

The Effect of Urban Registered Unemployment Rate on Suicidal Ideation: The Moderating Role of Sleep Quality

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Abstract

[Objective] To examine the impact of urban registered unemployment rate on suicidal ideation and analyze the moderating role of sleep quality in this relationship. [Methods] Using multi-level panel data, 341 observations were analyzed. R software was utilized to standardize variables including suicidal ideation, sleep quality, and urban registered unemployment rate. A random effects model was constructed and Johnson-Neyman interval analysis was performed to explore the moderating mechanism of sleep quality in the relationship between urban registered unemployment rate and suicidal ideation. Results The positive predictive effect of urban registered unemployment rate on suicidal ideation was significant ($\beta=0.236$, $p<0.001$), and sleep quality also significantly predicted suicidal ideation ($\beta=0.477$, $p<0.001$). Furthermore, sleep quality significantly moderated the relationship between urban registered unemployment rate and suicidal ideation ($\beta=-3.760$, $p<0.001$). Specifically, under conditions of low sleep quality, the positive predictive effect of unemployment rate on suicidal ideation was stronger, whereas under conditions of high sleep quality, the predictive effect was weakened or even reversed. Johnson-Neyman interval analysis indicated that when sleep quality was within a specific range ($[0.05, 0.09]$), the effect of urban registered unemployment rate was not significant, but was significant outside this range. [Conclusion] Sleep quality plays a key moderating role between urban registered unemployment rate and suicidal ideation, and improving sleep quality may be an important strategy for mitigating the adverse effects of unemployment rate on suicidal ideation.

Full Text

The Impact of Urban Registered Unemployment Rate on Suicidal Ideation: The Moderating Role of Sleep Quality

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Abstract

[Objective] This study aims to explore the impact of the urban registered unemployment rate on suicidal ideation and analyze the moderating role of sleep quality in this relationship. **[Methods]** Multilevel panel data were used to analyze 341 observations. R language was employed to standardize variables related to suicidal ideation, sleep quality, and the urban registered unemployment rate. A random effects model was constructed, and Johnson-Neyman interval analysis was conducted to examine the moderating mechanism of sleep quality in the relationship between the urban registered unemployment rate and suicidal ideation. **Results** The urban registered unemployment rate significantly predicted suicidal ideation ($\beta=0.236$, $p<0.001$), and sleep quality also significantly predicted suicidal ideation ($\beta=0.477$, $p<0.001$). Furthermore, sleep quality significantly moderated the relationship between the urban registered unemployment rate and suicidal ideation ($\beta=-3.760$, $p<0.001$). Specifically, under low sleep quality conditions, the positive predictive effect of unemployment rate on suicidal ideation was stronger, while under high sleep quality conditions, the predictive effect weakened or even reversed. Johnson-Neyman interval analysis indicated that when sleep quality was within a specific range ([0.05, 0.09]), the effect of the unemployment rate was not significant; outside this range, the effect was significant. **[Conclusion]** Sleep quality plays a critical moderating role in the relationship between the urban registered unemployment rate and suicidal ideation. Improving sleep quality may be an important strategy to reduce the negative impact of unemployment rate on suicidal ideation.

Keywords: Unemployment rate; Suicidal ideation; Sleep quality; Moderating effect

Introduction

Employment represents a fundamental pathway for individuals to achieve material and spiritual prosperity through their own labor, enabling them to obtain income and realize self-worth. It is the cornerstone of people's livelihood and social stability. In recent years, China's economy has faced the triple pressures of demand contraction, supply shocks, and weakening expectations, with significantly slowed growth and increased volatility, further amplifying uncertainty [1]. Protecting human capital and ensuring employment conditions are critical responsibilities for maintaining economic, political, and social stability and de-

velopment. Although China's macroeconomy has shown positive trends since the reform and opening up, with overall employment steadily improving, the country still faces serious unemployment challenges [2].

