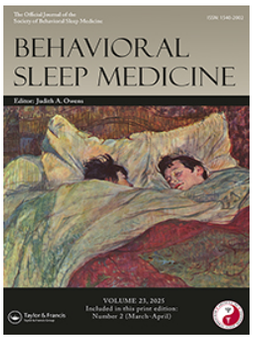

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Sleep in Gay, Lesbian and Bisexual Individuals: The Roles of Minority Stressors and Identity Positivity

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ABSTRACT

Objectives: Although there are increasing reports suggesting that sexual minorities sleep badly, very few empirical studies have used standard sleep measures. Moreover previous studies have not considered the ways in which different identities and identity processes may interact with sleep.

Methods: We addressed this in an on-line sample of almost 300 self-identified lesbian women ($N = 40$), gay men ($N = 55$) and bisexual men ($N = 87$)and bisexual women ($N = 118$). We assessed sleep using the Pittsburgh Sleep Quality Index, Insomnia Severity Index and Epworth Sleepiness Scale, among others; wellbeing using measures of life satisfaction, anxiety and depression, and lesbian, gay and bisexual (LGB) identification, social support, discrimination, identity resilience and minority stressors.

Results: All sleep measures suggested that sexual minorities sleep poorly, and experience identity challenges, minority stressors, high levels of anxiety and depression and reduced life satisfaction. The latter wellbeing variables and BMI account for substantial amounts of variance in scores on standard sleep measures, as do identity and minority stressors. These variables mediate each other such that a confident sexual identity is associated with reduced effects of minority stressors on sleep, and enhanced wellbeing and sleep. There were no differences between LGB subgroups in these effects, except for insomnia, which was worse in bisexuals than in lesbian and gay individuals.

Conclusions: Standard self-report measures of sleep confirm that sexual minorities sleep poorly, and identification with or stresses due to minority status exascerbates this.

Introduction

Poor sleep is increasingly linked to a host of negative emotional, mental and physical health outcomes. Recent reviews suggest that sexual minorities sleep worse than those who describe themselves as heterosexual/straight (Butler et al., 2020; Patterson & Potter, 2019). This is consistent with the more general observation that health and wellbeing is more precarious in the LGBTQ+ community when compared to the general population (Gonzales et al., 2016). While there is evidence that sleep is compromised in sexual minorities (Duncan et al., 2016), why this might be remains unclear, although some have hypothesized that minority stressors play a key role (Butler et al., 2020).The research here considers the role of two sets of factors that may either accentuate or attenuate the relationship between poor mental health and poor sleep quality – minority stressors (i.e., discrimination and acceptance concerns) and protective factors (i.e., identity resilience and social support).

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Very little of the research on sleep among sexual and gender minority (SGM) individuals uses measurement techniques that have become standard in other areas of sleep research. We have found just two such studies, both of which used the Pittsburgh Sleep Quality Index (Buysse et al., 1989), neither of which is directly relevant. In the first, which investigated sexual identity rather than sexual orientation, Auer et al. (2017) showed that PSQI was an equally strong determinant of the quality of life in large groups of transwomen (TW) and transmen (TM) attending German transgender health care clinics. There was no sex difference in thePSQI global score (TW: 7.0 ± 3.5; TM: 7.4 ± 3.4), or in the very large number (80%) who exceeded the cutoff for good sleep. There were sex differences in the relative importance of pain (TM), anxiety, appearance and unemployment (TW) behind sleep quality as a predictor of quality of life. Also, Li et al. (2017) compared sexual minority adolescents with heterosexual adolescents, using a Chinese version of the PSQI, again showing worse sleep in the minority group. Single items, largely the Sleep Quality component and Duration, have also been used in similar research, confirming lower sleep quality, and that sexual minorities sleep less than their heterosexual counterparts (Galinsky et al., 2018). However, they also note that sleep duration findings are complicated by a plethora of demographic and other variables.

Of course, while extracting individual items from validated scales may help to improve wording, it is unreasonable to assume that the validation of the whole instrument applies independently to each of its items. Arguably, there is no reason to suppose that this approach has any more validity than the many bespoke items that have been used in other research in this area. Despite this concern, it is generally found that the sleep of sexual minorities is shorter and of lower quality. Other studies have used items which reflect the types of problems associated with insomnia (e.g., delayed sleep onset, extended waking in the night, etc.), again usually showing deficits among sexual minorities. However, it must be reiterated that these items are neither validated, nor do they provide a comprehensive assessment of insomnia. In the study reported below, we address this issue by using the Insomnia Severity Index (Morin et al., 2011).

