Review article

Prevalence of depression in cardiovascular patients in Iran: A systematic review and meta-analysis from 2000 to 2017

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ABSTRACT

Background: In both developed and developing countries, cardiovascular disease is on the rise, representing nowadays one of the main challenges for the health systems worldwide. This increase generates relevant costs. The aim of this study was to conduct a systematic and meta-analytical review of the prevalence of depression in cardiovascular patients in Iran.
Methods: Articles written in English and Persian were searched from January 2000 to July 2017 in different scholarly databases.
Results: 12 studies were retained and included in the current meta-analysis. Selected studies were published between 2008 and 2016. The number of patients participating in these studies was 9292. Based on the random-effects model, the prevalence of depression in cardiovascular patients in Iran was 47% [95% confidence interval or CI 38–56], $I^2 = 98.2\%$ with P = 0.000. The relative risk (RR) of depression in cardiovascular patients yielded a value of 1.30 [95%CI 1.05–1.62] with P < 0.001. Women are more at risk for depression than men.
Conclusion: The current meta-analysis estimated the prevalence of depression among cardiovascular patients in Iran. The prevalence found computed by the present study is higher than the figures found in developed countries. Depression with cardiovascular disease causes many problems for these patients, and early diagnosis and treatment significantly helps in improving quality of life, as well as saving costs and resources.

1. Introduction

In both developed and developing countries, cardiovascular disease is on the rise, representing nowadays one of the main challenges for the health systems worldwide. This increase generates relevant costs (Ford and Capewell, 2007; Roger et al., 2012). According to the World Health Organization (WHO), 31% of people die every year because of cardiovascular disease, which is responsible for more than 75% of deaths in low-income and middle-income countries (World Health Organization, 2017a).

Depression is the most common mental illness worldwide and affects many people, impairing their personal, social and family activities. About 800,000 people die of suicidal thoughts every year (World Health Organization, 2017b).

In chronic-degenerative diseases such as diabetes, chronic obstructive pulmonary disease, asthma and cardiovascular disease, the risk of depression is two to three times higher than in other people. When depression occurs in patients with these diseases, physical, social and physical functions deteriorate further. Depression is one of the major implications for cardiovascular patients in various studies (Moussavi et al., 2007; Nicholson et al., 2006; Whooley, 2006).

In a meta-analysis study in China, based on 27 studies, the prevalence of depression was 51% in cardiovascular patients (Ren et al., 2014). In a cohort study in Germany, after 5 years of follow-up, the prevalence of depression was 21.8% for people with cardiovascular disease and 14.25% for non-patients (Konrad et al., 2016). In another study in Japan, the prevalence of depression in cardiovascular patients was 22% (Suzuki et al., 2011). Also, in Pakistan, 37% of cardiovascular

patients suffered from depression (Bokhari et al., 2002). In another study in the United States, a figure of 9.3% was reported (Lichtman et al., 2008). In another study in Sweden, the prevalence of depression in cardiovascular patients was 15% (Sowden et al., 2010).

Cardiovascular patients in Iran are also prone to depression, which can cause serious problems for patients, the family, the community and the health system. Several studies have been done to determine the extent of depression in cardiovascular patients, and this can provide a better and more transparent viewpoint for policy-and decision-makers, in that an early diagnosis of depression and its treatment reduces the costs and saves resources for the health sector.

Therefore, the aim of this study was to conduct a systematic and meta-analytical review of the prevalence of depression in cardiovascular patients in Iran.

2. Methods

2.1. Literature search

Articles written in English and Persian were searched from January 2000 to July 2017 in different databases (PubMed/Medline, Embase, CINAHL, Scopus, ISI Web of Science, PsycINFO, Irandoc, MagIran and SID). The search strategy was performed using Boolean operators (AND, OR) and keywords related to Prevalence, Depression, Cardiovascular disease, and Iran. The search was carried out independently by two authors (Supplementary).

2.2. Inclusion criteria

1. Observational studies (cross-sectional, cohort and case-control studies);
2. Studies that reported a figure of depression in cardiovascular patients, or the possibility of calculating a figure on the basis of the data reported by authors;
3. Studies carried out in Iran.

2.3. Exclusion criteria

1. Review studies, letters to editors, editorials, commentaries, expert opinions, case studies and case-series;
2. Studies that did not allow the calculation of the prevalence;
3. Studies not carried out in Iran.