[Figure 1: see original paper] illustrates changes in China's urban unemployed population and unemployment rate from 2010 to 2020. Prior to 2020, despite fluctuations influenced by macroeconomic conditions and policies, both the number of unemployed individuals and the unemployment rate showed a generally stable, slightly declining trend. However, between 2019 and 2020, the unemployed population increased by 2.15 million, and the unemployment rate experienced its largest increase in nearly a decade, reaching 0.58%—a development closely linked to the COVID-19 pandemic. Following the outbreak, strict quarantine policies forced numerous enterprises into operational difficulties or even bankruptcy, necessitating large-scale layoffs to reduce costs and consequently increasing unemployment. Simultaneously, the closure of nursing homes and the shift to online schooling intensified conflicts between family responsibilities and work, further expanding unemployment risks. Moreover, because official statistics are based on unemployment registration systems from social security departments and community organizations rather than census systems, many unemployed individuals who failed to register for various reasons are not included in the statistics, suggesting the actual unemployment situation may be more severe than the data indicate. For these reasons, exploring the impacts of unemployment in the post-pandemic era holds significant importance for summarizing historical experiences, mitigating the impact of public crises, protecting citizens' rights, and achieving common prosperity.

Economic crises affect people's health [3], and a key manifestation of such crises is increased unemployment. Researchers have examined the relationship between unemployment and a range of mental and physical health issues, including depression, physical health, and all-cause mortality [4], demonstrating that unemployment is closely associated with increased mental health problems [5] and that its impact on mental health continues to expand [6].

As socioeconomic restructuring and urbanization accelerate, urban unemployment rates have become a significant factor affecting residents' mental health, with suicide risk representing a critical aspect of this impact [7]. Suicide has emerged as a serious global public health concern. While researchers have conducted systematic reviews and meta-analyses on the relationship between unemployment and suicide, these studies have emphasized complex new meta-analytic methods, and the most recent meta-analytic work in this field has focused exclusively on suicide mortality among the unemployed [8]. However, suicidal behavior does not emerge directly; it typically progresses through three stages: painful despair, suicidal ideation, and suicide attempts [9]. Suicidal ideation refers to an individual's thoughts or desires to end their own life without actual behavior, representing an inevitable early psychological activity among both suicide attempters and completers. It serves as a precursor to suicide and strongly predicts suicide death [10]. Therefore, beyond suicidal behavior itself, suicidal

ideation and associated psychological, demographic, and physiological factors warrant attention. According to World Health Organization statistics, non-fatal suicidal behavior is more common than completed suicide [11], with some studies indicating that approximately 9% of people experience suicidal thoughts and 3% have attempted suicide during their lives [12]. Consequently, this study proposes Hypothesis H1: Urban unemployment rate positively predicts suicidal ideation.

Nevertheless, research indicates that the relationship between unemployment and suicidal ideation is not always strong or consistent [13]. The social causation model posits that unemployment leads to severe anxiety, stress, and mental health problems that ultimately result in suicidal behavior, suggesting that the relationship between unemployment and suicide is mediated by mental health [13]. However, mental health issues are influenced not only by unemployment but also significantly by individuals' current quality of life. When individuals possess better quality of life, does unemployment still exert a substantial impact on personal suicidal ideation?

Sleep quality represents a crucial indicator of quality of life, closely related to stress, emotion, personality, aggression, and mental health [14]. It is a comprehensive evaluation metric encompassing sleep duration, sleep onset speed, and depth of sleep [15], incorporating both objective physiological indicators and subjective psychological assessments. Research demonstrates that lower subjective sleep quality correlates with stronger suicidal ideation [16], with a meta-analysis revealing that insomnia shows the strongest relationship with suicidal ideation, while nightmares are most closely associated with suicide attempts [17]. Therefore, sleep quality is intimately linked to suicidal ideation. Based on this evidence, this study proposes Hypothesis H2: Sleep quality moderates the relationship between urban unemployment rate and suicidal ideation.

