Original Article

The Relationship between Loneliness and Academic Performance among Nursing Students: A Cross-sectional Study at Gonabad University of Medical Sciences

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Abstract

Background: Loneliness is one of the common psychological challenges among medical students and can lead to issues such as class absenteeism and academic underperformance. This study aimed to examine the relationship between loneliness and academic performance among nursing students at Gonabad University of Medical Sciences.

Methods: This cross-sectional study was conducted in 2023 among 176 nursing students at Gonabad University of Medical Sciences, selected through stratified sampling based on academic term. The instruments used for data collection included a demographic questionnaire, students' Grade Point Average (GPA) to assess academic performance, and the UCLA Loneliness Scale. The questionnaires were distributed after obtaining informed consent. Data were analyzed using R4.5.0 software.

Results: The mean age of the students was 21.36 ± 1.63 years. The relationship between loneliness and academic performance was statistically significant by gender (*P* value = 0.002), with a positive association in males ($\beta_{loneliness} = 0.007$) and a negative association in females ($\beta_{loneliness} = -0.019$). Furthermore, a significant relationship was observed between loneliness and academic performance by place of residence (*P* value = 0.001). Among non-dormitory students, the association was positive ($\beta_{loneliness} = 0.044$), while among dormitory students, it was negative ($\beta_{loneliness} = -0.013$).

Conclusion: This study revealed a nuanced relationship between loneliness and academic performance, varying by gender, academic term, and place of residence. Loneliness appears to influence men and women differently. Accordingly, men may exhibit resilience or even improved academic outcomes under loneliness, whereas women tend to experience decreased academic success. Moreover, loneliness among students in higher terms and those living in dormitories may contribute to poorer academic performance.

Keywords: Loneliness, Academic performance, Nursing students

Introduction

Loneliness is an unpleasant and subjective experience defined as a discrepancy between an individual's desired social relationships and the relationships they actually have, and it is usually accompanied by negative emotions such as sadness, anger, and depression (1). This condition can lead to cognitive, emotional, and behavioral maladjustments and affect mental health throughout various stages of life, particularly during adolescence and young adulthood (2,3). Statistics indicate that one out of every four people suffers from loneliness (4). Moreover, previous studies have reported a high prevalence of mild (50.5%) and severe (31.6%) loneliness among medical students (5, 6). Students, as the intellectual and creative human resources of any society, occupy a unique position. Thus, maintaining their mental health is of great importance for enhancing learning and scientific awareness (7)

In recent years, medical students have increasingly faced psychological issues that can lead to problems such as class absenteeism, impaired logical thinking, and academic underachievement (8). A study by Sadeghi Bahmani et al. demonstrated that lower scores in negative emotions (loneliness and depression) and higher scores in positive

emotions (social satisfaction) were associated with higher academic performance (9). Similarly, a study by Zarei et al revealed a positive correlation between loneliness and academic achievement (10), whereas Jefferson et al reported that loneliness exerts a negative effect on academic performance (11).

The most important criterion for the efficiency of educational systems is the satisfactory academic performance of their learners, and the development and improvement of this performance are among the primary educational objectives (12). Academic performance is a process that involves assessment, evaluation, and judgment of a learner's progress over a specified period. From this perspective, performance is considered a strategic process and a vital factor in achieving societal development programs. When implemented continuously and process-orientedly, it enhances individuals' effectiveness and efficiency (13, 14). Academic performance refers to students' ability to complete assigned academic tasks by their instructors (15). Given the importance of scientific, practical, and professional ethical competencies, academic performance holds a special position among nursing students. Therefore, investigating the factors affecting academic performance is of significant importance in this group (16).

The use of statistical models that provide greater analytical detail is of considerable importance. In the present study, the GLMtree model was employed to achieve a more comprehensive examination of the relationships among the variables in question. The GLMtree model is a decision tree in which a Generalized Linear Model (GLM) is fitted to each terminal node (leaf). During the model-building process, a specific stochastic Expectation–Maximization (EM) algorithm is utilized to generate several suitable trees. These trees are then evaluated and selected based on user-defined criteria such as the Bayesian Information Criterion (BIC), Akaike Information Criterion (AIC), or Gini coefficient on the test set (17).

