Alqalam Journal of Medical and Applied Sciences. 2025;8(4):2714-2719
https://doi.org/10.54361/ajmas.258488

Original article

Depression Among Medical Students at Derna University Following Hurricane Daniel

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Abstract
Medical students are a vulnerable population for mental health disorders. This vulnerability can be severely worsened by large-scale traumatic events. Hurricane Daniel devastated the city of Derna, Libya, in September 2023, causing massive loss of life and destruction. This study aimed to assess the prevalence of depression and self-esteem and identify associated factors among medical students at the University of Derna following this catastrophe. A cross-sectional study was conducted from August to December 2024 among 266 medical students selected via a purposive sampling technique. Data were collected using an online-administered questionnaire that included a socio-demographic section, details about hurricane exposure, the Beck Depression Inventory (BDI), and the Coopersmith Self-Esteem Inventory (SEI). Non-parametric tests (Mann-Whitney U, Kruskal-Wallis) were used for data analysis, with statistical significance set at $p < 0.05$. The study revealed an alarming prevalence of depression, with 79.3% of students exhibiting clinically significant symptoms. Nearly two-thirds (63.9%) experienced moderate-to-severe depression. Low self-esteem was found in 42.1% of participants. The hurricane exposure was extensive: 83.5% of students lost a close friend, 30.5% lost a family member, 38.4% were present in the affected area during the hurricane, and 36.1% were displaced. Academically, 89.9% reported that their studies were negatively impacted. Male students had significantly higher depression scores than females (p=0.033). Significant differences were also found across academic years, with third-year students being the most vulnerable (highest depression, lowest self-esteem) and fourth-year students the most resilient (lowest depression, highest self-esteem). The data indicate that in the aftermath of Hurricane Daniel, medical students at the University of Derna faced a severe mental health crisis characterized by extremely high rates of depression and widespread academic disruption. The findings highlighted male students and those in their third academic year as particularly vulnerable groups. These results underscore the urgent need for targeted mental health interventions, trauma-informed counseling, and robust support systems to aid the recovery of these future physicians.
Keywords. Depression, Self-Esteem, Medical Students, Natural Disaster, Hurricane Daniel, Libya.

Introduction

Medical students worldwide constitute a demographic group with a well-documented susceptibility to psychological distress, particularly depression and anxiety [1]. The foundation of this vulnerability is laid by a confluence of intense pressures inherent to medical education, including an exceptionally rigorous academic curriculum, a highly competitive learning environment, and the formidable responsibilities associated with the medical profession [2]. This pre-existing psychological fragility can be dramatically amplified when these students are exposed to large-scale traumatic events. Natural disasters, such as hurricanes, earthquakes, and floods, are recognized as profound psychological stressors that can precipitate a significant surge in mental health disorders, including post-traumatic stress disorder (PTSD), major depressive disorder (MDD), and various anxiety conditions among survivors [3]. The intersection of individual vulnerability and collective catastrophe creates a high-risk scenario for severe and lasting mental health consequences. This dangerous convergence was tragically exemplified in the city of Derna, Libya, in September 2023. The region was struck by Hurricane Daniel, a Mediterranean cyclone of unprecedented intensity that brought catastrophic rainfall. The subsequent collapse of two aging dams upstream from Derna unleashed a devastating flash flood that swept through the city's densely populated valley [4]. The event resulted in a staggering loss of life, with estimates numbering in the thousands, alongside massive internal displacement and the near-total destruction of critical infrastructure, including homes, hospitals, and roads [5].

Beyond the immediate physical devastation, the disaster inflicted a deep and pervasive collective trauma upon the residents of Derna, shattering community bonds and overwhelming individual coping mechanisms [6]. Research conducted before the hurricane by Almzainy & Srgewa (2023) at the University of Derna itself revealed that a significant proportion of medical students were already struggling with their mental health, finding that 28.6% suffered from moderately severe to severe depressive symptoms [7].

