Determinates of depressive disorder among adult patients with cardiovascular disease at outpatient cardiac clinic Jimma University Teaching Hospital, South West Ethiopia: cross-sectional study

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Abstract

Background: Depression and heart disease are an important public-health problem. Depression is one of the most prevalent and disabling psychiatric disorders with more than three times increased risk among patients with cardiovascular disorders.

Objective: To identify the prevalence and associated factors of depressive disorder among adult patients with cardiovascular disease.

Methods: Institution based cross-sectional study design was used to conduct this study on 293 study participants attending an outpatient cardiac clinic at Jimma University Teaching Hospital. All eligible patients were recruited into the study consecutively. Depression was assessed using patient health questionnaire-9. The patient health questionnaire-9 had a total score of 27, from which 0–4: no/minimal depression, 5–9: mild depression, 10–14: moderately depression, 15–19: moderately severe depression and 20–27 severe depression. The data was feed into Epi-data version 3.1 and lastly exported to SPSS version 21 for analysis. Bivariate analysis was used to analyze the statistical association of covariates of interest with depressive disorder among patients with cardiovascular disease. Then, logistic regression analysis was used as a final model to control confounders. The strength of association was measured by a 95% confidence interval.

Results: A total of 293 adult patients diagnosed with the cardiovascular disease were included in the study with 97% (n = 284) of response rate, 47.2% (n = 134) males and 52.8% (n = 150) females, making female to a male ratio around 1.1:1. The prevalence of depression was 52.8% (n = 150). Out of the subjects with depression 52.67% (n = 79), 36.0% (n = 54) and 11.33% (n = 17) were mild, moderate and severe depression, respectively. Variables such as employed, unemployed, physical activity, current cigarette user and poor social support were independently associated with depression in the final model.

Conclusions: In this study, depression was found to be highly prevalent psychiatric comorbidity in adult cardiovascular disease patients.

Keywords: Depression, Cardiovascular disease, Ethiopia, Determinants, Patient health questionnaire-9

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Background
Non-communicable diseases (NCD) currently account 60% of all deaths and 48% of the disability-adjusted life years (DALYs) worldwide, 40% for communicable diseases. In 2008, four out of five NCD deaths occurred in low- and middle-income countries [1]. Mental disorders are a major contributor to the burden of disease in all regions of the world [2]. Mental health conditions are the leading cause of DALYs worldwide and account for 37% of years of life lost (YLL) from NCDs [1].

According to the World Health Organization (WHO) report in 2011 unipolar depressive disorder is the third leading cause of disease burden worldwide. Mental disorders account for 25.3% and 33.5% of all years lived with a disability in low- and middle-income countries (LAMICs), respectively [3]. Mental illness is both a direct cause of mortality and a major risk factor for adverse health outcomes [4].

Depression is a substantial contributor to the global burden of disease. It affects people in all communities worldwide. In 2012, the WHO reported that depression is estimated to affect 350 million peoples [5]. Depression is a common mental disorder that has a clinical feature of depressed mood, loss of interest, reduced energy, feelings of guilt or low self-esteem, disturbance of sleep/appetite, and poor concentration, severe enough to cause severe impairment in important role function. At its worst, depression leads to suicide and is responsible for 1 million deaths due to suicide every year, which translates to 3000 suicide deaths every day [5].

World Health O report shows that 17.3 million people died from CVDs, contributing to 30% of all global deaths and this represents 50% of all death from NCD. In the same year, CVDs were the number one cause of death and deaths from these disorders in LAMIC constituted 80% [6, 7]. At the same time, it is estimated that about 19 million deaths occur annually from cardiovascular causes in lower-income countries [1, 6]. Mental health and cardiovascular diseases account for almost 70% of global economic losses [1].

The reported prevalence of major depression in patients with CAD is around 20%, the prevalence of depression is among patient with CHD is very high (31–34%) and is about three times more compared to that in the general population. Moreover, depression has been found to be a risk factor for the development of CAD and worsens its outcome when depression co-exists with established CAD [19–21]. One-fifth of the patients with CHD attending outpatients and one-third of patients with congestive heart failure (CHF) have co-existing depression.

Depression in patients with CHD and CHF, however, is not recognized or not properly treated most of the time [8].

Quality of life of patients and their significant others are seriously affected by debilitating physical health, psychological distress, and diminished family role [9]. In patients undergoing coronary artery bypass graft (CABG), depression has been associated with longer hospitalization, poorer functional outcomes, more preoperative complications, higher rates of mortality and more symptomatic before and also after surgery [10, 11].

Effects of untreated depression that include: increased risk of a coronary event, decreased feelings of wellbeing and quality of life (QOL), decreased medication compliance and decreased risk factor modification. Can seriously increase the risks of further cardiac morbidity or mortality. Despite this knowledge; Physicians usually under-detect depression among cardiac patients; moreover, some of the cardiovascular drugs such as beta blockers may worsen the overall depressive symptoms [12, 13].