Despite existing studies on the impact of loneliness on mental health, limited data are available regarding its relationship with the academic performance of nursing students. Consequently, the present study aimed to examine the relationship between loneliness and academic performance among nursing students at Gonabad University of Medical Sciences. The innovation of this study lies in the application of the GLMtree model, a tree-based model in which a generalized linear regression is fitted to each leaf, allowing for a more precise analysis of the effects of variables such as gender, place of residence, and academic term.

Methods

This cross-sectional study was conducted in 2023 to examine the relationship between loneliness and academic

performance among nursing students at Gonabad University of Medical Sciences. After obtaining approval from the Student Research Committee of the university (Ethics Code: IR.GMU.REC.1402.083), participants were selected using stratified random sampling based on academic term. Initially, all nursing students were enumerated to determine the total population size. Subsequently, students were stratified according to their academic term, and the proportional share of each stratum was calculated. Within each stratum (from the second to the eighth term), the participants were selected using a simple random sampling technique. After explaining the study objectives and obtaining informed consent, the questionnaires were distributed among the students. All collected data were treated as confidential and used exclusively for research purposes.

The inclusion criteria consisted of willingness to participate and being a bachelor's nursing student in the second term or higher. The exclusion criterion was incomplete questionnaire data. Based on the sample size formula and the findings (18), the minimum sample size was estimated at 160 participants. Considering a potential 10% attrition rate, the final target sample size was set at 176 students.

Instruments
The data collection tools consisted of three measures:
1. Demographic Information Questionnaire: The questionnaire contained items on age, gender, education, place of residence, and academic term.
2. Academic Performance: Academic performance was assessed through Grade Point Average (GPA), which was recorded in a designated section of the questionnaire.
3. UCLA Loneliness Scale: The UCLA Loneliness Scale, developed by Russell, Peplau, and Cutrona (1980), was used to measure loneliness. This 20-item scale consists of 10 negatively worded and 10 positively worded items, rated on a four-point Likert scale ranging from *Never (1)* to *Always (4)*. Scoring is reversed for some items (1,5,6,9, 10,15,16,19,20). The total score ranges from 20 to 80, with higher scores indicating greater perceived loneliness. The scale was initially developed by Russell and later revised three times, with the final version validated across four populations: students, nurses, teachers, and older adults, through self-report and interview-based methods, yielding Cronbach's alpha coefficients ranging from 0.89 to 0.94 (19). In Iran, the validity and reliability of the Persian version of this scale were examined, who translated it into Persian and reported a Cronbach's alpha of 0.78. Factor analysis identified four components: *isolation, sociability, lack of intimate relationships,* and *absence of loneliness,* which together explained 44.2% of the variance in

loneliness scores (20).

Data Analysis

Descriptive statistics, including mean, standard deviation, frequency, and percentage, were used to summarize the data. To examine the overall relationship between loneliness and academic performance, a simple linear regression analysis was initially conducted. Subsequently, to explore the relationship between loneliness and academic performance while considering the effects of demographic variables, the GLMtree model was applied. The use of advanced statistical models that provide a more detailed understanding of data is of particular importance. In this study, the GLMtree model was employed to achieve a more precise examination of the relationships among the variables. The GLMtree is a decision tree model in which a Generalized Linear Model (GLM) is fitted within each terminal node (leaf). During model construction, a specific stochastic Expectation–Maximization (EM) algorithm is used to generate several potential trees. These trees are then evaluated and selected based on user-defined criteria such as the Bayesian Information Criterion (BIC), Akaike Information Criterion (AIC), or the Gini coefficient from the test set (17). All analyses were performed using R software (version 4.5.0), employing the "glmtree" function. A significance level of 0.05 was considered for all statistical procedures.

