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Psychological Impact of Derna Floods: A Comparative Study between Benghazi and Derna Medical Students

Asma S. Salem^{1*}, Hala F. Benghasheer², Saud F. Alnasfi³, Yathrep O Alkhbulli³

^{1,3} Family and Community Medicine Department, Faculty of Medicine, University of Benghazi, Libya

² Dental Public Health and Preventive Dentistry Department, Faculty of Dentistry, University of Benghazi, Libya

³ Microbiology and Immunology Department, Faculty of Medicine, University of Zawia, Libya

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ABSTRACT

Psychological morbidities, including depression and anxiety, have been linked to flood exposure. The current study aimed to assess and compare the psychological effects of the Derna floods among medical students in the affected and non-affected areas and identify associated factors related to the crisis among medical students at Derna and Benghazi Universities. A cross-sectional study was conducted through a web-based questionnaire. The demographic characteristics, generalized anxiety disorder (GAD-7) scale, and patient health questionnaire (PHQ-9) scale were used to collect data. The data were analyzed using the Statistical Package for the Social Sciences (SPSS). All statistical analyses were performed at $P < 0.05$. A total of 707 completed web-based questionnaires were included in the analysis, of which female responses constituted 477 (67.5%) and male responses constituted 230 (32.5%). The prevalence of depression among students from Derna University was higher (76.0%) as compared to those from the University of Benghazi (64.5%). The depression score was significantly higher ($P = 0.001$) in Derna students (mean = 14.65, SD = 6.3) compared to Benghazi students (mean = 12.64, SD = 6.7). Derna students also had significantly higher anxiety scores (mean = 14.42, SD = 4.4) compared to Benghazi students (mean = 12.23, SD = 4.8, $p = 0.0001$). The mean score for depression was significantly higher among female and preclinical-year students ($p = 0.0001$). A startlingly high prevalence of anxiety and depression symptoms was evident among medical students after the Derna disaster. Effective intervention strategies are crucial in supporting the mental health of affected individuals and facilitating recovery and rebuilding.

* Corresponding author: Asma S Salem
E-mail address: asma.salem@uob.edu.ly

1. Introduction

Disasters are a complicated worldwide issue; they are an inescapable part of our lives.¹ They can be either man-made or natural, and they can disrupt the social and psychological well-being of the population. Natural disasters such as earthquakes, floods, and hurricanes can wreak havoc on communities and create lasting impacts on people's mental health.² Numerous detrimental effects of flooding on human health include a higher chance of drowning, injury, and property loss. People are also exposed to various health-related issues, from morbidity to mortality.³

Psychological morbidities including depression, anxiety, suicidal thoughts, and post-traumatic stress disorder (PTSD) have been repeatedly linked to flood exposure.^{4,5} Individuals impacted by the floods may anticipate experiencing short-term psychological anguish. Although the majority of individuals recover from these stress reactions, a sizable minority will continue to experience mental health issues.⁶

Depressive disorders and anxiety are among the leading causes of the overall global burden of disease and disability. Psychological disorders significantly affect the quality of life, including the physical and psychosocial domains.⁷ Moreover, medical students are more susceptible to developing emotional disturbances. This could be due to the stress associated with the academic environment, the pressure to succeed, or the difficulty of balancing their studies with other aspects of life. Furthermore, this can lead to depression, anxiety, and other mental health issues.^{8,9,10}

The catastrophic flooding in eastern Libya (Derna) in September 2023 caused widespread destruction, with whole neighborhoods flushed away and thousands of people killed. It has been anticipated that medical students who reside in locations devastated by the recent floods could be psychologically distressed. It is commonly established that for numerous individuals, experiencing some degree of distress in response to these events is acceptable and understandable, however, it might

additionally end in more chronic mental health issues.⁸

Medical students are a part of the population during the disaster, and measuring the psychological impact of a disaster on them can help to identify potential mental health issues that need to be addressed. It can also provide a better understanding of the psychological effects of disasters on the larger population.

Therefore, the current comparative study aims to assess the psychological effects of the Derna flood among two populations of affected and non-affected individuals. As well as to determine the risk factors that can increase the psychological effect among medical students, such as previous mental problems and loss of relatives in the Derna crisis.

2. Methodology

2.1. Study Design and Sampling

This was a cross-sectional study. The study population comprised of undergraduate medical students at Benghazi University, and Derna University (the flood-affected area). who consented to participate by filling out the questionnaire link.