Another research approach adopted in this area is to compare minority individuals with others from the same large sample data collection exercise. While at best the samples may be representative of the population as a whole, it cannot be assumed that those responding who identify as being from a sexual minority are necessarily representative of the LGTBQ+ community as a whole. Furthermore, given that relatively small proportions of the population identify as being from a sexual minority, very large random sample sizes are required in order to study minority communities with acceptable levels of statistical power. The alternative, purposively sampling minority communities, has its own drawbacks, but we note here the recent call by Segovia and Sparks (2024) for more research comparing "outcomes between different sexual and gender identities, rather than comparing them with their nonminority counterparts" (p. 41). Their study, among the first to consider disparities in clinical diagnoses of sleep disorders, showed that feeling stigmatized predicted sleep disorder diagnosis among sexual minority individuals.

Much less progress has been made toward understanding why such disparities exist, although discrimination, lack of acceptance, homophobia and identity issues are frequently suggested as candidate explanations (see Patterson & Potter, 2019). In other areas of research on sexual minorities, particularly in relation to mental health, two approaches have offered very worthwhile insights, as well as creating robust measures. Although LGB people generally report similar levels of life satisfaction to heterosexual people (Hu et al., 2016), anxiety and depression are more prevalent in LGB than in heterosexual people (Semlyen et al., 2016).

Meyer's (2003) Minority Stress Theory suggests that minority groups are exposed two types of stressor: distal stressors, which are external to the individual (e.g., discrimination), and proximal stressors, which are internal and may themselves be the result of exposure to distal stressors (e.g., low sexual self-acceptance). Exposure to minority stressors have been found to result in poor mental health outcomes, including anxiety, depression and decreased life satisfaction (Dulai & Jaspal, 2024; Jaspal et al., 2023). Some of these stress elements, especially discrimination, are associated with depressive symptomatology (Almeida et al., 2009; Lee et al., 2016) as well as poor sleep quality in sexual minorities (Butler et al., 2020; Gibbs & Fusco, 2023). Anxious concerns that one will not be accepted because of one's sexual

orientation is associated with poor mental health (Cohen et al., 2016 and similarly stigmatization is regularly found to be associated with social and generalized anxiety and symptoms suggestive of post-traumatic stress disorder (J. M. Cohen et al., 2016; Slimowicz et al., 2020).

In contrast to the agonist focus of Minority Stress Theory, Identity Process Theory stresses the protective role of self-esteem, self-efficacy, identity continuity and positive distinctiveness (Jaspal et al., 2023), the core identity elements we strive to achieve. These reflect the subjective belief in our ability to interpret and overcome the challenges we encounter, self-worth, certainty of who we are and will seek to remain despite challenges and change, the positive differentiation and uniqueness of who we are (see Breakwell, 2023 for discussion of identity resilience). Higher baseline identity resilience has been found to be associated with less distress when faced with a stressor (Breakwell & Jaspal, 2022) and with the adoption of more adaptive, effective and sustainable coping strategies in response to the stressor (Jaspal et al., 2022). The theory also refers to the psychological experience of identity threat which arises when the individual believes that their feelings of self-esteem, self-efficacy, continuity and positive distinctiveness are curtailed, for instance, by changes in one's context. Thus far, the role that Identity Process Theory might play in protecting against sleep challenges has not been examined empirically. However, some evidence suggests that individual components of identity resilience such as self-efficacy, self-esteem (Lemola et al., 2013) and general resilience itself (e.g. Brand et al., 2014), are associated with better sleep outcomes.

This study had several aims:

(1) to describe sexual minority sleep using standard, validated, research instruments (PSQI, ISI and the Epworth Sleepiness Scale, which assesses excessive daytime sleepiness), in order to address this deficiency in the literature
(2) to assess the degree to which elements of Minority Stress Theory and Identity Process Theory explain sleep quality (PSQI), insomnia (ISI) and excessive daytime sleepiness (ESS)
(3) to test whether elements of Minority Stress Theory (i.e., stressors) and Identity Process Theory (i.e., identity resilience) and LGB identification mediate the relationship between mental health outcomes (i.e., anxiety and depression) and poor sleep, since both anxiety and depression have previously been found to be related to poor sleep.

Method

Ethical approval

Nottingham Trent University's Schools of Business, Law and Social Sciences Ethics Committee (REF: 2021/13) provided a favorable opinion on the proposed study. All participants provided electronic consent before completing the study.

Design and procedure

A cross-sectional survey study focusing on sexual identity, mental health and sleep quality was conducted. Participants first provided socio-demographic data, including their age, gender, sexual orientation, ethnicity, level of education, income, and relationship status. They then completed measures of discrimination, acceptance concerns, identity resilience, social support, depression, anxiety, life satisfaction and sleep quality. Participants were fully debriefed, thanked and paid for their time.

