., 2022)." To our knowledge, only two studies have directly investigated links between sleep and suicide risk in SGM adolescents. One found that sleep quality (e.g., sleep duration, use of sleep medications) partially explained sexual orientation disparities in suicidal ideation in a sample of Chinese adolescents (Huang et al., 2018). The other study, conducted using YRBS data, found that sexual minority adolescents at the highest risk for suicide attempt were classified as having the shortest sleep duration in addition to experiencing high levels of several other modifiable risk factors (e.g., bullying, academic achievement) (Giano et al., 2020). Taken together, while sleep remains a nascent topic in SGM adolescent suicide research, the few studies that do exist suggest that SGM adolescents may experience worse sleep than their non-SGM peers and that this may confer risk for suicide.

Minority stress theory posits that excess stress generated from actual and anticipated experiences of discrimination and prejudice contributes to SGM people's adverse mental health outcomes including suicide risk (Meyer, 2003; Brooks, 1981; de Lange et al., 2022). For SGM adolescents, family/parental rejection is a particularly potent minority stressor that contributes to SGM adolescents' suicide risk. A recent meta-analysis documented that negative family treatment (e.g., family/parental rejection) was associated with 2× increased odds of suicidal ideation and 80% increased odds of suicide attempt among SGM adolescents and young adults (de Lange et al., 2022). Researchers have recently posited that sleep disturbance is an understudied mechanism on the pathway from minority stress to suicide risk in SGM populations (Dolsen et al., 2022). Previous reviews conducted without regard for SGM identity document that negative family environment and parental factors are strong risk factors for poorer sleep in adolescents (Bartel et al., 2015), yet studies linking family-related minority stressors and sleep in SGM adolescents are incredibly rare. In one of the only studies examining the link between minority stress and sleep disturbance in sexual minority adolescents, data from the UK Household Longitudinal Study revealed that as sexual minority adolescents' perceptions of family/parental support decreased, sleep disturbance (e.g., short sleep duration) increased (Chum et al., 2021). Beyond this single study, however, none to our knowledge have assessed the role of family/parent-related minority stress in SGM adolescents' sleep health.

To begin to uncover the role of sleep in SGM adolescent suicide risk, we leveraged a statewide population-based, cross-sectional study of adolescents in pursuit of three study aims: (1) document differences in sleep duration, suicidal ideation, and suicide attempt by SGM status; (2) identify the role of sleep duration in explaining SGM disparities in past-year suicidal ideation and suicide attempt; and (3) among SGM adolescents, identify associations among demographic factors, family-related minority stress, and sleep duration. We had three a priori hypotheses: *First,* that SGM adolescents, compared to non-SGM adolescents, would report higher prevalence of VSSD, suicidal ideation, and suicide attempt; *Second,* that VSSD would partially explain SGM disparities in both suicidal ideation and suicide attempt; and *Third,* among SGM adolescents, lower perceived parental care (as a proxy for parental minority stress) would be positively associated with shorter sleep duration.

2. Methods

Data were drawn from the 2022 Minnesota Student Survey (MSS), a triennial population-based survey of public-school students in 5th, 8th, 9th & 11th grade. In 2022, 70% of Minnesota public school districts participated in the MSS. The present analytic sample included students who were administered questions assessing sexual orientation and gender identity (8th, 9th & 11th graders) and who reported information for sex at birth, gender identity, sexual orientation, and sleep duration. The final analytic sample included 85,610 adolescents with an average age of 14.8 years old. This study was approved by the [redacted] Institutional Review Board.

2.1. Measures

2.1.1. Sexual orientation, sex at birth, and gender identity

Sexual orientation was assessed with the question, "How do you describe your sexual orientation?" with the following response options: Straight; Asexual; Bisexual; Gay/Lesbian; Questioning/Not sure; Pansexual; Queer; I don't describe myself in any of these ways; I am not sure what this question means. Students who selected the latter two options were not included in the current study.

