Regional Differences in Sleep Quality and Its Impact on Life Satisfaction

Authors: Lin Junqi, Sun Anqi, Chen Jing, Li Huiyan, Zhu Tingshao, Zhu Tingshao

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Abstract

[Objective] To investigate regional differences in sleep quality and life satisfaction, and to analyze the relationship between sleep quality and life satisfaction using large-scale Weibo data. [Method] Based on the posting location of Weibo users, users were divided into four regions to compare differences in sleep quality and life satisfaction across regions. [Results] (1) Sleep quality of Weibo users showed marginal significance across the four regions, $F(3, 489) = 2.363$, $p = 0.071$, with sleep quality scores of users in the central region being significantly higher than those in the western region ($p < 0.05$), but no significant differences were found among other regions ($ps > 0.05$). (2) Life satisfaction of Weibo users did not differ significantly across the four regions, $F(3, 489) = 1.490$, $p > 0.05$. (3) Sleep quality was significantly negatively correlated with life satisfaction ($r = -0.08$, $p < 0.05$); (4) Sleep quality did not significantly predict life satisfaction ($B = -1.27$, $p = 0.078$). [Conclusion] Sleep quality differs across regions, and poorer sleep quality affects life satisfaction.

Full Text

Regional Differences in Sleep Quality and Their Impact on Life Satisfaction: A Study Based on Weibo Big Data

Junqi Lin[1], Anqi Sun[1], Jing Chen[1], Huiyan Li[1], Tingshao Zhu[2],[3]*

[1] Department of Psychology, Renmin University of China, Beijing 100872, China
[2] Department of Psychology, University of Chinese Academy of Sciences, Beijing 100049, China
[3] Institute of Psychology, Chinese Academy of Sciences, Beijing 100101, China

Abstract:
[Objective] This study utilizes Weibo big data to investigate regional differences in sleep quality and life satisfaction among Chinese users, and to analyze

the relationship between these two variables. [**Method**] We categorized Weibo users into four geographic regions based on their posting locations and compared sleep quality and life satisfaction across these regions. [**Results**] (1) Sleep quality among Weibo users showed marginally significant differences across the four regions, $F(3,\ 489) = 2.363$, $p = 0.071$. Users in central China reported significantly poorer sleep quality than those in western China ($p < 0.05$), while no significant differences were observed between other regions ($ps > 0.05$). (2) Life satisfaction did not differ significantly across the four regions, $F(3,\ 489) = 1.490$, $p > 0.05$. (3) Sleep quality was significantly negatively correlated with life satisfaction ($r = -0.08$, $p < 0.05$). (4) Sleep quality did not significantly predict life satisfaction ($B = -1.27$, $p = 0.078$). [**Conclusion**] Sleep quality varies among users from different regions, and poorer sleep quality negatively impacts life satisfaction.

Keywords: Sleep Quality; Life Satisfaction; Regional Differences; Weibo Big Data

1 Introduction

Sleep quality is a crucial indicator of how well individuals sleep and constitutes an essential component of overall health and well-being (Yanxu et al., 2022). As modern lifestyles and daily rhythms continue to evolve, the detrimental effects of sleep problems cannot be overlooked. International studies indicate that the prevalence of sleep issues—including insomnia, sleep apnea, restless leg syndrome, and narcolepsy—ranges from 5% to 56% across different countries (Ohayon, 2011; Stickley et al., 2019). Sleep problems have become a significant public health concern that remains inadequately addressed. According to World Health Organization research, approximately 27% of the global population suffers from sleep disorders, with the resulting increases in medical costs and declines in work productivity drawing widespread attention (Meng, 2012).

Overall, sleep quality among Chinese citizens can be characterized as late, short, and light. Data from 2020 revealed that one-third of Chinese individuals experience poor sleep, with younger generations reporting even worse sleep quality. Comparative analyses across different cities and regions reveal marked geographic disparities: residents in southern China generally sleep slightly better than those in the north, while western regions tend to have longer sleep durations than eastern and central areas. Additionally, rural and village populations exhibit better sleep quality compared to those in fast-paced urban centers.

