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Article

Examining the prevalence of depression in coronary artery disease patients: a cross-sectional analysis

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SUMMARY

Coronary artery disease (CAD) is the narrowing or blockage of heart arteries due to atherosclerosis, an accumulation of fatty materials on the inner linings of arteries. CAD, also called coronary heart disease or heart disease, includes both angina and myocardial infarction. Many research studies have indicated a connection between depression and a heightened risk of chronic diseases, encompassing CAD. Our hypothesis suggests an association between CAD and depression, indicating that CAD patients may be at risk of depressive symptoms. This research aimed to assess depression prevalence and associated risk factors in CAD patients at a tertiary care hospital in Pakistan. A total of 360 patients were included in the study. The analysis, utilizing the Urdu version of the Patient Health Questionnaire-9 (PHQ-9), revealed a point prevalence of depression at 27% in the overall sample. Of those screened positive, 71 were males (25%) and 27 were females (36%). Various factors such as old age, lower literacy levels, unemployment, rural residence, and comorbidities exhibited a positive association with depression. These findings highlight the significant prevalence of depression among CAD patients, emphasizing the need for increased awareness among treating physicians and cardiologists. Recognizing and effectively managing this comorbidity is crucial for comprehensive patient care. This study contributes valuable insights to the understanding of the psychological well-being of CAD patients in the Pakistani healthcare context for further research and targeted interventions.

INTRODUCTION

Cardiovascular diseases (CVD) are a major cause of death worldwide representing 32% of total global deaths (1). It is predicted that the annual toll from CVDs is to exceed 23 million by 2030 (2). The burden of CVD is on the rise, particularly in low- and middle-income countries (LMICs), where 75% of all recorded deaths are attributed to cardiovascular diseases (3). While data from population-based studies is limited, findings from hospital-based research indicate an increasing prevalence of heart failure, particularly in LMICs (4). People dealing with heart failure often experience debilitating symptoms, including depression and a lower health-related quality of life, compared to the general population which is primarily attributed to the unpredictable nature of the disease (5, 6). The World Health Organization (WHO) has predicted that depression will become one of the top leading causes of health problems by 2030. This prediction highlights the significant impact of depression on disability-adjusted life years, representing years of healthy life lost to disability (7). Research has indicated that depression can predict the development of coronary artery disease (CAD) in initially healthy individuals (8). Studies have shown that clinical depression, rather than just a depressive mood, is a stronger predictor for heart disease. This suggests a potential dose-response relationship between the severity of depression and the likelihood of developing CAD (8). Coronary artery disease (CAD) occurs when the arteries and vessels supplying oxygen and nutrients to the heart become narrowed or blocked. This condition is caused by atherosclerosis, which is the buildup of fatty deposits on the inner walls of the arteries. CAD, also known as coronary heart disease or simply heart disease, encompasses conditions such as angina and myocardial infarction.

Over recent decades, numerous epidemiological studies have consistently indicated a connection between depression and a heightened risk of chronic diseases, encompassing CAD (9). The psychological implications of heart failure, such as depression, are on the rise and significantly contribute to a less favorable prognosis (10). Individuals with heart failures who experience depression are at a heightened risk of having a diminished health-related quality of life compared to those without depression (11). Recent systematic reviews reveal that 42% of people with heart failure experience some degree of depression, and overall health related quality of life in these populations is rated as moderate (12, 13). Notably, these reviews have limited studies from LMICs, leading to considerable uncertainty about depression prevalence in these regions. A specific study conducted in China found that 43% of individuals with heart failure exhibited depressive symptoms (14). However, it is important to note that this statistic does not adequately represent the issue's burden in LMICs, as all the data were solely from China.

Research shows that the co-occurrence of these illnesses is not random but driven by depression as a risk factor for the occurrence and progression of coronary heart disease (15). The relationship of depression with CAD is a complex one; depression being a risk factor for development of CAD and CAD leading to depression (16). There is increasing evidence indicating that depression alone poses a distinct risk for cardiac events in individuals without recognized CAD, as well as in those already diagnosed with CAD, particularly after myocardial infarction (17). Addressing depression through treatment has been demonstrated to improve the quality of life for cardiac patients (17).