The sample was recruited through a probability proportional to size sampling (PPS) technique. Among 5134 medical students enrolled at Benghazi University in 2023, 515 were recruited randomly (proportion 1:10), while the total number of medical students enrolled in the same year at the University of Derna was 980 students; 192 were randomly recruited in the study (proportion 1:5).

2.2. Data Collection

The data was collected through e-links using Google Forms over the period from October 15th to November 30th, 2023 (after a month of flood disaster). Students who volunteered to participate electronically submitted their consent after being informed of the study's objectives.

The patient health questionnaire (PHQ-9)¹¹ scale was applied to measure the level of depression (Appendix 1). The Generalized Anxiety Disorder 7 (GAD-7)¹² scale, which is the most frequently used anxiety measure in clinical practice and research due to its

diagnostic reliability and efficiency, was used to quantify the level of anxiety (Appendix 2). Excellent internal consistency has been shown by the well-validated GAD-7 screening instrument (Cronbach's $\alpha = 0.911$).

2.3. Statistical Analysis

The Statistical Package for the Social Sciences (SPSS), Version 25 has been employed to analyze the data. Standard deviation, mean, frequency, and percentages have all been employed to record descriptive statistics. Comparison differences in proportions were assessed using the chi-square test, whereas comparisons in means were assessed using the independent sample t-test. All statistical analyses were performed at a P value less than 0.05. The odds ratio (OR) and confidence interval (CIs) were used to determine the association in terms of which odds are larger and by how much between depression and risk factors, which in this study are identified as having relatives or friends who were flood victims, lost of any family members in the flood, and suffer from any psychological problems before.

3. Results

A total of 707 completed web-based questionnaires were included in the analysis, of which female responses constituted 477 (67.5%) and male responses constituted 230 (32.5%). Table 1 presents the sample characteristics of the participating medical students; around 41.4% were from the age group (22-25). The majority of students 675 (95.5%), were of Libyan nationality. More than two-thirds (72.8%) of students were from the University of Benghazi, compared to 27.2 % from Derna University. The discussion can be conducted in several sub-chapters.

The overall prevalence of depression was 67.6% among the medical students, with 18.8% who reported severe depression. One quarter (25.7%) had moderately severe depression, followed by 23.1% with moderate depression and 20.2% with mild depression (Table 2). The prevalence of depression among students from Derna University was higher (76.0%) as

compared to those from the University of Benghazi (64.5%), Regarding anxiety, the overall prevalence was 74.1%, with more than one-third reporting severe and moderate levels of anxiety, 39.9% and 34.2%, respectively.

Table 1: Sociodemographic Characteristics of Participants

Sociodemographic Characteristics	Number (%)
Gender	
Male	230 (32.5%)
Female	477 (67.5%)
Nationality	
Libyan	675 (95.5%)
Non-Libyan	32 (4.5%)
Age Groups	
18-21 years	190 (26.9%)
22-25 years	293 (41.4%)
> 25 years	224 (31.7%)
Academic Year	
First-year	103 (14.6%)
Second year	148 (20.9%)
Third year	113 (16.0%)
Fourth-year	122 (17.3%)
Fifth year	97 (13.7%)
Intern	124 (17.5%)
University	
University of Benghazi	515 (72.8%)
Derna University	192 (27.2 %)
Total	707 (100%)

Table 2: Participant distribution based on depression severity using PHQ9

Depression	N (%)		
	Benghazi	Derna	Total
No Depression	19	2	21
0	3.7%	1.0%	3.0 %
Minimal	52	13	65
1-4	10.1%	6.8%	9.2%
Mild	112	31	143
5-9	21.7%	16.1%	20.2 %
Moderate	121	42	163
10-14	23.5%	21.9%	23.1%
Moderately	124	58	182
severe	24.1%	30.2%	25.7%
15-19			
Sever	87	46	133
20-27	16.9%	24.0%	18.8%
Clinical	332	146	478
depression $\geq$	64.5%	76.0%	67.6%
10			
Total	515	192	707
	100.0%	100.0%	100.0%

Regarding anxiety, the overall prevalence was 74.1%, with more than one-third reporting severe and moderate levels of anxiety, 39.9% and 34.2%, respectively. On the other hand, minimal and mild levels of anxiety were reported by 4.8% and 21.1%, respectively (Table 3). The prevalence of anxiety among students from Derna University was higher (85.9%) as compared to those from the University of Benghazi (69.7%). Figure 1

shows the prevalence of clinical depression and anxiety (score>10) among medical students from both universities.