Sleep is not merely the cessation of activity but a vital state necessary for maintaining adaptive behaviors and biological defense mechanisms. Through sleep, fatigued nerve cells restore normal physiological functions, allowing for recovery of both mental and physical energy (Meng, 2012). Consequently, as sleep quality fluctuates, individuals' subjective experience of life satisfaction also changes, prompting researchers to investigate the relationship between these constructs.

Life satisfaction represents a cognitive evaluation of subjective well-being, measuring the degree of alignment between expected and actual life outcomes. Higher satisfaction emerges when life conditions meet personal expectations. Previous research demonstrates that good sleep quality predicts greater life satisfaction (Kim & Ko, 2018; Shin & Kim, 2018). Sleep quality serves as a key metric for assessing sleep conditions (Yang et al., 2022), while life satisfaction reflects a cognitive appraisal of one's life circumstances over time (Liu et al., 2015) and represents an important indicator of quality of life and mental health (Geng et al., 2020). Some researchers conceptualize life satisfaction as the cognitive component of subjective well-being (Yang et al., 2022).

Extensive evidence reveals a strong correlation between sleep quality and life satisfaction. Cross-sectional studies consistently show that good sleep quality predicts higher life satisfaction (Cao et al., 2022; Howell et al., 2008; Kim & Ko, 2018; Ness & Saksvik-Lehouillier, 2018; Pilcher & Ott, 1998; Piper, 2016; Shin & Kim, 2018). Specifically, variables such as sleep duration and sleep-wake timing stability correlate positively with life satisfaction (Ness & Saksvik-Lehouillier, 2018), and similar results have been obtained in Chinese populations (Li et al., 2020; Yu et al., 2022; Yu, 2021). A cohort study further demonstrated that poor sleep quality is more strongly associated with life dissatisfaction than good sleep quality is with satisfaction (Paunio et al., 2008). Collectively, these findings establish a stable relationship: good sleep quality predicts high life satisfaction, while poor sleep quality predicts dissatisfaction.

Existing Weibo research predominantly employs survey methods. However, with over a decade of development, Weibo has accumulated vast amounts of data that enable big data analysis of sleep quality and life satisfaction nationwide. This study focuses on the first half of 2023 to examine the overall sleep quality and life satisfaction levels among Chinese Weibo users.

In summary, this study analyzes regional differences in sleep quality and life satisfaction across China using Weibo user data. We hypothesize that: (1) sleep quality and life satisfaction vary across provinces; (2) regional differences exist, with western and northern regions showing better sleep quality and life satisfaction than eastern and central regions; (3) sleep quality correlates significantly with life satisfaction, such that better sleep quality corresponds to higher satisfaction; and (4) sleep quality significantly predicts life satisfaction.

2.1 Construction and Validation of the Sleep Quality Dictionary

To minimize the risk of omitting relevant keywords, we extracted comprehensive sleep quality-related terms from established questionnaires and existing dictionaries, then evaluated and filtered them to create a validated keyword list. We referenced numerous validated sleep quality instruments, including the Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS), Ford Insomnia Response to Stress Test (FIRST), Pittsburgh Sleep Quality Index (PSQI), Insomnia Sever-

ity Index (ISI), Epworth Sleepiness Scale (ESS), Morning and Evening Questionnaire (MEQ), Sleep Dysfunction Rating Scale (SDRS), Athens Insomnia Scale (AIS), One Day Fluctuation Assessment Scale (ODFAS), Mayo Fluctuations Composite Scale (MFCS), Parkinson's Disease Sleep Scale (PDSS), Stanford Sleepiness Scale (SSS), Berlin Questionnaire (BQ), STOP-BANG Scale, International Restless Legs Syndrome Rating Scale (IRLS), and REM Sleep Behavior Disorder Screening Questionnaire (RBDSQ).