Participants

Some 309 participants, ranging in age from 18–74 (30.7 ± 11.13 years), were recruited on Prolific (https://www.prolific.com/), an online participant recruitment platform. The study advertisement

explicitly requested that only those from sexual minorities respond. All recruited participants met the age eligibility criterion (18 years or older) and 300 self-identified as LGB. Nine participants were excluded because they identified their sexual identity as heterosexual (8) or other (1). See Table 1 for socio-demographic characteristics of those whose data were analyzed. Our estimates before data collection suggested that the survey would take less than an hour to complete, and Participants were paid $8/£6 for completing the study. The completion times for the survey were consistent with these pre-study estimates.

Measures

Sleep

The *Pittsburgh Sleep Quality Index* (PSQI, Buysse et al., 1989) was used to evaluate overall sleep quality. PSQI's 19 self-reported items typically request information about sleep over the previous month or are Likert scales, with each item belonging to one of 7 subcategories: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Here we use the Global score, which is the sum of each of the 7 categories, and ranges from 0–19. Scores greater than 5 are indicative of poor sleep quality,$\alpha = 0.85$.

SATED (Buysse, 2014; Satisfaction, Alertness, Timing, Efficiency and Duration) was used to assess sleep health. Using a 3-point scale (0: Never/Rarely; 1: sometimes; 2: usually/always) participants rated their 1) subjective satisfaction, 2) alertness during waking hours, 3) appropriate

Table 1. Sample socio-demographic statistics.

Demographic variable		Frequency (*N*)	Percentage (%)
Biological Sex	Male	139	47.6%
	Female	153	52.4%
	Other	1	0.3%
Sexual orientation	Lesbian	35	12.0%
	Gay	52	17.8%
	Bisexual	203	70.0%
	Other	1	0.3%
Ethnicity	White/White British/White Irish/Other	254	87.0%
	British South Asian (Indian/Pakistani)	3	1%
	Any other Asian	3	1%
	African	3	1%
	Mixed (White/Black African; White/Asian and White Black Caribbean)	10	3.4%
	Caribbean	1	0.3%
	Any other mixed background	1	0.3%
	Middle Eastern	1	0.3%
	Other Ethnic background	2	0.6%
Relationship status	Single	113	46.6%
	Monogamous	159	54.5%
	Open	19	6.5%
	Other	1	0.3%
Income	Less than £12,500	46	15.8%
	£12,500-£18,000	34	11.6%
	£18,001- £40,000	94	32.2%
	£40,001-£60,000	56	19.2%
	£60,001-£100,000	29	9.9%
	More than £100,000	9	3.1%
Employment status	Employed full-time	136	46.6%
	Employed part-time	40	13.7%
	Unemployed	20	6.8%
	Student	66	22.6%
	Retired	4	1.4%
	Unable to work through illness/disability	15	5.1%
	House/family duties	7	2.4%

Where percentages within categories do not sum to 100%, the deficit arises through Prefer not to say.

timing, 4) efficiency, and 5) adequate duration. The total score ranges from 0 to 10 points, with increasing scores representing better sleep, α = 0.77

The *Insomnia Severity Index* (ISI, Bastien et al., 2001) was used to assess insomnia. Its 7 items relate to severity of insomnia symptoms, interference with daily functioning, level of distress caused etc., all rated using 0–4 scales with higher scores indicating more acute challenges. The authors suggest a total score of 0–7 indicates "no clinically significant insomnia," 8–14 means "subthreshold insomnia," 15–21 is "clinical insomnia (moderate severity)," and 22–28 means "clinical insomnia (severe)."α = 0.74.

The *Epworth Sleepiness Scale* (ESS, Johns, 1992) was used to assess daytime sleepiness. Respondents report their recent likelihood of their dozing off in 8 situations using a 4-point scale (0: would never doze, 1: Slight . . . , 2: Moderate . . . , 3: High chance of dozing). Various cutoffs for excessive sleepiness have been proposed, with mild sleepiness (11–14), moderate sleepiness (15–17) and severe sleepiness (18+) among the most widely used (α = 0.88.but see Scharf, 2022).

Wellbeing

The *Hospital Anxiety Depression Scale* (HADS, Zigmond & Snaith, 1983) was used to measure symptoms of depression (7 items) and of anxiety (7 items). HADS is scored on a 4-point Likert scale (0=rarely or none of the time [less than one day] to 3=all of the time [5 to 7 days]), yielding maximum scores for anxiety and depression of 21. Zigmond and Snaith (1983) recommend cutoff scores of between 8–10 for clinical anxiety and clinical depression, α = 0.89.

