Prevalence of Depression in Hemodialysis Patients in Iran
A Systematic Review and Meta-analysis

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Introduction. Chronic kidney disease is a public health problem worldwide that is highly associated with psychological disorders. This study aimed to assess prevalence of depression in hemodialysis patients in Iran.

Materials and Methods. Relevant studies were identified from the PubMed, ISI Web of Science, Ovid, Scopus, EMBASE, and Iranian databases including Magiran, SID, IranMedex, and Irandoc, up to December 2015. The DerSimonian-Laird random effects model was employed to estimate the overall pooled prevalence. Heterogeneity was investigated and subgroup analyses were carried out by sample size and time of study.

Results. Twenty-seven studies on 2822 patients met the inclusion criteria for analysis. The pooled analysis of depressive symptoms in hemodialysis patients in Iran was estimated to be 62% (95% confidence interval, 0.54 to 0.71) with a maximum rate of 95% (95% confidence interval, 0.88 to 1.02) and a minimum rate of 9% (95% confidence interval, 0.02 to 0.16). Statistical heterogeneity was high (I^2 = 96.9%).

Conclusions. The results of this study showed that depression is common among dialysis patients in Iran. Early diagnosis and effective treatment of depression can improve quality of life, prognosis, and survival of patients.

INTRODUCTION

Chronic kidney disease is a public health problem worldwide.[1] Depression, as the 4rth leading cause of disability in the world, is one of the most common psychiatric disorders in hemodialysis patients.[2] Several factors can cause depression in dialysis patients, including physical and emotional stress, adverse effects of medication regimens, functional limitations, dietary constraints, and unsuitable economic conditions.[3,4] Depression in these patients is associated with the potential to increase mortality, hospitalization, fatigue, changes in appetite and weight, gastrointestinal disturbances, sexual dysfunction, general pain, backaches and headaches, and reduced quality and commitment to social activities.[5-7] Several studies have reported clinical depression in dialysis patients. A review study showed that the prevalence of depression is between 5% to 71.4% among hemodialysis patients.[8] In the United States and Sweden, these rates are 19.8% and 21.7%, respectively. In the Japanese population, the prevalence of depression in end-stage renal disease was only 2%.[9] In the China and Taiwan, this prevalence was 45.9%.[10]

The use of different screening tools to evaluate depression in different studies could be explained the disparity in the prevalence rates. The increased risk of suicide in these patients should always

be kept in mind. Several studies have focused on the prevalence of depression in hemodialysis patients in Iran, but they have reported different estimates. For prevention, promotion of quality of life, and treatment in these patients, knowing the prevalence is necessary. Such information is of utmost importance to contribute to better understanding of the epidemiology of this disease in the country and decision makers to strengthen preventive measures and to reduce the prevalence of depression in hemodialysis patients. Therefore, this study was carried out to determine the prevalence of depression in dialysis patients in Iran in a systematic review and meta-analysis.

MATERIALS AND METHODS
Study Selection

Databases including the PubMed, ISI Web of Science, Ovid, Scopus, EMBASE, and Iranian databases of Magiran, SID, IranMedex, and IranDoc were searched up to December 2015 using keywords: "hemodialysis," "renal replacement therapy," "dialysis," "end-stage renal disease," or "renal failure" and "depression" and "Iran"). Also, the conferences associated with chronic kidney disease and the references of identified articles were examined to identify further relevant studies. Language limit was not considered in the search. The findings were reported using the PRISMA guideline.[11]

Inclusion and Exclusion Criteria

The inclusion criteria were population-based studies which reported the prevalence of depression in dialysis patients in Iran, studies with results clearly indicating the prevalence of depression in dialysis patients; and cross-sectional studies.

Exclusion Criteria

The following studies were excluded: case reports, case series, quasi-experimental trials, letters to editor, and case-control studies; studies with no clear data to estimate the prevalence of the disease; studies that did not use the standard diagnostic method in the diagnosis of depression; and studies that were carried out on non-Iranian population.