Current international research on the impact of urban unemployment rates on suicidal ideation has yielded some findings [18], but existing literature exhibits several limitations. First, some studies lack diversity in age, occupational background, and other demographic factors among their samples, potentially introducing non-response bias [19] as certain groups may be underrepresented due to lower survey participation rates. Second, research has predominantly focused on Western cultural contexts, over-relying on European and American samples while neglecting cultural differences that may limit the applicability of conclusions to the Chinese cultural context [20]. Finally, although studies have separately examined the impact of unemployment on suicidal ideation [8] and the association between sleep quality and suicide risk [21], comprehensive empirical analyses integrating all three factors remain scarce domestically.

In summary, this study aims to investigate the relationship between urban unemployment rate and suicidal ideation and analyze the moderating role of sleep quality in this relationship.

Theoretical Framework and Hypotheses

2.1 Research Framework

This study explores the impact of urban registered unemployment rate on suicidal ideation and further analyzes the moderating role of sleep quality in this process. Based on existing theories and literature, the core framework includes the following components:

Independent Variable: Urban registered unemployment rate, representing the potential impact of unemployment phenomena in the economic environment on individuals' living conditions and mental health. Unemployment is recognized as a significant source of economic pressure, social isolation, and mental health problems.

Dependent Variable: Suicidal ideation, referring to an individual's thoughts or desires to end their own life within a certain period, though these thoughts may not ultimately result in action. Existing research demonstrates that suicidal ideation is closely associated with psychological distress, emotional difficulties, and life stress.

Moderating Variable: Sleep quality, referring to an individual's sleep experience and physiological sleep indicators (such as sleep onset time and depth) within a certain period, which plays an important role in mental health and emotional regulation. Sleep quality is considered a crucial factor in individuals' stress coping, emotion management, and mental health.

Under this framework, this study establishes a hypothetical path model (Figure 2 [Figure 2: see original paper]) to explore the interrelationships among urban registered unemployment rate, sleep quality, and suicidal ideation, and further analyzes the potential moderating role of sleep quality in the relationship between unemployment rate and suicidal ideation. Through empirical analysis, this study aims to provide new understanding of the mechanisms through which unemployment affects mental health and explore the potential role of improving sleep quality in alleviating suicidal ideation.

2.2 Theoretical Basis

Social Causation Model: This model posits that unemployment leads to economic pressure, anxiety, and mental health problems that may ultimately result in suicidal behavior. Drawing on this theory, this study proposes that unemployment is an important predictor of suicidal ideation.

Mental Health Model: Mental health is influenced not only by unemployment but also by factors such as individual quality of life, emotional regulation, and social support. Research indicates that unemployed populations generally face higher risks of mental health problems, necessitating consideration of mental health as a mediating variable.

Sleep Quality and Mental Health Theory: As an important dimension

of quality of life, sleep quality directly affects mental health. Studies show that poor sleep quality is closely associated with psychological issues such as depression and anxiety, which significantly increase the risk of suicidal ideation. Therefore, sleep quality may serve as a moderating variable playing an important role between unemployment and suicidal ideation.

2.3 Research Hypotheses

This study proposes the following hypotheses:

Hypothesis 1 (H1): Urban unemployment rate positively predicts suicidal ideation, meaning that increased unemployment rate significantly raises the probability of suicidal ideation occurrence.

Hypothesis 2 (H2): Sleep quality moderates the relationship between urban unemployment rate and suicidal ideation, such that when sleep quality is poor, the impact of unemployment rate on suicidal ideation is stronger, and when sleep quality is good, the impact is weaker.