The *Satisfaction with Life Scale* (Diener et al., 1985) was used to measure life satisfaction. The scale has 5 items, such as "I am satisfied with my life," and is scored on a 7-point Likert scale (1=strongly disagree to 7=strongly agree). Possible scores range from 5 to 35, with a higher score indicating higher life satisfaction, α = 0.90.

Identity and LGB status

Among a set of standard demographic questions. participants were asked "What is your biological sex?" (Offered alternatives of Male/Female/Other, please specify), "What is your gender?" (Offered alternatives of Male/Female/Other, please specify), and "Sexual orientation" (Offered alternatives of Gay, Lesbian, Bisexual, Heterosexual, Other (please specify). When we refer to male/female etc in this paper we are using these terms consistent with how participants answered these questions, rather than making any assumptions or assertions about what constitutes a "man/male" or "woman/female" recognizing that some might see these as contested terms.

The*Lesbian, Gay and Bisexual Identity Scale*(Mohr & Kendra, 2011) consists of 27 items scored on a 7-point scale(1 = "totally disagree" to 7 = "totally agree"). All 8 subscales ofIdentity Affirmation (α = 0.88), Identity Uncertainty (α = 0.91), Concealment Motivation (α = 0.77), Difficult Process (α = 0.81), Identity Centrality (α = 0.79),Acceptance Concerns (α = 0.76),Internalized Homophobia (α = 0.78) andIdentity Superiority (α = 0.77) were averaged, as recommended by Mohr to yield a composite Identity Challenges variable for use in the analyses.

This was complemented by Mohr and Fassinger's (2000) *Outness Inventory*in order to assess the degree to which respondents were open about their sexual identity.Respondents used 7-point scales to report their degree of openness to 11 different individuals/groups which are typically scored into three categories (Out to Family/World/Religion). Here we use the recommended average of each of these categories to quantify Overall Outness, with a higher score indicating greater openness, α = 0.88

The *Identity Resilience Index* (Breakwell et al., 2022), was used to measure 4 first-order identity dimensions (self-esteem, self-efficacy, continuity and positive distinctiveness) as well as a higher-order identity factor (identity resilience). All items were scored on a 5-point Likert scale (1=strongly disagree to 5=strongly agree). The four subscales were averaged to form a score of identity resilience. A higher score indicates greater identity resilience, α = 0.82.

Discrimination and support

Perceived *Social Support*was measured using the 12-item Interpersonal Support Evaluation List (S. Cohen & Hoberman, 1983), measured on a 4-point scale (1=definitely false to 4=definitely true). All 3 subscales of Appraisal Support, Belonging Support, and Tangible Support were averaged into an overall measure of perceived social support, $\alpha = 0.89$.

Identity Threat (Breakwell & Jaspal, 2022) was measured on a 5-point scale using four items that assessed the extent to which individuals believed that their feelings of self-esteem, self-efficacy, continuity and distinctiveness were curtailed, with a higher score indicating higher identity threat, $\alpha = 0.87$.

Perceived *Everyday Discrimination* due to sexual orientation was measured using Williams' original 9-item scale (Williams et al., 1997). These were anchored in descending order of frequency (i.e. Almost every day, At least once a week, A few times a month, A few times a year, Less than once a year, Never). The total score is calculated by summing all nine items, with possible scores ranging from 0 to 45. A higher score indicates more frequent discrimination, $\alpha = .92$.

Data management

Missing data were omitted in a list-wise fashion, as were cases where respondents claimed biological sex or sexual orientations (e.g. heterosexual, $N = 8$, Other = 1), or incompatibilities between these (e.g. male lesbians, $N = 4$, gay women, $N = 5$)the analysis of which were beyond the scope of this paper. Statistical analyses consisted of chi-squared test (for above/below a measure's cut off threshold for "abnormal" or clinically relevant scores), simultaneous entry linear regressions (for establishing variance explained in different sleep measures), mixed effects models contrasting the effects on sleep measures of Biological Sex and Same/Both sex sexual attraction (Fixed Effects), with Participants treated as a Random effect, using a Restricted Maximum Likelihood method with a Satterthwaite approximation for degrees of freedom. The final analyses created composite measures of Wellbeing (i.e. individual's scores for Depression, Anxiety, BMI and higher levels of Life Satisfaction), Better Sleep (low PSQI, ESS, ISI, high SATED),Sexual Minority Identity Strength (high Overall Outness, Identity Resilience and low Overall Identity Challenge), and Minority Stressors (highEveryday Discrimination and Identity Threat, low Perceived Social Support); by forcing each of the relevant variables into a single Principal Component, using Principal Components Analysis, and saving factor scores as a new variable. These were used in a Moderated-Mediation analysis (Hayes'Process v4.2, Model 7). All analyses were conducted using IBM SPSS Version 29.0.1.0.