Sex at birth was assessed with the question, "What was your sex assigned at birth (as on your original birth certificate)?" with response options being Male or Female.

Gender identity was assessed with the question, "What is your gender identity (mark ALL that apply)?" with the following response options: Agender; Boy/man (cisgender); Boy/man (transgender); Genderfluid, gender non-conforming, genderqueer; Girl/woman (cisgender); Girl/woman (transgender); nonbinary; Two spirit; Questioning/unsure; Identity not listed.

Adolescents were categorized as non-SGM (i.e., heterosexual and cisgender) if they marked their sexual orientation as Straight AND (1) they selected Male sex at birth and only Boy/man (cisgender) OR (2) they selected Female sex at birth and only Girl/woman (cisgender); otherwise, they were classified as SGM.

2.1.2. Sleep duration

Sleep duration was assessed by the question, "During a typical school night, how many hours of sleep do you get?" with the following response options: 4 h or less; 5 h; 6 h; 7 h; 8 h; 9 h; 10 or more hours. Consistent with research on adolescent sleep including with SGM adolescents, respondents were defined as having VSSD if they reported <6 h per night (Dai et al., 2020).

2.1.3. Suicidal ideation and suicide attempt

Suicidal ideation was assessed with the question, "Have you ever seriously considered attempting suicide?" Adolescents who responded "Yes, during the past year" were classified as having past-year suicidal ideation. Suicide attempt was assessed with the question, "Have you ever actually attempted suicide?" Adolescents who responded "Yes, during the past year" were classified as having past-year suicide attempt.

2.1.4. Parental care

Parental care was assessed with the question, "How much do you feel your parents care about you?" with the following possible response options: Very much; Quite a bit; Some; A little; Not at all.

2.1.5. Demographic factors

Demographic factors assessed included age, race/ethnicity, region, and number of books in the home as a proxy for socio-economic status (SES) (Froiland et al., 2013).

2.1.6. Statistical analyses

Statistical analyses were conducted in SAS version 9.4 and proceeded in three steps: First, we conducted descriptive statistics including

frequencies and proportions to document demographic factors, sleep duration, and suicidal ideation and suicide attempt by SGM status. Second, mediation analyses were conducted within a potential outcomes framework to calculate the indirect effects of SGM status on suicidal ideation and suicide attempt, respectively, via VSSD (Valeri and Vanderweele, 2013). All demographic factors (age, race/ethnicity, region, number of books in the home) were included as covariates and the effects of VSSD were allowed to differ by SGM status (Bauer and Scheim, 2019). The significance of the indirect effects was tested using 5000 bootstrap estimates. As a measure of effect size, we report percentage mediated which documents the proportion of the suicidal ideation and suicide attempt disparity by SGM status that can be attributed to VSSD. Lastly, to examine minority stress-related contributors to VSSD, we restricted to SGM adolescents and conducted a logistic regression analysis whereby we regressed VSSD (dependent variable) onto demographic factors and parental care. Across variables, there was inconsequential missingness (ranging from 0.07% missing age to 0.60% missing parental care); thus, missing data were handled by listwise deletion. Analyses were 2-tailed and statistical significance was assessed at $p < 0.05$.

3. Results

3.1. Bivariate analyses

This study included 85,610 adolescents of whom 20,171 (23.6%) identified as SGM. Table 1 depicts demographic factors, sleep duration, and suicidal ideation and suicide attempt stratified by SGM status. Regarding demographic characteristics, a substantially higher proportion of SGM adolescents were assigned female sex at birth (76.4%) compared to non-SGM adolescents (43.5%). Approximately 44% of SGM adolescents identified as transgender or gender diverse (e.g., non-binary). SGM adolescents were diverse with regards to sexual orientation with the highest proportion identifying as bisexual (37.9%). Regarding sleep duration, a substantially higher proportion of SGM adolescents reported 4 or fewer (11.0%) or 5 h (15.7%) of sleep per night compared to non-SGM adolescents (4.1% and 8.0%, respectively). A similarly small proportion of SGM adolescents (1.8%) and non-SGM adolescents (2.1%) reported excessive sleep (10 or more hours). Regarding suicide risk, there were large SGM disparities in past-year suicidal ideation (SGM = 30.6%, non-SGM = 8.6%) and past-year suicide attempt (SGM = 8.9%, non-SGM = 2.1%).

