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Investigating the Effect of Loneliness on Panic Disorder Symptoms and Frequency of Panic Attacks in Clients with Panic Disorder with the Mediating Role of Sleep Disorders and the Moderating Role of Social Support

Mohammadreza Javedani[1] (MSc), Fateme Najafi[2] (MSc), Fateme Bazrafkan[3] (MSc), Sepideh Asghari[4] (MSc), Atefeh Ostadzadeh[5] (MSc)

1. Department of psychology, Science and Research Branch, Islamic Azad University, Tehran, Iran
2. Department of Clinical Psychology, Kermanshah Branch, Islamic Azad University, Kermanshah, Iran
3. Department of Psychology, Marvdasht Branch, Islamic Azad University, Marvdasht, Fars, Iran
4. Department of Psychology, Shahre Ghods Branch, Islamic Azad University, Shahrak Ghods, Iran
5. Department of Psychology, Science and Research Branch, Islamic Azad University, Isfahan, Iran

Corresponding Author:
Atefeh Ostadzadeh,
Department of Psychology,
Science and Research Branch,
Islamic Azad University,
Isfahan,
Iran
E-mail: Miss.ostadzade@gmail.com

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Abstract

Introduction: Loneliness is a recognized risk factor for anxiety disorders, yet its mechanisms in panic disorder remain insufficiently examined. The present study investigated the relationships between loneliness, panic disorder symptoms, and panic attack frequency, examining sleep disorders as mediators and social support as a moderator.

Method: This descriptive-correlational, cross-sectional study was conducted among patients diagnosed with panic disorder who referred to psychological clinics in Tehran between July and October 2023. A convenience sample of 158 participants completed the UCLA-R Loneliness Scale, Mini Sleep Questionnaire, Multidimensional Scale of Perceived Social Support, and Acute Panic Inventory. Data were analyzed using Spearman correlations in SPSS-27 and structural path analysis in SmartPLS-4.

Results: Insomnia ($\beta = -0.02$, $p = 0.827$) and hypersomnia ($\beta = 0.02$, $p = 0.675$) did not predict panic attack frequency, but both were positively associated with panic disorder symptoms (insomnia: $\beta = 0.25$, $p = 0.010$; hypersomnia: $\beta = 0.16$, $p = 0.006$). Loneliness was significantly associated with insomnia, hypersomnia, panic symptoms, and attack frequency ($p < 0.01$); insomnia mediated the loneliness–panic symptoms link ($\beta = 0.15$, $p = 0.014$), while social support moderated the loneliness–panic attack frequency relationship ($\beta = -0.16$, $p = 0.021$).

Conclusion: Loneliness significantly exacerbates the severity of panic disorder by increasing insomnia and related panic symptoms, while both insomnia and hypersomnia contribute to greater symptom severity. Social support reduces the impact of loneliness on panic attack frequency, underscoring its protective role in clinical practice and mental health planning.

Keywords: Loneliness, Panic Disorder, Sleep Disorders, Social Support

Introduction

Loneliness, a negative psychological experience, significantly affects mental health and has gained increased attention in recent years due to lifestyle changes and reduced social connections. Loneliness often results from a lack of meaningful emotional relationships and can contribute to the development or worsening of mental disorders [1]. Individuals facing new social challenges, particularly during times of crisis, are more susceptible to feelings of

loneliness and psychological difficulties. Research indicates that loneliness is closely associated with various mental disorders, including social anxiety disorder and depression [2]. Moreover, individuals experiencing loneliness frequently report poorer sleep quality and higher levels of anxiety and depression [3]. Younger individuals and those with a history of mental illness often exhibit the highest levels of loneliness [4].

