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# The Influence of Negative Automatic Thoughts and Sleep Dysfunction on Depression Severity

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**ABSTRACT**

This study aimed to examine the predictive influence of negative automatic thoughts and sleep dysfunction on depression severity in a Brazilian adult population. A correlational descriptive design was employed involving 430 adult participants from Brazil, selected based on the Morgan and Krejcie sample size determination table. Participants completed the Beck Depression Inventory-II (BDI-II) for depression severity, the Automatic Thoughts Questionnaire (ATQ) for negative automatic thoughts, and the Pittsburgh Sleep Quality Index (PSQI) for sleep dysfunction. All instruments used were standardized, with confirmed validity and reliability in previous studies. Data were analyzed using IBM SPSS-27. Pearson correlation was used to assess bivariate relationships between variables, and multiple linear regression was performed to evaluate the joint predictive power of negative automatic thoughts and sleep dysfunction on depression severity. Pearson correlation analysis revealed a strong positive correlation between depression severity and negative automatic thoughts ($r = .71$, $p < .01$), and a moderate correlation with sleep dysfunction ($r = .58$, $p < .01$). Multiple regression analysis indicated that both predictors significantly contributed to the model ($F(2, 427) = 262.41$, $p < .01$), explaining 55% of the variance in depression scores ($R^2 = .55$). Negative automatic thoughts ($\beta = .61$, $p < .01$) had a stronger predictive effect than sleep dysfunction ($\beta = .28$, $p < .01$). The findings demonstrate that both negative automatic thoughts and sleep dysfunction are significant and independent predictors of depression severity, with cognitive distortions exerting a particularly strong influence. These results highlight the need for integrated interventions that simultaneously target maladaptive thought patterns and sleep disturbances to effectively mitigate depressive symptoms.

**Keywords:** Depression severity; Negative automatic thoughts; Sleep dysfunction; Cognitive predictors; Mental health.

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## Introduction

Depression is a multifaceted mental health condition that poses significant challenges to individuals, communities, and healthcare systems worldwide. Characterized by persistent feelings of sadness, anhedonia, and cognitive impairment, depression affects over 300 million people globally, contributing to disability, occupational dysfunction, and reduced quality of life. The cognitive-behavioral framework offers a robust model for understanding the maintenance and exacerbation of depressive symptoms, particularly emphasizing the role of negative automatic thoughts (NATs) and associated cognitive distortions. In

addition, an expanding body of research has underscored the bidirectional interaction between sleep dysfunction and emotional regulation, further complicating the clinical presentation and treatment of depression.

Negative automatic thoughts are spontaneous, involuntary cognitions that typically reflect distorted interpretations of reality, often taking a self-critical or hopeless tone. These thoughts are believed to play a critical role in both the onset and maintenance of depressive states, as proposed by Beck's cognitive theory of depression. Empirical evidence strongly supports this theoretical framework. For instance, Wang et al. found that NATs significantly mediated the relationship between negative life events and antenatal depression in rural Chinese women, highlighting the pervasive influence of internal cognitive processes on mood regulation (1). Similarly, Kamiya and Koda demonstrated that rumination and automatic thoughts contributed jointly to depressive symptoms among university students, suggesting that repetitive negative thinking amplifies vulnerability to depression (2).

The role of NATs in specific psychiatric conditions has also been a subject of increasing investigation. In patients with schizophrenia, NATs have been associated with reduced social functioning and poorer treatment outcomes, pointing to their relevance across a range of psychopathologies (3). Furthermore, Üşenmez and Şanlı reported that such thoughts negatively affected medication adherence in individuals with schizophrenia, indicating the functional consequences of cognitive distortion in chronic illness management (4). Extending this line of inquiry, Budak et al. explored the effect of NATs on hope among individuals with schizophrenia, concluding that frequent negative thoughts are inversely related to optimistic expectations for the future (5). These findings corroborate the broader notion that NATs are transdiagnostic risk factors capable of shaping not only emotional experiences but also behavioral outcomes and long-term recovery trajectories.