Fig. 1 depicts point prevalence of past-year suicidal ideation (Panel A) and past-year suicide attempt (Panel B) stratified by sleep duration and SGM status. Among all adolescents, there was a curvilinear pattern between sleep duration and suicide risk such that the highest prevalence of suicidal ideation and suicide attempt was experienced among those reporting VSSD, the lowest prevalence of suicidal ideation and suicide attempt was experienced among those reporting 8 or 9 h with a slight elevation in prevalence of suicidal ideation and suicide attempt observed among those reporting 10 or more hours. Regardless of sleep duration, SGM adolescents experienced substantially higher prevalence of suicidal ideation and suicide attempt. Notably, SGM adolescents who experienced VSSD reported a strikingly high prevalence of past-year suicidal ideation (4 h or less = 49%; 5 h = 39%) and suicide attempt (4 h or less = 19%; 5 h = 12%).

3.2. Mediation analyses

Results of the mediation analyses with bootstrapping demonstrated that VSSD partially mediates the association between SGM status and past-year suicidal ideation (indirect effect odds ratio (OR) = 1.13, 95% CI = 1.12–1.15, $p < 0.001$) and past-year suicide attempt (indirect effect OR = 1.15, 95% CI = 1.12–1.17, $p < 0.001$). Percentage mediated showed that 15.5% and 17.2% of the SGM disparity in past-year suicidal ideation and suicide attempt, respectively, is explained by VSSD.

Table 1
Demographic characteristics, sleep duration, and suicidal ideation and attempt in 2022 Minnesota Student Survey, $N = 85,610$.