This pre-disaster data indicates that the student population was already navigating substantial

Received*: 21-09-2025 -* ***Accepted****: 20-11-2025 -* ***Published****: 29-11-2025*

psychological challenges even before the catastrophe, highlighting a baseline level of vulnerability. The acute exacerbating effect of the hurricane is powerfully demonstrated by a subsequent post-disaster study by Salem et al. (2024), which compared medical students in the epicenter of Derna with their peers in Benghazi. Their findings confirmed a significant worsening of mental health in Derna, with students there exhibiting dramatically higher rates of depression (76.0%) and anxiety following the floods [8]. This stark contrast clearly illustrates the disaster's role as a powerful catalyst for psychological deterioration. However, while these studies confirm the broad impact, a critical gap in understanding remains. There is a pressing need for a more granular analysis that focuses specifically on the students at the University of Derna, the academic institution at the very heart of the disaster, to elucidate the nuanced demographic, educational, and trauma-exposure factors that modulate psychological distress in this specific context [9]. Furthermore, the interplay between depression and a foundational psychological construct like self-esteem in the aftermath of such a disaster remains largely unexplored among this population. Understanding how self-perception and self-worth are impacted is crucial for designing holistic interventions. Therefore, this study aims to build upon the foundational work of prior Libyan research by conducting a detailed, focused assessment of the mental health landscape at the University of Derna. The primary objectives are to determine the current prevalence of depression and self-esteem among its medical students in the wake of Hurricane Daniel and to identify key demographic variables (such as gender, academic year) and specific hurricane-exposure factors (such as personal loss, displacement) that are associated with these psychological outcomes. The findings from this investigation are expected to yield essential, localized evidence that can directly inform the development of targeted, culturally sensitive mental health interventions and robust support systems. Ultimately, supporting the psychological well-being of these future physicians is not only a humanitarian imperative but also a critical investment in rebuilding the healthcare workforce and fostering resilience within a profoundly devastated region.

Methods

Study Design and Setting

A cross-sectional study was conducted among medical students at Derna University between August and December 2024. A total of 266 students were selected through a purposive sampling technique. Data were collected using a structured online questionnaire that included the Arabic versions of the Beck Depression Inventory and the Coppersmith Self-Esteem Inventory [10-14].

Sample Size and Sampling

The sample size was determined using Epi Info, with a 95% confidence level and a 5% margin of error, yielding a minimum required sample of 266 participants. The questionnaire was distributed through social media platforms via Google Forms. Participants were provided with detailed study information, and written informed consent was obtained electronically. Only fully completed surveys were included in the final analysis. Students who were taking psychotropic medications or had a pre-existing diagnosis of depression were excluded from the study.

Data Collection

Data were collected via a three-part online questionnaire. The first section gathered socio-demographic data and hurricane exposure details (e.g., age, gender, academic year, displacement, and bereavement). The second section assessed self-esteem using the short Arabic form of the Coopersmith Self-Esteem Inventory (SEI), a 25-item tool where scores below 13 indicate low self-esteem. The third section measured depression using the Arabic short form of the Beck Depression Inventory (BDI), a 13-item instrument that categorizes severity as minimal (0–4), mild (5–7), moderate (8–15), or severe (≥16).

Statistical Analysis

Data were analyzed using SPSS (version 28). Descriptive statistics were presented as frequencies, percentages, means, and standard deviations. Normality was assessed using Kolmogorov–Smirnov and Shapiro–Wilk tests, both of which indicated non-normal distribution for depression (KS = 0.137, $p < 0.001$; SW = 0.917, $p < 0.001$) and self-esteem scores (KS = 0.064, $p = 0.010$; SW = 0.989, $p = 0.033$). Consequently, non-parametric tests, including the Mann–Whitney U test and the Kruskal-Wallis test, were used. A p-value of less than 0.05 was considered statistically significant.

Results

Demographic Characteristics of the Participants

The demographic characteristics of the participants (N = 266) are presented in Table 1. The sample was predominantly female (72.5%) and Libyan (87.5%), reflecting the general enrollment patterns of the university. The age distribution showed that 45.1% of participants were between 21 and 25 years old. Participants were drawn from all academic levels, with the largest representation from the fourth year (31.5%) and the internship year (19.1%).