Data Extraction

Two independent investigators evaluated the studies based on title and abstract, in accordance with the inclusion and exclusion criteria. Finally, studies which were entered into the meta-analysis were selected. There was a disagreement between the two searchers; hence, a third person was employed as a referee and the dispute was resolved with exchange of views. The variables, which included the first author, year of publication, language of study, place of study, sample size, and the type of questionnaire used to diagnose depression, age of participants, and the prevalence of depression, were extracted from the studies and entered into the Microsoft Excel software (version 2010, Microsoft Corp, Redmond, WA, USA).

Quality Assessment

To assess the quality of studies entered into the meta-analysis, the STROBE checklist was used.[12] Based on this checklist, 2 reviewers assessed the articles. The studies were classified into 3 categories according to the checklist score: high quality, medium quality, and low quality. Eightselected items from the recommended checklist of STROBE were used for assessing the quality of studies. These items included: (a) present key elements of the study design early in the paper; (b) clearly define all outcomes prevalence of depression in hemodialysis patients, exposures, predictors, potential confounders, and effect modifiers and give diagnostic criteria; (c) give the eligibility criteria and the sources and methods of selection of participants; (d) describe any efforts to address potential sources of bias; (e) explain how the study sample was arrived at; (f) describe the setting (locations and relevant dates); (g) give sources of data and details of methods of assessment; and (h) describe all statistical methods. The studies were classified high quality if they all items, as in intermediate quality if they did not achieve 2 items, and as low quality if they did not achieve more than 2 items.

Data Analysis

The prevalence of depression in dialysis patients in Iran was investigated based on the DerSimonian-Laird random model.[13] The results were reported with 95% confidence intervals. The I^2 and Q tests were used to assess heterogeneity among studies. Also, a meta-regression was planned by including the variables defined a priori to explore further

sources of heterogeneity based on publication year and sample size. To assess the bias in publication, the Egger test was used.[14] To ensure the robustness of the results, a sensitivity analysis was performed in order to show the impact of any study on the final result. To do this, a sensitivity analysis was performed to assess the effect of each study on the prevalence of depression in hemodialysis patients by sequentially omitting each data set.[15] A *P* value less than .05 was considered significant. In this study, the data were analyzed using the Stata (version 12.0, StataCorp LP, College Station, TX, USA).

RESULTS

During the initial search, 335 papers were eligible and 61 articles were duplicates. The titles of 274 articles were investigated and 183 were excluded due to nonrelevance with the research subject. The full text of 91 articles was evaluated and finally, 27 studies were selected for meta-analysis that included 13 English studies and 14 Persian studies.[16-42]

Figure 1 shows the flowchart of the PRISMA for the selection of articles. A total of 2822 participants were enrolled for the study with an average of 104 for each study. The compiled studies were carried

out between 2003 and 2014. Table 1 shows the study's specifications; 21 to 218 patients participated in the studies. The largest numbers of participants were observed in Bayat and colleagues' study which was conducted in 2012 in Isfahan,[35] and the minimum number of participants was reported by Kazemi and colleagues in Ardebil in 2010.[27]

The overall prevalence of depressive symptoms in dialysis patients in Iran observed based on the random model was 62% (95% confidence interval, 0.54 to 0.71). Heterogeneity among studies was observed (I^2 = 96.9%). There was a significant heterogeneity among the studies and as a result, the chi-square test result was significant (*P* < .001). Figure 2 shows the overall prevalence. The highest prevalence of 95% (95% confidence interval, 0.88 to 1.02) was observed in Rahimi and coworkers' study in 2007 in Hamedan Province,[21] and the lowest prevalence of 9% (95% confidence interval, 0.02 to 0.16) was observed in Bayat and colleagues' study in 2011 in Tehran.[31]