Characteristic	SGM + non-SGM (Total sample) ($N = 85,610$)	SGM adolescents ($N = 20,171$)	Non-SGM adolescents ($N = 65,439$)
	n (%)	n (%)	n (%)
Age[a]			
12–14 years old	43,981 (51.4)	10,397 (51.6)	33,584 (51.4)
15–16 years old	27,777 (32.5)	6527 (32.4)	21,250 (32.5)
17–19 years old	13,790 (16.1)	3235 (16.1)	10,555 (16.1)
Race/ethnicity			
American Indian or Alaskan native	905 (1.1)	273 (1.4)	632 (1.0)
Asian or Asian American	5432 (6.4)	1333 (6.6)	4099 (6.3)
Black, African or African American	6196 (7.2)	1164 (5.8)	5032 (7.7)
Hispanic/Latinx	5297 (6.2)	1282 (6.4)	4015 (6.1)
Middle eastern or north African	380 (0.4)	64 (0.3)	316 (0.5)
Native Hawaiian or Pacific islander	143 (0.2)	38 (0.2)	105 (0.2)
Non-Hispanic white	58,211 (68.0)	13,085 (64.9)	45,126 (69.0)
> 1 race	8565 (10.0)	2796 (13.9)	5769 (8.8)
No answer	481 (0.6)	136 (0.7)	345 (0.5)
Sex assigned at birth			
Male	41,743 (48.8)	4754 (23.6)	36,989 (56.5)
Female	43,867 (51.2)	15,417 (76.4)	28,450 (43.5)
Gender identity			
Cisgender	76,791 (89.7)	11,352 (56.3)	65,439 (100.0)
Transgender/ gender diverse	8819 (10.3)	8819 (43.7)	0 (0.0)
Sexual orientation			
Heterosexual (straight)	67,197 (78.5)	1758 (8.7)	65,439 (100.0)
Asexual	1150 (1.3)	1150 (5.7)	0 (0.0)
Bisexual	7649 (8.9)	7649 (37.9)	0 (0.0)
Gay or lesbian	2457 (2.9)	2457 (12.2)	0 (0.0)
Pansexual	2953 (3.5)	2953 (14.6)	0 (0.0)
Queer	1256 (1.5)	1256 (6.2)	0 (0.0)
Questioning/not sure	2948 (3.4)	2948 (14.6)	0 (0.0)
Number of books at Home[b]			
Few (0–10)	11,628 (13.6)	2286 (11.3)	9342 (14.3)
Enough to fill one shelf (11–25)	16,346 (19.2)	3390 (16.8)	12,956 (19.9)
Enough to fill one bookcase (26–100)	31,045 (36.4)	7016 (34.9)	24,029 (36.9)
Enough to fill several bookcases (>100)	26,313 (30.8)	7437 (37.0)	18,876 (29.0)
Region			
7-county twin cities metro area	44,839 (52.4)	11,579 (57.4)	33,260 (50.8)
Greater Minnesota	40,771 (47.6)	8592 (42.6)	32,179 (49.2)
Average hours of sleep on a school night			
4 h or less	4918 (5.7)	2210 (11.0)	2708 (4.1)
5 h	8397 (9.8)	3169 (15.7)	5228 (8.0)
6 h	16,950 (19.8)	4851 (24.1)	12,099 (18.5)
7 h	24,826 (29.0)	5154 (25.6)	19,672 (30.1)
8 h	22,043 (25.8)	3416 (16.9)	18,627 (28.5)
9 h	6732 (7.9)	1002 (5.0)	5730 (8.8)
10 h or more	1744 (2.0)	369 (1.8)	1375 (2.1)
Suicide ideation in the past year			
No	73,845 (86.3)	14,008 (69.5)	59,837 (91.4)
Yes	11,765 (13.7)	6163 (30.6)	5602 (8.6)
Suicide attempt in the past year			
No	82,436 (96.3)	18,378 (91.1)	64,058 (97.9)
Yes	3174 (3.7)	1793 (8.9)	1381 (2.1)

SGM = sexual and/or gender minority.
Percentages may not equal 100.0% due to rounding.
[a] $n = 85{,}548$
[b] $n = 85{,}332$

3.3. Multivariable logistic regression

Fig. 2 depicts results including adjusted ORs and 95% CIs from the logistic regression model restricted to SGM adolescents ($N = 20{,}171$). Demographic subgroups with elevated odds of VSSD included 17–19 (versus 12–14) year olds; multiracial, Hispanic, Black, and American Indian/Alaskan Native (versus White); pansexual (versus gay/lesbian); transgender/gender diverse (versus cisgender); and lower SES as proxied by fewer (versus greater) number of books in the home. As depicted in Fig. 2, we observed a dose-response relationship between perceived parental care and VSSD such that as level of perceived parental care decreased, odds of VSSD increased (reference = 'very much', 'quite a bit' OR = 1.61, 95% CI = 1.49–1.75; 'some' OR = 2.71, 95% CI = 2.46–2.97; 'a little' OR = 4.57, 95% CI = 4.03–5.17; 'not at all' OR = 7.93, 95% CI = 6.40–9.84).

3.4. Sensitivity analyses

Sensitivity analyses were conducted specifying the mediator as short sleep duration (<8 h on average) rather than VSSD and showed that the indirect effect remained significant for suicidal ideation and suicide attempt ($p < 0.001$) but was attenuated as documented by reduced ORs and lower percentage mediated for both outcomes (suicidal ideation indirect effect OR = 1.08, percentage mediated = 9.8%; suicide attempt indirect effect OR = 1.07, percentage mediated = 8.9%). These supplemental analyses pinpoint the importance of considering VSSD (<6 h on average) specifically in understanding the relationship between SGM status and suicide risk.