Factors associated with depression, most studies have found that younger patients and women were more likely to have the disorder in the context of CVD [16]. Poor social support, prior ACS, and in some cases, comorbid diabetes may also increase depression risk [14–16].

Many studies implicate depression among CAD patients to have the association with female sex, younger age, living situation, prior ACS, comorbid diabetes, HF severity class, low educational attainment, use of beta blockers, being housewives, unemployment status [14, 17–21]. Positive family history of depression, smoking, history of CHD/MI, social isolation/social support, NYHA CLASS classification system based on clinical severity and prognosis, antihypertensive medication [22, 23]. People with depression are 25 to 40% more likely to die from heart disease than people without depression [24].

Furthermore, several candidate biological and behavioral factors believed to be mechanisms through which depression could lead to cardiac events have been identified. Such as tricyclic antidepressants toxicity associated with cardiac risk factors. Potential behavior related mechanisms comprise dietary factors, sedentary lifestyle with lack of exercise, non-adherence to cardiac prevention and treatment regimens, lack of optimal social support, unhealthy lifestyles such as smoking, alcoholism and reduced functional capacity [8, 25].

Therefore, the fact that depression is a predictor of cardiac events among patients with CVD is has gained universal consensus although such information is lacking from countries such as Ethiopia. Furthermore, it was a well-known fact that comorbid depression increases
negative events such as progression to arteriosclerosis, increased health care utilization and increased hospital readmissions before or after a cardiac event.

In spite of evidence, depression can be observed in many cardiovascular conditions. Detection of depression in cardiac patients remains low. According to the principal investigator’s knowledge, there is no study conducted in Ethiopia and the extent of the problem is not yet known. A better understanding of the extent of depression and associated factors is significant. This research will narrow this huge gap and will serve as a baseline for further researches to be undertaken on the subject matter.

Methods and materials
Study setting and period
The study was conducted in Jimma University Teaching Hospital (JUTH) outpatient cardiac clinic from October to November 2014. It has been running a public health care institution under the ministry of health by different names at a different time. Geographically, it is located in Jimma town 352 km south west of Addis Ababa. It provides service for at least 15 million populations residing in South-West Ethiopia. The cardiac clinic is one of the follow-up clinics giving service for a patient with chronic CVDs among other clinics that give service for patients with other chronic NCDs [26].

Participants
The study participants were all adult patients who had CVD age 18 years and above who came for follow-up at JUTH cardiac clinic during the study period. A total of 293 adult patients who had CVD were involved in the study. This study exclude, individual who seriously ill and were not able to give information, had a severe neuropsychiatric condition or language deficit that would preclude informed consent or valid assessment was excluded.

Measurements
The dependent variable was depression. The independent variables include socio-demographic characteristics such as age, sex, marital status, educational status, place of residence, income, empowerment, psychosocial, medication, clinical-related, behavioral and lifestyle factors.

Data collection procedures and instruments
Data were collected using interview-administered questionnaires. Questionnaires were abstracted and adapted from different literature sources and modified according to the local context. The questionnaire prepared by the English language, translate to Afan Oromo and Amharic language by the language department who is a native speaker for oromifa language and back translation also made. Depression was measured using patient health questionnaire nine (PHQ-9) which is a validated instrument in Ethiopia [27]. The PHQ-9 has a total score of 27, from which 0–4: no/minimal depression, 5–9: mild depression, 10–14: moderately depression, 15–19: moderately severe depression and 20–27 severe depression. Morisky medical adherence scale-8 (MMAS-8) was used to assess medication adherence which is a validated tool in Ethiopia to screening and monitoring in clinical practice to identify and monitor high-risk non-adherent patients [28]. Oslo 3-items social support scale (OSS-3) was used to measure the strength of social support [29]. Pretest of the questionnaire was carried out on 5% of respondents; whose socio-demographic factors are the same with those actual study participants; from the cardiac clinic in Jimma University Teaching Hospital (JUTH) those individuals not included in the main study differentiated by making a mark on their chart.

Data processing, analysis, interpretation, and presentation
The quantitative data were entered into the computer by using Epi-data version 3.1 and lastly exported to SPSS version 21 for analysis. Bivariate analysis and multiple logistic regressions were used. Finally, variables had a P-value of less than .25 on binary logistic regression were entered into multivariable logistic regression. The strength of association was measured by 95% confidence interval and Then P-value<.05 considered as significantly associated variables with depression in the final model. The result was presented by frequency tables, graphs and discussed with previous study findings.