Results

Only data from individuals identifying as male or female at birth self-identifying as lesbian, gay or bisexual are reported here.Table 1 summarizes their demographic data. Table 2 summarizes the sleep, sexuality, wellbeing, identity, stressor and wellbeing data subjected to analysis. In terms of demographics, wellbeing and BMI, there were differences by sexual orientation only in BMI (gay men reported higher BMI than bisexual men) and life satisfaction (lesbian women reported higher life satisfaction than all other groups). Identity issues generally showed greater identity confidence strength in lesbians, but also more identity challenges. Bisexual individuals experienced more challenges, concealment, uncertainty and discrimination than other groups, Other than a higher level of insomnia symptoms in lesbian women, there were no differences by sexual orientation in sleep measures.

Scores on anxiety and depression measures revealed that 33.1% and 24.6%, respectively, were above the criterion for "valid cases" according to the original criteria (i.e., 11 and higher) presented by Zigmond and Snaith (1983). However, it is noteworthy that 69.6% and 57.3%, respectively, were above current cutoff levels for normal levels of anxiety and depression respectively (i.e., using a threshold of 8

Table 2. Sleep, wellbeing and identity as a function of sexual orientation.

	Gay		Lesbian		Bisexual		Bonferroni-corrected Post hoc			
	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range	$F_{(2,284)}$	Eta^2	p=	
Age (yrs)	36.00 ± 12.00	18.00–62.00	29.00 ± 11.00	18.00–74.00	33.00 ± 12.00	18.00–64.00	7.988	0.054	<.001	
BMI	25.32 ± 4.77	16.11–41.28	26.08 ± 6.91	13.06–53.77	26.98 ± 4.54	20.03–35.53	0.721	0.005	0.487	B<G
Wellbeing										
Anxiety	8.23 ± 4.54	1.00–17.00	9.66 ± 3.92	0.00–18.00	7.91 ± 4.71	0.00–16.00	4.418	0.03	0.013	
Depression	7.44 ± 3.96	2.00–18.00	8.47 ± 3.22	2.00–17.00	7.23 ± 3.42	3.00–16.00	3.383	0.023	0.035	
Life Satisfaction	19.25 ± 7.97	5.00–35.00	18.13 ± 7.19	5.00–31.00	22.97 ± 6.96	6.00–35.00	6.915	0.047	0.001	B,G<L
Sleep										
SATED	5.73 ± 2.58	0.00–10.00	5.82 ± 2.16	1.00–10.00	6.40 ± 1.93	2.00–9.00	1.046	0.007	0.353	
ISI	8.79 ± 5.59	0.00–26.00	9.68 ± 5.81	0.00–26.00	6.86 ± 4.44	0.00–16.00	3.735	0.026	0.025	L<B
ESS	5.17 ± 3.78	0.00–16.00	6.17 ± 3.65	0.00–15.00	6.11 ± 3.57	0.00–13.00	1.5	0.011	0.225	
PSQI	8.00 ± 2.72	3.00–15.00	8.43 ± 2.63	3.00–16.00	7.63 ± 2.02	3.00–12.00	1.572	0.011	0.209	
Identity strength										
Overall Outness	8.97 ± 3.58	1.00–21.00	5.53 ± 3.24	0.50–21.00	9.39 ± 3.08	2.75–14.00	35.439	0.201	<.001	B<G,L
Identity Threat	7.15 ± 3.10	4.00–16.00	7.28 ± 3.32	4.00–20.00	7.34 ± 2.62	4.00–13.00	0.05	0	0.951	
Overall Identity Challenge	2.54 ± 0.53	1.21–3.88	2.78 ± 0.52	1.21–4.08	2.87 ± 0.51	1.97–4.10	36.961	0.038	<.001	G<B,L
Identity Resilience Index	53.75 ± 9.89	26.00–73.00	48.78 ± 8.37	23.00–74.00	53.29 ± 8.41	37.00–72.00	9.79	0.065	<.001	B<G,L
Minority Stressors										
Social Support	29.04 ± 7.63	11.00–40.00	28.17 ± 6.12	10.00–40.00	31.57 ± 4.56	20.00–40.00	4.553	0.031	0.011	B,G<L
Everyday Discrimination	15.98 ± 5.51	9.00–32.00	13.98 ± 6.65	9.00–45.00	17.74 ± 5.57	9.00–31.00	6.39	0.043	0.002	B<L
Acceptance Concerns	9.00 ± 3.19	3.00–15.00	8.20 ± 2.96	3.00–15.00	9.34 ± 3.09	4.00–15.00	2.739	0.019	0.066	
Identity processes										
ConcealmentMotivation	9.17 ± 3.63	3.00–15.00	10.66 ± 3.17	3.00–15.00	8.51 ± 3.49	3.00–15.00	9.085	0.061	<.001	G,L<B
Internalised Homonegativity	5.71 ± 3.21	3.00–15.00	5.52 ± 2.80	3.00–15.00	4.71 ± 2.40	3.00–12.00	1.444	0.01	0.238	
Difficult Process	8.10 ± 3.39	3.00–15.00	8.79 ± 3.28	3.00–15.00	9.80 ± 3.34	3.00–15.00	2.816	0.02	0.062	
Identity Uncertainty	5.77 ± 2.82	4.00–13.00	9.67 ± 3.93	4.00–20.00	7.06 ± 4.14	4.00–19.00	25.453	0.153	<.001	G,L<B
Identity Superiority	4.85 ± 2.37	3.00–12.00	5.35 ± 2.44	3.00–13.00	6.86 ± 3.34	3.00–14.00	7.155	0.048	<.001	B,G<L
Identity Affirmation	10.27 ± 3.12	3.00–15.00	10.90 ± 2.93	3.00–15.00	12.49 ± 2.24	7.00–15.00	6.487	0.044	0.002	B,G<L
Identity Centrality	13.60 ± 4.93	5.00–24.00	12.67 ± 4.55	5.00–23.00	16.94 ± 4.07	7.00–23.00	12.76	0.083	<.001	B,G<L