2.4. Data extraction

Two of the authors independently extracted the study data. In case of controversy concerning the data, it was resolved through the consultation of a third author or through discussion until consensus was reached. The name of the first author, the year of publication, the number of participants stratified by gender, the place where the study was conducted, the reported prevalence figure, the diagnostic tools of depression, the number of men and women with depression, and the age of the individuals were extracted.

2.5. Quality of assessment

The "STrengthening the Reporting of OBservational studies" (STROBE) tool was used to evaluate selected studies. The STROBE contains 22 items (von Elm et al., 2007). According to the items in this tool, the studies were categorized into three categories: namely, studies with low $(1-7)$, moderate $(8-16)$, and good $(17-22)$ quality. The evaluation was done by two authors independently. Any disagreements were resolved by discussion.

2.6. Statistical Analysis

To calculate the prevalence of depression in cardiovascular patients, the Der-Simonian and Laird's random model with 95% confidence interval (CI) was used (DerSimonian and Laird, 1986). Figures with $P < 0.05$ were considered significant. I^2 test was used to evaluate heterogeneity of studies (Higgins et al., 2003). Subgroup-analysis studies were performed based on the participants' sample size, the questionnaires used to diagnose depression, gender, and quality of studies. Sensitivity analysis was used to ensure the stability of the results. To study the heterogeneity of sources, meta-regressions were conducted based on the year of publication and the sample size. Egger's test was used to evaluate the publication bias (Egger et al., 1997). All analyses were performed using STATA Ver.12 software (Stata Corp, College Station, TX, USA).

3. Results

3.1. Search results

The results of the current investigation were reported according to the PRISMA items (Supplementary). After initial search, 117 studies were found. 44 duplicate articles were deleted and 73 articles were considered. The abstracts and full texts of 26 pertinent studies were reviewed by two authors, and finally 12 studies were selected based on inclusion criteria (Abbasi et al., 2016; Araste, 2008; Bayani et al., 2011; Etesami pour and Amirpour, 2014; Ghaleiha et al., 2011; Kheirabadi et al., 2013; Komasi and Saeidi, 2016; Najafipour et al., 2016; Rohani et al., 2011; Safaie et al., 2012; Shokrgozar et al., 2015; Tajfard et al., 2014). Fig. 1 shows the process of searching and selecting studies.

Selected studies were published between 2008 and 2016. The number of patients participating in these studies was 9292. Table 1 shows the main characteristics of the studies.