4. Discussion

Despite the documented role of sleep duration in adolescent suicide risk and the strikingly high prevalence of suicidal ideation and suicide

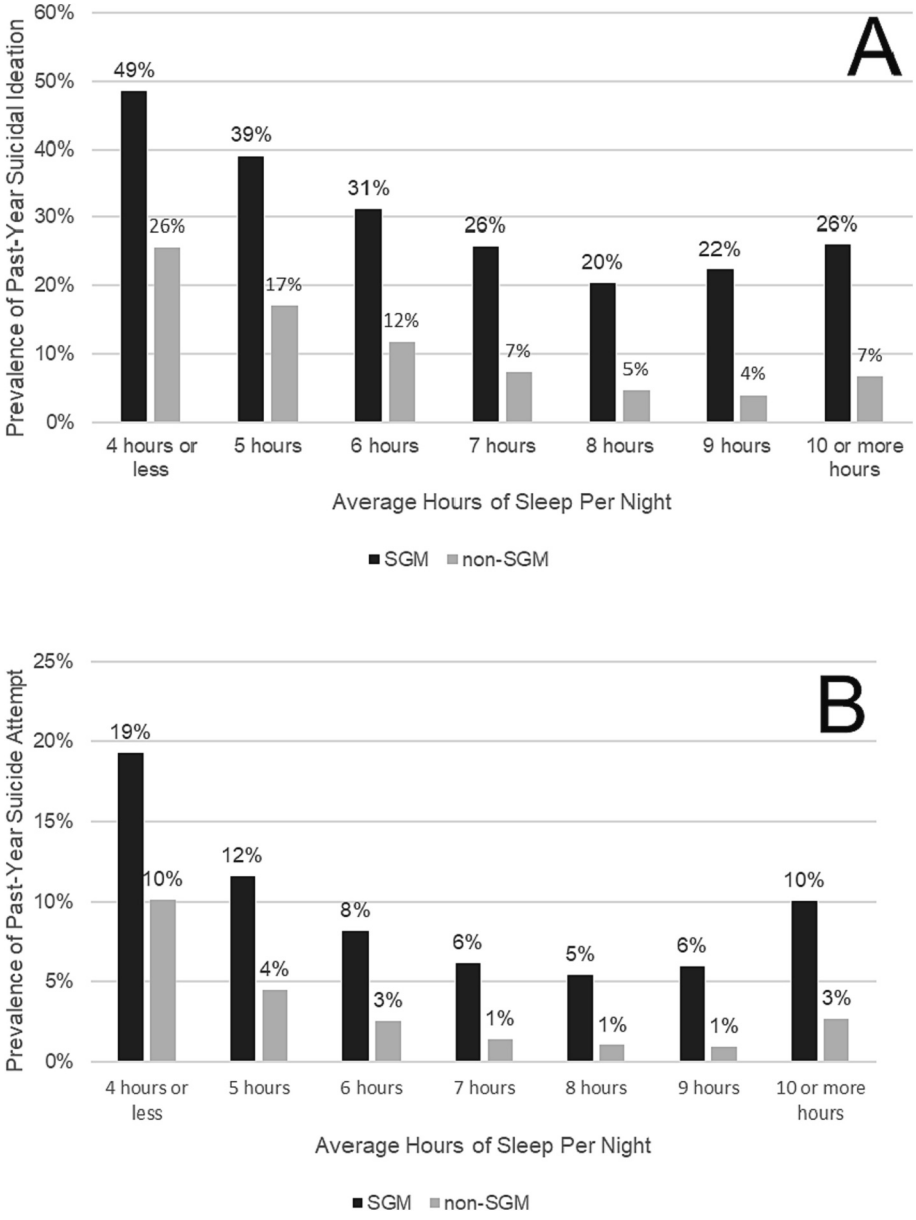

Fig. 1. Average sleep duration and past-year suicidal ideation and attempt prevalence by SGM status, 2022 Minnesota Student Survey, N = 85,610.

