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# Prevalence of depression in postmyocardial infarction patients in a tertiary care center in Riyadh

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## Abstract:

**BACKGROUND:** The coexistence of coronary artery disease (CAD) and depression is a growing concern, as both conditions lead to disability. Although depression is more prevalent in CAD patients than in the general population and has been associated with adverse cardiac outcomes, the underlying mechanisms linking depression and CAD are not yet fully understood. This study aims to assess the prevalence of depression in postmyocardial infarction (MI) patients as baseline data in Saudi Arabia.

**MATERIALS AND METHODS:** A cross-sectional study was conducted at King Saud Medical City, Riyadh. The study population included male and female patients who had survived MI from January 2022 to June 2022. A sample size of 323 patients was initially planned, but only 249 patients could be included on account of exclusions. The patients underwent screening for depression using Patient Health Questionnaire-2 (PHQ-2), and those who were positive on screening were further assessed using the PHQ-9 according to DSM-5 criteria. Sociodemographic data, comorbidities, and previous cardiac interventions were collected from medical records.

**RESULTS:** The mean age of the study participants was 57.15 years, and majority (76.6%) were males. The prevalence of previously diagnosed depression was 9.2%, and 5.2% of patients reported using antidepressant medication. According to the PHQ-9 scores, 33.33% had depression, 9% had moderate depression, and 2.4% had severe depression. There were significant associations between the severity of depression and previous CAD ( $P < 0.05$ ), previous coronary artery bypass graft surgery ( $P < 0.05$ ), and heart failure ( $P < 0.05$ ).

**CONCLUSION:** This study reveals a high prevalence of depression in post-MI patients at King Saud Medical City. The findings highlight the need for comprehensive management of depression in this population to improve outcomes. Further research into the underlying mechanisms linking depression and CAD to develop effective interventions is required.

## Keywords:

Depression, myocardial infarction, Saudi Arabia

## Introduction

The prevalence of coronary artery disease (CAD) and depression is increasing at an alarming rate.<sup>[1]</sup> The relation between depression and CAD is bidirectional, i.e., depression can increase the risk of CAD, and CAD can lead to depression. The

evidence shows that people with CAD have a much higher risk of depression than the general population, with three times higher prevalence rate.<sup>[2]</sup>

In the other direction, depression can increase the risk of developing CAD.<sup>[3]</sup> In addition, depression plays a major role in the prognosis after myocardial infarction (MI). Many researchers have studied the prognosis of patients following MI and

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found that cardiac function and total mortality rates are strongly affected by depressive symptoms in patients with CAD.<sup>[4]</sup> According to an article published in 2008 by the American Heart Association, the major depressive disorder can increase the risk of having another cardiac event two fold in the next 1–2 years after an MI.<sup>[5]</sup> The findings from extensive research done on the effect of depression on patients with CAD indicate that depression can predict the risk of another cardiac event in the years following<sup>[6-8]</sup> and precipitate mortality.<sup>[9-11]</sup> Multiple studies have investigated the pathophysiological changes associated with depression, and no model has as yet been accepted to explain how depression affects the risk of cardiovascular morbidity and mortality, even though there is empirical evidence of this link.<sup>[12,13]</sup> One study found that depression can directly increase the risk of CAD in three main ways. The hypothalamic–pituitary–adrenal axis activation and the distortion of the autonomic nervous system balance<sup>[14]</sup> immunologic mechanism dysregulation.<sup>[15-17]</sup> Furthermore, some studies found that the blood clotting process and the function of the blood vessel lining are impaired in depressed patients with CAD compared with nondepressed patients; all these processes will initiate atheroma formation, which contributes to the development or progression of atherosclerosis.<sup>[18-21]</sup> Noncompliance with medications is also a major factor related to the behavior and psychosocial matters in depressed patients.<sup>[22]</sup> The importance of depression screening is for early intervention and prevention of the direct and indirect impact on the heart. Treating depression effectively with antidepressants, cognitive behavioral therapy, and exercise will result in the reduction of inflammatory response which can further limit atheromatous plaque buildup in post-MI patients. However, studies have not shown a decrease in CAD events with selective serotonin receptor inhibitor only.<sup>[23]</sup> From the evidence described above, the risk of mortality and morbidity is higher for patients who have depression after an MI when compared to other patients. However, there is a dearth of studies conducted in Saudi Arabia on the prevalence of depression in post-MI patients. We believe that depression is underdiagnosed in these patients in our society. This study aims to measure how common depression is in patients who had MI and the relation between the severity of depression and other factors.