3.2. Systematic review

Araste (2008) performed a cross-sectional study recruiting 140 people suffering from coronary artery disease (CAD) with census-based sampling method. Being female, having hypertension, diabetes and hyperlipidemia were associated with higher depression rate. Rohani and collaborators (2011) analyzed 250 consecutive outpatients referred for evaluation of chest pain. Authors found that males with abnormal test were depressed and that patients with negative tests had significantly higher scores for depression scores than those with positive tests. Bayani and coworkers (2011) analyzed 238 subjects attending a cardiovascular clinic. Authors found that the severity of depression was related to hypertension as co-morbidity. Safaie and colleagues (2012) studied 128 hospitalized patients suffering from myocardial infarction. Unhealthy attitudes and lifestyles were found to be associated to depression, as well as gender. Kheirabadi and coauthors (2013) performed a cross-sectional study, selecting 254 participants using a clustered random sampling. Authors found that depression score was correlated inversely with endothelial function flow-mediated dilation among patients with diabetes. Etesami pour and coworkers (2014) investigated a convenience sample of 106 cardiac patients matched with 102 healthy volunteers. Comparing the two groups, authors found that cardiac patients had lower resiliency and higher depressive scores. Tajfard and collaborators (2014) performed a case-control study (486 patients and 440 healthy volunteers). The two groups did not differ based on the depressive scores. Shokrgozar and colleagues (2015) carried out a cross-sectional study among 108 consecutive hospitalized patients with cardiovascular diseases. Authors did not find any association between gender and depressive scores. Ghaleiha and coworkers (2015) performed a descriptive cross-sectional study, recruiting 360 patients with acute coronary syndrome. Age was not associated with depression, whereas depressive scores were significantly higher in females than in
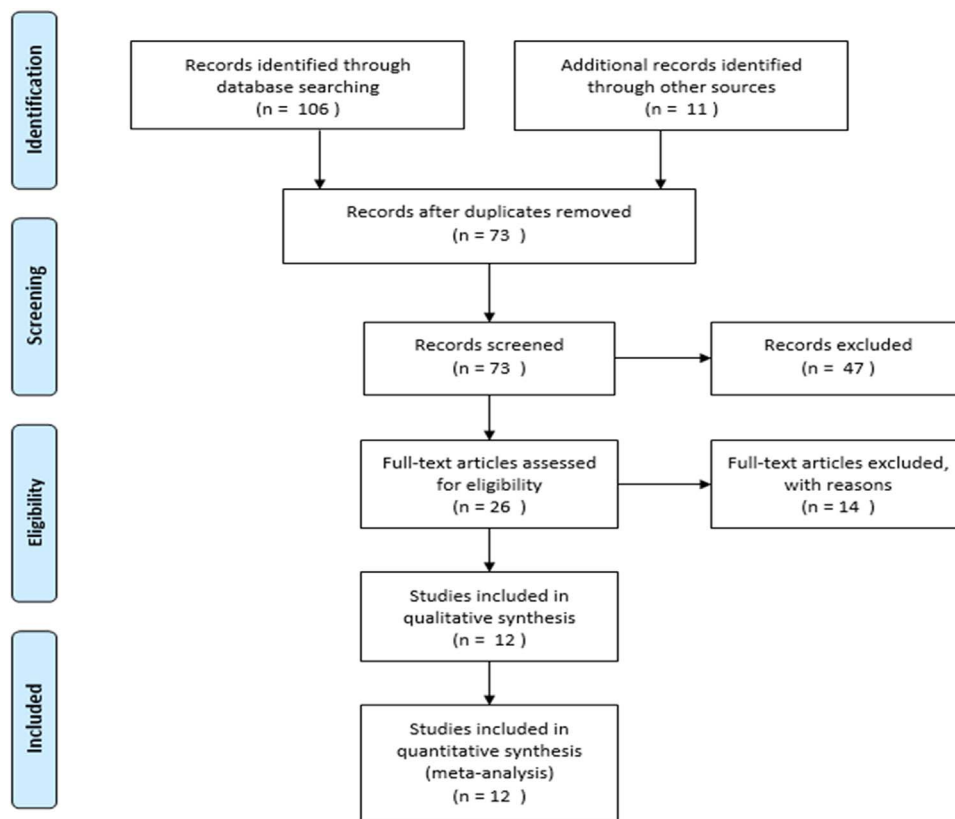
males. Abbasi and colleagues (2016) performed a cross-sectional study, recruiting 770 young adult CAD patients and found a point prevalence of depressive symptoms of 46.9% in women and of 30.2% in men. Among male patients, opium usage, major adverse cardiac events, initial coronary artery bypass grafting treatment, positive family history for CAD and cigarette smoking were predictors of depressive symptoms, whereas hypertension was a protective factor. In the female patients, hypertension and body mass index were predictors of depressive symptoms. Komasi and coworkers (2016) performed a retrospective cross-sectional study recruiting 745 patients. Authors found that depressive scores were significantly higher among those with a perceived risk factor than among those without such risk factor. When stratifying according to gender, this hold true for males, but not for females. Najafipour and colleagues (2016) recruited 5900 people aged 15–75 years, performing a single-stage cluster sampling. Depression was significantly associated with the cardiovascular disease. The risk of depression was higher among females, those holding high-school level of education, and those consuming opium occasionally or frequently, and those doing

low physical activity.

3.3. Meta-analysis

Due to the highly statistically significant heterogeneity ($I^2 = 98.2\%$ with P = 0.000), the random-effects model was utilized. Based on this model, the overall prevalence of depression in cardiovascular patients in Iran was 47% [95%CI 38–56], (Fig. 2).

To ensure the stability of the results, a sensitivity analysis was performed. In this analysis, the impact of each study on the overall outcome is systematically evaluated. The results did not change before and after the sensitivity analysis (Fig. 3). Table 2 shows the results of subgroups-analysis in terms of sample size, quality of studies, diagnostic questionnaires for depression and gender in cardiovascular patients.