Results indicated that depression was significantly higher ($P = 0.001$) in Derna students (mean =14.65, SD 6.3) compared to Benghazi students (mean 12.64, SD= 6.7).

Derna students (Mean= 14.42, SD= 4.4) compared to Benghazi students (Mean= 12.23, SD= 4.8), $p = 0.0001$ (Table 4).

Table 3: Participant distribution based on Anxiety severity using GAD-7

Anxiety		N (%)		
		Benghazi	Derna	Total
Minimal	0-4	30 5.8%	4 2.1%	34 4.8%
Mild	5-9	126 24.5%	23 12.0%	149 21.1%
Moderate	10-14	181 35.1%	61 31.8%	242 34.2%
Sever	15-21	178 34.6%	104 54.2%	282 39.9%
Clinical anxiety ≥ 10		359 69.7%	165 85.9%	524 74.1%
Total		515 100.0%	192 100.0%	707 100.0%

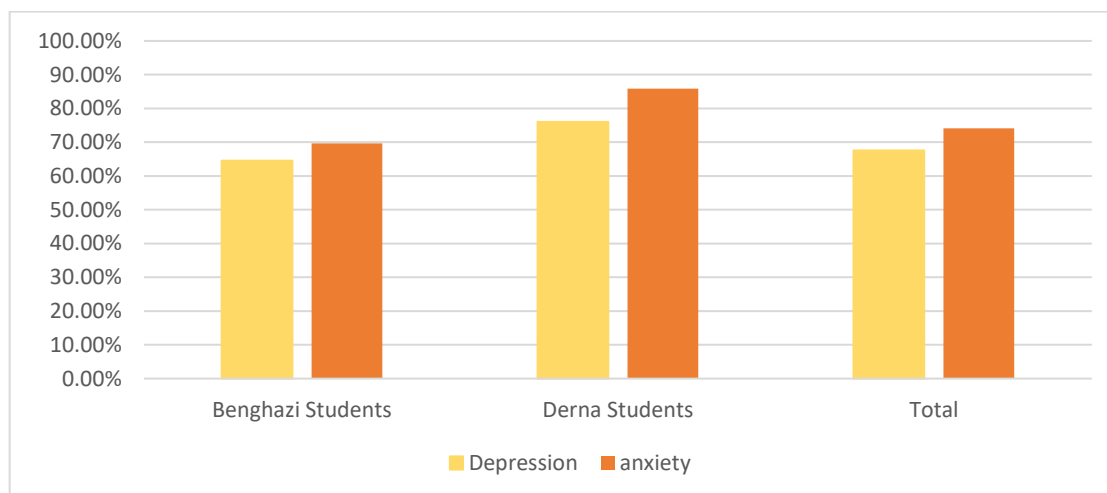


Figure 1: Prevalence of clinical depression and anxiety (score>10)

Subsequent analysis revealed that, in comparison to male students, female students displayed significantly higher mean scores for anxiety and depression (mean = 13.70, SD=6.3) vs. 12.12, SD=7.2), $p = 0.05$; for anxiety (mean = 13.96, SD=4.6) vs. 10.46, SD=4.2), $p = 0.0001$ (Table 4).

Additionally, the mean depression score for pre-clinical students had been determined to be

significantly higher than that of clinical students (mean = 14.35, SD = 6.7) vs. (mean = 12.54, SD = 6.5), $p = 0.001$). Pre-clinical and clinical year students' mean anxiety scores, however, did not change significantly ($p > 0.05$; Table 4).

The association between depression and risk factors is displayed in Table 5. Having friends or family who were affected by flooding ($X^2=11.34$, $df=1$, $P=0.0001$), losing any family

members ($X^2=4.5$, $df=1$, $P=0.03$), and having psychiatric issues in the past ($X^2=5.58$, $df=1$, $P=0.01$) were all substantially linked to depression. Medical students who had family members harmed by flooding were 0.89 times more likely to experience depression ($OR=0.89$, $95\% CI=0.849-0.946$), and those who had previously experienced psychological issues were nearly three times as probable to experience depression ($OR=2.92$, $95\% CI=1.154-7.409$). Those who had flood victims in their own families were two times as likely to experience depression ($OR=2.09$, $95\% CI=1.353-3.230$).