[Figure 2: see original paper] Hypothetical Path Model

2.4 Research Methods

This study employs quantitative research methods, using a random effects model to empirically analyze the relationships among urban unemployment rate, suicidal ideation, and sleep quality. Specific methods are as follows:

Data Collection: This study utilizes Weibo data and frequency statistics of keywords related to sleep quality and suicidal ideation. Data sources include Weibo text data from 31 provinces and municipalities between 2010 and 2020. Specifically, the research extracts data by analyzing the frequency of keywords related to suicidal ideation and emotional expression in Weibo users' posts. Unemployment rate data are obtained as macro-level panel data from the *China Statistical Yearbook*.

Variable Measurement:

- **Suicidal Ideation:** Quantified based on the frequency of suicide-related topics in Weibo data. By analyzing content posted by Weibo users, keywords containing suicidal ideation or emotional expression are identified.
- **Sleep Quality:** Assessed by applying a sleep quality dictionary to analyze keywords related to sleep quality in Weibo posts, thereby evaluating users' sleep status.
- **Unemployment Rate:** Official urban unemployment rate data obtained from the *China Statistical Yearbook*.

Model Specification: A random effects model is used to examine the impact of urban unemployment rate on suicidal ideation and analyze the moderating role of sleep quality. This model can effectively control for heterogeneity among

different individuals, thereby enhancing the accuracy and scientific rigor of the results. The following path model is established:

$$\text{Suicidal Ideation} = \beta_0 + \beta_1 \times \text{Unemployment Rate} + \beta_2 \times \text{Sleep Quality} + \beta_3 \times (\text{Unemployment Rate} \times \text{Sleep Quality})$$

where β_3 represents the moderating effect of sleep quality on the relationship between unemployment rate and suicidal ideation.

Data Analysis: Statistical software such as SPSS, R, or Stata is used for data processing and analysis. Data processing primarily includes standardization, correlation analysis, and regression analysis.

2.5 Innovation and Significance

Innovation: This study is the first to integrate urban unemployment rate, sleep quality, and suicidal ideation, exploring the multiple impact mechanisms of unemployment on mental health and introducing sleep quality as a moderating variable, thereby demonstrating strong theoretical innovation.

Significance: By analyzing the moderating role of sleep quality in the relationship between unemployment and suicidal ideation, this study provides a new perspective for social policy and mental health intervention, particularly in the context of increasingly severe unemployment issues following the pandemic, thus holding important public health significance.

To ensure scientific rigor and consistency in the analysis, this study standardized the raw data using the L2 norm method for variable normalization. Standardized variables eliminate the influence of different measurement units on the analysis results and enhance comparability.

Results

3.1 Random Effects Model Results

This study employed a random effects model to analyze the relationship between urban registered unemployment rate and suicidal ideation and examined the moderating role of sleep quality. The model demonstrated good fit ($R^2 = 0.653$, adjusted $R^2 = 0.650$, $F = 633.359$, $p < 0.001$). Random effects model results are presented in Table 2 .

Results show that urban registered unemployment rate has a significant positive predictive effect on suicidal ideation ($\beta = 0.236$, $SE = 0.064$, $p < 0.001$), indicating that increased unemployment rate significantly raises the probability of suicidal ideation occurrence. Sleep quality also significantly predicts suicidal ideation ($\beta = 0.477$, $SE = 0.067$, $p < 0.001$), revealing that individuals with poorer sleep quality are more likely to experience higher levels of suicidal ideation. The interaction term between urban registered unemployment

rate and sleep quality significantly affects suicidal ideation ($\beta = -3.760$, $SE = 1.191$, $p < 0.001$), demonstrating that sleep quality significantly moderates the relationship between unemployment rate and suicidal ideation: low sleep quality amplifies the positive predictive effect of unemployment rate on suicidal ideation, whereas high sleep quality buffers and even reverses this effect.

Results are shown in Table 1 .

3.2 Simple Slope Analysis Results

To further verify the moderating effect, simple slope analysis was conducted, with results illustrated in Figure 1 [Figure 3: see original paper].