The relative risk (RR) of depression in cardiovascular patients is presented in Fig. 4. We computed a RR of 1.30 [95%CI 1.05–1.62] with P < 0.001. Concerning gender-based prevalence ratio, women are more

Table 1

The main characteristics of the studies included in the present systematic review/meta-analysis. Abbreviations: Beck Depression Inventory (BDI); Cardiac Depression Scale (CDS); Hospital Anxiety Depression Scale (HADS); Not Available (NA); Patient Health Questionnaire (PHQ); Symptom Checklist-90 (SCL-90-R).

| Author	Year	Sample size	Number of Females	Number of Males	Prevalence (%)	City	Age (mean ± standard deviation)	Diagnosis
Araste	2008	140	61	79	70%	Sanandaj	NA	Beck
Rohani	2011	200	102	98	31%	Yasouj	NA	HADS
Bayani	2011	238	145	93	42.10%	Tehran	54.4 ± 16.2	HADS
Safaie	2012	128	NA	NA	22%	Tabriz	NA	Beck
Kheirabadi	2013	254	2	252	40.10%	Isfahan	51.4 ± 6.1	HADS
Etesami pour	2014	106	58	48	87.70%	Jahrom	53 ± 9.74	Beck
Tajfard	2014	486	239	247	NA	Mashhad	55.75 ± 10.64	Beck
Shokrgozar	2015	108	36	72	68.50%	Rasht	59.82 ± 13.17	CDS
Ghaleiha	2015	360	153	207	66.60%	Hamedan	54.98 ± 4.78	SCL−90
Abbasi	2016	770	403	367	NA	Tehran	52.88 ± 25	Beck
Komasi	2016	602	181	421	NA	Kermanshah	57.6 ± 8.8	Beck
Najafipour	2016	5900	NA	NA	34.70%	Kerman	33.5 ± 4	Beck
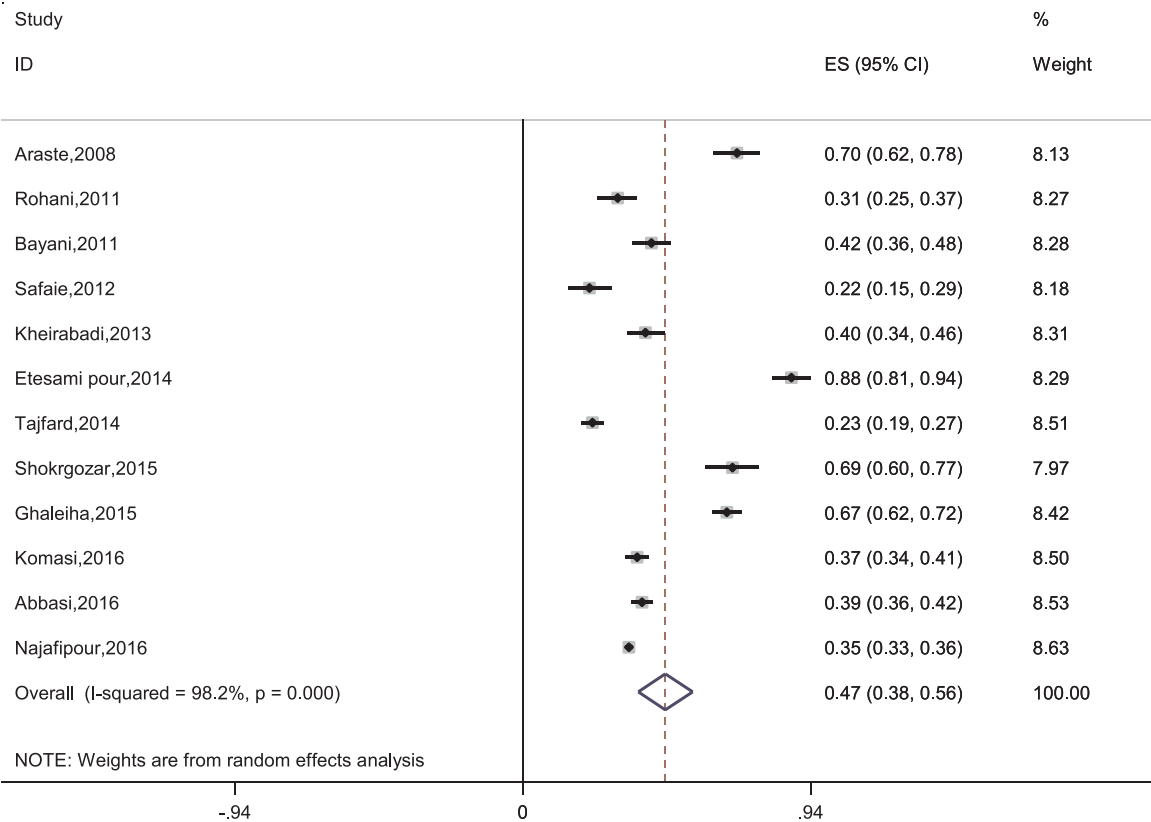
Fig. 2. The overall prevalence of depression in cardiovascular patients in Iran.
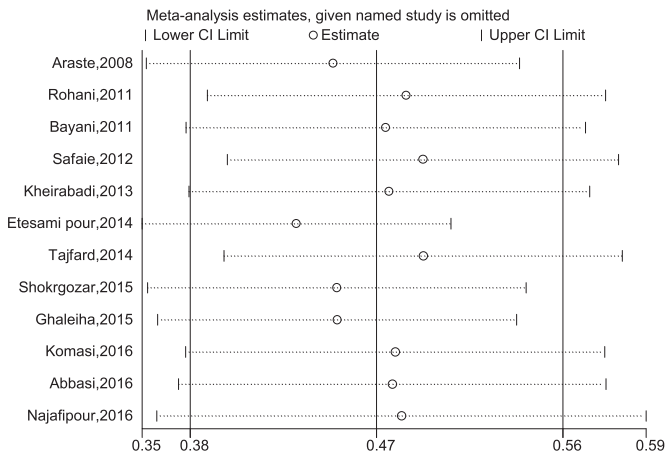
Fig. 3. The sensitivity analysis of depression prevalence in cardiovascular patients in Iran.