Results

Data from 176 students were analyzed in this study. Table 1 presents the descriptive statistics for the students' demographic variables. The mean age of the participating students was 21.36 ± 1.63 years, their mean GPA was 16.8 ± 1.32, their mean academic term was 4.64 ± 1.97, and their mean loneliness score was 49.04 ± 6.48. In this study, the frequency of male and female students was equal. The majority of students (76.1%) resided in dormitories, and

Table 1. Demographic characteristics of nursing students

Variable	Level	N (%)
Gender	Female	88 (50.0)
	Male	88 (50.0)
Place of Residence	Dormitory accommodation	134 (76.1)
	Native accommodation	42 (23.9)
Marital Status	Married	23 (13.1)
	Single	153 (86.9)
Religion	Shia	170 (96.6)
	Others	6 (3.4)
Variable	Min–Max	Mean ± SD
Age (year)	19.0–32.0	21.36 ± 1.63
GPA (Score)	13.0–20.0	16.8 ± 1.32
Academic Term	2.0–8.0	4.64 ± 1.97
Loneliness	20.0–71.0	49.04 ± 6.48

approximately 86.9% were single.

Table 2 presents the comparison of mean loneliness and academic performance (GPA) across demographic subgroups of nursing students. The mean loneliness score among female students was 51.17, and among male students it was 50.65 ($P = 0.668$). The mean loneliness score among sixth-term nursing students was 54.07, compared to 49.62 among eighth-term students ($P = 0.521$). The mean loneliness score of non-dormitory students was 51.02, compared to 50.94 among dormitory residents ($P = 0.942$). Furthermore, the mean loneliness score among single students was 51.22, while among married students it was 49.21 ($P = 0.168$).

The results of ANOVA and t-test indicated that the mean academic performance (GPA) among female students (17.14) was significantly higher than that of male students (16.47) ($P < 0.001$). The highest mean GPA was observed among fifth-term students (17.49), whereas the lowest belonged to third-term students (16.37) ($P = 0.009$). Moreover, non-dormitory students had a higher mean GPA (17.44) compared to dormitory students (16.61) ($P < 0.001$). The mean GPA among single students (16.82) was slightly higher than that of married students (16.67) ($P = 0.607$).

Figure 1 illustrates the relationship between loneliness and academic performance among the nursing students in the study. The Pearson correlation analysis revealed a positive correlation between academic performance (GPA) and academic term ($P = 0.020$).

The results of the simple linear regression analysis presented in Table 3 (in which none of the demographic variables were adjusted) showed no statistically significant association between loneliness and academic performance ($P = 0.718$).

As shown in Figure 2, the pattern of the relationship between loneliness and academic performance differed between the male and female students ($P = 0.002$). Among male students, an insignificant positive association was observed, indicating a slight increase in GPA with higher levels of loneliness ($\beta_{loneliness} = 0.007$, $P = 0.771$). In contrast, among female students, an insignificant negative relationship emerged, showing a minor decrease in GPA as loneliness increased ($\beta_{loneliness} = -0.019$, $P = 0.309$). Furthermore, the relationship between loneliness and academic performance varied according to academic term ($P = 0.047$). For students in lower terms (below 6), GPA showed a slight but insignificant increase with higher loneliness ($\beta_{loneliness} = 0.018$, $P = 0.194$), whereas for those in higher terms (above 6), GPA significantly decreased as loneliness increased ($\beta_{loneliness} = -0.073$, $P = 0.004$). Moreover, the association between loneliness and academic performance differed by place of residence ($P = 0.001$). Among dormitory residents, GPA showed a small, insignificant decrease with increasing loneliness ($\beta_{loneliness} = -0.013$, $P = 0.430$), while among non-dormitory

Table 2. Differences in the mean of loneliness and academic performance based on qualitative demographic variables of nursing students