## Materials and Methods

This cross-sectional study was conducted at King Saud Medical City (KSMC), Riyadh, Saudi Arabia. The study included all patients of different nationalities who survived MI between January 2022 and June 2022. In this study, all non-Arabic speakers were excluded to avoid lack of comprehension. Patients were recruited

from the medical records using convenience sampling, in which the patient’s diagnosis, contact number, and length of hospital stay were obtained, After that the researchers had contacted them through phone call and obtained the other sociodemographic data such as age and gender. In addition, they were first screened for depression using the Patient Health Questionnaire (PHQ)-2. If they tested positive, the healthcare provider would continue with PHQ-9. The interview was conducted by phone since it was hard to get patients to come to the hospital. The data were collected from September 2022 to December 2022. The sample size was 323, with a confidence interval of 95%, a margin of error of 5%, and a population of 2000 patients as the average number of patients admitted annually at the coronary care unit (CCU) at KSMC. Ethical approval was obtained from the Institutional Review Board (IRB) vide Letter number H1RI dated 24/08/2022, and informed written consent was taken digitally from all participants in the study.

PHQ-9 questionnaire is used widely to screen and give the initial diagnosis for depression. In addition, it determines the severity of depression with a scoring system, in which a score below 4 is considered no depression, 5–9 mild depression, 10–14 moderate, 15–19 moderately severe, and 20–27 severe with symptoms lasting a minimum duration of 2 weeks.<sup>[5]</sup>

Other variables included prior diagnosis with major depressive disorder, prior use of antidepressant treatment, history of MI, previous percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) procedure, and other comorbidities. Data were collected by a certified medical doctor who screened the patient over the phone. For statistical analysis, descriptive data such as sex, nationality, and comorbidities are presented as frequency and percentage, whereas age and BMI are presented as mean (standard deviation). The PHQ-9 scales (no depression, mild, moderate, moderately severe, and severe) were presented as frequency (percentage), to find any significant difference between the PHQ-9 scale and sex, nationality, and previous comorbidities, Pearson’s Chi-square test was used. The data were considered significant at a  $P = 0.05$ . The data were analyzed using the STATA-13 (College Station, Texas, United state) program.

## Results

This study was conducted to assess the prevalence of depression in patients post-MI who were admitted to the CCU at KSMC. Initially, 323 patients were enrolled, but only 249 patients were finally recruited in the study 19 months post-MI. Seventy-four patients were excluded on passing away, wrong phone number registered

in the medical records, or refusal to participate. The mean age was 57.15 years (median 58), which indicates a large variability in the data, and the majority of the participants in this study were male (76.7%) of Saudi nationality (63%) [Table 1].

Table 2 shows the comorbidities present, which included hypertension (HTN), diabetes mellitus (DM), dyslipidemia, previous MI/CAD, and heart failure. In the study sample, the average hospital stay was 5 days (SD=6.8), whereas the median was 3 days, which might indicate high variability. Nevertheless, 58.6% reported they had diabetes, 14% reported previous MI/

**Table 1: Sociodemographic of postmyocardial infarction patients at King Saud Medical City, Riyadh, Saudi Arabia**

Variable	N (%)
Age (years), Mean±SD, (median)	57.15±12.25, (58)
Gender	
Male	191 (6.7)
Female	58 (23.2)
Nationality	
Saudi	157 (63.0)
Non-Saudi	92 (36.9)
BMI, Mean±SD, (median)	26.6±4.75, (27)

SD=Standard deviation, BMI=Body mass index

**Table 2: Comorbidities among postmyocardial infarction patients at King Saud Medical City patients, Riyadh, Saudi Arabia**

Variable	N (%)
Length of hospital stay (Days), Mean±SD, (median)	5.12±6.8, (3)
HTN	
No	92 (37.1)
Yes	156 (62.9)
DM	
No	103 (41.3)
Yes	146 (58.6)
Dyslipidemia	
No	75 (30.1)
Yes	174 (69.8)
Previous MI/CAD	
No	212 (85.1)
Yes	37 (14.8)
Previous PCI	
No	213 (85.5)
Yes	36 (14.4)
Previous CABG	
No	244 (97.9)
Yes	5 (2.01)
Heart failure	
No	180 (91.8)
Yes	16 (8.1)

MI=Myocardial infarction, PCI=Percutaneous coronary intervention, CABG=Coronary artery bypass graft, SD=Standard deviation, CAD=Coronary artery disease, HTN=Hypertension, DM=Diabetes mellitus