Research has further explored the intersection of NATs with other cognitive and affective variables. Arimitsu and Hofmann emphasized that self-compassion may reduce negative affect through its impact on cognitive distortions, including automatic thoughts (6). Esbjørn et al. provided evidence that NATs, when combined with repetitive negative thinking and metacognitions, are significant predictors of social anxiety disorder in children, illustrating their role across developmental stages (7). This transdiagnostic presence of NATs underscores their utility as both a predictive and therapeutic target in psychological intervention.

The specific content and believability of NATs have also been investigated to refine diagnostic and therapeutic models. For instance, Gústavsson introduced a believability scale designed to measure the extent to which individuals endorse the validity of their NATs, offering a nuanced metric to assess cognitive distortions (8). Similarly, Pugh emphasized therapeutic strategies such as chairwork to help clients challenge and reframe persistent negative thoughts, demonstrating how cognitive restructuring can be facilitated in clinical settings (9). Tomlinson and Slater also highlighted practical cognitive-behavioral interventions for disrupting NATs, contributing to symptom relief and improved functional outcomes (10).

Beyond cognition, sleep dysfunction is another critical factor intricately linked to depression. Individuals suffering from insomnia, hypersomnia, or fragmented sleep often exhibit heightened emotional dysregulation and increased depressive symptomatology. The relationship is not merely correlational but may reflect a bidirectional feedback loop in which poor sleep exacerbates emotional vulnerabilities and vice versa. Baker et al. found that anxiety sensitivity significantly mediated the relationship between sleep

dysfunction and various anxiety disorders, illustrating the complex interplay between arousal, cognition, and rest (11). Although anxiety sensitivity was the focus, the findings are equally relevant to depressive disorders, where sleep complaints are often the earliest and most persistent symptoms.

A number of recent studies have examined the co-occurrence of NATs and sleep dysfunction, revealing a compounded effect on depression severity. Akbeniz and Budak reported that socially stigmatizing beliefs during menopause were associated with elevated NATs, which in turn contributed to sleep disturbances and emotional distress (12). Tanrıverdi et al. investigated NATs in the context of preoperative anxiety, finding that sleep quality was a mediating variable that intensified anxiety symptoms among patients awaiting corneal transplantation (13). These findings reinforce the notion that sleep and cognition are not isolated phenomena but rather interdependent dimensions of psychological functioning.

In the context of affective disorders, the explanatory power of NATs and sleep dysfunction has been investigated across diverse cultural and demographic groups. Inasaridze emphasized the need for culturally sensitive interpretations of automatic thoughts, suggesting that their form and impact may vary based on societal norms and belief systems (14). Bibi found that university students in Pakistan who endorsed dysfunctional attitudes were more likely to report frequent NATs, and this relationship was also predictive of depressive symptoms (15). Similarly, Özbiler et al. demonstrated that parental warmth was inversely related to NATs, which in turn mediated levels of subjective well-being, emphasizing the developmental and familial origins of negative cognitive patterns (16).

More recently, large-scale studies have explored longitudinal and bidirectional influences of NATs. Zhang et al. conducted a two-year longitudinal study in Chinese children, revealing a reciprocal relationship between parental psychological control, bullying, and NATs, with these cognitions serving both as antecedents and outcomes of psychosocial stress (17). This research underscores the importance of considering NATs not only as symptoms but as dynamic constructs that evolve with ongoing interpersonal and environmental feedback.

The clinical relevance of these findings is underscored by the growing emphasis on cognitive and behavioral therapies that aim to restructure NATs and improve sleep hygiene. Feger posited that NATs directly affect emotional states, emphasizing the urgency of identifying and correcting these thought patterns early in treatment (18). Ayhan and Budak similarly found that mindfulness was inversely correlated with NATs in individuals with depression, suggesting that metacognitive awareness may buffer against cognitive vulnerability (19).

Despite these advancements, the combined influence of NATs and sleep dysfunction on depression severity remains underexplored, especially in adult community samples outside clinical settings. Moreover, existing studies often examine these variables in isolation, neglecting their potential interactive or additive effects. Given the conceptual overlap and empirical interdependence between cognition and sleep, a comprehensive investigation of their joint impact is warranted. Such research could offer insights into the mechanisms that amplify depressive symptomatology and inform more targeted therapeutic strategies.