Table 2
The results of subgroups-analysis. Abbreviations: Confidence Interval (CI).

Variables	Number of studies	Number of participants	Prevalence (95% CI)	I^2	P
Sample size	6	920	53% (32–75)	98.2%	0.000
≤ 250	6	8372	40% (31–49)	97.6%	0.000
> 250					
Quality of studies					
Good	5	7078	34% (28–40)	91.46%	0.000
Moderate	5	1336	57% (35–79)	98.7%	0.000
Low	2	878	53% (24–82)	97.4%	0.000
Questionnaires					
Beck	7	8132	45% (33–56)	98.5%	0.000
HADS	3	692	38% (31–44)	69.9%	0.000
CDS	1	108	69% (60–77)	–	–
SCL − 90-R	1	360	67% (62–72)	–	–
Gender					
Male	5	991	46% (24–67)	98.3%	0.000
Female	5	933	61% (41–81)	97.6%	0.000

at risk for depression than men. (Fig. 5)

To study heterogeneity sources, meta-regressions were carried out based on the year of publication and the sample size. The results are presented in Table 3 and Fig. 6.

Fig. 5 shows the result of the publication bias based on the Egger's test. A P-value of 0.108 was computed, therefore, there was no publication bias.

4. Discussion

Depression is often found in patients with chronic illnesses, according to the WHO report, which found a rate between 9.3% and 23% (Moussavi et al., 2007). The results of a cohort study in the