Ethical consideration
The ethical approval of the study was obtained from the Ethical Review Board of Jimma University, college of public health and Medical Sciences. Oral consent was obtained from the study participants. Patient those found to be severally depressed and suicidal risk appropriate intervention was done according to PHQ-9 score.

Results
Socio-demographic characteristics
A total of 293 adult patients diagnosed with CVD were included in the study with a response rate of 97% (n = 284). Out of the total respondents 47.2% (n = 134) males and 52.8% (n = 150) females with male-to-female ratio of 1.1:1. The age of the respondents ranged from 18 to 90 with a mean (SD) of 50.3 (17.13) years.

Nearly to two-third of (64.4%) patients came from the rural area and nearly three-fourths of the respondents were married (76.0%). About one-half of the total participants were illiterate (53.2%) (n = 151). Regarding the
occupation status, more than one half of the total of the respondents were farmers, 50.7% (n = 144). Unemployed and housewives constituted 18% (n = 144) and 8.8% (n = 25) respectively. About 26.1% (n = 74) of the study participants claimed to earn an annual average income of 10,800 birrs (Table 1).

Table 1 Socio-demographic characteristics of the respondents in Jimma University Teaching Hospital cardiac clinic, 2014–2015 (n = 284)

| Characteristics                  | Non depressed (PHQ-9 < 5) N (%) | Depressed (PHQ-9 ≥ 5) N (%) | Total (%) |
|----------------------------------|---------------------------------|-----------------------------|-----------|
| **Sex**                          |                                 |                             |           |
| Male                             | 60 (44.8)                       | 74 (49.3)                   | 134 (47.2)|
| Female                           | 74 (55.2)                       | 76 (50.7)                   | 150 (52.8)|
| **Age**                          |                                 |                             |           |
| 18–26                            | 17 (12.7)                       | 17 (11.3)                   | 34 (12.0)|
| 27–35                            | 15 (11.2)                       | 21 (14.0)                   | 36 (12.7)|
| 36–44                            | 20 (14.9)                       | 13 (8.7)                    | 33 (11.6)|
| 45–53                            | 22 (16.4)                       | 25 (16.7)                   | 47 (16.5)|
| ≥62 ref                          | 28 (20.9)                       | 26 (17.3)                   | 54 (19.0)|
| 63–71                            | 22 (16.4)                       | 28 (18.7)                   | 50 (17.6)|
| ≥72                              | 10 (7.5)                        | 20 (13.3)                   | 30 (11.2)|
| **Marital status**               |                                 |                             |           |
| Single                           | 20 (14.9)                       | 13 (8.7)                    | 33 (11.6)|
| Married                          | 105 (78.4)                      | 111 (74.0)                  | 216 (76.0)|
| Divorced/separate                | 4 (3.0)                         | 10 (6.7)                    | 14 (5.0)|
| Widowed                          | 5 (3.7)                         | 16 (10.7)                   | 21 (7.4)|
| **Educational status**           |                                 |                             |           |
| Illiterate                       | 67 (5.0)                        | 84 (56.0)                   | 151 (53.2)|
| Able to read and write only      | 20 (14.9)                       | 36 (24.0)                   | 56 (19.7)|
| Primary (1–8)                    | 28 (20.9)                       | 19 (12.7)                   | 47 (16.5)|
| Secondary (9–12)                 | 14 (10.4)                       | 7 (4.7)                     | 21 (7.4)|
| Tertiary (+12)                   | 5 (3.7)                         | 4 (2.7)                     | 9 (3.2)|
| **Occupational status**          |                                 |                             |           |
| Unemployed                       | 16 (11.9)                       | 35 (23.3)                   | 51 (18.0)|
| Employed                         | 12 (9.0)                        | 4 (2.7)                     | 16 (5.6)|
| Farmer                           | 70 (52.2)                       | 74 (49.3)                   | 144 (50.7)|
| Merchant                         | 9 (6.7)                         | 10 (6.7)                    | 19 (6.7)|
| Retired                          | 7 (5.2)                         | 5 (3.3)                     | 12 (4.2)|
| Housewife                        | 11 (8.2)                        | 14 (9.3)                    | 25 (8.8)|
| Other                            | 9 (6.7)                         | 8 (5.3)                     | 17 (6.0)|
| **Residence**                    |                                 |                             |           |
| Rural areas                      | 80 (59.7)                       | 103 (68.7)                  | 183 (64.4)|
| Urban areas                      | 54 (40.3)                       | 47 (31.3)                   | 101 (35.6)|
| **Average annual income**        |                                 |                             |           |
| 0–999                            | 33 (24.6)                       | 37 (24.7)                   | 70 (24.6)|
| 1000–3599                        | 32 (23.9)                       | 37 (24.7)                   | 69 (24.3)|
| 3600–10,799                      | 28 (20.9)                       | 43 (28.7)                   | 71 (25.0)|
| ≥10,800                          | 41 (30.6)                       | 33 (22.0)                   | 74 (26.1)|

Other employment status—student, daily labor and house servants

Psychosocial and behavioral factors
The majority (90.5%) of respondents were living with their family and 6.3% (n = 18) were living alone. Only 24.4% (n = 69) reported having good social support whereas 35.2% (n = 100) claimed to have poor social support. Those who reported having almost satisfactory or moderate social support constituted 40.5% (n = 115). About half of respondent (48.9%) do not do moderate to vigorous activities for 30 min or more, at least 4 days in a week. Respondents who used that in their lifetime were 26.8% (n = 76) and 8.8% (n = 25) were current use (Table 2).