The psychological effects of loneliness may increase vulnerability to panic attacks through alterations in brain regulation and stress response systems. Loneliness can induce a strong sense of insecurity, priming the brain for heightened anxiety responses and greater susceptibility to panic attacks. These attacks typically stem from emotional isolation and disconnection, linked to disruptions in psychological regulation and hyperactivation of both the brain's fear and loneliness systems [5]. Panic disorder, characterized by sudden episodes of intense fear and discomfort, affects approximately 1.7% of the global population and presents with symptoms such as rapid heart rate, sweating, and chest pain [6]. Individuals with panic disorder often experience pronounced sleep disturbances and elevated anxiety, especially under prolonged stress [7, 8]. Loneliness and disrupted sleep may amplify physiological stress responses, creating a feedback loop that increases vulnerability to panic episodes [7].

Heightened anxiety and stress related to panic disorder can disrupt normal sleep patterns, contributing to insomnia and related sleep disturbances. Patients with panic disorder often face difficulty initiating or maintaining sleep. This disorder is commonly associated with episodes of sleep terrors and dysregulation of the arousal system. The interplay between trauma and panic may alter fear-processing networks in the brain, contributing to clinical symptoms and disruptions in the sleep-wake cycle [8]. Adequate sleep duration is critical for mood regulation, as insufficient sleep can intensify negative emotions and reduce responsiveness to positive experiences [9]. Consequently, disrupted sleep can affect quality of life, cognitive functioning, work performance, and overall physical and mental well-being [10].

Research has demonstrated a higher prevalence of panic disorder in individuals with obstructive sleep apnea [11]. Cramm et al. (2021) reported that individuals diagnosed with insomnia were more likely to experience anxiety disorders, panic disorder, social phobia, and depression [12]. Feelings of fear and profound loneliness can trigger panic attacks, but social support can mitigate these effects. Studies indicate that individuals with strong social support are less likely to experience panic attacks [7]. Social support plays a key role in buffering the negative impact of stress and moderating the relationship between stressful events and their consequences [13]. Engaging in social activities and maintaining frequent contact with others may reduce levels of depression and related psychological symptoms [14, 15].

Panic disorder represents a significant mental health concern that requires a comprehensive examination of contributing factors. The interplay between loneliness, sleep disturbances, social support, and panic symptoms highlights the need for further research to improve understanding and guide treatment and prevention strategies. However, comprehensive information on how loneliness, sleep disturbances, and social support act as mediators and moderators in the onset and severity of panic attacks remains limited. Therefore, this study aims to investigate the impact of loneliness on panic disorder symptoms and attack frequency, considering sleep disturbances as mediators and social support as moderators. By exploring these relationships, the study seeks to provide practical recommendations for enhancing psychological and social interventions for individuals with panic disorder. The conceptual model of the study is presented in Figure 1.

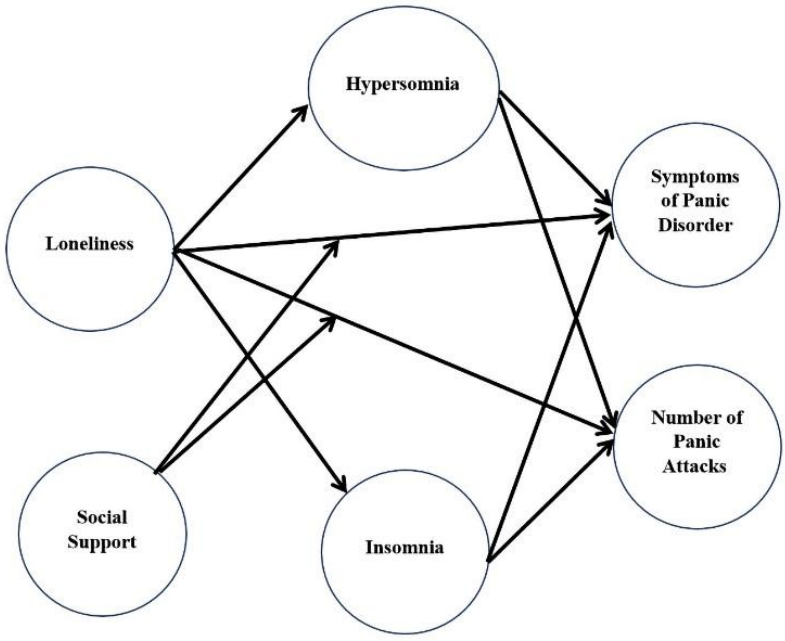

Figure 1. Conceptual framework of the research.