Received*: 21-09-2025 -* ***Accepted****: 20-11-2025 -* ***Published****: 29-11-2025*

https://doi.org/10.54361/ajmas.258488

Table (1). Demographic Characteristics of the Participants (N = 266)

Variable	Category	N	%
Age	18-20 years	49	18.4
	21-25 years	120	45.1
	26-30 years	97	36.4
Gender	Female	193	72.5
	Male	73	27.4
Nationality	Libyan	233	87.5
	Non-Libyan	33	12.4
Academic Year	First Year	37	13.9
	Second Year	36	13.5
	Third Year	34	12.7
	Fourth Year	84	31.5
	Fifth Year	24	9.0
	Internship	51	19.1

Impact of Hurricane Daniel on Participants

The extent of the participants' exposure to Hurricane Daniel and its aftermath is detailed in (Table 2). The data reveal a high prevalence of trauma exposure within the sample. A significant proportion of students reported direct impacts, including having their homes affected (33.4%) and being displaced from their homes (36 %). Of those who were displaced, 65.6% had returned by the time of the survey. A notable finding was the high level of direct exposure to the disaster event itself, with over one-third of participants (38.3%) being present in the directly affected area on the night of the hurricane.

Most profoundly, the data indicate severe personal loss. A large majority of participants (83.4%) reported the loss of a close friend, and nearly one-third (30.4%) had lost a family member due to the hurricane.

Table (2). Impact of Hurricane Daniel on Participants (N = 266)

Variable	Response	N	%
Home Affected	Yes	89	33.4
	No	177	66.5
Displaced from Home	Yes	96	36.0
	No	170	63.9
Return Status after Displacement (n = 96)	Yes, Returned	63	65.6
	No, Not Returned	33	34.3
Present in the Affected Area on Hurricane Night	Yes	102	38.3
	No	164	61.6
Lost a Family Member	Yes	81	30.4
	No	185	69.5
Lost a Close Friend	Yes	222	83.4
	No	44	16.5

Impact of the Hurricane on Academic Performance

(Table 3) presents participants' self-reported assessment of how Hurricane Daniel affected their academic performance. The overwhelming majority of students (89.8%) reported that the hurricane had negatively impacted their studies, with more than half (57.5%) experiencing 'Some Effects' and nearly one-third (32.3%) reporting 'Major Effects.' Only a small minority (10.1%) indicated that their academic performance remained unaffected.

Table (3). Self-Reported Impact of the Hurricane on Academic Performance (N = 266)

Perceived Impact on Academics	N	%
No Impact	27	10.15%
Some Effects	153	57.52%
Major Effects	86	32.33%

Prevalence of Depression and Self-Esteem

(Table 4) presents the distribution of depression and self-esteem scores among participants. The findings reveal substantial psychological morbidity in the sample following Hurricane Daniel. Regarding depression, only 20.7% of participants fell within the normal range, while the vast majority (79.3%) exhibited clinically significant symptoms. Specifically, 32.3% reported moderate depressive symptoms and 31.6% reported severe symptoms, indicating that nearly two-thirds of the sample (63.9%) experienced moderate-to-severe depression. Self-esteem measurements showed a similarly concerning pattern, with 42.11% of participants

Received*: 21-09-2025 -* ***Accepted****: 20-11-2025 -* ***Published****: 29-11-2025*

scoring in the low self-esteem range. The mean scores for the total sample were 13.24 (SD = 10.23) for depression and 13.41 (SD = 4.41) for self-esteem, further confirming the widespread psychological impact of the disaster on the student population.