Clinical characteristics and medication related factors

Medication related factors
The most prescribed drugs were diuretics in 75.0% (n = 213); angiotensin-converting enzyme inhibitors in 55.3% (n = 157) and beta-blockers in 45.2% (n = 137). The rate of depression was higher at 77.3% (n = 116) among participants who were taking diuretics. The majority of participants, 32.0% (n = 91) were ≤1 year of duration of treatment. The rate of depression is higher among those whose duration of treatment for CVD was greater than or equal to 5 years 30.7% (n = 46). Nearly three-fourth of participants (n = 206) were adherence to CVD medication (Table 3).

Clinical related factors
The majority of participants were diagnosed with Hypertensive heart disease (HHD) constituting 35.9% (n = 102). Cases with CHD were found in 26.4% (n = 75) whereas patients with Valvular heart disease (VHD) were found in 12.3% (n = 35). The highest rate of depression was found among HHD 36.0% (n = 54) and the lowest in other diagnostic groups of CVD (Corpulmonary, acute rheumatic fever, congenital heart disease, pericarditis and CHF due to thyrotoxicosis) classification 6.0% (n = 9). Among depressed 30.0% (n = 45) were the age of onset of CVD above 60 years. Close to one-third (30%) of the patients have been ill with CVD for the duration of 1–3 years.

Majority of participants 87.3% (n = 248) had no family history of mental illness. From those who had a family history of mental illness (55.6%; n = 95/17) had no history of depression (44.4%; n = 16/36). Two hundred seventy (95.1%) of participants had no comorbid diabetes mellitus. Among those who had comorbid diabetes mellitus, most had depressed mood (64.3%; n = 9/14) as compared to that non-comorbid diabetes mellitus (35.7%; n = 5/14) with depression. Majority of participants who had comorbid diabetes mellitus 72.7% (n = 8) had onset ≤3 years after CVD illness. They had more depression (71.4%) as compared to those who had >3 years of duration of comorbid DM after the onset of CVD illness.
Participants those who had comorbid hypertension constituted 45.1% (n = 128). Among CVD patients with comorbid hypertension, depression prevalence was 46.0% (n = 69). Among those who had comorbid hypertension their duration of onset ≤ 3 years, after CVD illness 64.0% (n = 33) were more depressed as compared to duration > 3 years of comorbid hypertension. Majority of the participants 60.9% (n = 173) with the previous history of hospitalization had more prevalence rate of depression (64.0%), as compared to previously none hospitalized for CVD patients (Table 4).

New York Heart Association classification among CVD patients and its association with depression One-half of the participants (51.8%) belonged to NYHA-class II as documented in the secondary data. The prevalence rate of depression in this group was 51.2% (n = 62). This is more than in each of the remaining groups (Table 4).

Lipid profile among CVD patients and its association to depression Cholesterol was investigated and found that patients with a total cholesterol level of < 200 mg/dl constituted in 78% and that they were more depressed 91.7% as to compared with those having total cholesterol level > 200 mg/dl. Those having lipoprotein level > 40 mg/dl were 64% and they were the ones more depressed as compared to those whose LDL level of was < 40 mg/dl. Similarly CVD patients with triglycerides level of < 150 mg/dl were compared with having triglycerides level > 150 mg/dl but there was no statistically significant difference in the level of depression (Table 4).
Two hundred eighty-four of participants completed the interview of PHQ-9 questions at baseline. The prevalence of depression was 52.8% (n = 150) (Fig. 1).

Out of the subjects with depression 52.67% (n = 79), 36.0% (n = 54), 10.0% (n = 15), 1.33% (n = 2) mild, moderate, moderately severe, and severe depression, respectively had depressive symptoms (Fig. 2).

Factors associated with depression in bivariate analysis among adult CVD patients
Among different variables age, marital status, educational status, employment status, residence, average annual income (according to quartile income classification), living condition, social support, physical activity, current...
cigarette use, diagnosis type of CVD illness, age onset of CVD, B-blocker medication, duration of treatment for CVD and lipid profile level—total cholesterol were showed association with depression at P-value < .25 on bivariate analysis (Tables 4, 5 and 6).