A significantly higher proportion of females and students from Derna University had long-term symptoms than males and those from Benghazi University ($p=0.0001$). As shown in Table 6, female students were almost twice as likely to have long-term symptoms ($OR=1.85$, $95\% CI=1.335-2.587$), and the likelihood of long-term complaints is almost threefold (3.89) higher for individuals from Derna University ($OR=3.65$, $95\% CI=2.360-5.671$).

4. Discussion

It is well documented that the prevalence of depression and anxiety among medical students is significantly higher than among their peers in other specialties due to the stress of their studies and the pressure to succeed.⁷ The estimates of

the prevalence of depression and anxiety in medical students range from 1.4% to 73.5%.^{13,14} The present study revealed an overall substantially higher prevalence rate of depressive and anxiety symptoms 67.6% and 74.1%, respectively, than that reported in the other studies among medical students.¹⁵ Overall, the regional distribution demonstrated that the Middle East reported the highest incidence of depression among medical students (31.8%), followed by North America (30.3%), Asia (30.1%), South America (26.8%), and Europe (20%).¹⁶ It was reported that medical students in Middle Eastern nations, notably Libya, had the greatest depression rates.¹⁷

Moreover, the current study indicated a higher prevalence (76.0%) of clinical depression (PHQ score ≥ 10) as compared with a previous study conducted among medical students before the flood at Derna University, where the prevalence of clinical depression was 56%.¹⁸

The high prevalence in this study could be explained by the fact that natural disasters such as flooding can exacerbate these conditions. The prevalence of depression and anxiety among medical students during flooding can be influenced by various factors such as the disruption of academic activities, displacement from homes, financial stress, and increased workload due to disaster response efforts.¹⁹

Table 4: Comparison of Depression and Anxiety based on gender, university, study year

	Characteristics	Mean (SD)	T statistic	95% CI		P Value
				Lower	Upper	
Depression	Male	12.12 (7.2)	-2.821	-2.674	-0.478	0.05*
	Female	13.70 (6.3)				
	Benghazi University	12.64 (6.7)	-3.595	-3.102	-0.910	0.0001***
	Derna University	14.65 (6.3)				
	Pre-clinical years	14.35 (6.7)	3.480	0.787	2.825	0.001**
	Clinical years	12.54 (6.5)				
Anxiety	Male	10.46 (4.2)	-9.970	-4.193	-2.812	0.0001***
	Female	13.96 (4.6)				
	Benghazi University	12.23 (4.8)	-5.503	-2.967	-1.406	0.0001***
	Derna University	14.42 (4.4)				
	Pre-clinical years	13.18 (4.9)	1.476	-0.183	1.295	0.141
	Clinical years	12.63 (4.6)				

* $P<0.05$, ** $P<0.01$, *** $P<0.001$,

Independent samples t-test was used to compare means

Table 5: Association between depression and risk factors

Risk factors		Depression Count (%)		X ² (df)	P value	Odds Ratio 95% Confidence Interval		
		No	yes			OR	Lower Bound	Upper Bound
Do you have relatives or friends who were flood victims?	No	71 67.0%	296 49.3%	11.34 (1)	0.001***	2.09	1.353	3.230
	Yes	35 33.0%	305 50.7%					
have you lost any of your family members in the flood?	No	16 100.0%	138 78.4%	4.30 (1)	0.03*	0.89	0.849	0.946
	Yes	0 0.0%	38 21.6%					
Do you suffer from any psychological problems before?	No	101 95.3%	525 87.4%	5.58 (1)	0.018**	2.92	1.154	7.409
	Yes	5 4.7%	76 12.6%					

Table 6: Duration of symptoms (short or long-term) and association with gender, place of residence, academic year level

Do the previously mentioned symptoms persist	N (%)		X ² (df)	P value	Odds Ratio 95% Confidence Interval		
	No (Short)	Yes (Long)			OR	Lower Bound	Upper Bound
Male	95 42.0%	135 28.1%	13.66 (1)	0.001	1.859	1.335	2.587
Female	131 58.0%	346 71.9%					
Benghazi University	198 87.6%	317 65.9%	36.62 (1)	0.001	3.658	2.360	5.671
Derna University	28 12.4%	164 34.1%					
Pre-clinical years	78 34.5%	173 36.0%	1.14 (1)	0.706	0.938	0.674	1.307
Clinical years	148 65.5%	308 64.0%					
Total	226 (32.0%)	481 (68.0%)					