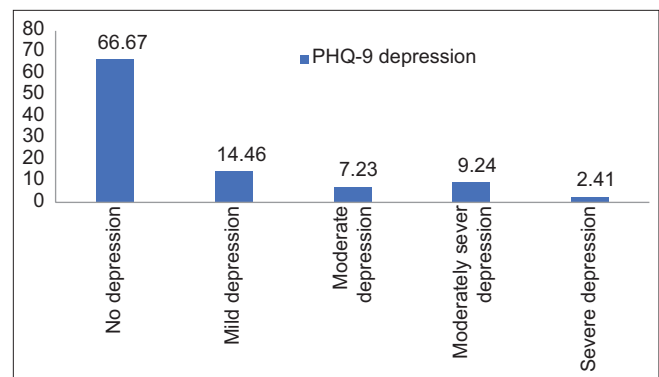
CAD, 8.1% had heart failure, 14.4% reported had had a previous PCI, and 2% had a previous CABG.

Figure 1 and Table 3 illustrate the prevalence of previously diagnosed depression, antidepressant use, and the PHQ-9 score. As shown in Table 3, the prevalence of previously diagnosed depression was 9.2%. In addition, 13 (5.2%) patients reported taking antidepressant medication in the past. Figure 1 illustrates the PHQ-9 scale, which classifies patient symptoms as no depression, mild depression, moderate depression, moderately severe depression, and severe depression.

According to the PHQ-9 score, 33.33% had depression, around 9% had moderately severe depression, and 2.4% had severe depression.

Table 4 shows the PHQ-9 scale assessment (no depression, mild depression, moderate depression, moderately severe depression, and severe depression) by sex, nationality, HTN, DM, dyslipidemia, CAD, PCI, and CABG. There was no significant difference in PHQ-9 by sex, nationality, HTN, DM, dyslipidemia, and previous PCI. However, there was a significant difference in the PHQ-9 score in people with previous CAD ( $\chi^2 = 9.83; P < 0.05$ ), as it appears that people who had had a previous CAD diagnosis had a higher prevalence of severe, moderately severe, and moderate depression compared to people without a previous CAD diagnosis. 5.4% of people with previous CAD had severe depression, compared with 1.89% of people without the disease.

Moreover, there was a significant difference between people who had undergone CABG and people who did not; 40.0% of patients who had undergone CABG had moderately severe depression in contrast to 8.61% of the patients who had not undergone CABG. None of those who had CABG reported they had no depression, whereas of those without CABG, 68.0% reported they did not have depression.



**Figure 1: Patient Health Questionnaire-9 depression scale. PHQ-9 = Patient Health Questionnaire-9**

Finally, a significant difference was observed between the severity of depression and heart failure. For people with heart failure, 18.7% showed severe depression compared to 0.5% among people who did not have heart failure.

### Discussion

From the literature, it is evident that major depressive disorder can worsen the prognosis of CAD. In one

study, the researcher found that the presence of major depressive disorder was the best single predictor of hospitalization as a result of cardiac event during the first year following diagnostic coronary angiography.<sup>[24]</sup> However, depression post-MI often goes unrecognized. We found that only 9.2% of depressed MI patients were diagnosed. This finding is consistent with that of another study (10%).<sup>[7]</sup> The findings from our study align with previous literature that explored the link between depression and cardiovascular disease. Our study revealed a noteworthy association between a previous MI and the severity of depression. There was a higher prevalence of severe depression in individuals with a history of MI, and moderately severe depression than those without a previous MI. Furthermore, our study identified a significant correlation between previous CABG surgery and depression severity. Patients who underwent CABG had a substantially higher prevalence of moderately severe depression than those without a history of CABG. In addition, we observed a significant association between heart failure and severity of depression. Patients with heart failure exhibited a substantially higher prevalence of severe

**Table 3: Depressions among postmyocardial infarction patients at King Saud Medical City, Riyadh, Saudi Arabia**

Depression	N (%)
Diagnosed with depression	
No	226 (90.7)
Yes	23 (9.2)
When were you diagnosed with depression?	
Before	7 (50.0)
After	7 (50.0)
Antidepressant medication use	
No	236 (94.7)
Yes	13 (5.2)

**Table 4: Association between Deepression and sociodemographic characteristics and comorbidities among postmyocardial infarction patients at King Saud Medical City, Riyadh**