Under conditions of low sleep quality (-1 SD), the positive predictive effect of urban registered unemployment rate on suicidal ideation was significantly enhanced ($\beta = 0.080$, $SE = 0.020$, $t = 3.93$, $p < 0.001$). This suggests that poor sleep quality may amplify the adverse mental health effects of unemployment rate.

At mean sleep quality levels, the positive predictive effect of urban registered unemployment rate on suicidal ideation remained weaker but significant ($\beta = 0.030$, $SE = 0.020$, $t = 1.97$, $p = 0.05$).

Under conditions of high sleep quality (+1 SD), the predictive effect of urban registered unemployment rate on suicidal ideation was negative and non-significant ($\beta = -0.020$, $SE = 0.030$, $t = -0.59$, $p = 0.55$). This indicates that high sleep quality can significantly buffer the detrimental impact of unemployment rate on mental health.

Johnson-Neyman Interval Analysis: To further clarify the significant range of the moderating effect, Johnson-Neyman interval analysis was performed, as shown in Figure 2. Results indicate that when sleep quality falls within the range of [0.05, 0.09], the predictive effect of urban registered unemployment rate on suicidal ideation is not significant ($p > 0.05$); when sleep quality falls outside this interval, the effect of unemployment rate becomes significant. This further validates the role of sleep quality as a moderating variable.

[Figure 3: see original paper] Interaction Effect Diagram

Discussion

4.1 Interpretation of Findings

This study found that urban registered unemployment rate has a significant positive predictive effect on suicidal ideation, consistent with the expectations of the social causation model. Unemployment not only creates economic pressure but may also trigger social isolation and mental health problems, thereby increasing the probability of suicidal ideation. Additionally, sleep quality significantly predicts suicidal ideation, with individuals experiencing poor sleep

quality being more prone to suicidal ideation. This result supports the close relationship between sleep quality and mental health; poor sleep quality may increase psychological pressure and emotional distress, consequently elevating the risk of suicidal ideation.

4.2 The Moderating Role of Sleep Quality

Study results demonstrate that sleep quality significantly moderates the relationship between urban registered unemployment rate and suicidal ideation. Under conditions of low sleep quality, the positive predictive effect of unemployment rate on suicidal ideation is stronger, whereas under high sleep quality conditions, the predictive effect weakens or even reverses. This indicates that sleep quality serves as an important buffering mechanism between unemployment and suicidal ideation. High sleep quality may alleviate the psychological pressure caused by unemployment by improving individuals' emotional regulation and stress coping abilities, thereby reducing the probability of suicidal ideation.

Conclusion and Future Directions

This study explored the relationship between urban unemployment rate and suicidal ideation and analyzed the moderating role of sleep quality in this process. Results show that urban registered unemployment rate significantly and positively predicts suicidal ideation, indicating that increased unemployment rate significantly raises the probability of suicidal ideation occurrence. Sleep quality plays an important moderating role in the relationship between unemployment rate and suicidal ideation: low sleep quality significantly amplifies the impact of unemployment rate on suicidal ideation, while high sleep quality effectively mitigates this effect. These findings suggest that improving sleep quality may represent an important strategy for alleviating the negative mental health effects of unemployment.

However, this study has several limitations. Data sources primarily relied on Weibo data and official unemployment statistics, which may not fully cover all population groups. Additionally, the study did not consider factors such as social support and emotional relationships; future research could further enrich the model by exploring how these factors moderate the relationship between unemployment and mental health. At the policy level, how to reduce the negative mental health impacts of unemployment through measures such as social security and mental health interventions represents an important issue worthy of attention. Future research could combine additional data sources and variables to further validate these conclusions and provide policymakers with more effective intervention strategies.

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Author Contributions

Sun Xinbo: Conceptualized the study, designed the research protocol;

Li Yawen: Revised the final manuscript;

Sun Wen: Drafted the manuscript;

Zhou Jingyao: Collected, cleaned, and analyzed data.

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

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