The Prevalence of severe depression in Iranian elderly: A meta-analysis and meta-regression

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SUBJECT AREAS
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Abstract
Background Depression is one of the most common psychiatric disorders in the elderly and one of the most common risk factors for suicide in the elderly. Studies show different and inconsistent prevalence rates in Iran. This study aims to determine the prevalence of severe depression in Iranian elderly through a meta-analysis approach.

Methods The present meta-analysis was conducted between January 2000-August 2019. Articles related to the subject matter were obtained by searching Scopus, Sciencedirect, SID, magiran, Barakat Knowledge Network System, Medline (PubMed), and Google Scholar databases. The heterogeneity of the studies was evaluated using I $^2$ index and the data were analyzed in Comprehensive Meta-Analysis software.

Results In a study of 3948 individuals aged 50-90 years, the overall prevalence of severe depression in Iranian elderly was 8.2% (95% CI: 4.14-6.3%) based on meta-analysis. Also, in order to investigate the effects of potential factors (sample size and year of study) on the heterogeneity of severe depression in Iranian elderly, meta-regression was used. It was reported that the prevalence of severe depression in Iranian elderly decreased with increasing sample size and increasing years of the study, which is significantly different (P<0.05).

Conclusion Considering the high prevalence of severe depression in Iranian elderly, it is necessary for health policy makers to take effective control measures and periodic care for the elderly.

Background
Elderly is an inevitable biological process that affects all living things and is associated with unpleasant experiences in some cases [1]. The aging process refers to the gradual decline in the function of the body's systems, including cardiovascular, respiratory, genitourinary, endocrine glands, and immune system [2].

Social, economic, and scientific developments in recent years have increased life expectancy and reduced mortality rates, leading to an increase in the world’s elderly population [3]. The elderly population is estimated to be doubled during next 40 years in the world [4].

Today, aging has become a major global phenomenon and according to WHO statistics, the number of
elderly in Southwest Asian countries, including Iran, will reach 15% of the total population by 2030 [5]. Other reports suggest that the number of people aged ≥ 60 years will increase from 841 million people in 2013 to 1.2 billion people in 2025, with 70% of them living in developing countries and 8 out of every 10 elderly people in the world are expected to live in developing areas by 2050 [6]. Iran, as one of the developing countries, is not excluded from these demographic changes, with the elderly population is projected to grow from 8.2% in 2011 to 10% in 2021 [8]. Despite the growth of the elderly population, the needs and problems of this stratum are more pronounced and need to be taken into consideration [7–9].

Depression is one of the most common psychiatric disorders in the elderly and one of the most common risk factors for suicide in the elderly [10], which accounts for nearly 24% of successful suicides, and most elderly suicide victims attempted suicide in their first depression attack. The frequency of the symptoms of major depression has been reported to be 8–15% and approximately 30% among the non-hospitalized and hospitalized elderly, respectively [10–12].

Previous studies in different parts of Iran show different reports of the prevalence of severe depression, including 23% in Isfahan [13], 3.3% in Birjand [14], and 11% prevalence in the study in Gilan [15]; therefore, as can be seen, the reported information provides scattered and inconsistent information and since interventional studies to reduce the prevalence of severe depression in the elderly require accurate and consistent information in order to prevent severe depression problems and complications in this population, the question is, how much is the overall prevalence of severe depression in Iranian elderly?

The aim of the present study is to review the overall prevalence of severe depression in Iranian elderly based on a meta-analysis approach.

Methods

Searching technique

This study is a meta-analysis, based on the findings of studies on the prevalence of severe depression among Iranian elderly, including articles published in domestic and foreign journals and searches carried out in the databases of Sciedirect, Scopus, SID, magiran, Medline (PubMed), Barakat Knowledge Network System, and Google Scholar between January 2000 to August 2019. The search
The process was carried out using the keywords Elderly, Depression, Mood Disorders, Types of Depression, Severe Depression and their English equivalents and their possible combinations, so that the process of the Persian databases were searched using the mentioned Persian keywords and in the English databases using their English equivalents including Elderly, Depression, Mood disorders, Types of depression, Severe depression as well as in the Google Scholar search engine using both English and Persian words. AND and OR operators were used in combination to provide more comprehensive access to all articles, therefore, the OR operator was used to check for common names for disorders such as (Elderly OR Aging), (depression OR Depressive Disorder), (mood disorders OR Affective Disorders). The AND operator was also used among the keywords (Elderly AND depression AND severe depression) by matching words in the MeSH browser.

(((Elderly [Title/Abstract]) OR Aging [Title/Abstract]) AND depression [Title/Abstract]) OR OR Depressive Disorder [Title/Abstract]) OR severe depression [Title/Abstract]) AND mood disorders [Title/Abstract]) OR Affective Disorders [Title/Abstract]))).