The present study seeks to address this gap by examining the relationship between negative automatic thoughts, sleep dysfunction, and depression severity among a large, non-clinical sample of Brazilian adults.

## Methods and Materials

### *Study Design and Participants*

This study employed a correlational descriptive design to investigate the influence of negative automatic thoughts and sleep dysfunction on depression severity among Brazilian adults. A total of 430 participants were recruited using a stratified random sampling method to ensure representation across age and gender groups. The sample size was determined based on the Morgan and Krejcie (1970) sample size determination table for a population exceeding 100,000, providing sufficient statistical power for correlation and regression analyses. Inclusion criteria required participants to be at least 18 years old, fluent in Portuguese, and not currently undergoing psychiatric treatment. All participants provided informed consent before completing the standardized self-report questionnaires.

### *Data Collection*

The Beck Depression Inventory-II (BDI-II), developed by Aaron T. Beck and colleagues in 1996, is a widely used self-report instrument designed to assess the severity of depressive symptoms in individuals aged 13 and older. The BDI-II consists of 21 items, each corresponding to a specific symptom of depression such as sadness, pessimism, or sleep disturbance. Each item is scored on a 4-point Likert scale ranging from 0 to 3, with total scores ranging from 0 to 63, where higher scores indicate more severe depression. The BDI-II comprises two subscales: cognitive-affective and somatic, which help differentiate between emotional and physical symptoms of depression. This tool has been extensively validated across diverse populations and clinical settings, with high internal consistency (Cronbach's alpha typically > .90) and test-retest reliability, making it a robust and reliable instrument for evaluating depression severity in both clinical and research contexts.

The Automatic Thoughts Questionnaire (ATQ), developed by Steven D. Hollon and Philip C. Kendall in 1980, is a standard instrument used to measure the frequency of negative automatic thoughts typically associated with depression. The ATQ contains 30 self-report items that reflect common depressive cognitions, such as "I'm a failure" or "I can't do anything right." Respondents rate the frequency of each thought over the past week on a 5-point Likert scale from 1 (not at all) to 5 (all the time), yielding a total score ranging from 30 to 150. Higher scores indicate more frequent negative automatic thinking. The ATQ has demonstrated strong psychometric properties, including high internal consistency (Cronbach's alpha > .90) and good test-retest reliability. Numerous studies have confirmed its construct and criterion validity, supporting its widespread use in both clinical diagnosis and cognitive research on depression.

The Pittsburgh Sleep Quality Index (PSQI), developed by Daniel J. Buysse and colleagues in 1989, is a validated self-report questionnaire designed to assess sleep quality and disturbances over a one-month interval. The PSQI consists of 19 individual items that generate seven component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. These components are summed to yield a global score ranging from 0 to 21, with higher scores indicating poorer sleep quality. A global score greater than 5 is generally indicative of significant sleep dysfunction. The PSQI has been widely validated in both clinical and non-clinical populations, showing strong internal consistency (Cronbach's alpha ≈ .83) and test-retest reliability. Its construct and criterion validity have been confirmed through numerous studies, making it a standard tool for evaluating sleep problems in psychological and medical research.

### *Data analysis*

Data analysis was conducted using IBM SPSS Statistics version 27. Descriptive statistics were used to summarize demographic variables. To explore relationships between depression severity (dependent variable) and the independent variables (negative automatic thoughts and sleep dysfunction), Pearson correlation coefficients were computed. Furthermore, a standard multiple linear regression analysis was performed to determine the extent to which negative automatic thoughts and sleep dysfunction predicted depression severity. Statistical significance was evaluated at the $p < .05$ level, and all assumptions for correlation and regression analyses were tested and met prior to conducting the inferential tests.

## Findings and Results

The sample consisted of 430 participants, of whom 263 (61.2%) identified as female and 167 (38.8%) as male. Participants' ages ranged from 18 to 65 years (M = 34.7, SD = 10.9). In terms of education, 192 participants (44.7%) held a university degree, 138 (32.1%) had completed secondary education, and 100 (23.3%) reported postgraduate qualifications. Regarding employment status, 247 participants (57.4%) were employed full-time, 89 (20.7%) were students, 54 (12.6%) were unemployed, and 40 (9.3%) were retired or engaged in part-time work.