or higher on each measure, Bjelland et al., 2002). Chi-squared tests revealed associations between being below or above normal cutoffs and sexual orientation for depression (chi-squared $_{(2)} = 6.802$, $p < .05$) and anxiety (chi-squared $_{(2)} = 8.553$, $p < .05$). While lesbians and gay individuals were equally likely to have clinically important levels of anxiety or depression, the incidence of abnormal scores was higher in bisexual individuals.

Scores on the Insomnia Severity Index show that substantial numbers of respondents met the criterion for sub-threshold insomnia (39.2%, critical range 8–14), moderate insomnia (14.6%, critical range 15–21) and severe insomnia (4.6%, 22–28). According to criteria for excessive daytime sleepiness in the Epworth Scale, 21.1% "may be excessively sleepy" and a further 0.4% definitively were. A remarkable 89.6% exceeded the threshold for poor sleep quality (i.e., PSQI > 5). Again, unfortunately there is a lack of relevant normative information, but as mentioned above, Auer et al. (2017) cite figures of 80% for transmen and transwomen, this indicates dramatically high levels of poor sleep in sexual minorities. It is noteworthy that sexual orientation was independent of whether or not individuals reached or exceeded clinical cutoffs for PSQI, ISI or ESS (all $p > .4$ or higher).

Linear regressions to assess independent contributions of all variables revealed that substantial amounts of variance in sleep scores are explained by the demographic, LGB identity, minority stressors and wellbeing variables (see Table 3). Substantial amounts of variance are accounted for by the model's tests, particularly for PSQI and ISI, which approach 40%. Higher BMI is associated with worse sleep in each sleep measure, as are higher levels of depression and anxiety, but higher levels of life satisfaction are associated with better sleep quality (PSQI) and lower levels of insomnia (ISI). Being more open about one's sexuality and having fewer sexual identity challenges are associated with better quality sleep (PSQI), but no other identity or minority stressor variables accounted for significant variance in sleep measures. It is also noteworthy that sexual orientation (i.e., being lesbian, gay or bisexual) failed to uniquely to account for variance in sleep.

The absence of sexual orientation (i.e., being lesbian, gay or bisexual) effects was explored further by using mixed model analyses with biological sex and sexual orientation as fixed factors, and participants as a random factor. Table 4 shows the outcomes with and without adjustment for BMI, anxiety, depression and life satisfaction. The only statistically significant difference in sleep is that bisexual men and bisexual women (9.636; 95% CI: 8.843–10.429) have higher levels of insomnia than lesbian and gay individuals(7.823; 95% CI: 6.608–9.037). This remains the case even when the contributions of BMI, life satisfaction, anxiety and depression are statistically controlled.