*P<0.05, **P<0.01, ***P<0.001

The chi-square test was used to compare proportions

This is further supported by our results, where the depression and anxiety scores were significantly higher among medical students from the affected city (Derna) as compared to those from the non-affected city (Benghazi). Natural disasters have been found to have a significant effect on mental health, leading to disorders such as generalized anxiety disorder (GAD), depression, substance use, post-traumatic stress disorder (PTSD), and adjustment disorder.²⁰

Additionally, it has been observed that female medical students exhibit higher levels of depression and anxiety relative to their male counterparts. The current findings are in line

with the conclusions of multiple previous studies conducted in various nations and areas, which include Pakistan, India, Turkey, and the Middle East, which have noted significant gender variations in the prevalence of anxiety, with females being more likely than males to experience it.^{21,16,22 23,24}

Besides the role of biological factors, e.g. hormonal fluctuations, that could make female medical students more susceptible to mood disorders. One of the possible explanations for this difference is the unique stressors and challenges that female medical students may face. Studies have shown that female medical students often juggle multiple roles, such as

student, caregiver, and potentially mother or spouse, which can lead to increased stress and pressure.²⁵ Additionally, societal expectations and stereotypes about gender roles may contribute to higher levels of perfectionism and self-doubt among female medical students, which can exacerbate feelings of anxiety and depression.²⁶

According to the results of the current study, medical students in their preclinical year reported higher levels of depression and anxiety than their clinical year peers. This result was consistent with past research carried out in Libya and other contexts.^{18,27,28} This phenomenon can be attributed to various factors, including the rigorous academic demands, adjustment to a new learning environment, lack of clinical exposure, and uncertainty about future career prospects. The transition from preclinical to clinical years typically involves increased patient interaction, hands-on clinical experience, and a sense of progress toward becoming a practicing physician. These changes can reduce stress and anxiety levels among medical students as they gain more practical skills and confidence in their abilities.²⁹

Furthermore, preclinical years are characterized by heavy coursework loads, long study hours, and frequent examinations, which can lead to burnout and mental health issues if not properly managed. The lack of direct patient contact during this phase may also contribute to feelings of isolation and detachment from the ultimate goal of practicing medicine. In contrast, clinical years provide students with opportunities for real-world application of knowledge, mentorship from experienced clinicians, and a clearer sense of purpose in their medical education journey.³⁰

Evidently, in the setting of Libya generally and in Derna and Benghazi specifically, students witnessed the distressing calamities of civil conflict, ISIS resistance,³¹ and COVID-19 lockdowns,³² these events harmed medical students. Medical schools need to prioritize the mental health and well-being of their students by offering support services, promoting work-life balance, and fostering a culture of open communication about mental health issues. By

addressing the unique challenges especially faced by females and preclinical year students and providing resources for coping with stress and anxiety, institutions can help mitigate the negative impact on student mental health during this critical stage of medical education.

In this study, it was revealed that the development of depression was significantly associated with several risk factors, including having relatives or friends who were flood victims, missing any family members in the flood, and suffering from any previous psychological issues. The results we obtained additionally demonstrate that the experience of secondary stressors is influenced differentially by gender and by living in a region affected by flooding. This is consistent with a previous study conducted in England demonstrated that secondary stressors had been associated with likely psychological issues following flooding.³³

5. Conclusions

According to the current findings, there is a startlingly high prevalence of anxiety and depression symptoms among medical students after the Derna disaster. Overall, addressing the mental health challenges faced by medical students is crucial for promoting their well-being and success in their academic and professional pursuits.

Effective intervention strategies, such as critical incident stress management and psychological first aid, are crucial in supporting the mental health of affected individuals and facilitating recovery and rebuilding. Medical schools and healthcare institutions need to recognize these disparities and provide adequate support and resources, especially for female and preclinical-year medical students to address their mental health needs.

Identifying preventative and therapeutic approaches for this population requires additional research. Prospective research designs should be considered in future epidemiological studies to enable the same individuals to be evaluated over time and to yield more pertinent data.

Conflict of Interest

The authors did not disclose any conflicts of interest.

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