Variable	Categories	Loneliness			Academic Performance		
		Mean ± SD	Statistic	*P* value*	Mean ± SD	Statistic	*P* value*
Gender	Male	50.75 ± 6.25	-0.42	0.668	16.47 ± 1.35	-3.49	<0.001*
	Female	51.17 ± 6.73			17.14 ± 1.19		
Place of Residence	Dormitory	50.94 ± 6.93	-0.07	0.942	16.61 ± 1.34	-3.67	<0.001*
	Native	51.02 ± 4.83			17.44 ± 1.00		
Marital Status	Married	49.21 ± 4.92	-1.38	0.168	16.67 ± 1.51	-0.51	0.607
	Single	51.22 ± 6.66			16.82 ± 1.29		
Religion	Shia	51.12 ± 6.04	0.80	0.458	16.82 ± 1.29	0.87	0.386
	Others	46.33 ± 14.55			16.34 ± 2.04		

* Independent T-test/ ANOVA
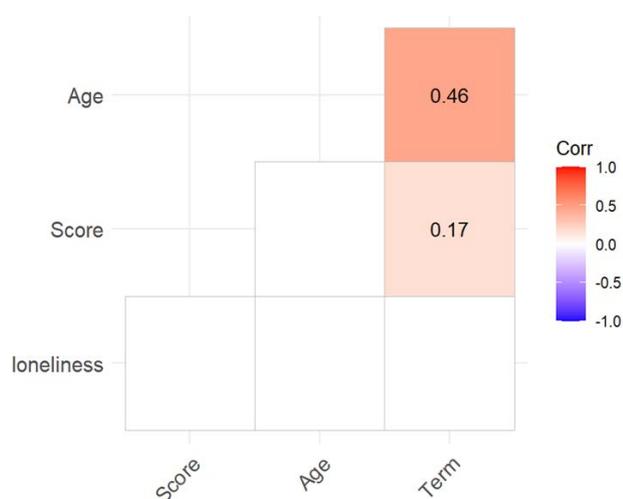
Figure 1. The relationship between loneliness and academic performance among nursing students

Table 3. The relationship between loneliness and academic performance among nursing students

Model	Unstandardized coefficients		t	*P* value	R
	B	SE			
(Constant)	17.09	0.79	21.55	<0.001	0.27
loneliness	-0.01	0.01	-.36	0.718	

students, GPA showed a slight, insignificant increase with higher loneliness ($\beta_{loneliness} = 0.044$, $P = 0.177$).