**Criteria for selection and evaluation of articles**

All articles were first collected using the selected keywords and a list of abstracts was prepared after the search was completed. After hiding the article specifications, including the name of the magazine and the author, the full text of the articles was made available to the reviewers. Each article was studied independently by two reviewers and if the article was excluded, the reason was mentioned. Moreover, if there were differences between the two reviewers, the article was judged by the third reviewer and the third reviewer’s opinion was considered. Articles in Persian and English extracted from cross-sectional studies on the prevalence and of severe depression in Iranian elderly met the inclusion criteria. Other review, case-control, cohort, and intervention studies were excluded from the list of articles. To review gray literature, i.e. that piece of evidence and documents that have not been published for any reason, attempts to search the Google search engine search and related websites were also on our agenda. The studies were then reviewed based on four-phase PRISMA (2009),
including identifying articles, screening, reviewing articles acceptance criteria, and finally articles entered the meta-analysis.

**Quality control**

STROBE checklist was used to review studies. This checklist consists of 22 sections, 18 of which are general and applicable to all observational studies, including cohort, case-control, and cross-sectional, and 4 are specific depending on the type of study and include various methodological aspects, including study objectives, determination of appropriate sample size, type of study, sampling method, research population, data collection method, definition of variables and procedure, study data collection tool, study objectives, statistical tests, and findings. Accordingly, a maximum quality evaluation score of 32 was considered and articles with scores below 14 were recognized poor in terms of quality evaluation and were excluded from the study.

**Statistical analysis**

In each study, the prevalence of severe depression in the elderly was obtained in studies in Iran. The heterogeneity of the studies was assessed using the $I^2$ test. In general, heterogeneity was classified into three categories, heterogeneity less than 25% (low heterogeneity), Between 25 and 75% (moderate heterogeneity) and 75% (high heterogeneity), data were analyzed using Comprehensive Meta-analysis software (Biostat, Englewood, NJ, USA version 3), probability of publication bias Funnel chart using Egger test and significance level 0.05 and also to investigate the effects of potential factors on heterogeneity of studies from Meta-regression test in two groups. Mel sample size of the study were used.

**Results**

Based on investigations on the prevalence of severe depression in Iranian elderly, including articles published in domestic and foreign journals and searches in Magiran, SID, Barakat Knowledge Network System databases, the following results were obtained: Magiran, SID, Barakat Knowledge Network System (42 articles), Medline (147 articles), ScienceDirect (512 articles), Scopus (98 articles), and Google scholar (304 articles) and total of 1103 articles. PRISMA 2009 was used to show the reviewing process (Figure 1). A total of 191 articles met the initial inclusion criteria based on initial reviews after
deleting 912 duplicate articles. Ultimately 13 articles entered the meta-analysis phase after excluding 172 unrelated articles, 6 articles during secondary review because of lack of access to their abstracts and main articles, and low quality of articles (Table 1).

(Figure 1 Here)  
(Table 1 Here)  
Investigation of heterogeneity and publication bias

The heterogeneity of the studies was evaluated using $I^2$ test that was equal to 98.7%, indicating high heterogeneity of the included studies, so, random effects model was used to combine the results of the studies. Also, the results of the publication bias were compared using Egger test (Figure 2), which was not statistically significant ($P = 0.061$).

(Figure 2 Here)

The total number of samples included in the study was 3948 individuals aged 50–90 years. The overall prevalence of severe depression among Iranian elderly was 8.2% (95% CI: 4.6–14.3%) according to the meta-analysis. The highest prevalence of severe depression among Iranian elderly 46.3% was seen among the elderly in Qom (95% CI: 38.6–54.3%) in 2009 [22], and the lowest prevalence of severe depression 0.03% was also reported in the elderly in Kerman Province (95% CI: 0.1–0.9%) in 2003 [24] (Figure 3). Fig. 3 shows the prevalence of severe depression by a random effects model, in which the black square indicates the prevalence rate and the length of the segment on which, the square is located, represents 95% CI in each study. The diamond sign indicates the prevalence rate at the national level in all studies.

(Figure 3 Here)  
Meta-regression test

In order to investigate the effects of potential contributing factors on the heterogeneity of studies on prevalence of severe depression in Iranian elderly, the meta-regression test was used to study the
two factors of sample size and year of study (Figures 4 and 5). With increasing sample size, the prevalence of severe depression in Iranian elderly decreases, which is statistically significant (Figure 4) \((P<0.05)\).