Finally, in order to explore more fully how the various influences on sexual minority sleep might operate, we carried out a mediation-moderation analysis (see Figure 1). To do so four new variables were created. The first sought to combine the various sleep measured reported upon above, since clearly none alone provide a comprehensive measure of sleep. This single factor accounted for 63.17% of the common variance, and each measure contributed substantially to the new Better Sleep variable (SATED: 0.813, ISI: −0.895, ESS: −0.606, PSQI: −0.836. Numerical values show component weightings). A single variable was also calculated to reflect Confident Sexuality. This accounted for 45.549% of the common variance between Overall Outness (0.734), Overall Identity Challenges (−0.591) andIdentity Resilience (0.692).

Confident sexuality and better sleep were positively correlated ($r_{(289)}$= .301, <.001). The regression analyses above show that depression, anxiety and life satisfaction all influenced sleep, and a wellbeing variable combining these was created. This accounted for 64.947% of their common variance, and each variable contributed substantially: anxiety: (−0.786), depression (−0.836) and life satisfaction (0.794). We wished to quantify the contribution of wellbeing and minority stressors to the relationship between confident sexuality and good sleep, and thus created a final new variable, minority stressors. This combined perceived social support (0.607), discrimination (−0.676) and identity threat (0.782) into a single variable accounting for 46.945% of their common variance. Finally, in order to assess

Table 3. Contributions of demographic, wellbeing and minority variables to variance in standard sleep measures.

	PSQI	ESS	ISI	SATED
F(13,271)=	15.583, $p < .001$	5.396, $p < .001$	14.966 $p < .001$	8.061 $p < .001$
Adjusted R-Squared	.381	.166	.387	.242
Biological Sex (M1, F2)	.012	.009	−.079	.118
Same/Both Sex Attraction (1,2)	−.033	.051	.061	.012
Age (yrs)	.026	−.064	−.005	.068
BMI	.148**	.187***	.196***	−.151**
Overall Outness	−.117*	.030	.032	−.051
Overall Identity Challenges	−.133*	.028	−.023	.060
Identity Resilience Index	.029	.043	.030	.016
Perceived Social Support	.046	−.021	.037	.050
Everyday Discrimination	.088	.114	.045	−.090
Identity Threat	.024	.128	.049	−.068
Anxiety	.257***	.164*	.236***	−.223***
Depression	.390***	.179**	.346***	−.191*
Life Satisfaction	−.125*	.061	−.151*	.069

PSQI: Pittsburgh Sleep Quality Index, ISI: Insomnia Severity Index, ESS: Epworth Sleepiness Scale, SATED: Satisfaction, Duration. (higher scores indicate better sleep); *p<.05, **p<.01, ***p<.001.

Table 4. Outcomes of mixed effects analyses of biological sex and same/both sex attraction influences on standard sleep measures.

	SATED F(1,288)=	p=	ISI F(1,288)=	p=	ESS F(1,288)=	p=	SATED F(1,288)=	p=
Biological Sex	.069	.793	2.111	.147	.719	.397	3.150	.077
Same/Both Sex attraction	3.136	.078	6.503	.011	1.241	.266	.863	.354
Sex*Attraction	.705	.402	1.393	.239	1.261	.262	.299	.585
Adjusted*	F(1,284)=	p=	F(1,284)=	p=	F(1,284)=	p=	F(1,284)=	p=
Biological Sex	.052	.821	2.065	.152	.805	.370	3.170	.076
Same/Both Sex attraction	2.808	.095	6.056	.014	1.057	.305	.621	.432
Sex*Attraction	.754	.386	1.402	.237	1.183	.278	.290	.591

*BMI, Anxiety, Depression, Life Satisfaction.

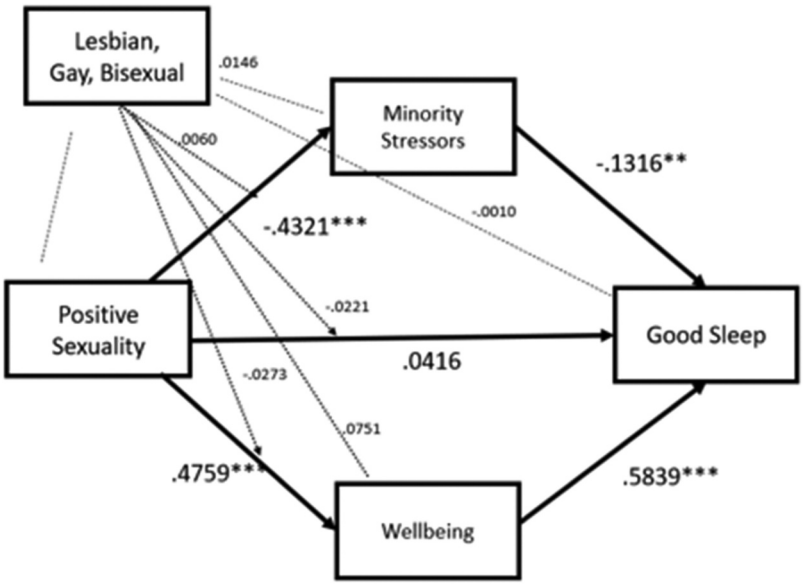

Figure 1. Minority sexual identity, stressors, wellbeing and good sleep un-moderated Mediation.

whether being lesbian, gay or bisexual altered these the relationships between these new variables, we used sexual orientation as a moderator variable.