After assessing the quality of the included studies using the STROBE checklist, 17 high-quality studies (62.3%), 6 average-quality studies (22.2%), and 4 low-quality studies (15.5%) were identified. The prevalence of depressive symptoms in hemodialysis patients was investigated based on the quality of
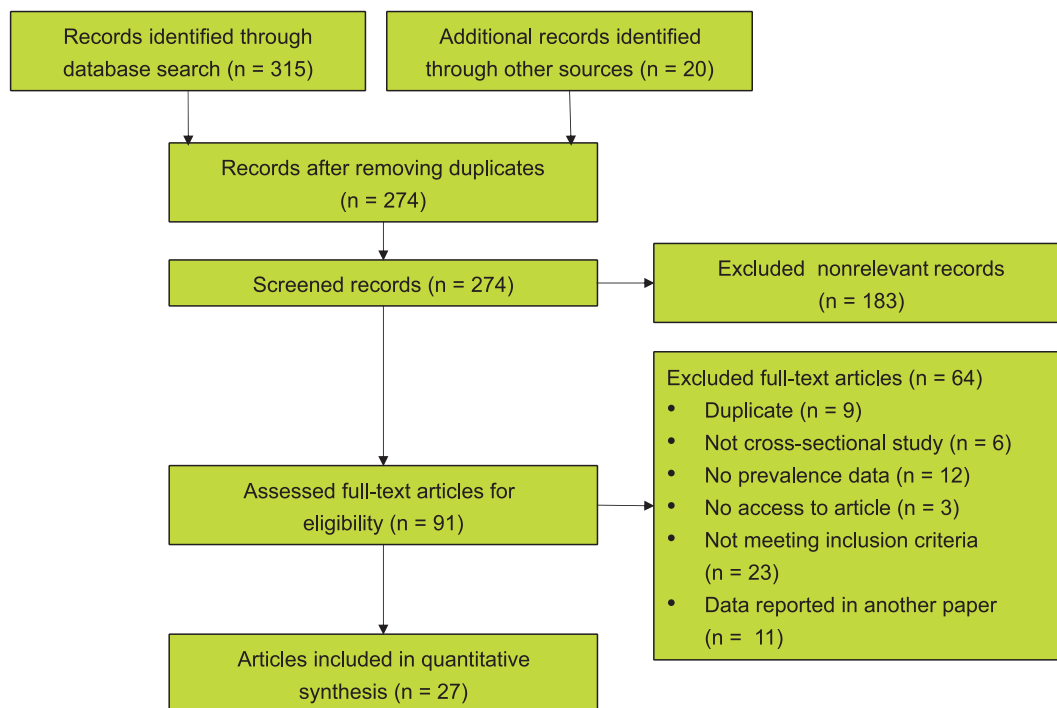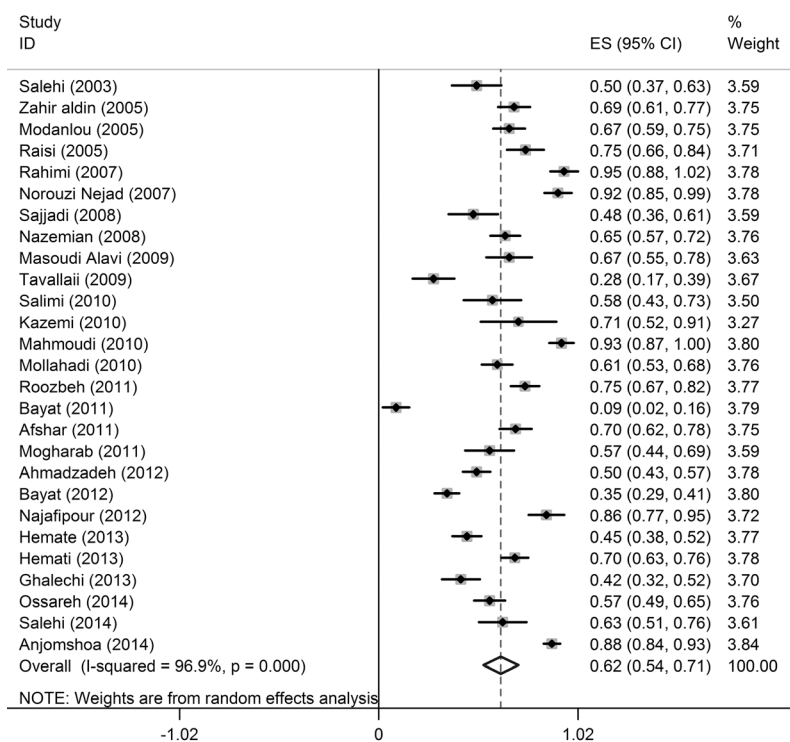

Figure 1. Selection of studies for meta-analysis.