(Figure 4 Here)  
(Figure 5 Here)

Discussion
The results of the present study and investigation of 3948 people aged 50–90 years, the overall prevalence of severe depression in Iranian elderly was reported to be 8.2% based on a meta-analysis. Results of a meta-analysis study showed the overall prevalence of depression in the elderly was 43% in Iran between 2001 and 2015 [26]. A study in Sweden showed the prevalence of depression was 4.2% and the moderate-severe type was 1.6% [27]. A study in China also showed that the overall prevalence of depression in the elderly was 36.9%, and reported that the prevalence of symptoms was higher in women 50.4% as compared to men 33.3%. In general, the prevalence of moderate to severe depression was 3.9% in their study [28]. The prevalence of mild-moderate depression and mild-severe depression was reported to be 27%, and 12% in a study in Greek, respectively [29]. Another study in China reported that 26.5% and 4.4% of elderly people with depression had mild and severe depression, respectively [30].

Depression is often not diagnosed in the elderly and has important impacts on quality of life, clinical outcomes, functional status, medical services, mortality, and disability [31]. Depression in the elderly also leads to increased drug use, increase costs for drugs and over-the-counter drugs, higher risk of alcohol abuse, increased length of stay, and cost of care [32]. Depression occurs in the elderly, similar to younger people due to socio-psychological and biological factors [33]. Depression is a relapsing persistent disease, and risk factors for depression in elderly people include social isolation, marital status, divorce or separation, low socioeconomic status, debilitating comorbidities, insomnia, and functional and cognitive disorders [34].

Increased rates of depression in the elderly, especially the severe type reported in this study, are often neglected, making it difficult to diagnose and treat the disease in a timely manner. This is an
unfortunate reality because depression is a disorder for which effective treatments are available today. It is also worth noting that the reduced mental ability and the feeling of sadness is not part of the normal aging process and this mood state should be considered important [34, 35]; therefore, considering the foregoing, screening and secondary prevention measures by nurses and healthcare providers are of great importance. Moreover, increasing families’ awareness of depression in the elderly will also pave the way for early diagnosis and more appropriate treatment.

Limitations
The most important limitations of the current study include the lack of access to full text and the poor quality of some of the studies studied.

Conclusions
Considering the high prevalence of severe depression in the Iranian elderly, it is necessary for health policy makers to take effective control measures including periodic care for the elderly.

Declarations

Abbreviations
WHO: World Health Organization
SID: Scientific Information Database
STROBE: Strengthening the Reporting of Observational Studies in Epidemiology for cross-sectional Study
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analysis.

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Authors’ contributions
AVR and RJ and NS contributed to the design, MM and AA and BKH statistical analysis, participated in most of the study steps. SHSH and AD prepared the manuscript. RJ and MM and NS assisted in designing the study, and helped in the, interpretation of the study. All authors have read and
approved the content of the manuscript

Ethics approval and consent to participate
Not declared.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no conflict of interest.

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Table 1
Specifications of studies entered the study
| Prevalence | Sample size | Participant's Age | Area          | Publication year | Author                  | Row |
|------------|-------------|-------------------|---------------|-----------------|-------------------------|-----|
| 23         | 248         | 60-74             | Isfahan       | 2009            | Manzori et al (13)      | 1   |
| 3.3        | 389         | 63.6±3.7          | Birjand       | 2015            | Miri et al (14)         | 2   |
| 11         | 100         | 64.6±5.05         | Guilan        | 2007            | Khodadadi et al (15)    | 3   |
| 7          | 302         | 60-90             | Bukan         | 2012            | Ghaderi et al (16)      | 4   |
| 6.3        | 150         | 69.9±6.8          | Salmas        | 2017            | Ashrafi et al (17)      | 5   |
| 14.7       | 279         | 65-85             | Tehran        | 2002            | Sadeghi et al (18)      | 6   |
| 3.5        | 61          | 68.7±16.1         | Shahr-e-kord  | 2009            | Mobasheri et al (19)    | 7   |
| 5.8        | 500         | 72.07±9.03        | Kashan        | 2015            | Khalili et al (20)      | 8   |
| 43.5       | 136         | 76.5±11.1         | Shahroud      | 2008            | Sohrabi et al (21)      | 9   |
| 43.3       | 151         | 68.2±7.7          | Qom           | 2009            | Nejati et al (22)       | 10  |
| 3          | 300         | -                 | Torkaman      | 2011            | Gharanjik et al (23)    | 11  |
| 0.3        | 1212        | ≥50               | Kerman        | 2003            | Rajabizadeh et al (24)  | 12  |
| 9.1        | 120         | ≥60               | Shiraz        | 2010            | Kashfi et al (25)       | 13  |

Figures
the flowchart on the stages of including the studies in the systematic review and meta-analysis (PRISMA 2009)
Figure 2

Funnel plot of results on the prevalence of severe depression among Iranian elderly
Figure 3

Prevalence of severe depression in Iranian elderly based on a random effects model
Figure 4

A meta-regression chart of the prevalence of severe depression in Iranian elderly by sample size
Figure 5

A meta-regression chart of the prevalence of severe depression in Iranian elderly by year of study

Supplementary Files

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PRISMA 2009 checklist.docx