Method

The present investigation used a descriptive-correlational research design and applied a cross-sectional research method. A structural model and path analysis were employed in the study. The statistical population for this study consisted of individuals diagnosed with panic disorder who sought treatment at psychological clinics in Tehran between July and October 2023. A sample of 158 patients diagnosed with panic disorder was selected based on confirmation by specialists at the clinics where the study took place, using the available sampling method. The adequacy of the sample size was determined using Cohen's formula (2013) for the Structural Equation Modeling (SEM) method. The calculation considered the number of observed and latent variables, the anticipated effect size, and the desired probability and statistical power levels [16]. By applying the formula with an anticipated effect size of 0.3, a desired statistical power level of 0.8, six latent variables, 65 observed variables, and a probability level of 0.01, the required sample size was calculated to be 203 people.

The study's inclusion criteria required individuals to have a panic disorder for over a year, be referred to medical centers at the research site with a clinical record, have no acute psychiatric illness or drug abuse, possess sufficient literacy to answer questions, and be willing to participate. Exclusion criteria involved any physical or mental conditions hindering responses and failing to answer more than eight questionnaire items, leading to withdrawal. To begin the research, the researcher obtained necessary permits from their university, then, with professors, were introduced to four psychology and counseling clinics in Tehran (clinic names kept confidential). These clinics were chosen for easy coordination, implementation, and participant communication. The researcher then visited the clinics to arrange research activities.

The counseling clinics then reached out to clients diagnosed with panic disorder, who had past counseling and treatment history at the research clinics, inviting them to participate in the research study. They were provided with detailed information about the research objectives, permits, and guidelines regarding ethical standards. Due to challenges in individual participation, the research process, including in-person and online questionnaire completion, lasted for four months. Ultimately, 158 out of 203 completed questionnaires were used for analysis, with 45 questionnaires being excluded due to incomplete or erroneous responses. Participants self-reported feelings of loneliness, symptoms of panic disorder, sleep disorders, and levels of social support. The study strictly adhered to ethical guidelines, allowing participants to withdraw from the study at their discretion. Participants were assured that their personal information was not disclosed in the research materials, and they had the freedom to opt out of the research at any time.

The tools used in this study were as follows:

Loneliness Scale UCLA-R: The Loneliness Questionnaire was developed by Russell in 1980 to assess loneliness in adolescents. This instrument, known as the UCLA Loneliness Questionnaire, consisted of 20 items, including 10 positively worded and 10 negatively worded statements, rated on a four-point Likert scale. Response options ranged from never (1) to always (4), yielding total scores between 20 and 80, with higher scores indicating greater levels of loneliness [17]. Scores above the mean reflected increased feelings of loneliness. The reliability of the questionnaire was evaluated using internal consistency and test–retest methods. In an Iranian study, the Cronbach's alpha coefficient was reported as 0.83, while in the present study, the Cronbach's alpha coefficient was 0.766 [18].

Mini Sleep Questionnaire (MSQ): The Mini Sleep Questionnaire was developed by Zomer et al. in 1985 to assess the presence of sleep disorders. The questionnaire consisted of six items rated on a seven-point Likert scale [19]. It comprised two dimensions: hypersomnia and insomnia. Items 4, 8, and 9 contributed to the hypersomnia subscale, whereas items 1, 2, and 7 contributed to the insomnia subscale. Higher scores indicated greater severity of sleep disorders. The reliability of the scale was previously evaluated in Iran, with a reported Cronbach's alpha coefficient of 0.79 [20].

Multidimensional Scale of Perceived Social Support (MSPSS): The Multidimensional Scale of Perceived Social Support was developed by Dahlem, Zimet, and Walker in 1988 to assess perceived social support [21]. This self-report questionnaire consisted of 12 items rated on a seven-point Likert scale ranging from strongly disagree (1) to strongly agree (7). The scale included three subscales measuring support from family, friends, and significant others. Total scores ranged from 12 to 84, with higher scores indicating greater perceived social support. In an Iranian study, the Cronbach's alpha coefficient for the scale was reported as 0.88 [22]. In this study, the Cronbach's alpha coefficient was 0.692.