Those variables widowed, unemployed, poor social support, physical inactivity was significantly associated with depression in bivariate analysis at P-value < .05 (Tables 5, 6 and 7).

### Table 5 Socio-demographic factors that associated with depression in bivariate analysis (< .25) among CVD patients in Jimma University Teaching Hospital cardiac clinic, 2014–2015

| Characteristics         | Non depressed N (%) | Depressed N (%) | COR (95% CI) | P-value |
|-------------------------|---------------------|-----------------|--------------|---------|
| Age                     |                     |                 |              |         |
| 18–26                   | 17 (12.7)           | 17 (11.3)       | 1.077 (.456, 2.541) | .866    |
| 27–35                   | 15 (11.2)           | 21 (14.0)       | 1.508 (644, 3.531) | .344    |
| 36–44                   | 20 (14.9)           | 13 (8.7)        | .700 (291, 1.686) | .426    |
| 45–53                   | 22 (16.4)           | 25 (16.7)       | 1.224 (559, 2.678) | .613    |
| 54–62                   | 28 (20.9)           | 26 (17.3)       | 1            |         |
| 63–71                   | 22 (16.4)           | 28 (18.7)       | 1.371 (633, 2.968) | .424    |
| ≥ 72                    | 10 (7.5)            | 20 (13.3)       | 2.154 (852, 5.448) | .105    |
| Marital status          |                     |                 |              |         |
| Single                  | 20 (14.9)           | 13 (8.7)        | .615 (291, 1.298) | .202    |
| Married                 | 105 (78.4)          | 111 (74.0)      | 1            |         |
| Divorced/separate       | 4 (3.0)             | 10 (6.7)        | 2.365 (720, 7.772) | .156    |
| Widowed                 | 5 (3.7)             | 16 (10.7)       | 3.027 (1.071, 8.556) | .037    |
| Educational status      |                     |                 |              |         |
| Illiterate              | 67 (50.0)           | 84 (56.0)       | 1            |         |
| Able to read and write only | 20 (14.9)       | 36 (24.0)       | 1.436 (762, 2.706) | .263    |
| Primary (1–8)           | 28 (20.9)           | 19 (12.7)       | .541 (278, 1.053) | .070    |
| Secondary (9–12)        | 14 (10.4)           | 7 (4.7)         | .399 (152, 1.044) | .061    |
| Tertiary (+12)          | 5 (3.7)             | 4 (2.7)         | .638 (165, 2.470) | .515    |
| Employment status       |                     |                 |              |         |
| Unemployed              | 16 (11.9)           | 35 (23.3)       | 2.069 (1.053, 4.067) | .035    |
| Employed                | 12 (9.0)            | 4 (2.7)         | .315 (1097, 1.024) | .055    |
| Farmer                  | 70 (52.2)           | 74 (49.3)       | 1            |         |
| Merchant                | 9 (6.7)             | 10 (6.7)        | 1.051 (403, 2.740) | .919    |
| Retired                 | 7 (5.2)             | 5 (3.3)         | .676 (205, 2.228) | .52     |
| Housewife               | 11 (8.2)            | 14 (9.3)        | 1.204 (307, 2.301) | .67     |
| Other                   | 9 (6.7)             | 8 (5.3)         | .841 (307, 2.301) | .736    |
| Residence               |                     |                 |              |         |
| Rural areas             | 80 (59.7)           | 103 (68.7)      | 1            |         |
| Urban areas             | 54 (40.3)           | 47 (31.3)       | .676 (415, 1.101) | .116    |
| Average annual income   |                     |                 |              |         |
| 0–999                   | 33 (24.6)           | 37 (24.7)       | 1.393 (723, 2.684) | .322    |
| 1000–3599               | 32 (23.9)           | 37 (24.7)       | 1.437 (743, 2.776) | .281    |
| 3600–10,799             | 28 (20.9)           | 43 (28.7)       | 1.908 (985, 3.694) | .055    |
| ≥ 10,800                | 41 (30.6)           | 33 (22.0)       | 1            |         |

* Variables which shown statistically significant association during the bivariate analysis