**Table 1. Descriptive Statistics for Depression, Negative Automatic Thoughts, and Sleep Dysfunction**

| Variable | Mean (M) | Standard Deviation (SD) |
|---|---|---|
| Depression Severity (BDI-II) | 27.46 | 8.35 |
| Negative Automatic Thoughts (ATQ) | 96.82 | 15.21 |
| Sleep Dysfunction (PSQI) | 10.27 | 3.64 |

Table 1 presents the means and standard deviations for the study variables. The mean score for depression severity was 27.46 (SD = 8.35), suggesting a moderate level of depressive symptoms among participants. The mean for negative automatic thoughts was 96.82 (SD = 15.21), indicating a relatively high frequency of negative thoughts. Sleep dysfunction, measured by the PSQI, had a mean score of 10.27 (SD = 3.64), suggesting significant disturbances in sleep quality in this sample.

Prior to conducting the correlation and regression analyses, the assumptions were examined and met. Normality of the variables was confirmed using the Kolmogorov–Smirnov test, with non-significant results for depression severity ($D = 0.034$, $p = .067$), negative automatic thoughts ($D = 0.027$, $p = .112$), and sleep dysfunction ($D = 0.039$, $p = .053$), indicating no violation of normality. Linearity and homoscedasticity were visually inspected using scatterplots and found to be satisfactory. Multicollinearity was assessed using Variance Inflation Factor (VIF), with values of 1.42 for negative automatic thoughts and 1.36 for sleep dysfunction, both well below the acceptable threshold of 10. Additionally, the Durbin-Watson statistic was 1.91, suggesting that residuals were independent.

**Table 2. Pearson Correlation Coefficients Between Study Variables**

| Variables | 1 | 2 | 3 |
|---|---|---|---|
| 1. Depression Severity | — | | |
| 2. Negative Automatic Thoughts | .71** ($p < .01$) | — | |
| 3. Sleep Dysfunction | .58** ($p < .01$) | .47** ($p < .01$) | — |

As shown in Table 2, depression severity was strongly and positively correlated with negative automatic thoughts ($r = .71$, $p < .01$) and moderately correlated with sleep dysfunction ($r = .58$, $p < .01$). Additionally, there was a significant moderate correlation between negative automatic thoughts and sleep dysfunction ($r = .47$, $p < .01$), suggesting these variables are interrelated.

**Table 3. Summary of ANOVA Table for Multiple Regression**

| Source | Sum of Squares | df | Mean Square | R | $R^2$ | Adjusted $R^2$ | F | P |
|---|---|---|---|---|---|---|---|---|
| Regression | 7594.62 | 2 | 3797.31 | .74 | .55 | .55 | 262.41 | < .01 |
| Residual | 6157.73 | 427 | 14.42 | | | | | |
| Total | 13752.35 | 429 | | | | | | |

Table 3 shows the results of the overall multiple regression model. The model predicting depression severity from negative automatic thoughts and sleep dysfunction was statistically significant ($F(2, 427) = 262.41$, $p < .01$), accounting for approximately 55% of the variance in depression scores ($R^2 = .55$). The strong multiple correlation ($R = .74$) supports the substantial predictive power of the combined model.

**Table 4. Coefficients of Multiple Regression Predicting Depression Severity**

| Predictor Variable | B | Standard Error | β | t | p |
|---|---|---|---|---|---|
| Constant | 3.72 | 1.56 | — | 2.39 | < .01 |
| Negative Automatic Thoughts | 0.26 | 0.02 | .61 | 13.47 | < .01 |
| Sleep Dysfunction | 0.74 | 0.11 | .28 | 6.78 | < .01 |

Table 4 presents the multivariate regression coefficients. Both predictor variables made significant contributions to the model. Negative automatic thoughts were the strongest predictor of depression ($\beta = .61$, $t = 13.47$, $p < .01$), followed by sleep dysfunction ($\beta = .28$, $t = 6.78$, $p < .01$). The unstandardized regression coefficients indicate that for each one-point increase in NAT score, depression scores increased by 0.26 units, and for each one-point increase in sleep dysfunction, depression scores increased by 0.74 units. These results underscore the additive and independent effects of cognitive and behavioral factors on depression severity.