Table 1. Characteristics of Included Studies*

First author	Article's Language	Publication Year	City	Sample Size	Depression Scale
Salehi	Persian	2003	Tehran	60	BDI
Zahir aldin	Persian	2005	Tehran	120	BDI
Modanlou	Persian	2005	Gorgan	129	BDI
Raisi	Persian	2005	Tehran	80	BDI
Rahimi	Persian	2007	Hamedan	38	BDI
Norouzi Nejad	Persian	2007	Ahvaz	60	BDI
Sajjadi	Persian	2008	Mashhad	60	CESD
Masoudi Alavi	Persian	2009	Kashan	63	SCL-90-R
Nazemian	Persian	2008	Mashhad	150	CESD
Tavallaii	English	2009	Tehran	68	HADS
Salimi	English	2010	Tehran	43	DASS
Kazemi	English	2010	Ardabil	21	BDI
Mahmoudi	Persian	2010	Sanandaj	61	BDI
Mollahadi	English	2010	Tehran	147	DASS
Roozbeh	English	2011	Shiraz	135	BDI
Bayat	English	2011	Tehran	68	HADS
Afshar	Persian	2010	Tehran	120	BDI
Mogharab	Persian	2011	Birjand	60	BDI
Ahmadzadeh	Persian	2012	Isfahan	196	SCL-90-R
Bayat	English	2011	Isfahan	218	HADS
Najafipour	English	2012	Jahrom	56	BDI
Hemate	English	2013	Shahrekord	171	BDI
Hemati	English	2013	Shahrekord	171	BDI
Rezaei Ghalechi	English	2013	Ardabil	100	Unclear
Ossareh	English	2014	Tehran	150	BDI
Salehi	Persian	2014	Mahabad	60	HADS
Anjomshoa	English	2014	Kerman	217	BDI

*BDI indicates Beck Depression Inventory; CESD, Epidemiological Studies Depression Scale; SCL-90-R, Symptom Checklist-90-Revised; HADS, Hospital Anxiety and Depression Scale; and DASS, Depression Anxiety Stress Scales.

Study ID		ES (95% CI)	% Weight
Salehi (2003)		0.50 (0.37, 0.63)	3.59
Zahir aldin (2005)		0.69 (0.61, 0.77)	3.75
Modanlou (2005)		0.67 (0.59, 0.75)	3.75
Raisi (2005)		0.75 (0.66, 0.84)	3.71
Rahimi (2007)		0.95 (0.88, 1.02)	3.78
Norouzi Nejad (2007)		0.92 (0.85, 0.99)	3.78
Sajjadi (2008)		0.48 (0.36, 0.61)	3.59
Nazemian (2008)		0.65 (0.57, 0.72)	3.76
Masoudi Alavi (2009)		0.67 (0.55, 0.78)	3.63
Tavallaii (2009)		0.28 (0.17, 0.39)	3.67
Salimi (2010)		0.58 (0.43, 0.73)	3.50
Kazemi (2010)		0.71 (0.52, 0.91)	3.27
Mahmoudi (2010)		0.93 (0.87, 1.00)	3.80
Mollahadi (2010)		0.61 (0.53, 0.68)	3.76
Roozbeh (2011)		0.75 (0.67, 0.82)	3.77
Bayat (2011)		0.09 (0.02, 0.16)	3.79
Afshar (2011)		0.70 (0.62, 0.78)	3.75
Mogharab (2011)		0.57 (0.44, 0.69)	3.59
Ahmadzadeh (2012)		0.50 (0.43, 0.57)	3.78
Bayat (2012)		0.35 (0.29, 0.41)	3.80
Najafipour (2012)		0.86 (0.77, 0.95)	3.72
Hemate (2013)		0.45 (0.38, 0.52)	3.77
Hemati (2013)		0.70 (0.63, 0.76)	3.78
Ghalechi (2013)		0.42 (0.32, 0.52)	3.70
Ossareh (2014)		0.57 (0.49, 0.65)	3.76
Salehi (2014)		0.63 (0.51, 0.76)	3.61
Anjomshoa (2014)		0.88 (0.84, 0.93)	3.84
Overall (I-squared = 96.9%, p = 0.000)		0.62 (0.54, 0.71)	100.00