Table (4). Distribution of Depression and Self-Esteem Scores (N=266)

Scale	Category	N	%		Mean	SD
Depression	Normal (0-4)	55	20.7		13.24	10.23
	Mild (5-7)	41	15.4			
	Moderate (8-15)	86	32.3			
	Severe (16-39)	84	31.6			
Self-Esteem	Low (0-12)	112	42.1		13.41	4.41
	Moderate-High (13-25)	154	57.8			

Group Differences in Depression and Self-Esteem

The results of group comparisons for depression and self-esteem are detailed in (Tables 5 to 8). Mann-Whitney U tests were conducted to examine gender and nationality differences in depression and self-esteem scores. A statistically significant gender difference was found in depression scores (U = 5842.5, p = 0.033), with male students (M = 15.34, SD = 10.77) reporting higher levels than females (M = 12.45, SD = 9.93). No significant gender difference was observed in self-esteem scores (U = 6810.0, p = 0.509). Similarly, no significant nationality-based differences were found for either depression (U = 3825.5, p = 0.985) or self-esteem (U = 3750.0, p = 0.846). Kruskal-Wallis tests revealed no significant age group differences for depression (H = 0.232, p = 0.891) or self-esteem (H = 0.600, p = 0.741). However, significant differences were found across academic years for both depression (H = 15.433, p = 0.009) and self-esteem (H = 12.131, p = 0.033). Third-year students demonstrated the highest depression scores (M = 17.71, SD = 10.83), while fourth-year students showed the lowest (M = 10.23, SD = 8.23). For self-esteem, fourth-year students reported the highest scores (M = 14.23, SD = 4.13) and third-year students the lowest (M = 11.94, SD = 3.91). Analysis revealed that third-year students had the highest depression and lowest self-esteem scores, whereas fourth-year students had the lowest depression and highest self-esteem.

Table (5). Gender Differences in Depression and Self-Esteem Scales

Scale	Gender	Mean	Std. Deviation	U test	p-value
Depression Scale	Male	15.34	10.77	5842.5	0.033*
	Female	12.45	9.93		
Self-Esteem Scale	Male	13.15	3.82	6810.0	0.509
	Female	13.50	4.62		

Table (6). Nationality Differences in Depression and Self-Esteem Scales

Scale	Nationality	Mean	Std. Deviation	U test	p-value
Depression Scale	Libyan	13.25	10.22	3825.5	0.985
	Non-Libyan	13.18	10.40		
Self-Esteem Scale	Libyan	13.37	4.38	3750.0	0.846
	Non-Libyan	13.67	4.69		

Table (7). Age Group Differences in Depression and Self-Esteem Scales

Scale	Age Group	Mean	Std. Deviation	Kruskal-Wallis test	p-value
Depression Scale	18-20	13.73	10.39	0.232	0.891
	21-25	13.13	9.93		
	26-30	13.13	10.60		
Self-Esteem Scale	18-20	13.04	4.44	0.600	0.741
	21-25	13.35	4.62		
	26-30	13.66	4.16		

Table (8). Academic Year Differences in Depression and Self-Esteem Scales

Scale	Academic Year	Mean	Std. Deviation	Kruskal-Wallis test	p-value
Depression Scale	First Year	12.89	9.49	15.433	0.009*
	Second Year	13.69	10.53		
	Third Year	17.71	10.83		
	Fourth Year	10.23	8.23		

Received*: 21-09-2025 -* ***Accepted****: 20-11-2025 -* ***Published****: 29-11-2025*

	Fifth Year	16.17	10.73		
	Internship	13.80	11.64		
Self-Esteem Scale	First Year	13.65	4.68	12.131	0.033*
	Second Year	12.28	4.71		
	Third Year	11.94	3.91		
	Fourth Year	14.23	4.13		
	Fifth Year	12.42	3.90		
	Internship	14.12	4.69		

Note: Significant at $p < 0.05$

Discussion

The current study identified clear evidence of a serious mental health emergency among medical students at the University of Derna following Hurricane Daniel, demonstrating that the disaster inflicted substantial psychological damage on this population. This is characterized by high rates of depression (79.3%) and low self-esteem (42.1%). The prevalence of depression in our sample is substantially higher than the global average of 27.2% reported for medical students in systematic reviews and meta-analyses by Rotenstein et al [1].