In Pakistan, especially the cosmopolitan areas, cardiovascular disease is contributing significantly to the

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overall non-communicable disease burden. There are very few studies on the prevalence of cardiac mortality to evaluate the prevalence and risk factors for depression in cardiac patients in Pakistan (18, 19). Depression can affect the mortality and morbidity of these patients; thus, it is important to screen for symptoms of depression, especially in cardiovascular patients in developing countries (20). We hypothesized that there is a correlation between CAD and depression, with CAD patients at risk of suffering from depression. The objective of this study was to improve the overall health and quality of life of individuals with heart disease by identifying risk factors linked to depression in CAD patients in Pakistan.

Screening for depression in these individuals is crucial to addressing this significant public health concern and effectively managing its impact on cardiac patients. By understanding this correlation, healthcare providers can better target interventions and support systems for this vulnerable population. Addressing mental health as a part of the comprehensive care for CAD patients is essential not only for improving mental health outcomes but also for enhancing cardiac care, ultimately leading to better overall health outcomes and a higher quality of life for these patients.

RESULTS

Our study hypothesized that there is an association between CAD and depression, and CAD patients may be at risk of depressive symptoms. This research was aimed at assessing the prevalence of depression in patients with CAD and identify associated risk factors, to improve the overall health and quality of life of individuals with heart disease in a tertiary care hospital in Pakistan. A total of 360 patients diagnosed with CAD were included in the study from the cardiology unit outpatient department of Pakistan Institute of Medical Sciences (PIMS). The mean age of the sample was 55 years, ranging from 22 to 70 years. Our study encompassed a broad range of demographics such as age, sex, residence, family structure, employment status, and comorbidities **(Table 1).**

	N (%)	Without Depression	With Depression	Chi square	*p*-value
Age					
20-45 years	77 (21.39)	58 (16.11)	19 (5.28)	19.68	<0.0001
46-60 years	152 (42.22)	126 (35.00)	26 (7.22)		
60+ years	131 (36.39)	78 (21.67)	53 (14.72)		
Sex					
Male	284 (78.89)	213 (59.17)	71 (19.72)	3.353	0.0671
Female	76 (21.11)	49 (13.61)	27 (7.50)		
Residence					
Rural	136 (37.78)	84 (23.33)	52 (14.44)	13.381	0.0003
Urban	224 (62.22)	178 (49.44)	46 (12.78)		
Family structure					
Nuclear	200 (55.56)	162 (45.00)	38 (10.56)	15.356	<0.0001
Joint	160 (44.44)	100 (27.78)	60 (16.67)		
Employment Status					
Not Employed	199 (55.28)	125(34.72)	74 (20.56)	22.297	<0.0001
Employed	161 (44.72)	137(38.06)	24 (6.67)		
Education					
No	71 (19.72)	38 (10.56)	33 (9.17)	16.554	<0.0001
Yes	289 (80.28)	224 (62.22)	65 (18.06)		
Comorbidities					
No	214 (59.44)	162 (45.00)	52 (14.44)	2.275	0.1314
Yes	146 (40.56)	100 (27.78)	46 (12.78)		
Total	360 (100)	262 (72.78)	98 (27.22)		

Table 1: Demographics characteristics of the study sample. Summary of key demographic details of the study population including age, sex, residence, education level, employment status, and comorbidities, presented as sample size percentages (N(%)). p-values, derived from chi-square tests, indicate the significance of associations observed within demographic variables.

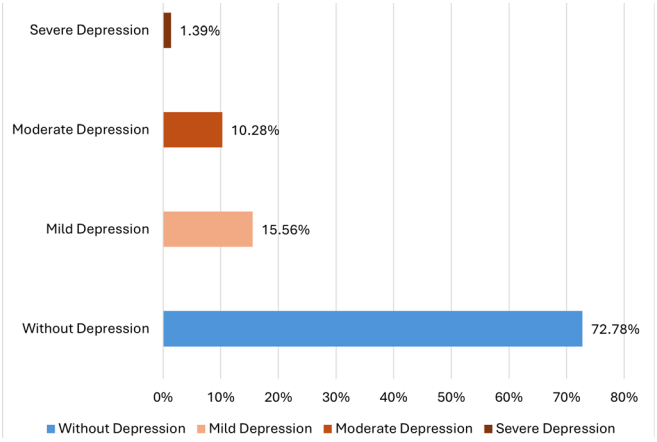

Figure 1: Overall prevalence of depression based on Patient Health Questionnaire-9 (PHQ-9) in study sample. Bar chart for the prevalence of depression among the study population, represented in percentages based on Patient Health Questionnaire-9 (PHQ-9) scores.