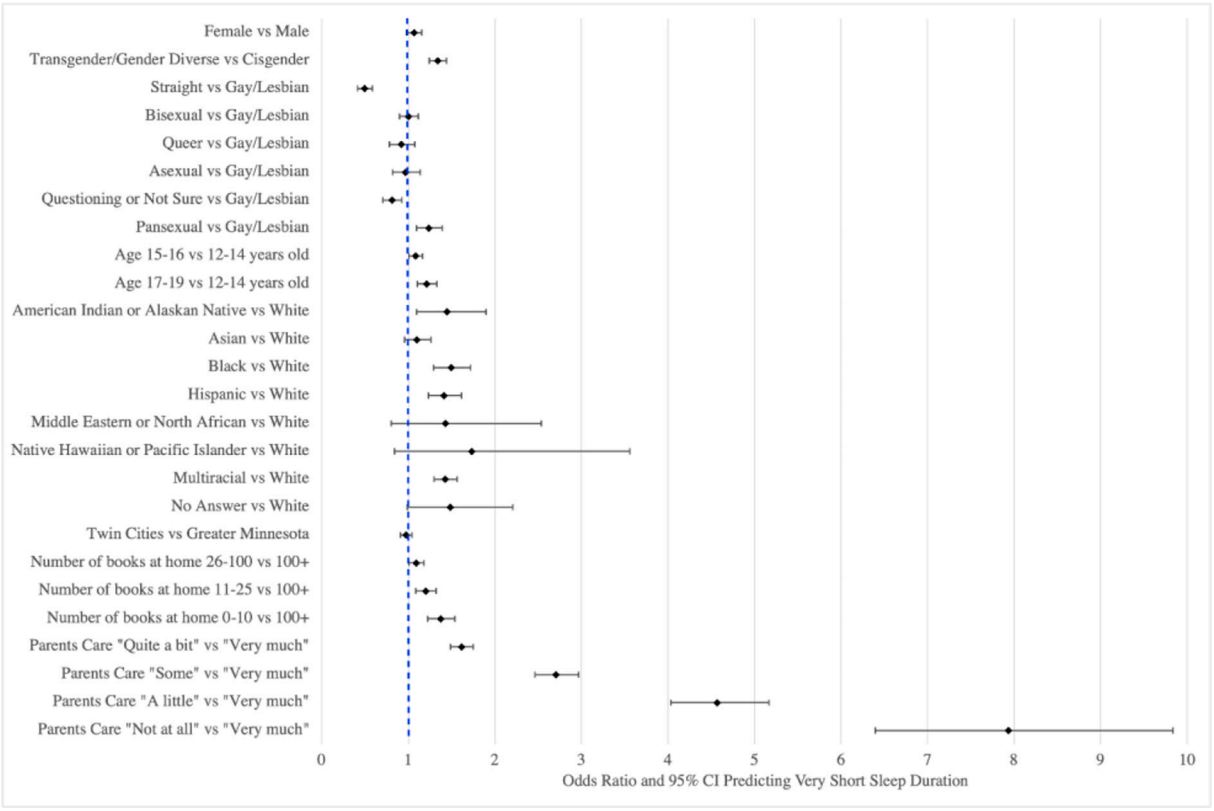

Fig. 2. Odds Ratios and 95% CI from Multivariable Logistic Regression Model Documenting Associations among Demographic Factors, Parental Care, and Very Short Sleep Duration (VSSD, <6 h) among SGM Adolescents in 2022 Minnesota Student Survey, $N = 19{,}984$.