NOTE: Weights are from random effects analysis

-1.02   0   1.02

Figure 2. The overall of prevalence of depression in hemodialysis patients in Iran.

the studies. The results of this analysis showed that high prevalence rates had been mostly reported in low-quality studies.

The meta-regression results are listed in Table 2 based on year of publication and sample size; although the results showed that the prevalence of depressive symptoms decreased in years 2003 to 2014, the trend was not significant. Moreover, the results showed that depression increased by increasing the sample size, but not significantly.

The subgroup analysis results are listed in Table 3 based on year of publication, sample size, language of studies, quality of studies, diagnostic tests, and geographic location. For geographic location, subgroup studies were divided based on Iranian metropolises. Articles published in the years 2007 to 2010 had the highest prevalence rates. Studies in Persian language showed higher prevalence rates of depressive symptoms. Also, the prevalence was higher in studies that used the Beck Depression Inventory test for detection of patients with depression.

To make the results robust, a sensitivity analysis was performed. The sensitivity analysis in Figure 3 shows that by eliminating each study, the overall prevalence did not change significantly.

Publication bias analysis was performed as shown in Figure 4 for the meta-analysis. There was no bias in the dissemination of results (Egger bias, $P = 0.18$).

Table 2. Results of Meta-Regression on Depressive Symptoms Results

Factor	Standard Error	Coefficient	Confidence Interval	T	P
Sample size	0.015	-0.008	-0.039 to 0.203	-0.54	.60
Year	0.001	-0.0002	-0.002 to 0.001	-0.34	.74
Cons	30.352	17.004	-45.638 to 79.647	0.56	.58

Table 3. Results of Subgroup Analysis*

Subgroup	Prevalence, %	95% Confidence Interval	I^2, %	Q-Cochran	P
Publication year					
2003-2006	66	0.57 to 0.75	69.8	9.93	< .001
2007-2010	68	0.54 to 0.82	95.6	204.08	< .001
2011-2013	57	0.43 to 0.71	97.8	551.64	< .001
Language of article					
English	56	0.41 to 0.70	97.9	573.28	< .001
Persian	69	0.60 to 0.78	93.2	192.20	< .001
Quality of the study					
High	57	0.46 to 0.68	97.0	531.13	< .001
Intermediate	70	0.54 to 0.87	96.4	138.84	< .001
Low	74	0.48 to 0.99	96.1	77.68	< .001
Type of test					
BDI	73	0.65 to 0.81	93.8	240.49	< .001
HADS	33	0.13 to 0.53	95.6	67.85	< .001
SCL-90-R	58	0.41 to 0.74	82.7	5.78	.02
CESD	57	0.41 to 0.73	78.7	4.69	.03
DASS	60	0.53 to 0.67	0.0	0.08	.78
Not known	42	0.32 to 0.52	…	0.00	…
Location of studies					
Tehran	53	0.36 to 0.69	96.7	240.51	< .001
Isfahan	42	0.28 to 0.57	89.9	9.89	.002
Mashhad	57	0.41 to 0.73	78.7	4.69	.03
Shiraz	75	0.67 to 0.82	…	0.00	-
Other Cities	72	0.62 to 0.82	95.2	248.08	< .001
Sample Size					
≤ 100	62	0.46 to 0.78	97.6	577.13	< .001
> 100	63	0.53 to 0.73	95.9	266.19	< .001