### Factors associated with depression in multiple logistic regression among patients with CVD

Multivariable analysis was done and found that those who were unemployed had about 2 times the odds of developing depression as compared to farmers, adjusted odds ratio (AOR = 2.248, 1.102, 4.583). The odds of developing depression among patients employed were 75% less as compared to farmers (AOR = 0.252, 0.073, 0.869). The odds of developing depression among those
Table 6 Psychosocial and behavioral related factors that associated with depression in bivariate analysis (<.25) among CVD patients in Jimma University Teaching Hospital cardiac clinic, 2014–2015

| Characteristics                              | Non depressed   | Depressed      | COR (95% CI)     | P-value |
|----------------------------------------------|-----------------|----------------|------------------|---------|
| Living condition                             |                 |                |                  |         |
| Alone                                        | 6 (4.5)         | 12 (8.0)       | 1.779 (.648, 4.886) | .263    |
| With family                                  | 121 (90.3)      | 136 (90.7)     | 1                |         |
| Othera                                       | 7 (5.2)         | 2 (1.3)        | .254 (.052, 1.247) | .091^b  |
| Oslo 3-items social support scale            |                 |                |                  |         |
| Poor support                                 | 38 (28.4)       | 62 (41.3)      | 1.909 (1.106, 3.293) | .020^a  |
| Moderate support                             | 62 (46.3)       | 53 (35.3)      | 1                |         |
| Strong support                               | 34 (25.4)       | 35 (23.3)      | 1.204 (.662, 2.189) | .542    |
| Physical activity                            |                 |                |                  |         |
| Yes                                          | 79 (59.0)       | 66 (44.0)      | .547 (.341, 0.877) | .012^b  |
| No                                           | 55 (41.0)       | 84 (56.0)      | 1                |         |
| Cigarette current user                       |                 |                |                  |         |
| Yes                                          | 3 (2.2)         | 11 (7.3)       | 3.456 (.943, 12.664) | .061^b  |
| No                                           | 131 (97.8)      | 139 (92.7)     | 1                |         |

Living condition othera with relative/friends/homeless

^b Variables which shown statistically significant association during the bivariate analysis

Table 7 Clinical and medication related factors that associated with depression in bivariate analysis (<.25) among CVD patients in Jimma University Teaching Hospital cardiac clinic, 2014–2015

| Characteristics                              | Non depressed   | Depressed      | COR (95% CI)     | P-value |
|----------------------------------------------|-----------------|----------------|------------------|---------|
| Diagnosis type of CVD illness                |                 |                |                  |         |
| Hypertensive heart diseases                  | 102 (35.9)      | 48 (35.8)      | 1                | .765    |
| Ischemic heart disease                       | 75 (26.4)       | 37 (27.6)      | 1.913 (.503, 1.658) | .110^a  |
| Valvular heart disease                       | 35 (12.3)       | 11 (8.2)       | 1.939 (86, 4.371) | .537    |
| Rheumatic heart disease                      | 26 (9.2)        | 14 (10.4)      | .762 (321, 1.807) | .442    |
| Cardiomyopathy                               | 29 (10.2)       | 16 (11.9)      | .722 (315, 1.654) | .521    |
| Other                                        | 17 (5.0)        | 8 (6.0)        | 1.000 (357, 2.797) | .537    |
| Age onset of CVD                             |                 |                |                  |         |
| 9–19                                         | 11 (8.2)        | 12 (8.0)       | .679 (264, 1.745) | .421    |
| 20–29                                        | 17 (12.7)       | 21 (14.0)      | .769 (347, 1.701) | .516    |
| 30–39                                        | 24 (17.9)       | 19 (12.7)      | .693 (229, 1.058) | .070^a  |
| 40–49                                        | 24 (17.9)       | 27 (18.0)      | .700 (339, 1.445) | .335    |
| 50–59                                        | 30 (22.4)       | 26 (17.3)      | .539 (266, 1.092) | .086^a  |
| ≥ 60                                         | 28 (20.9)       | 45 (30.0)      | 1                | .081^a  |
| Medication                                   |                 |                |                  |         |
| B-blocker                                    | 72 (53.7)       | 65 (43.3)      | 1.519 (950, 2.426) | .081^a  |
| Duration of treatment (year)                 |                 |                |                  |         |
| ≤ 1                                          | 91 (32.0)       | 50 (37.3)      | 1                | .086^a  |
| 1–2                                          | 51 (18.0)       | 24 (17.9)      | 1.372 (69, 2.729) | .367    |
| 2–3                                          | 29 (10.2)       | 12 (9.0)       | 1.728 (741, 4.028) | .206^a  |
| 3–4                                          | 30 (10.6)       | 11 (8.2)       | 2.106 (901, 4.927) | .086^a  |
| ≥ 5                                          | 83 (29.2)       | 37 (27.6)      | 1.516 (834, 2.758) | .173^a  |
| Lipid profile level—total cholesterol (mg/dl)|                 |                |                  |         |
| < 200                                        | 7 (63.6)        | 11 (91.7)      | 4.488 (495, 40.69) | .182^a  |
| ≥ 200                                        | 4 (36.4)        | 1 (8.3)        | 1                |         |

Diagnosis of CVD other—corpulmonary, acute rheumatic fever, congenital heart disease, pericarditis, CHF due to thyrotoxicosis

^a Variables which shown statistically significant association during the bivariate analysis
who had poor social support was 2 times odd of depression as compared to those with moderate social support (AOR = 2.324, 1.290, 4.187). Similarly, among patients, current cigarette user were 5 times greater odds to develop depression as compared to those who were none current cigarette user (AOR = 4.722, 1.218, 18.311). The odds of developing depression among patients who have a habit of doing physical activity was 53% less as compared to who didn’t do physical activity (AOR = .541, .328, .893) (Table 8).