Acute Panic Inventory (API): The Acute Panic Inventory was developed by Liebowitz in 1984 to assess symptoms of panic disorder and acute anxiety attacks [23]. The questionnaire consisted of 27 items rated on a four-point Likert scale ranging from never (1) to severe (4). The items assessed various panic-related symptoms, including somatic and cognitive manifestations such as feelings of detachment from the body. Total scores ranged from 27 to 108, with higher scores indicating greater severity of panic symptoms. In an Iranian study, the Cronbach's alpha coefficient was reported as 0.82 [24]. In the current study, the Cronbach's alpha coefficient was 0.811.

The SPSS 27 was utilized for conducting descriptive statistics and Spearman correlation, while SmartPLS 4 was employed for path analysis. The significance of the mediator variable was determined using the Sobel test, and the moderating variable was examined using JAMOVI 2.4.14. The normality of the research variables distribution was assessed using the Shapiro-Wilk test, with a P-VALUE set at 0.05. The normality of the distribution of the research variables was evaluated using the Shapiro-Wilk test. The significance of this test indicated that the research variables did not follow a normal distribution, leading to the use of SmartPLS software for running the

structural equation model. The researcher's random sampling method aligned with this assumption. With a sample size of 158 individuals, there was adequate data to execute the structural equation model through the partial least squares method.

Results

At first, the descriptive statistics of the variables in the study were analyzed. The participants were segregated into two groups based on gender: males (43.7%) and females (56.3%). Likewise, in education, 31.6% of individuals possessed a diploma or lower, 63.9% held an associate's or bachelor's degree, and 4.4% had obtained a master's degree.

Table 2 displays the mean and variation from the norm of the variables being studied.

Table 3 illustrates the correlation between the research variables using the Spearman correlation coefficient.

Based on Table 3, Loneliness showed a strong and positive correlation with Hypersomnia, Insomnia, Symptoms of panic disorder, and Number of panic attacks ($p<0.01$). Conversely, Loneliness had a significant and negative association with Social Support ($p<0.001$). Just like that, Social Support demonstrated a significant and negative relationship with Hypersomnia, Insomnia, Symptoms of panic disorder, and Number of panic attacks ($p<0.01$). Path coefficients and p-values between variables were analyzed as presented in Table 4. A bootstrap value of 5000 was used in this study.

Table 1. Description of the Demographic Variables

Variables	Groups	F	%	Sample size	Md
Gender	Female	89	56.3	158	1
	Man	69	43.7		
Education	Lower than Diploma and Diploma	50	31.6	158	2
	Associate and Bachelor	101	63.9		
	Master's Degree	7	4.4		

Table 2. Description of the Main Research Variables

Variables	M	SD	Max	Min	N	Skewness	Kurtosis	Shapiro-Wilk	P
Loneliness	48.35	4.46	56	38	158	-0.48	-0.52	0.95	< .001
Hypersomnia	4.46	0.92	7	3	158	1.17	1.58	0.79	< .001
Insomnia	4.77	1.17	7	3	158	0.77	-0.66	0.79	< .001
Social Support	48.79	7.11	60	37	158	-0.13	-0.87	0.92	< .001
Symptoms of Panic Disorder	54.15	9.57	73	39	158	0.24	-0.85	0.94	< .001
Number of Panic Attacks Per Month	11.75	4.68	20	1	158	-0.56	-0.50	0.94	< .001

Table 3. Correlation Between Variables

Variable	1	2	3	4	5	6
1. Loneliness	—					
2. Hypersomnia	0.25**	—				
3. Insomnia	0.61***	0.28***	—			
4. Social Support	-0.81***	-0.16*	-0.68***	—		
5. Symptoms of Panic Disorder	0.63***	0.35***	0.57***	-0.53***	—	
6. Number of Panic Attacks	0.69***	0.20*	0.49***	-0.61***	0.56***	—