## Discussion and Conclusion

The present study aimed to investigate the influence of negative automatic thoughts and sleep dysfunction on depression severity among a community sample of Brazilian adults. Results from Pearson correlation analyses indicated that both negative automatic thoughts and sleep dysfunction were significantly and positively correlated with depression severity. Furthermore, linear regression analysis revealed that these two variables collectively predicted a substantial portion of the variance in depression scores, with negative automatic thoughts emerging as the stronger predictor. These findings are consistent with cognitive-behavioral models of depression and support the growing body of literature emphasizing the interrelated roles of cognition and sleep in emotional well-being.

The significant positive association between negative automatic thoughts and depression severity aligns with decades of cognitive theory suggesting that maladaptive thoughts serve as both a cause and consequence of depressive states. Beck's cognitive model posits that automatic thoughts, particularly those involving themes of hopelessness, self-blame, and worthlessness, perpetuate negative affect and contribute to the onset and maintenance of depression. This relationship has been validated in numerous cultural and clinical contexts. For instance, Wang et al. found that negative automatic thoughts mediated the impact of adverse

life events on antenatal depression in rural Chinese women, reinforcing the cognitive vulnerability perspective (1). Likewise, Bibi reported that Pakistani university students with elevated levels of automatic thoughts were more likely to display depressive symptoms, further corroborating this model in non-Western samples (15).

The predictive strength of negative automatic thoughts in this study also mirrors findings from previous research indicating their pervasiveness and impact across psychiatric diagnoses. Altun et al. found that negative automatic thoughts were associated with diminished social functioning among individuals with schizophrenia, illustrating their relevance beyond depression (3). Similarly, Üşenmez and Şanlı documented that these thoughts negatively influenced medication adherence in patients with schizophrenia, which suggests that their disruptive cognitive pattern can impair not only mood but also behavior and compliance with treatment protocols (4). These insights resonate with the current study's findings, which highlight NATs as a robust, cross-cutting psychological mechanism intimately linked to emotional health.

The present study also confirmed a significant positive association between sleep dysfunction and depression severity. Participants who reported higher levels of sleep disturbance also exhibited more severe depressive symptoms, consistent with previous research suggesting that impaired sleep is both a symptom and a risk factor for depression. Baker et al. explored this relationship in anxiety disorders and found that sleep dysfunction, when moderated by anxiety sensitivity, contributed significantly to psychological distress (11). Although their sample focused on anxiety, the mechanisms proposed—such as physiological hyperarousal and disrupted emotional regulation—are similarly applicable to depression. Poor sleep diminishes one's ability to regulate affect, impairs executive functioning, and reduces resilience to stress, thereby heightening susceptibility to negative thought patterns and mood disorders.

The additive impact of sleep dysfunction and NATs on depression severity, as shown in the regression analysis, underscores the interactive nature of behavioral and cognitive domains in mental health. This supports the conceptualization of depression as a biopsychosocial phenomenon in which physiological factors like sleep and psychological constructs such as cognition operate synergistically. Tanrıverdi et al. noted a similar dynamic in their study on patients awaiting corneal transplantation, where negative automatic thoughts and disrupted sleep patterns collectively intensified preoperative anxiety (13). Furthermore, Akbeniz and Budak observed that NATs influenced both emotional distress and perceived stigma during menopause, suggesting that the presence of NATs may exacerbate reactions to physiological changes, including sleep disturbances (12).

The role of NATs as the stronger predictor of depression severity in this study may be partially explained by their capacity to shape emotional interpretations and amplify internal distress. Feger emphasized that automatic negative thoughts often escalate emotional reactions by skewing one's interpretation of daily experiences, which can create a feedback loop that reinforces depression (18). Arimitsu and Hofmann argued that such cognitive distortions mediate the link between self-compassion and negative affect, suggesting that targeting NATs could lead to reductions in depressive symptoms (6). In line with these perspectives, the current findings reinforce the notion that addressing NATs may be particularly effective in reducing depression severity, potentially more so than interventions that focus solely on sleep hygiene.