We extracted all sleep quality-related vocabulary from these instruments and compiled them into an initial sleep quality lexicon. Four psychology professionals evaluated each keyword, rating it as relevant or irrelevant to sleep quality. Keywords approved by over half of the raters were retained, resulting in 158 keywords in a single dimension . Through subsequent rounds of expert screening, we finalized a dictionary comprising 92 keywords.

To validate the dictionary, we first developed a manual for human rating of sleep quality, with the operational definition: determining whether a Weibo text expresses poor sleep quality, assessed on a 5-point Likert scale. Fifty Weibo texts were randomly selected from the sample data and independently rated by four psychology professionals. Inter-rater reliability was strong (Kendall's $W = 0.666$, $p < 0.001$), indicating high consistency and reliable data.

Second, another 50 texts were randomly selected and rated by five psychology professionals using a 7-point Likert scale. We simultaneously applied the sleep quality dictionary to these texts for word frequency analysis. The correlation between human ratings and dictionary-based word frequencies was positive and significant ($r = 0.430$, $p < 0.001$), indicating moderate correlation and good dictionary validity.

Sleep Quality Assessment. For the independent variable of sleep quality, we employed the validated Chinese text analysis software "Wenxin System" to conduct word frequency analysis using our sleep quality dictionary, which contains 92 validated terms, thereby obtaining sleep quality feature scores for each user.

Life Satisfaction Assessment. For the dependent variable of life satisfaction, we utilized an established life satisfaction prediction model to calculate scores for each user based on their textual information.

2.2 Data Acquisition

All data were collected from Sina Weibo using Python-based web scraping programs. This study aimed to investigate regional differences in sleep quality and life satisfaction among Weibo users. Therefore, we first identified target users through keyword searches before collecting their Weibo data for text analysis. The data acquisition process consisted of three stages:

First, we conducted sample extraction through keyword targeting. Using the weibo-search program (https://github.com/dataabc/weibo-search.git), we

searched for keywords derived from our sleep quality lexicon during the period from January 1, 2023, to April 30, 2023. This initial crawl yielded over 50,000 non-duplicate user IDs. We then manually screened users based on whether their posts displayed location tags and whether content expressed poor sleep quality (excluding popular science and advertising posts), resulting in 494 valid data entries.

Second, after preliminary screening, we randomly sorted the user IDs and employed the weibo-spider program (https://github.com/dataabc/weiboSpider.git) to crawl users' basic information and all original posts published between January 1, 2023, and April 30, 2023. Since forwarded content does not represent users' self-expression, we only collected original posts and original portions of forwarded posts, storing each user's data in separate files.

Third, we applied the Pandas toolkit for additional user screening based on account activity and authenticity. For activity, we required accounts registered for at least one year with a minimum of 20 total posts. For authenticity, we targeted ordinary users rather than official accounts, celebrities, or professional bloggers by excluding accounts with more than 3,000 followers. After this cleaning process, 493 users remained in the final sample.

We used the Wenxin text analysis system and life satisfaction prediction model to calculate sleep quality and life satisfaction scores for each user, then conducted data analysis using SPSS 26.0. In total, we collected approximately 50,000 Weibo posts from 31 provinces and municipalities between January and April 2023, performed word frequency analysis to obtain regional sleep quality levels, and computed life satisfaction scores using the established prediction model.

3.1 Sleep Quality and Life Satisfaction Across Chinese Provinces

We used the mean sleep quality and life satisfaction scores from January to April 2023 to represent each province's average levels, as shown in Table 3 , which lists the sleep quality and life satisfaction levels for 34 provinces and municipalities. Based on these data, we created choropleth maps. Figure 1 [Figure 1: see original paper] displays national sleep quality levels, where darker colors indicate poorer sleep quality and lighter colors indicate better sleep quality. Figure 2 [Figure 2: see original paper] displays national life satisfaction levels, where darker colors indicate higher satisfaction and lighter colors indicate lower satisfaction.