Discussion

The present study demonstrated that female students exhibited higher academic performance than male students, and non-dormitory students outperformed dormitory residents. Significant differences were observed in the relationship between loneliness and academic performance across subgroups defined by academic term, gender, and place of residence. Specifically, students in terms below 6 showed improved academic performance with increasing loneliness, whereas students in terms 6 and above exhibited a decline in performance as loneliness increased. Among male students, higher loneliness was associated with slightly improved academic performance, whereas among female students, increased loneliness corresponded to a decrease in performance. Similarly, non-dormitory students experienced modest improvements in academic performance with higher loneliness, whereas dormitory students showed a slight decline in performance as loneliness increased.
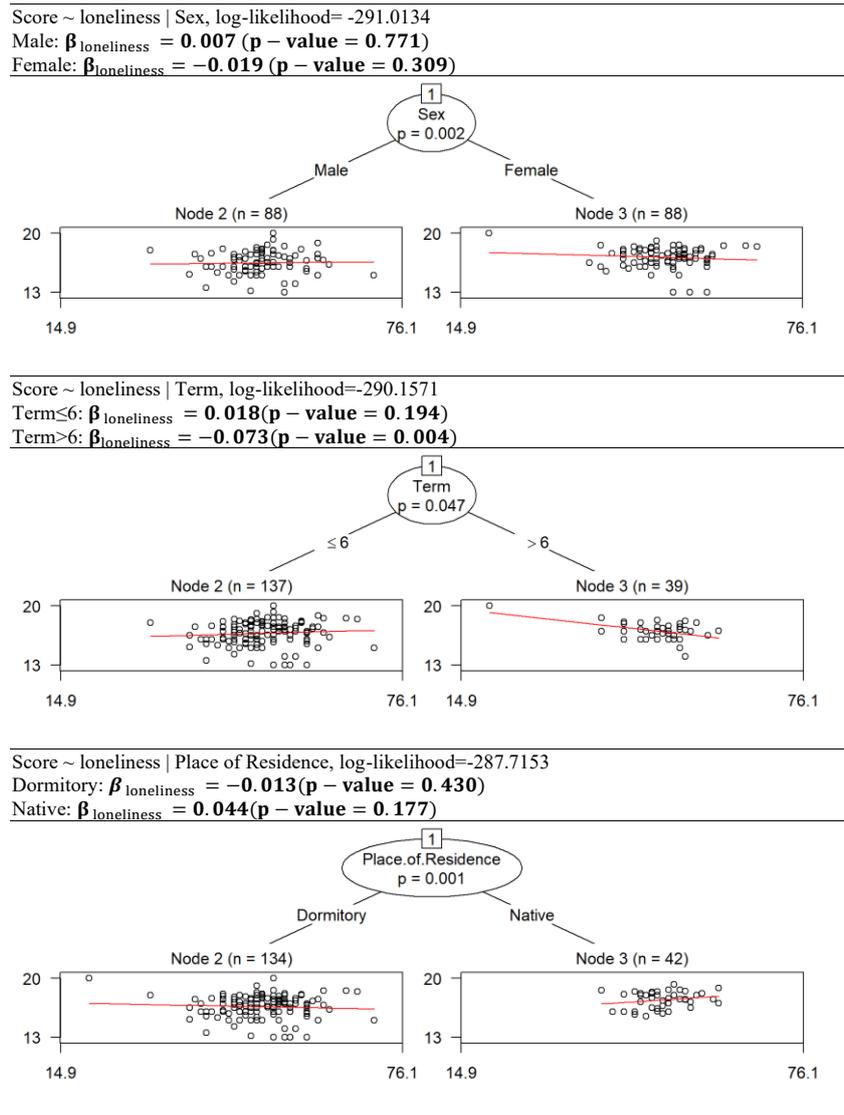
The findings from this study indicated that female students and native (non-dormitory) students generally achieved better academic performance. Consistent with these results, Voyer et al and Duckworth et al reported that female students generally demonstrate superior academic achievement compared to males, attributing this difference to higher self-discipline, better study habits, greater motivation, and more active classroom engagement among women, which facilitates higher grades (21,22). Moreover, Abbaspour et al reported that non-dormitory students outperform dormitory residents academically, identifying residence-related challenges, including homesickness, limited study space, noise, and roommate conflicts, as negative factors influencing academic progress (23). Conversely, a study by de Araujo and Murray indicated that dormitory life could positively affect academic performance, citing proximity to university resources and peer support as possible mechanisms for this positive effect (24). Dormitories with limited shared social spaces may restrict student interactions and socialization, which can indirectly influence academic performance (25). These mixed findings suggest that the impact of dormitory life on academic performance depends on dormitory design, quality of living conditions, roommate relationships, and individual student factors. Therefore, with proper management and supportive environments, dormitory conditions can be optimized to enhance students' academic outcomes.

The present study also revealed that increasing loneliness in students in terms 6 and above was associated with a significant decline in academic performance, whereas in students in terms below 6, higher loneliness was linked to improved performance. These findings align with prior

Score ~ loneliness | Sex, log-likelihood= -291.0134
Male: $\beta_{loneliness} = 0.007 (p-value = 0.771)$
Female: $\beta_{loneliness} = -0.019 (p-value = 0.309)$

Score ~ loneliness | Term, log-likelihood=-290.1571
Term≤6: $\beta_{loneliness} = 0.018 (p-value = 0.194)$
Term>6: $\beta_{loneliness} = -0.073 (p-value = 0.004)$

Score ~ loneliness | Place of Residence, log-likelihood=-287.7153
Dormitory: $\beta_{loneliness} = -0.013 (p-value = 0.430)$
Native: $\beta_{loneliness} = 0.044 (p-value = 0.177)$

Figure 2. The correlation between loneliness and academic performance among the nursing students by adjusting demographic variables using the GLMtree model

research, although previous studies often focused on age or academic level rather than academic term. For instance, a large international study of adolescents (mostly in later years of schooling) by Jefferson et al found that loneliness was associated with poorer academic progress and lower school satisfaction (11). Similarly, a study by Zarei et al investigating the relationship between loneliness, social acceptance, and academic performance found that students experiencing higher loneliness may devote more time to studying, potentially resulting in better academic outcomes (10).