attempt in SGM adolescents, few studies have investigated the role of sleep in SGM adolescent suicide risk. In this first study linking sleep duration, suicidal ideation, and suicide attempt in a population-based sample including SGM adolescents, findings supported this study's three hypotheses. First, we documented that SGM, versus non-SGM, adolescents have a higher prevalence of VSSD (<6 h), suicidal ideation, and suicide attempt. Second, we found that VSSD partially mediates associations between SGM status and past-year suicidal ideation and suicide attempt. Third, among SGM adolescents we identified a robust dose-response relationship between perceived parental care (as a proxy for parent-related minority stress) and VSSD such that, as levels of perceived parental care decreased, odds of experiencing VSSD sharply increased. This study provides the most robust evidence to date of the crucial role of sleep duration in SGM adolescent suicide risk, with implications for theory, research, and intervention as described below.

Regarding implications for theory, these findings provide empirical support for the importance of considering sleep disturbance in the minority stress model. A recent review of sleep disturbance and suicide risk in SGM populations posited an integrated conceptual model depicting that minority stress exposure may increase sleep disturbance (e.g., short sleep), which then contributes to suicidal thoughts and behaviors (Dolsen et al., 2022). The current findings test components of the integrated sleep-minority stress model by showing that sleep disturbance (i.e., VSSD) indeed mediates the association between SGM identity and heightened suicide risk and that (lack of) parental care – a potent minority stressor for SGM adolescents – is a strong contributor to VSSD. These findings suggest that studies of minority stress and suicide risk will be limited if they do not measure sleep as a mechanism contributing to heightened suicide risk, especially in studies of SGM adolescents.

Regarding implications for research, the current study lays the foundation for future research integrating sleep science into studies of SGM adolescent suicide risk. While our study assessed relationships among SGM identity, sleep duration, and suicide risk, the cross-sectional nature of the study cannot establish temporal relationships between variables. While reviews have shown that sleep disturbance prospectively predicts depressive symptoms (and not vice-versa) (Blake and Allen, 2020), future longitudinal research – especially intensive longitudinal methods such as ecological momentary assessment methods – can help to untangle prospective associations among minority stress exposure, sleep disturbance, and suicide risk in SGM adolescents (Littlewood et al., 2018). Additionally, objectively derived sleep information obtained through actigraphy (i.e., wearable noninvasive accelerometer that measures sleep parameters) has been shown to predict suicidal ideation in adolescent samples (Bernert et al., 2017) with recent research demonstrating that multi-modal approaches (e.g., integrating actigraphy and sleep diary) are most effective in capturing the full spectrum of objective and subjective sleep information (Kearns et al., 2023). Sleep studies incorporating actigraphy have not yet been conducted with SGM adolescents, representing an important opportunity for future research.

Regarding implications for intervention, these findings point to the need to address sleep disturbance in SGM adolescents to reduce suicide risk. Cognitive-behavioral sleep interventions are structured, goal-orientated psychotherapies that aim to intervene upon the negative patterns of thinking (e.g., bedtime worry and rumination) and behaviors (e.g., screen time before bed) that underlie sleep disturbance (Blake and Allen, 2020; Blake et al., 2017) A recent systematic review and meta-analysis of 9 cognitive-behavioral sleep interventions for adolescents found that these interventions were generally effective in improving sleep quality, reducing daytime sleepiness, and reducing depression and anxiety in adolescent samples, although authors called for more high-quality randomized-controlled trials (RCTs) (Blake et al., 2017). Any adolescents reporting VSSD or other problems initiating or maintaining sleep and associated daytime consequences (e.g., staying awake at school, behavioral problems) should be assessed for cognitive-behavioral sleep therapies. Relatedly, SGM-affirmative cognitive-

behavioral therapy (CBT) – which works to affirmatively modify the cognitive, affective, and behavioral pathways by which minority stress contributes to depression, anxiety, and suicide risk in SGM populations – has shown promise in reducing negative psychological symptoms in RCTs with SGM adolescents and young adults (Craig et al., 2021; Pachankis et al., 2022). Yet, whether cognitive-behavioral sleep interventions require adaptation (e.g., to incorporate minority stress theory) for SGM adolescents and whether SGM-affirmative CBT changes sleep patterns in SGM adolescents remain unanswered questions, representing important opportunities for future intervention science.