Moreover, the relationship between NATs and depression may be sustained by the believability and repetition of these thoughts. Gústavsson developed a scale to assess how much individuals believe their

automatic thoughts, revealing that higher believability scores are associated with greater psychological distress (8). This insight aligns with Kamiya and Koda's research, which demonstrated that the interaction between NATs and rumination predicted depressive states in university students (2). Both studies point to the mechanism by which NATs become entrenched, persistent, and emotionally consequential.

Notably, the influence of contextual and developmental factors on NATs has been highlighted in longitudinal studies. Zhang et al. revealed that parental psychological control and bullying experiences predicted increased NATs in children, and that these thoughts in turn predicted future behavioral and emotional difficulties (17). This bidirectional framework offers a developmental explanation for the persistence of NATs and supports the view that early intervention could mitigate long-term psychological consequences. Özbiler et al. also identified that lower parental warmth predicted increased NATs, which mediated the decline in subjective well-being in young adults, illustrating how family environments shape cognitive vulnerability (16).

The finding that both NATs and sleep dysfunction predict depression underscores the need for integrated treatment approaches. Esbjørn et al. argued for the inclusion of cognitive and metacognitive strategies in the treatment of social anxiety in children, a principle equally applicable to depression treatment (7). Similarly, Ayhan and Budak demonstrated that mindfulness, a practice that cultivates metacognitive awareness, was inversely related to NATs among individuals with depression (19). This suggests that interventions enhancing cognitive awareness and behavioral regulation (e.g., sleep routines) may collectively produce optimal outcomes.

Additionally, Pugh's and Tomlinson's therapeutic frameworks suggest that addressing the content and believability of automatic thoughts through methods such as chairwork and cognitive restructuring can provide relief for clients struggling with depressive symptoms (9, 10). These methods may be particularly beneficial when combined with behavioral interventions targeting sleep hygiene, forming a comprehensive treatment model that addresses both primary and secondary symptoms.

While the study presents meaningful findings, several limitations should be acknowledged. First, the cross-sectional design limits causal inferences. Although NATs and sleep dysfunction were associated with depression severity, it is not possible to determine the directionality of these relationships. Longitudinal or experimental designs are necessary to establish causal links. Second, data were collected via self-report measures, which are subject to social desirability bias and may not accurately reflect objective experiences. Third, although the study used a large and demographically diverse sample from Brazil, the results may not generalize to other cultural contexts or clinical populations. Additionally, other potential variables such as anxiety, trauma history, or medication use were not controlled for, which may have influenced the outcomes.

Future studies should adopt longitudinal designs to explore the temporal dynamics between negative automatic thoughts, sleep dysfunction, and depression. Investigating how these variables interact over time would provide deeper insights into their causal relationships and reciprocal effects. Future research may also benefit from including physiological or behavioral measures of sleep (e.g., actigraphy or polysomnography) to corroborate self-report data. Moreover, expanding this line of inquiry to clinical populations—such as individuals diagnosed with major depressive disorder or insomnia disorder—could enhance the clinical applicability of the findings. Research should also consider examining potential

moderating variables such as resilience, coping style, or mindfulness, which may buffer the impact of NATs and sleep problems on emotional well-being.

Mental health practitioners should prioritize the assessment and treatment of negative automatic thoughts when working with individuals experiencing depression. Cognitive restructuring techniques can be effectively used to challenge and modify maladaptive thoughts that contribute to emotional distress. Additionally, interventions aimed at improving sleep quality—such as cognitive-behavioral therapy for insomnia (CBT-I) and behavioral sleep hygiene education—should be integrated into treatment plans for individuals with depression. Combining cognitive and behavioral strategies may yield synergistic effects, addressing both the psychological and physiological aspects of depression. Early intervention and psychoeducation about the role of thoughts and sleep in emotional health may also serve as preventive measures, particularly in populations at risk of developing mood disorders.

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## Authors' Contributions

All authors equally contributed to this study.

## Declaration of Interest

The authors of this article declared no conflict of interest.

## Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Written consent was obtained from all participants in the study.

## Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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