Loneliness, in the absence of social interaction, may encourage students to devote more time to academic activities, particularly when other motivational factors, such as life goals, are present (26). This finding supports our results for early-term students, where loneliness may reduce social distractions and increase study time. Moreover, students in lower terms may still benefit from

social support from family or high school peers, which can buffer the negative effects of loneliness. Conversely, in upper-term students, academic tasks become more complex and collaborative, resulting in higher stress levels (27). These tasks require engagement, motivation, and social support, all of which can be weakened by loneliness, potentially leading to decreased academic performance. Loneliness can act as a job demand, reducing intrinsic motivation and engagement, and consequently impairing academic outcomes (28). Moreover, upper-term students often face greater independence and less social support, making them more susceptible to the adverse effects of loneliness on motivation and academic success (29). This dual effect of loneliness, according to academic terms, may reflect changing academic demands and evolving social needs of students over the course of their university education.

In this study, male students showed improved academic

performance with increasing loneliness, whereas the opposite was observed in female students. Likewise, Liu et al highlighted gender differences in the relationship between loneliness and academic performance. Their longitudinal study indicated that female students are more vulnerable to negative outcomes associated with loneliness, including increased depressive symptoms that may disrupt academic performance (30). It is plausible that males, due to different coping styles or lower emotional distress from loneliness, may channel their focus toward academic work, leading to improved performance. In contrast, loneliness in females is more strongly associated with depressive symptoms and social anxiety, which can undermine motivation, engagement, and academic achievement, resulting in decreased performance.

The present study also showed that dormitory students experienced decreased academic performance with increased loneliness, whereas non-dormitory students displayed the opposite pattern. This finding is supported by Zahedi et al and Alavian et al, who reported a higher prevalence of loneliness among dormitory residents, placing them at increased risk for negative outcomes such as depression and reduced academic motivation, which can directly affect academic performance (5, 29). Dormitory life is identified as a risk factor for loneliness and related mental health issues, as lack of privacy, constant social proximity, and roommate conflicts can exacerbate loneliness and reduce concentration and performance (31, 32). Non-dormitory students, by contrast, benefit from greater family support and familiar environments, which can act as a buffer against loneliness and its adverse effects on academic outcomes.

One of the limitations of this study was its cross-sectional design, which limits causal inference. The research population was restricted to undergraduate nursing students at Gonabad University of Medical Sciences, and therefore, generalization to other disciplines or universities should be approached with caution. Furthermore, cultural and social factors that may influence loneliness and academic performance were not assessed in this study.

Conclusion

The results of this study indicated that loneliness is prevalent among nursing students. However, its relationship with academic performance varies depending on individual characteristics, circumstances, and student context. Findings from the GLMtree statistical model revealed that loneliness may negatively affect academic performance in female students, students in terms 6 and above, and those residing in dormitories, whereas being male, in lower terms, or living off-campus is associated with improved academic performance despite increased loneliness. Hence, addressing loneliness as part of comprehensive student support is essential.

Policymakers and healthcare staff can enhance students' academic performance by implementing targeted mental health interventions, including social support programs, improvements in dormitory conditions, and stress management workshops, particularly tailored to students' academic and individual needs. Moreover, future studies need to employ longitudinal and interventional methods to clarify causal pathways between loneliness and academic performance, as well as to assess the effectiveness of psychosocial interventions in nursing student populations.

Authors' Contribution
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Competing Interests
The authors declare no conflicts of interest.

Ethical Approval
This study was approved by ethic committee of Gonabad University of Medical Science (Ethic code: IR.GMU.REC.1402.083).

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