The overall prevalence of depression in the sample was 27.22% **(Figure 1)**. Depression symptoms were more prominent among males, older age groups, individuals with lower literacy levels, unemployment, those residing in rural areas, and those with joint family structure ($p < 0.05$, chi-square test) **(Table 1)**.

Out of 360 individuals, there were 98 (27.22%) who screened positive for depression using Patient Health Questionnaire-9 (PHQ-9). Out of those who scored positive for depression, there were 71 males (25% of all males) and 27 females (36% of all females) **(Table 1)**. The number of males in the overall sample was higher (n=284; 78.89%), as compared to females (n=76; 21.11%). Our sample population contained a higher number of individuals who screened negative for depression in a 1:2.5 ratio. We found that the ratio of individuals without depression-related issues to those with depression was approximately 3:1 in our sample. Out of those who screened positive for depression, the highest proportion of the individuals were above 60 years of age (n=53; 14.72%), followed by those between 46–65 years (n=26; 7.22%), and 20-45 years (n=19; 5.28%), respectively. Individuals living in rural areas were more likely to test positive for depression on the PHQ-9. Those who belonged to joint family structures also showed a higher likelihood of testing positive. Additionally, low literacy levels and unemployment were associated with an increased risk of depression **(Figure 2)**.

In the adjusted logistic regression model for the overall sample, the adjusted odds ratios were higher in individuals in the 60+ years age group (Odds Ratio, OR 1.19; Confidence Interval (CI), 1.58-2.42) as compared to younger individuals **(Table 2)**. This means that older adults were more likely to experience the outcome than younger adults. A higher risk of anxiety and depression was observed among those residing in rural areas (OR,1.14; CI, 1.62-2.08), unemployed individuals (OR 2.15; CI, 1.05-4.41), as well as illiterate individuals (OR, 2.04; CI, 1.06-3.95). Also, those who suffered from other co-morbidities such as diabetes, stroke or other illnesses were at higher risk of mental illness (OR 1.27; CI, 1.27-2.14).

In summary, the analysis using the Urdu version of the PHQ-9 revealed a 27% prevalence of depression in the overall

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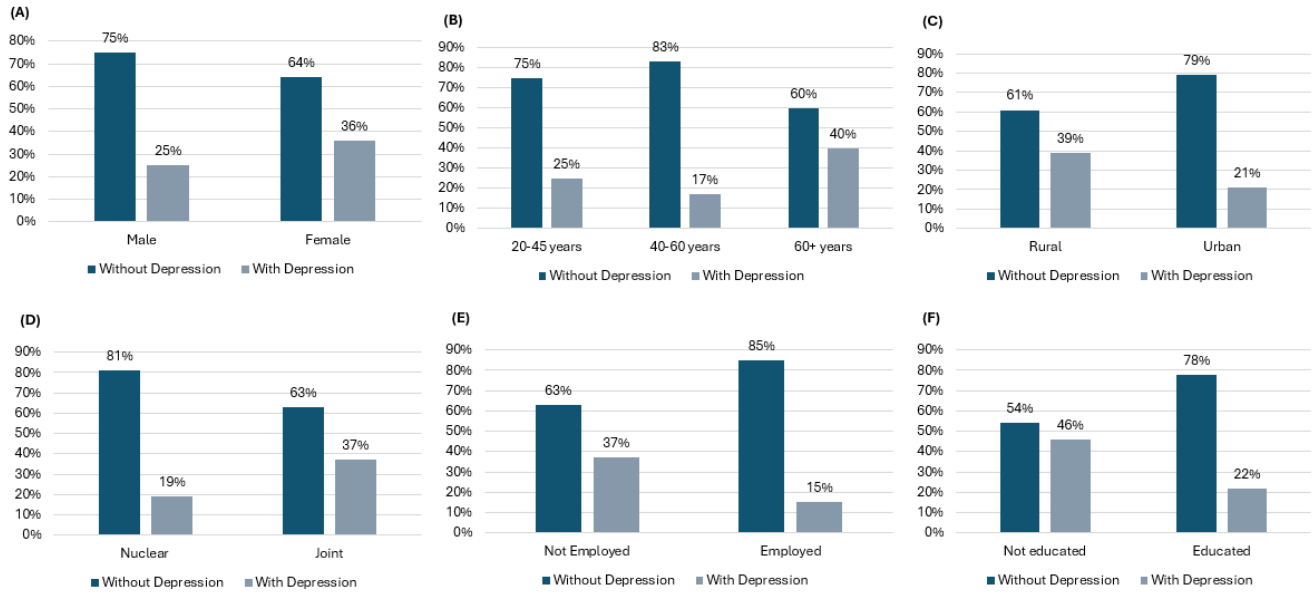