United States showed that the prevalence of depression in cardiovascular, diabetic and hypertensive patients was 9.3%, 9.3%, 8%, and 4.8%, respectively (Lichtman et al., 2008). The present study aimed to investigate the prevalence of depression in Iranian cardiovascular patients. This study is the first systematic review and meta-analysis in this regard, and comprehensively performs an array of analyses, such as subgroup-analysis, sensitivity analysis and meta-analysis, which are among the strengths of this study. The findings showed that the prevalence of depression in cardiovascular patients in Iran is 47%. Compared to studies conducted in other countries, this figure is similar to Pakistan 47% (Dogar et al., 2008), lower than the rate of 51% found in China (Ren et al., 2014) but much higher than the rates of 21.8% and 22%, computed in Germany (Konrad et al., 2016) and Japan (Suzuki et al., 2011), respectively.
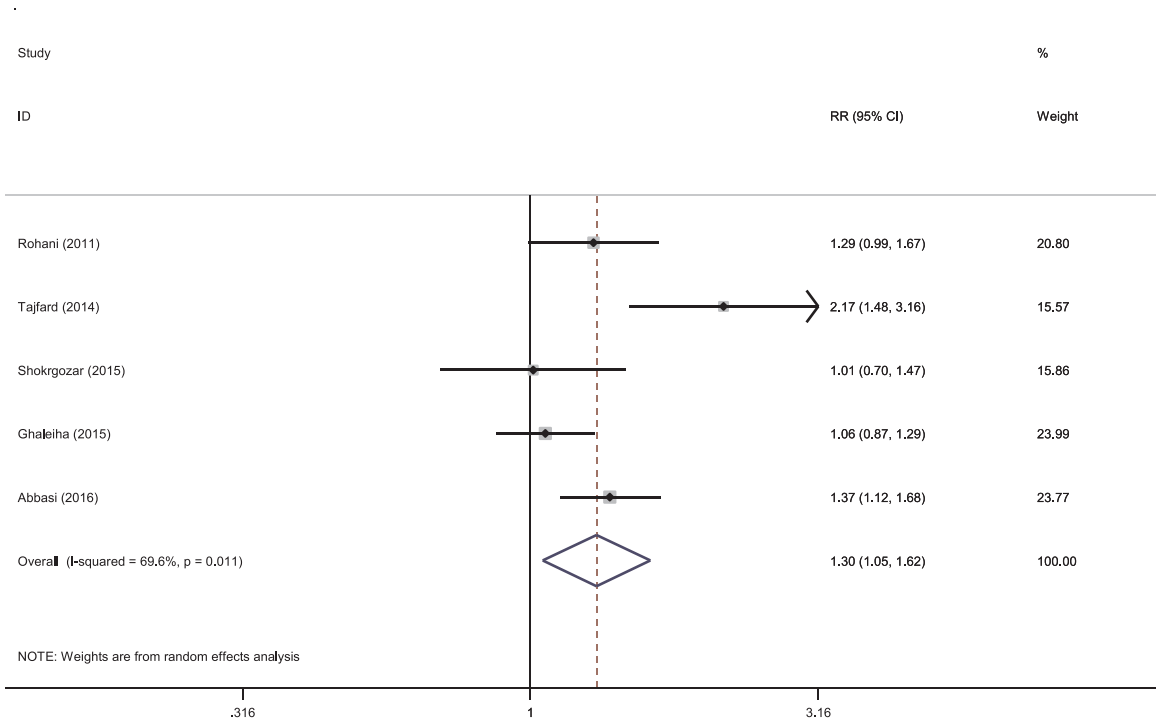
Fig. 4. Gender-based prevalence ratio of depression in cardiovascular patients in Iran.
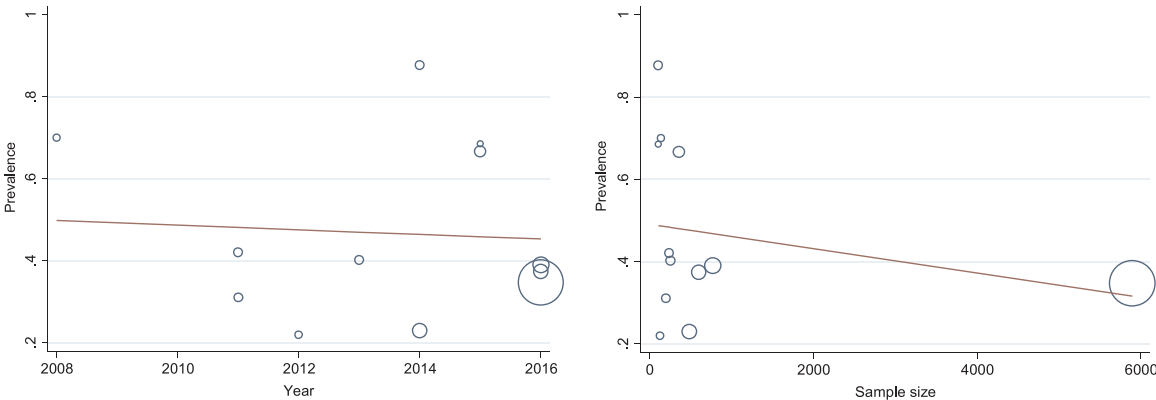

Fig. 5. The graphs of meta-regressions based on the year of publication and sample size of studies.