Characteristics and comorbidities	No depression N (%)	Mild N (%)	Moderate N (%)	Moderately severe N (%)	Severe N (%)	$\chi^2$	P-value
Gender							
Male	135 (70.7)	23 (12.0)	12 (6.3)	17 (8.9)	4 (2.1)	6.74	0.15
Female	31 (53.4)	13 (22.4)	6 (10.3)	6 (10.3)	2 (3.4)		
Nationality							
Saudi	103 (65.6)	25 (15.9)	12 (7.6)	15 (9.5)	2 (1.3)	3.12	0.53
Non-Saudi	63 (68.5)	11 (11.9)	6 (6.5)	8 (8.7)	4 (4.3)		
HTN							
No	64 (69.6)	13 (14.1)	4 (4.3)	9 (9.8)	2 (2.2)	2.00	0.73
Yes	101 (64.7)	23 (14.7)	14 (9)	14 (8.9)	4 (2.6)		
DM							
No	67 (65.0)	17 (16.5)	4 (3.9)	12 (11.6)	3 (2.9)	4.59	0.33
Yes	99 (67.8)	19 (13.0)	14 (9.6)	11 (7.5)	3 (2.0)		
Dyslipidemia							
No	53 (70.7)	13 (17.3)	2 (2.7)	5 (6.7)	2 (2.7)	4.75	0.31
Yes	113 (64.9)	23 (13.2)	16 (9.2)	18 (10.3)	4 (2.3)		
Previous MI/CAD							
No	149 (70.3)	27 (12.7)	13 (6.1)	19 (8.9)	4 (1.9)	9.83	0.04
Yes	17 (45.9)	9 (24.3)	5 (13.5)	4 (10.8)	2 (5.4)		
Previous PCI							
No	147 (69.0)	28 (13.1)	14 (6.6)	19 (8.9)	5 (2.3)	4.03	0.275
Yes	19 (52.8)	8 (22.2)	4 (11.1)	4 (11.1)	1 (2)		
Previous CABG							
No	166 (68.0)	34 (13.9)	17 (7)	21 (8.6)	6 (2.5)	12.20	0.005
Yes	0	2 (40.0)	1 (20.0)	2 (40.0)	0		
Heart failure							
No	124 (68.9)	25 (13.9)	13 (7.2)	17 (9.4)	1 (0.6)	25.03	0.006
Yes	8 (50.0)	3 (18.7)	1 (6.2)	1 (6.2)	3 (18.7)		

MI=Myocardial infarction, PCI=Percutaneous coronary intervention, CABG=Coronary artery bypass graft, CAD=Coronary artery disease, HTN=Hypertension, DM=Diabetes mellitus



depression than those without. It is worth noting that no significant differences were observed in the severity of depression based on sex, nationality, HTN, DM, or dyslipidemia. Recognizing the psychological impact of MI and implementing appropriate interventions can significantly improve patient outcomes and reduce the risk of complications. Based on our study and the literature, we propose the following recommendations:

- Routine screening for depression: Healthcare providers should make regular depression screening a part of the standard care protocol for patients with a history of MI. Routine screening will enable early detection and timely intervention
- Integrated care approach: A multidisciplinary and integrated care model involving collaboration between cardiologists, psychiatrists, psychologists, and primary care physicians is crucial for the management of patients with MI and comorbid depression. This approach ensures a comprehensive assessment, appropriate treatment, and continuous support for individuals with cardiovascular and mental health needs. Education and awareness: Healthcare professionals, including cardiologists, nurses, and other members of the healthcare team should be educated and trained to identify and manage depression in patients with MI. Increasing awareness about the bidirectional relationship between cardiovascular disease and depression will help destigmatize mental health issues and promote early intervention. Further research: Additional research is warranted to explore the underlying mechanisms linking depression and MI. Longitudinal studies examining the temporal relationship between depression and cardiovascular outcomes, as well as the impact of different treatment modalities, are needed. By implementing these recommendations, healthcare providers can enhance the care provided to patients with a history of MI and comorbid depression. Treating depression improves patients' quality of life and plays a vital role in preventing future cardiovascular events and reducing overall healthcare costs. Adopting a holistic approach that recognizes the interconnectedness of mental and physical health to optimize patient outcomes is crucial.

Limitations of our study include its relatively small sample size as some patients died, some did not answer the call or refused to participate, exclusion because of the lack of comprehension by the non-Arabic or English speakers. Future research should aim at including larger and more diverse populations to explore the associations between depression and MI further, considering potential confounding variables.

## Conclusion

This study reveals a high prevalence of depression in post-MI patients at King Saud Medical City, especially in patients with previous MI, CABG surgery, and heart failure. The findings highlight the need for comprehensive management of depression in this population to improve outcomes. Further research is warranted to investigate the underlying mechanisms linking depression and CAD and develop effective interventions.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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