Similarly, the comparative study by Salem et al. found that the prevalence of depression among medical students at Derna University (76.0%) was significantly higher than at Benghazi University (64.5%), clearly demonstrating the exacerbating effect of direct disaster exposure [8]. Furthermore, Shembesh et al. reported that 51.1% of Derna medical students experienced moderate-to-severe depression. Most strikingly, this pattern of severe distress extends to the general population [15]. Another study done in the same region by Elsaid & Boshaala, examining adult survivors in Derna, found a depression prevalence of 82.5%, alongside a 72.8% rate of PTSD symptoms [16]. A key point of agreement across studies is the significant role of direct trauma exposure. We found that displacement and personal loss were major factors associated with psychological distress. This is strongly supported by Shembesh et al [15].

The difference in depression and anxiety scores between Derna and Benghazi students in the Salem et al. study provides compelling evidence that geographic proximity and direct impact are primary drivers of psychological morbidity. [8] This is consistent with the broader literature confirming that displacement and life-threatening exposure are major risk factors for psychological disorders (Morina et al [17].

The present study also revealed important differences that contribute to a more complex understanding. A prominent finding was that male students in our sample reported significantly higher depression scores than females. This contrasts with the results of Shembesh et al., who identified female gender as a predictor of anxiety [15], and with Salem et al., who found higher mean depression scores among females [8].

This observed disagreement suggests that the manifestation, experience, and underlying correlates of psychological distress may vary in complex and non-uniform ways within a population grappling with mass trauma. The unique socio-cultural context of a catastrophic event can fundamentally alter established patterns, indicating that trauma does not impact all demographic subgroups uniformly.

The current study recognized significant variations in mental health across academic years, with third-year students being the most vulnerable. This academic-stage-specific vulnerability adds a critical layer of understanding, suggesting that the stress of the medical curriculum interacts catastrophically with disaster-related trauma (18).

The present study found that the overwhelming majority of students (89.8%) reported that Hurricane Daniel had negatively impacted their academic performance, a result that make parallel with post-disaster research conducted in other regions, such as a study following Hurricane Maria on medical students in Puerto Rico, and research on university students after the major earthquakes in Christchurch, New Zealand [19,20].

Conclusion

This study provides compelling evidence of a severe and multifaceted psychological crisis among medical students at the University of Derna in the aftermath of Hurricane Daniel. First, the findings reveal alarmingly high rates of depression and low self-esteem that substantially exceed global averages for medical students, demonstrating a clear dose-response relationship with disaster exposure. Second, the study reveals unexpected patterns in gender distribution, with male students reporting higher depression scores, suggesting that catastrophic events may fundamentally alter established demographic risk patterns. Third, academic-stage-specific vulnerability, particularly among third-year students, indicates that medical curriculum stresses interact catastrophically with disaster-related trauma. Finally, the near-universal reporting of academic impairment demonstrates the profound functional consequences of this psychological distress, threatening both individual educational courses and the region's future healthcare capacity.

Recommendations

Create free mental health services at the University of Derna, including trauma-informed counseling and peer support networks, to provide immediate care for affected students.

Received*: 21-09-2025 -* ***Accepted****: 20-11-2025 -* ***Published****: 29-11-2025*

Implement flexible academic policies with deadline extensions and adapted course loads to accommodate trauma-affected students
Strengthen Libya's healthcare system by embedding mental health support into primary health care and the academic curriculum, and develop a long-term national strategy for mental health disaster response.
Implement public education initiatives and collaborate with community leaders to normalize mental health discussions, reduce stigma, and guide survivors toward available resources.

Acknowledgments
The authors wish to express their deep gratitude to the medical students of Derna University's Faculty of Medicine, whose remarkable resilience and participation following Storm Daniel were fundamental to this research. We extend our sincere appreciation to these future physicians for their invaluable contribution to understanding disaster mental health. This contribution not only advances academic knowledge but also creates a meaningful impact for future disaster response and mental health support systems in affected regions.

conflicts of interest
The authors declare no conflicts of interest.