*BDI indicates Beck Depression Inventory; CESD, Epidemiological Studies Depression Scale; SCL-90-R, Symptom Checklist-90-Revised; HADS, Hospital Anxiety and Depression Scale; and DASS, Depression Anxiety Stress Scales.
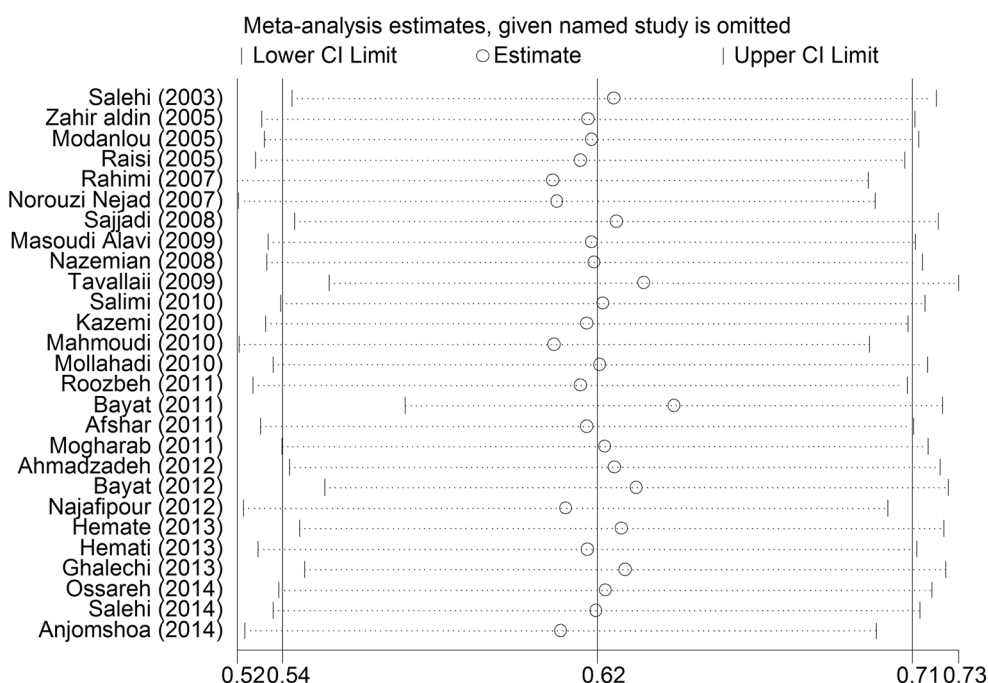
Figure 3. Sensitivity analysis effect of each study on standard error of prevalence of depression in hemodialysis patients in Iran.
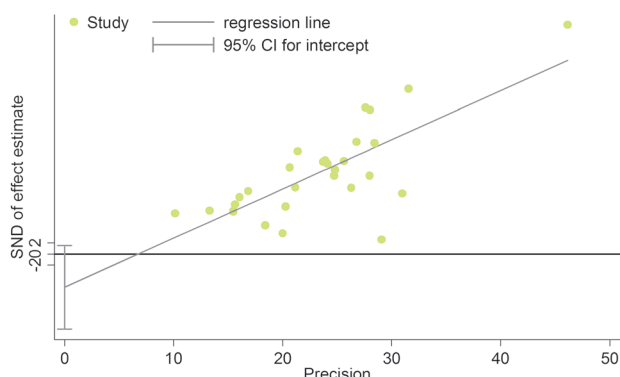

Figure 4. The Egger test for publication bias.