**Table 8** Factors that associated with depression in multiple logistic regression of CVD patients in Jimma University Teaching Hospital cardiac clinic, 2014–2015 (n = 284)

| Characteristics                  | Non depression N (%) | Depression N (%) | AOR (95% CI)     | P-value |
|----------------------------------|----------------------|------------------|------------------|---------|
| **Occupational status**          |                      |                  |                  |         |
| Unemployed                       | 16 (11.9)            | 35 (23.3)        | 2.248 (1.102, 4.583)a | .026    |
| Employed                         | 12 (9.0)             | 4 (2.7)          | .252 (0.773, 8.699)a | .029    |
| Farmer                           | 70 (52.2)            | 74 (49.3)        | 1                |         |
| Merchant                         | 9 (6.7)              | 10 (6.7)         | .904 (0.326, 2.510) | .847    |
| Retired                          | 7 (5.2)              | 5 (3.3)          | .723 (0.212, 2.472) | .605    |
| Housewife                        | 11 (8.2)             | 14 (9.3)         | 1.417 (0.587, 3.419) | .438    |
| Other                            | 9 (6.7)              | 8 (5.3)          | .635 (0.224, 1.805) | .395    |
| **Oslo 3-items social support scale** |                  |                  |                  |         |
| Poor support                     | 38 (28.4)            | 62 (41.3)        | 2.324 (1.290, 4.187)a | .005    |
| Moderate support                 | 62 (46.3)            | 53 (35.3)        | 1                |         |
| Strong support                   | 34 (25.4)            | 35 (23.3)        | 1.336 (0.702, 2.545) | .378    |
| **Current cigarette user**       |                      |                  |                  |         |
| Yes                              | 3 (2.2)              | 11 (7.3)         | 4.722 (1.218, 18.311)a | .025    |
| No                               | 131 (97.8)           | 139 (92.7)       | 1                |         |
| **Physical activity**            |                      |                  |                  |         |
| Yes                              | 79 (59.0)            | 66 (44.0)        | .541 (0.328, 0.893) | .016    |
| No                               | 55 (41.0)            | 84 (56.0)        | 1                |         |

*a* Significant level in 95% CI

Discussion

In this study, an attempt was made to assess the prevalence and associated factors of depression. The prevalence of depression was 52.8% which high as compared to a study done in the US (21.5%), Pakistan (37%), and Jamaica (19.9%) [19, 30, 31]. The prevalence of depression was almost similar to the study done in Washington, USA 51.0% [38]. However, it was lower in magnitude than a study done in Nigerian 67.0% [50], in Brazil 67.0% [32] and USA (Utah) (75%) [27].

In our study, the finding of depression was higher than the studies done in Pakistan (37.0% and 47.0%), Netherlands (42%) Iran (41.9%), Canada (35%) and Nigeria (30.0%) [30, 33–37]. The difference might be studying population, study setting, the tool used, study design and sociocultural difference. The prevalence of depression was higher among CVD patients. This implies that doctors and other professionals should routinely screen depression among patients with CVD.

In this study CVD related employment status, physical activity, current cigarette user and social support were found the potent variable that statically significant association with depression in the final model.

Our study finding revealed that the likelihood of developing depression among those unemployed was 2 times higher than as compared to farmers (AOR = 2.248, 1.102, 4.583). The possibility of developing depression among patients employed was 75% less likely as compared to farmers (AOR = .252, .073, .869). This study in line with the study done in South Korea and the USA [38, 39]. They are more likely to engage in drinking alcohol, smoking, drug use, suicide intentions, and crime. Additionally, because a majority of people among CVD patients were pre-retirement or retirement age was forced to leave their jobs. These things lead to depression among the unemployed [39]. Meta-analyses and systematic reviews did have shown that unemployed have at least twofold risk of mental illness, particularly depression and anxiety disorders, compared to employed persons [40].

In our finding, the likelihood of developing depression among those who had poor social support was 2 times odd of depression as compared to those with moderate social support (AOR = 2.324, 1.290, 4.187). This finding
similar to the study done in Canada, Italy, the USA, Brazil, and Iran [41–46]. Low social support levels are important risk factors for the subsequent development or worsening of depression.

In our study finding, among patients who current cigarette user was 5 times more likely to develop depression as compared to those who were none current cigarette user (AOR = 4.722, 1.218, 18.311). This finding similar to the study done in the Netherlands supports that smoking as an independent predictor of depression in CVD patients. Smokers, in turn, have a higher risk of being depressed and a decreased chance of recovery from depression. Both tobacco smoking and depression are associated with cardiac mortality and morbidity [47].