* p < .05, ** p < .01, *** p < .001

Table 4. Standard Research Coefficients

Result of the Hypothesis	Path	STDEV	P	T-value	Result
Insomnia -> Number of Panic Attacks	-0.02	0.09	0.827	0.21	rejection
Insomnia -> Symptoms of Panic Disorder	0.25	0.09	0.010	2.57	confirmation
Loneliness -> Insomnia	0.61	0.04	< .001	14.57	confirmation
Loneliness -> Number of Panic Attacks	0.67	0.11	< .001	6.15	confirmation
Loneliness -> Hypersomnia	0.24	0.09	0.009	2.61	confirmation
Loneliness -> Symptoms of Panic Disorder	0.51	0.10	< .001	4.67	confirmation
Hypersomnia -> Number of Panic Attacks	0.02	0.06	0.675	0.41	rejection
Hypersomnia -> Symptoms of Panic Disorder	0.16	0.05	0.006	2.73	confirmation
Social Support -> Number of Panic Attacks	-0.08	0.10	0.416	0.81	rejection
Social Support -> Symptoms of Panic Disorder	0.08	0.11	0.490	0.69	rejection
Social Support x Loneliness -> Number of Panic Attacks	-0.16	0.07	0.021	2.31	confirmation
Social Support x Loneliness -> Symptoms of Panic Disorder	-0.03	0.06	0.611	0.50	rejection
Indirect Effects Between Research Variables					
Loneliness -> Hypersomnia -> Number of Panic Attacks	0.007	0.01	0.717	0.36	rejection
Loneliness -> Insomnia -> Symptoms of Panic Disorder	0.15	0.06	0.014	2.46	confirmation
Loneliness -> Hypersomnia -> Symptoms of Panic Disorder	0.04	0.02	0.114	1.58	rejection
Loneliness -> Insomnia -> Number of Panic Attacks	-0.01	0.06	0.828	0.21	rejection

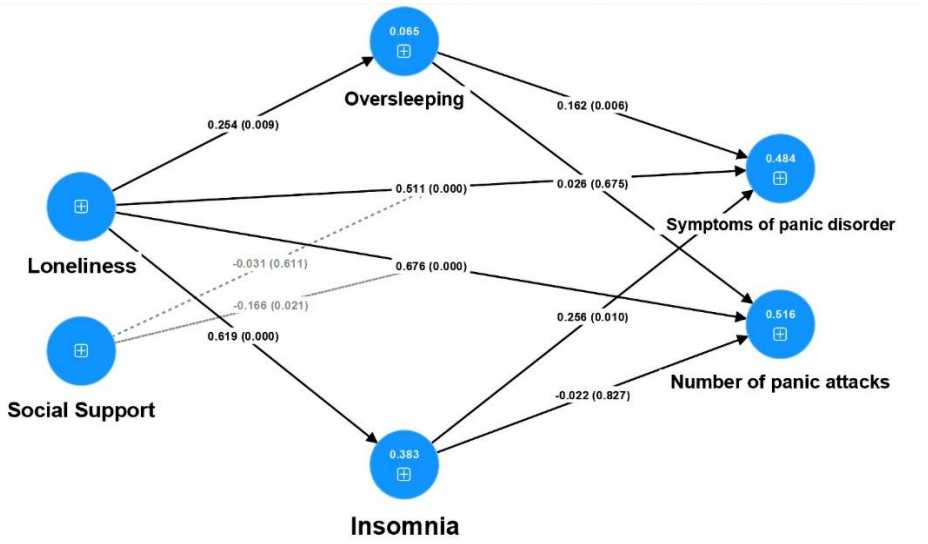

Figure 2. Path coefficients between variables and P-value.