It seems that in order to address this difference, we should mention different cultural, social, economic and health system features in Iran. Lack of proper use of services and less health care due to economic conditions as well as lack of appropriate care insurance are likely to worsen the quality of life among Iranian cardiovascular patients. This dramatically impacts on their mental health and results into a high prevalence rate of depression. Cardiovascular patients also need to be supported by the health sector as they suffer from depression, due to medical conditions and increased economic costs. Therefore, having adequate insurance could help reducing their complications and improving their depression condition. Therefore, they should receive a stronger support (Walker et al., 2015). However, given the fact that Iran is a developing country, there are economic constraints in the health sector, and this could interfere with the delivery of health-care services needed by cardiovascular patients.

According to subgroup-analyses, on the basis of the Beck questionnaire (7 studies), a higher prevalence (45%) was found, while using the studies exploiting the HADS questionnaire (3 studies) the prevalence computed was lower (38%). These findings are generally in line with the extant literature: for example, according to Thombs et al. (Thombs et al., 2006), a prevalence rate of 31.1% was found using the Beck's questionnaire. Using different diagnostic questionnaires to diagnose depression is one of the most important reasons for the difference in reported prevalence rates among studies (Koenig et al., 1997). It

Table 3
The result of meta-regressions.

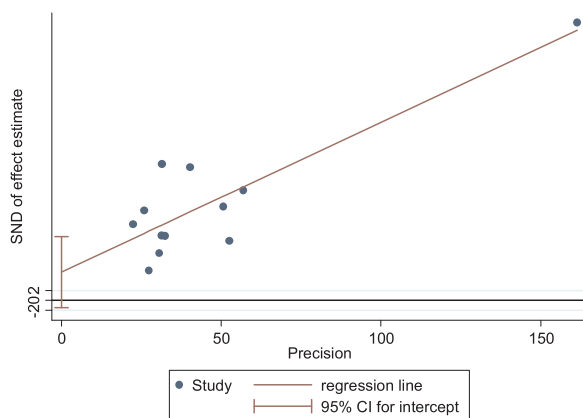| Variables	Coefficient	Standard error	T	p	Lower 95%	Upper 95%
Year	0.00	0.02	0.08	0.93	−0.06	0.069
Sample size	−0.00	0.00	−0.69	0.50	−0.00	−0.00

Fig. 6. Egger's regression test to assess publication bias.

should be, indeed, stressed that the HADS questionnaire has no questions about physical symptoms, whereas the Beck's questionnaire has questions that assess the individual's physical condition. As such, it is not surprising that the prevalence of depression is higher in studies that use the Beck's questionnaire (Thombs et al., 2006; Verdam et al., 2017; Zigmond and Snaith, 1983).

The results of this study showed that the prevalence was 61% in women and 46% in men. A relative risk analysis also showed that women with cardiovascular diseases are at higher risk for depression (RR = 1.30). This finding is consistent with the results of some studies (Barefoot and Schroll, 1996; Bokhari et al., 2002; Frasure-Smith and Lespérance, 2003). Women are more prone to depression due to disorders such as premenstrual syndrome, postpartum depression, depression associated with changes in hormones in postmenopausal women. These hormonal changes, especially when they suffer from chronic illness, also increase the risk, whereas interventions aimed at reducing/controlling endocrinologic changes in women seem to have a protective effect (Abate, 2013; Bartels et al., 2013; Cyranowski et al., 2000).

However, the current study has some limitations, including:

1. In many provinces of Iran, there is a dearth of studies concerning depression rate in cardiovascular patients;
2. The heterogeneity observed in the studies is significantly high. This could be due to differences in methodology (most studies were cross-sectional, some studies were case-control; some utilized convenience samples, whilst others clustering sampling techniques), geographic location of studies, use of different diagnostic questionnaires for depression, and/or conditions of patients (suffering from CAD, myocardial infarction or complaining of chest pain; hospitalized *versus* attending a clinic; with or without risk factors and/or co-morbidities, *etc.)*;
3. Data of studies did not allow authors to analyze relationships with other variables.

5. Conclusion

The current systematic review and meta-analysis estimated the prevalence of depression among cardiovascular patients in Iran. The prevalence found is higher than the figures computed in developed countries. Depression with cardiovascular disease causes many problems for these patients, and early diagnosis and treatment significantly helps in improving quality of life, as well as saving costs and resources. This has practical implications for both health-care providers and decision- and policy-makers in designing and delivering *ad hoc* programs for this kind of patients. Due to the aforementioned shortcomings and drawbacks of the current systematic review and meta-analysis, further high-quality studies are warranted in the field.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.jad.2017.10.026.

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