Figure 2: Prevalence of depression in study population based on demographics characteristics. Bar charts showing the prevalence of depression for comparisons, based on demographic attributes such as (A) sex, (B) age, (C) residence, (D) family structure, (E) employment, and (F) education status.

sample. Depression was more common in females than in males. Key factors associated with depression include older age, lower literacy levels, unemployment, rural residence, and comorbidities.

DISCUSSION

CVD has emerged as a significant health concern in Pakistan, mirroring global trends (22). This study highlights the prevalence of depression among CAD patients in Pakistan, aligning with findings from Western studies (21, 22). The observed 27% prevalence of depression among CAD patients highlights the critical need for attention to mental health within this population. Depression not only serves as a risk factor for CAD development but also exacerbates its prognosis (22).

Our study findings indicated a notable association between age and depression among CAD patients, with a higher prevalence observed in older age groups. This aligns with existing literature indicating that as age increases, so does the prevalence of depression in CAD patients (23, 24).

Although female patients exhibited significantly higher depression scores compared to males, the study did not establish a significant association between gender and depression for adjusted ORs. Our finding agrees with prior research indicating a higher prevalence of depression among females in CAD populations (13,14), but the discrepancy may partly stem from underrepresentation of females in the outpatient cardiology department during data collection. Nevertheless, existing literature supports the notion of females being more susceptible to depression, while males may experience both anxiety and depression concurrently (22).

Patients residing in rural areas exhibited a significant difference in depression prevalence compared to urban residents, with joint family structures also being significantly associated with depression. This suggests that social and familial factors, possibly exacerbated by financial pressures in rural settings, contribute to higher rates of depression among CAD patients. Employment status and literacy level also emerged as significant factors associated with depression among CAD patients. Unemployed patients displayed higher rates of depression, although limitations in data collection regarding employed patients hindered comprehensive analysis. Moreover, lower levels of education were associated with increased depression prevalence, with illiterate patients exhibiting the highest rates. This underscores the importance of education in raising awareness about illness management and treatment options, potentially mitigating depressive

Variables	Crude ORs (95% CI)	Adjusted ORs (95% CI)
Age		
20-45 years	Ref	Ref
46-60 years	0.63 (0.32-1.22)	0.56 (0.27-1.13)
60+ years	2.07 (1.11-3.87)	1.19 (1.58-2.42)
Sex		
Male	Ref	Ref
Female	1.65 (1.09-2.84)	0.76 (0.37-1.56)
Residence		
Urban	Ref	Ref
Rural	2.39 (1.49-3.84)	1.14 (1.62-2.08)
Family Structure		
Nuclear	Ref	Ref
Joint	2.55 (1.58-4.12)	1.24 (0.66-2.32)
Employment Status		
Employed	Ref	Ref
Unemployed	3.37 (2.00-5.68)	2.15 (1.05-4.41)
Education		
Yes	Ref	Ref
No	2.99 (1.74-5.14)	2.04 (1.06-3.95)
Comorbidities		
No	Ref	Ref
Yes	1.43 (0.89-2.29)	1.27 (1.27-2.14)

Table 2: Multivariate Binary Logistic Regression model for risk factors associated with Coronary Artery Disease Patients and Depression for Study Population. Odds ratios (ORs) and corresponding 95% confidence intervals (CIs) are reported for each predictor variable, providing insights into the strength and direction of their association with depression among CAD patients.

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symptoms.

In a developing country like Pakistan, financial considerations likely contribute to the genesis of depression in CAD patients, particularly among low-income populations (25). Despite the established impact of depression on CAD outcomes, the study highlights a concerning underdiagnosis of depression in the local setting. Our study underscores the necessity for improved awareness and integration of mental health screening and management within CAD care protocols. This issue becomes even more important in developing countries like Pakistan where there is already a lack of mental health services, thus making it more important for the general practitioners and cardiologists to understand the importance and risks of untreated anxiety and depression in cardiovascular patients. Complicating this picture is the prevailing social stigma associated with mental illness in Pakistan (19).