Importantly, findings from the present study highlight that perceived parental care represents a substantial contributor to sleep disturbance in SGM adolescents. Thus, family-based interventions aimed at improving parents' caring and supportive attitudes and behaviors towards their SGM children are warranted to improve SGM adolescent sleep and associated suicide risk. Attachment-based Family Therapy-SGM (ABFT-SGM) is a manualized, 26-week, family-based therapy that involves SGM adolescents and their parents and is designed to reduce parental rejection, increase parental acceptance, and improve the parent-SGM child relationship. In studies with SGM adolescents and young adults experiencing suicidal ideation, ABFT-SGM has been shown to be efficacious in treating depression and suicidal ideation via increases in parental acceptance (Diamond et al., 2022). Future work focused on the scale-up and implementation of ABFT-SGM is warranted.

Lastly, while our findings showed that SGM adolescents are at increased risk for VSSD and associated suicide risk, we also corroborated previous research demonstrating that short sleep duration is a suicidogenic risk factor for *all* adolescents. Thus, multi-pronged, universal interventions aimed at increasing adolescent sleep duration at the policy level (e.g., pushing back school start times) (Minges and Redeker, 2016), institutional level (e.g., school-based sleep hygiene programming) (Chung et al., 2017), and family level (e.g., parental psychoeducation programs) (Mindell et al., 2016) are warranted to increase adolescent sleep duration and reduce associated suicide risk.

4.1. Limitations

Despite this study's methodological strengths including a large, population-based sample of adolescents reporting detailed information on SGM identity, there are three primary limitations warranting mention. First, the survey only assessed sleep duration through a single, self-report item rather than assessing other important aspects of sleep disturbance (e.g., perceived sleep quality, wakefulness in bed, daytime sleepiness). As mentioned previously, future multi-modal studies involving comprehensive assessment of sleep (i.e., through sleep diary) as well as objective indicators of sleep (e.g., through actigraphy) are warranted to increase accuracy and resolution of sleep data. While such thorough assessment may be infeasible on population-based surveys, we recommend including at least an additional item assessing sleep quality along with sleep duration. Second, this population-based survey is limited to Minnesota and may not necessarily be generalizable to adolescents residing in other US states or those residing outside the US. Third, the MSS is a cross-sectional survey which hampers causal inference. The use of a cross-sectional survey in mediation analysis is not ideal as the sequencing of variables is unclear. While previous longitudinal research shows that sleep difficulties prospectively predict suicide risk, and not the other way around, future longitudinal research is warranted to disentangle these associations (Blake and Allen, 2020). Additionally, future longitudinal research could help to illuminate the temporal ordering of other potential cognitive, affective, behavioral, and mental health mechanisms on the minority stress-sleep-suicide pathway such as hopelessness, emotion dysregulation, interpersonal difficulties, and depressive symptoms.

5. Conclusions

Results of the current study pinpoint sleep duration as a crucial mechanism underlying SGM disparities in adolescent suicide risk. Further, among SGM adolescents, parental minority stress is a robust contributor to shorter sleep duration. These findings add to a nascent body of research highlighting that advancements in the understanding and treatment of SGM adolescent suicide risk will lag behind without meaningful integration of sleep science (Dolsen et al., 2022). This study lays the groundwork for future empirical research to interrogate the role of sleep in SGM adolescent suicidality through multi-modal approaches and to develop and test sleep interventions tailored for SGM adolescents.

CRediT authorship contribution statement

Kirsty A. Clark: Conceptualization, Methodology, Formal analysis, Writing – original draft. **Katherine Schafer:** Writing – original draft. **Nathaniel M. Tran:** Visualization, Writing – original draft. **Lana Trautman:** Writing – review & editing. **Tara McKay:** Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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