Confident sexuality and sexual orientation predictors accounted for significant variation in minority stressors, R-square = 0.191; $F(3,285) = 22.316$, $p < .0001$, but only the confident sexuality – minority stressor relationship was statistically significant.Confidentsexuality also strongly predicted wellbeing, R-square = 0.245; $F(3,285) = 30.838$, $p < .0001$, with non-significant contributions from sexual orientation and the confident sexuality*sexual orientation interaction. Good sleep is very strongly predicted by these variables R-square=.413, $F(5,285) = 39.882$, $p < .0001$ - higher levels of well being enhance good sleep, but minority stressors reduce good sleep. When these relationships are taken into account, confident sexuality no longer makes any unique contribution to good sleep. None of these relationships are moderated by sexual orientation, that is, they are equally true for lesbian women, gay men and bisexual individuals.

Discussion

We set out to characterize the sleep of a sample of LGB sexual minority individuals using the self-report measures typically used in other sleep research. The findings revealed very poor sleep in our sample, especially in terms of Sleep Quality (PSQI) and Insomnia (ISI). The absence of such "normative" data for sexual orientation may be useful for others in future research. Other than a higher incidence of insomnia among bisexual women, there were no substantial influences of biological sex or sexual orientation (i.e., being lesbian, gay or bisexual). We also assessed the contribution of identity, wellness and minority stressors to each of the four sleep measures used. In each case BMI, anxiety, depression, and, for some sleep measures(PSQI, ISI),life satisfaction were the most powerful predictors of sleep. Overall,outness and lower levels of overall identity challenge were associated with better sleep quality (PSQI), but for no other sleep measures; nor did any other identity or minor stressor variable predict sleep on any of the four measures. Finally, we sought to examine the relationship between having self-confidence in relation to one's sexuality and sleeping well. Although confident sexuality and better sleep are significantly correlated, in fact their relationship is wholly mediated by two pathways. First, minority stressors increase where confident sexuality is reduced and in turn make sleep worse. Second, confident sexuality enhances well being which in turn improves sleep.

Although the methodological approach adopted here differs from most if not all research investigating sleep in sexual minorities, the results largely confirm the conclusions of various reviews of this area (Butler et al., 2020; Patterson & Potter, 2019): sleep is generally poor and levels of anxiety and depression high inLGB people. Exposure to minority stressors undermines sleep, although their effects can be mitigated by being confident in one's sexuality.Unlike studies which appear to show differences in sleep by biological sex and sexual orientation (Duncan et al., 2016; Fatima et al., 2016), no such differences were empirically observed in the present study. This may be attributed to methodological differences – we sampled individuals prepared to complete tests on-line, made no attempt to purposively sample specific groups, and focused exclusively on LGB individuals. These can be seen as weaknesses, but we believe, as do Segovia and Sparks (2024), that focusing on sexual minorities, rather than including heterosexuals has its own merits. We would argue that doing so avoids another methodological pitfall: assuming that a large random sample which necessarily includes relatively few individuals from sexual minorities is somehow representative of those communities. Similarly, purposive sampling to boost numbers of minority communities runs the risk that there are very different efforts made, and strategies used, for recruitment. Finally, in order manage the participant burden and enhance response rate we deliberately limited questions regarding potentially important potentially explanatory variables. For example, we did not question participants regarding substance abuse, obesity, affluence of area of domicile etc, any of which might be associated with insomnia, poor sleep quality, depression or anxiety.

Despite these caveats, we believe the data reported above provide important practical and theoretical insights into how and why sexual orientation may affect sleep. Having confidence in one's sexual identity can contribute positively to sleep since it may be protective against minority stressors and enhance wellbeing. Facilitating a confident sexual identity and reducing exposure to minority stressors would appear to be important foci for interventions to enhance not only sleep but overall health outcomes in LGB communities.

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Data availability statement

Any reasonable request for data access will be considered favorably by the authors

Author contributions

Both authors analyzed the data and wrote the manuscript. Both authors approved the submitted version.

Positionality and identity statement

The first author identifies as a male heterosexual, and has been researching sleep in different individuals and groups for many years. The second author identifies as a gay man and has a track record of examining aspects of identity and mental health in sexual minorities.

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