Similarly, the study had done in Australia supports our study finding that reports, smoking as an independent predictor of depression in CVD patients. The mechanisms through which smoking is associated with depression might be biogenic, psychological and environmental factors. Smoking-induced neurobiological changes that might predispose to depression; the transient alleviation of depressive symptoms and psychotropic side effects with smoking [48]. The study was done in Greece and systematic review done also reported that smokers have higher rates of depressive symptoms than nonsmokers [49, 50]. Smoking cessation among depressed CVD patients is associated with concurrent improvement in depression [51]. Our study finding also contrasts with the study done in Toronto, Canada [52].

In our study participants, those who physically active (do moderate to vigorous activity for 30 min or more, at least 4 days in a week) were 46% less likely to develop depression as compared to physically inactivate, (AOR = .541, .328, .893). This is consistent with the study done in Italy and Spain that report that physical inactivity increases the risk of depression [53, 54]. The study was done in Pakistan also supports our study finding, additionally reported that physical activity shows positive effects to reduce the level of depression among CVD patients [55]. Other studies which were done in Canada and the USA also in line with our study finding [56]. Lastly, in this study respondent’s age, sex, place of residence, B-blocker medication, marital status, comorbid diabetes mellitus and hypertension, living condition and lipid profile were not significantly associated with depression among CVD patients in the final model. The finding was in line with the study done in USA, Netherlands, Japan, Denmark, Brazil, Pakistan [12, 20, 27, 30, 32, 38, 53, 57–59].

Conclusions
Our study finding showed that the prevalence of depression was 52.8% and it was found to be highly prevalent psychiatric comorbidity in adult CVD patients. Depression had independently associated with employment status, physical activity, current cigarette user and social support. This study could be taken as an eye-opener with regards to bridging the knowledge gap that exists in the country and particularly among Jimma University Teaching Hospital’s health workers and specialists working with cardiac patients attending cardiac clinic and could help to put an effort for integration of knowledge from both Internists and psychiatrists through multidisciplinary team approach for achieving quality of patient care.

Abbreviations
ACS: acute coronary syndrome; AMI: acute myocardial infarction; AF: atrial fibrillation; BDI: Beck depression inventory; BMI: body mass index; BSC: Bachelor of science; CAD: coronary arterial disease; CABG: coronary artery bypass graft; CHD: coronary heart disease; CHF: congestive heart disease; CVD: cardiovascular disease; CPMJU: College of Public Health Medical Science of Jimma University; DIS: diagnostic interview schedule; DSM-IV: Diagnostic and Statistical Manual of Mental Health Disorders, Fourth Edition; HADS: Hospital anxiety and depression scale; HHD: hypertension heart disease; HRQOL: heart-related quality of life; HTN: hypertension; ICD: implantable cardioverter-defibrillator; IHD: ischemic heart disease; JUTH: Jimma University Teaching Hospital; LVEF: left ventricular ejection fraction; MDD: major depressive disorder; MI: myocardial infarction; NYHA: New York Heart Association; NCDs: non-communicable diseases; PHQ-9: patient health questioner; QOL: quality of life; RHD: rheumatic heart disease; SHHD: Sudan Heart Association; SPSS: statistical package for social sciences; USA: United States of America; WHO: World health organization; YLL: years of life lost.

Authors’ contributions
HU, MB, and AB contributed to the design, conduct analysis of the research and in the manuscript preparation. AN contributed to the design, conduct, and analysis of the research. All authors read and approved the final manuscript.

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Competing interests
The authors declare that they have no competing interests.
Consent for publication
We all authors approve that our consent for publication our manuscript titled as prevalence and associated factors of depressive disorders among adult patients with cardiovascular disease at the outpatient cardiac clinic in Jimma University Teaching Hospital, southwest Ethiopia in the international journal of a mental health system. And we put our agreement signature as below.

Name of Authors Signature
1. Halima Umer
2. Alemayehu Negash
3. Mengesha Birkie
4. Asnare Belete

Data availability
The authors approve that all data underlying the findings are completely accessible without limitation and also pertinent data are in the paper.

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This is from a developing country; our salary couldn’t cover the fee for publication. This paper is original and has a great impact on to design prevention strategy for policymaker and it will be used as the reference for researchers. Therefore, I request your journal to publish this paper free.

Informed consent
Procedures followed were in accordance with the ethical standards of the responsible committee from the Ethical Review Board of Jimma University, College of public health and Medical Sciences. Oral consent was obtained from the study participants. Patients those found to be severally depressed and suculcal risk appropriate intervention was done according to PHQ-9 score.

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