While our study contributes valuable insights into the relationship between CAD and depression among the Pakistani population, it is crucial to acknowledge several limitations that may affect the interpretation and generalizability of our findings. One notable limitation is the potential for interview bias, particularly concerning the narration of questionnaire choices for illiterate participants. This approach may introduce unintentional influence or misinterpretation of responses, impacting the accuracy of data collected from this subgroup. Moreover, the cross-sectional design of our study inherently restricts our ability to establish causal relationships between CAD and depression. While we can observe associations between variables, we cannot infer causation or determine the directionality of the relationship. We utilized PHQ-9, which is only a screening tool, not a diagnostic tool. For definitive diagnosis of depression, psychiatric evaluation is warranted. It was difficult to rule out whether depression symptoms were due to cardiac illness itself or due to some life events.

To better understand the relationship between CAD and depression in the Pakistani population, more research is needed. Our study provides important insights into this connection, highlighting the need for regular screening for depression in individuals with CAD. Depression can significantly affect the health and recovery of cardiac patients, making it essential to address this issue as part of their overall care. By identifying and managing depression early, healthcare providers can improve patient outcomes and reduce the burden of both mental health issues and heart disease. Further studies will help refine these strategies to ensure they are effective and appropriate for the specific needs of the Pakistani population.

MATERIALS AND METHODS

The research was a cross-sectional study conducted at the outpatient department of PIMS spanning three months (May-August 2019). The study focused only on patients diagnosed with CAD, selected through a convenience-based sampling technique. Data collection occurred daily during the months of April and May. A questionnaire was specifically developed to capture the basic demographics like age, gender, family structure, employment status, and literacy level. The variable for family structure was categorized as nuclear family and joint family. A nuclear family typically consists of parents and their children living together in one household, while a joint family includes extended family members like grandparents, aunts, uncles, and cousins all living together as a single unit. Variable for literacy was categorized as educated if patient has ever attained a formal primary, secondary or higher education and “not educated” if the individual had not attended any school. This questionnaire also had PHQ-9 translated into Urdu. The PHQ-9 is a 9-item instrument with a score ranging from 0 to 3 for each question (0 = not at all, 1 = several days, 2 = more than half days, 3 = almost daily), asking about symptoms in the past two weeks. A threshold score of 10 or higher is considered to indicate mild major depression, 15 or higher indicates moderate major depression, and 20 or higher severe major depression. At nine items, the PHQ-9 depression scale is half the length of many other depressions measures, has comparable sensitivity and specificity, and consists of the actual nine criteria on which the diagnosis of depressive disorders is based. The PHQ-9 is thus a dual-purpose instrument that, with the same nine items, can establish provisional depressive disorder diagnosis as well as grade depressive symptom severity. For our study, we broadly categorized patients into a binary outcome: “not depressed” for scores 0-9 and “depressed” for scores above 10.

We applied inclusion criteria to ensure that only individuals diagnosed with CAD were screened using the Urdu PHQ-9 questionnaire. Patients who had the diagnosis of cardiac illnesses other than CAD, like left ventricular failure or mitral valve prolapse, and patients who already had a diagnosis of mental and psychological disease or terminal illness were excluded. A total of six questionnaires were pretested, and necessary adaptations were made prior to data collection. Pretested questionnaires were not included in the analysis. The questionnaire used in the final study was narrated to illiterate patients and findings were recorded. All the study participants were given the same questionnaire. All the data was entered on the same day into the computer to reduce errors. No one refused to participate in the study, so the response rate was 100%.

Consent was sought from participants before filling out the questionnaire, and the aim of the study was explained to ensure transparency and ethical compliance. Formal permission was obtained from relevant authorities to conduct the study in the outpatient department of the cardiology unit. The confidentiality of all gathered information was maintained. In cases where patients exhibited high scores on the PHQ-9, their respective consultants were promptly notified about the prevalence of positive symptoms.

Descriptive statistics (e.g., mean, standard deviation) were calculated for the study sample. Frequencies for demographic variables and depression score based on PHQ-9 were examined with cross-tabulations across the comparison groups using chi-squared statistics. Criteria for statistical significance were set at $p < 0.05$. For our outcome analysis, multivariable logistic regression analysis was utilized to assess the association of risk factors with depression based on PHQ-9 score, and results were summarized using ORs with corresponding 95% confidence intervals (CIs) for the overall sample. All analyses were performed using SAS Enterprise Guide 7.1 (SAS Institute, Cary, NC).

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