3.2 Regional Comparisons of Sleep Quality and Life Satisfaction

According to the National Bureau of Statistics' classification of economic regions, China is divided into eastern, central, western, and northeastern regions

. Table 5 presents the sleep quality and life satisfaction scores for these four regions from January to April 2023, enabling regional comparisons.

3.2.1 Regional Differences in Sleep Quality

To examine whether sleep quality differed significantly across regions, we conducted a one-way ANOVA with sleep quality as the dependent variable and region (eastern, central, western, northeastern) as the independent variable. Results showed marginally significant differences across the four regions, $F(3, 489) = 2.363$, $p = 0.071$, indicating that regional differences in sleep quality did not reach statistical significance. As shown in Figure 3 [Figure 3: see original paper], central China had the highest sleep quality score (0.08), indicating relatively poor sleep quality, while northeastern China had the lowest score (0.05), indicating relatively good sleep quality. Post-hoc LSD tests revealed that central region users reported significantly poorer sleep quality than western region users ($p = 0.014 < 0.05$), with no significant differences between other regions ($ps > 0.05$).

3.2.2 Regional Differences in Life Satisfaction

To examine regional differences in life satisfaction, we conducted a one-way ANOVA with life satisfaction as the dependent variable and region as the independent variable. Results showed no significant differences across the four regions, $F(3, 489) = 1.490$, $p = 0.216$. As depicted in Figure 4 [Figure 4: see original paper], central China had the lowest life satisfaction score (0.57), while northeastern China had the highest (0.61), indicating relatively better life satisfaction in the northeast.

3.3 Correlation and Regression Analysis

Correlation analysis revealed a significant negative correlation between sleep quality and life satisfaction nationwide ($r = -0.08$, $p = 0.039 < 0.05$), confirming our hypothesis that poorer sleep quality is associated with lower life satisfaction.

Regression analysis further examined the predictive effect of sleep quality on life satisfaction. Results showed a marginally significant negative prediction ($B = -1.27$, $p = 0.078$), indicating that sleep quality did not significantly predict life satisfaction at the conventional statistical level. This suggests that additional variables may influence life satisfaction, warranting further investigation.

4 Discussion

This study explored the relationship between sleep quality and life satisfaction across different regions using Weibo big data. Regional differences in sleep quality were marginally significant, with central China users reporting significantly poorer sleep quality than western China users. Although life satisfaction did

not differ significantly across regions, northeastern China users exhibited the highest satisfaction while central China users showed the lowest.

Correlation and regression analyses confirmed a significant negative correlation between sleep quality and life satisfaction, such that poorer sleep quality was associated with lower satisfaction. However, sleep quality did not significantly predict life satisfaction, possibly due to sample size limitations and the influence of other unmeasured variables on life satisfaction.

Several limitations should be noted. First, although social media platforms have broad coverage, they do not represent the entire population. Social media users constitute a specific group with potential sampling bias, and different platforms attract distinct demographic characteristics. Future research should incorporate additional platforms such as Zhihu and Jianshu to enhance representativeness. Second, time and technical constraints limited our data volume, which may have prevented us from achieving expected results. Future studies should extend data collection periods to obtain larger samples. Finally, our data were collected in early 2023, immediately following significant changes in COVID-19 policies, which may have substantially affected users' emotions and lifestyles, potentially biasing results. Longitudinal data collection across different periods would help examine temporal changes in life satisfaction.

Despite these limitations, this big data analysis reveals regional differences in sleep quality among Weibo users and demonstrates that poor sleep quality negatively impacts life satisfaction. These findings underscore the importance of sleep in daily life and highlight the need for effective strategies to improve sleep quality.

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Author Contributions

Jing Chen: Conceptualization, methodology design, data cleaning, introduction writing
Huiyan Li: Conceptualization, methodology design, data cleaning, literature review writing
Junqi Lin: Conceptualization, methodology design, data crawling, methods/results/discussion writing, manuscript editing
Anqi Sun: Conceptualization, methodology design, data cleaning, results writing
Tingshao Zhu: Course design supervision

Note: Figure translations are in progress. See original paper for figures.