DISCUSSION

Based on available information, evidence synthesis was performed in this study on the prevalence of depressive symptoms among hemodialysis patients in Iran, which was 62% (95% confidence interval, 0.54 to 0.71), lower than the rates found in neighboring countries such as Iraq (80%), Pakistan (75%), and Saudi Arabia (63%).[43-45] This was more than that found in Hungary (33%) and China (21%).[46,47] In another study carried out by Knuth and coworkers in Brazil, the prevalence of depressive symptoms in hemodialysis patients was reported as 48%.[48]

The results showed that depression is common among hemodialysis patients and can be affected by various factors. In this study, the prevalence of depression in hemodialysis patients in Iran was less than that of other countries with lower health status conditions. According to the results obtained in this study, there is an inverse relationship between the level of development and depression rate in hemodialysis patients and by increasing the degree of development of countries, the prevalence of depression is reduced. Better health-medical status, the use of advanced medical equipment, more convenient services for patients, psychiatric services, and emotional, social and familial supports in developed countries can cause differences in various prevalence rates between developed and developing countries.

In this study, the observed depressive symptoms range in hemodialysis patients was between 9% and 95%. The reason for variations may be the differences in diagnostic tools, too. It is worthy of note that most studies have observed the prevalence of depressive symptoms to be 65% to 81% using the Beck Depression Inventory. In another systematic review,[49] the prevalence was reported to be 5% to 58%. The reason for this range of rates was attributed to the differences in diagnostic tools. Also, in a study conducted in the United States on the comparison of different

diagnostic tools to identify depression in dialysis patients (according to the depression rate), the use of Beck Depression Inventory resulted in a 50% rate; an adapted checklist, 17%; and clinical interview, 5%.[50] The difference in diagnostic tools included depression score, anxiety of hospital services, Center for Epidemiologic Studies Depression Scale, epidemiological studies, Beck Depression Inventory, and the Hamilton Zhong Depression. Disease stage, cultural differences, lifestyle, care and treatment of personnel with patients are the reasons for the extent of depression among these patients. It has also been noted that when the total scale scores (patient self-report) was used to determine depression, the highest rate of depression was observed, and when clinical interview was used, the lowest prevalence of depression was observed.

As shown in this study, the results of studies based on geographic regions showed that the prevalence of depression ranged from 53% to 75% in large cities. Different ethnicities and cultures, high population density, population access to diagnostic centers, and supportive services for this disease are associated with high prevalence of depression in hemodialysis patients in major cities of Iran. Depression in patients with chronic kidney failure is significantly related to poor economic and health conditions,[51] reduced quality of life,[52-54] increased self-care,[55] and unwillingness to use health services.[56] A systematic review, carried out to determine the prevalence of depression in patients with chronic kidney disease,[57] using studies from the Europe, North America, the West Pacific Ocean, Eastern Mediterranean region, South-East Asia, and Africa, reported a range from 1.4% to 49.9% (pooled prevalence of depressive symptoms, 34%).

Depression can have significant negative effects on an individual's social and occupational roles. Most of the studies included in the present study showed that the prevalence of depression in dialysis patients is high. This also has an impact on the treatment of patients. This disorder is associated with 1.5 to 3 times higher rates of other chronic diseases among dialysis patients, which leads to increased mortality rates.[58] One of the strengths of this study is the performance of a meta-regression for the effectiveness of heterogeneity results. The high number of studies included in the meta-analysis is the strength of this research.

This study has some limitations: (1) the use of different questionnaires and the different methodologies of conducting studies for the detection of depression in hemodialysis patients; (2) unavailability of appropriate data to help evaluating the prevalence of depression in dialysis patients by sex; (3) high heterogeneity (96.9%) between studies; and (4) low research quality of 15.5% of the studies.

CONCLUSIONS

The results of this study showed that depressive symptoms are very common among dialysis patients. Appropriate social and economic environment and family's social and emotional supports for patients can have an effective role in improving the quality of life. Early diagnosis and effective treatment of depression can improve quality of life, prognosis, and survival of patients. Detection methods in hemodialysis patients should be implemented. Also, due to the importance of depression in these patients, it is recommended that patients be examined periodically.

CONFLICT OF INTEREST

None declared.

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