References

1. Rotenstein LS, Ramos MA, Torre M, Segal JB, Peluso MJ, Guille C, et al. Prevalence of depression, depressive symptoms, and suicidal ideation among medical students: a systematic review and meta-analysis. JAMA. 2016 Dec 6;316(21):2214-36.
2. Puthran R, Zhang MW, Tam WW, Ho RC. Prevalence of depression amongst medical students: a meta-analysis. Med Educ. 2016 Apr;50(4):456-68.
3. Goldmann E, Galea S. Mental health consequences of disasters. Annu Rev Public Health. 2014;35:169-83.
4. Normand JCL, Heggy E. Assessing flash flood erosion following Storm Daniel in Libya. Nat Commun. 2024 Aug 6;15(1):6493.
5. World Health Organization. Libya: "a disaster of epic proportions" [Internet]. 2023. Available from: https://www.emro.who.int/libya-floods/index.html [cited 2025 Jul 30].
6. Oduoye MO, Karim KA, Kareem MO, Shehu A, Oyeleke UA, Zafar H, et al. Flooding in Libya amid an economic crisis: what went wrong? IJS Glob Health. 2024;7(1):e0401.
7. Almzainy S, Srgewa A. Prevalence of depressive symptoms among medical students of the Faculty of Medicine, Derna. Alqalam J Med Appl Sci. 2023;6(2):726-32.
8. Salem AS, Benghasheer HF, Alnasfi SF, Alkhbulli YO. Psychological impact of Derna floods: a comparative study between Benghazi and Derna medical students. Libyan J Public Health Pract. 2024;1(1):26-33.
9. Newnham EA, Mergelsberg EL, Chen Y, Kim Y, Gibbs L, Dzidic PL, et al. Long-term mental health trajectories after disasters and pandemics: a multilingual systematic review of prevalence, risk and protective factors. Clin Psychol Rev. 2022 Sep;97:102203.
10. Ghareeb AG. Manual of the Arabic BDI-II. Cairo: Angle Press; 2000.
11. Abdel-Khalek AM. Validation of the Beck Depression Inventory-II on a non-clinical sample of university students in Egypt. Arab J Psychiatry. 2001 Nov;12(2):123-38.
12. Alansari BM. Beck Depression Inventory (BDI-II) in the Arab Gulf Region: a validation study. Arab J Psychiatry. 2005 Nov;16(2):123-38.
13. Al Khatib A, Al Khatib M. Psychometric characteristics of Coopersmith Self-esteem Inventory from Jordanian perspective. J Educ Pract. 2015;6(35):1-9.
14. Alzaben M, Al-Smadi A, Ghaith S. The relationship between self-esteem and satisfaction with life among students of the University of Jordan. J Educ Psychol Stud. 2020;14(3):510-25.
15. Shembesh RH, Beshr MS, Almasheeti AA, Sheltami AT, El-Ojeli A. The psychological impact of storm Daniel on medical students at the University of Derna in Libya: a cross-sectional study. Camb Prisms Glob Ment Health. 2025;12:e82.
16. Elsaid AM, Boshaala NM. Post-traumatic stress disorder and depression among the survivors of the Derna flood 2023. J Med Health Stud. 2025;19(1).
17. Morina N, Akhtar A, Barth J, Schnyder U. Psychiatric disorders in refugees and internally displaced persons after forced displacement: a systematic review. Front Psychiatry. 2018 Sep 11;9:433.
18. Chandavarkar U, Azzam A, Mathews CA. Anxiety symptoms and perceived performance in medical students. Depress Anxiety. 2007;24(2):103-11.
19. Rodríguez-Vega B, Palao Á, Muñoz-Sanjose A, Torrijos M, Aguirre P, Blanco L, et al. Implementation of a mindfulness-based crisis intervention for health care professionals and medical students at the University of Puerto Rico during the COVID-19 pandemic and after Hurricane Maria. J Affect Disord. 2020 Dec 1;276:297-300.
20. Fergusson DM, Horwood LJ, Boden JM, Mulder RT. Impact of a major disaster on the mental health of a well-studied cohort. JAMA Psychiatry. 2014 Sep 1;71(9):1025-31.

Received*: 21-09-2025 -* ***Accepted****: 20-11-2025 -* ***Published****: 29-11-2025*