As reported in Table 4, insomnia did not significantly predict the number of panic attacks (β = −0.02, P = 0.827) but showed a significant positive association with panic disorder symptoms (β = 0.25, P = 0.010), while hypersomnia showed a similar pattern (β = 0.16, P = 0.006; attacks: β = 0.02, P = 0.675). Loneliness was significantly associated with insomnia (β = 0.61, P < 0.001), panic attacks (β = 0.676, P < 0.001), hypersomnia (β = 0.25, P = 0.009), and panic disorder symptoms (β = 0.51, P < 0.001). Social support showed no significant direct effects (P > 0.05) but significantly moderated the loneliness–panic attacks relationship (β = −0.16, P = 0.021), while insomnia significantly mediated the effect of loneliness on panic symptoms (β = 0.15, P = 0.014; Sobel Z = 2.54).

Discussion

This study examined the impact of loneliness on panic disorder symptoms and the frequency of panic attacks, considering the role of sleep disturbances and social support. Findings indicated that insomnia and hypersomnia did not directly alter panic attack frequency but exacerbated panic symptoms. Loneliness was associated with increased symptom severity, higher frequency of panic attacks, and disrupted sleep patterns. Social support moderated the relationship between loneliness and panic frequency, and insomnia partially mediated the effect of loneliness on panic disorder symptoms.

These results suggest that sleep disturbances alone may not directly trigger panic attacks, but they can amplify vulnerability to physiological and psychological stress. Prior research demonstrates that loneliness correlates with poorer sleep quality, elevated anxiety, and heightened stress sensitivity, all of which contribute to panic vulnerability [3, 7, 8, 11]. Sleep plays a critical role in regulating the autonomic nervous system and emotional responses; disruptions may increase reactivity to stressors and exacerbate panic disorder symptoms [7–10, 29, 30]. Loneliness may also elevate cortisol and hyperactivate stress-related neural circuits, thereby impacting both sleep quality and susceptibility to panic attacks [25, 26].

Social support buffers these effects by enhancing coping mechanisms and psychological security. Individuals with stronger social networks experience reduced effects of loneliness on panic symptoms, consistent with previous evidence highlighting its moderating role in mental health outcomes [7, 12, 14, 15, 28]. Reduced access to social support increases susceptibility to anxiety responses and stress-related physiological reactions, indirectly influencing panic severity.

The interaction between loneliness, sleep disturbances, and social support illustrates how psychosocial and biological mechanisms jointly influence panic disorder. Loneliness can disrupt sleep, worsening emotional regulation and central nervous system functioning, while social support mitigates these negative effects. This integrated perspective aligns with prior theoretical models and empirical studies emphasizing the multifactorial etiology of panic disorder [3, 7–10, 25, 26].

This study relied on self-report measures, which may introduce bias. Future research should incorporate objective assessments, including structured interviews, physiological monitoring, or polysomnography. Potential confounders, such as overall health status, medication use, comorbid mental disorders, and cultural or social factors, should be carefully controlled. Further investigation into sleep timing and quality is warranted to clarify their role in panic symptomatology across diverse populations.

Conclusion

Loneliness is a key factor in the severity of panic disorder, contributing to increased insomnia and exacerbated symptoms. Although insomnia and hypersomnia may worsen panic symptoms, social support can mitigate the impact of loneliness on panic attack frequency. These findings have practical implications for mental health professionals: interventions enhancing social support and improving sleep quality may reduce the negative effects

of loneliness in individuals with panic disorder. Group-based programs and supportive networks, whether in clinical settings or online platforms, may offer beneficial environments to address loneliness and strengthen coping mechanisms. Educating individuals about the consequences of loneliness on mental and physical health can further promote early intervention and reduce stigma. Future research should evaluate targeted sleep management strategies, including sleep hygiene education, pre-sleep relaxation, and cognitive-behavioral therapy, to alleviate panic disorder symptoms.

Conflict of Interest

The authors declare no conflicts of interest.

Ethical Approval

Participants' privacy and confidentiality were respected, and they were given the option to voluntarily participate or withdraw from the study at any time. The research was approved under the ethical code of IR.SRB.REC. 1402.221.

Declaration of Generative AI and AI-Assisted Technologies

During the preparation of this work, the authors did not use any AI tools.

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