

Global prevalence of depression in HIV/AIDS: a systematic review and meta-analysis

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ABSTRACT

Introduction The incidence of some fatal diseases, including HIV/AIDS, accompanied by depression has become a significant concern in developed, developing and underdeveloped countries. A great deal of time and money are spent on controlling and reducing the complications of this infection across the world. Accordingly, the main purpose of this study was to clarify the global prevalence rate of depression in patients living with HIV/AIDS via a systematic review and meta-analysis.

Methodology All articles in English, published between 2000 and 2018, were systematically searched from the original databases of Web of Science, PubMed, Scopus, Cochrane Library, Google Scholar and Embase. As a result, a total of 118 articles were identified.

Results The total sample size in these articles was 51143 people, and the number of patients suffering from moderate and severe levels of depression was 14942. The results of the analysis based on the random-effects (DerSimonian and Laird) model revealed that the prevalence rate of depression in patients with HIV/AIDS was 31% (95% CI 28% to 34%), with a 98% heterogeneity index which was reported significant. Meanwhile, the highest prevalence rate of depression based on continent was in South America at 44% (95% CI 35% to 53%) and the lowest rate was in Europe at 22% (95% CI 17% to 27%).

Conclusion In general, there was a higher prevalence rate of depression in developing and underdeveloped countries than in developed countries, which could be attributed to the advancement of science and the possibilities for early diagnosis of this syndrome.

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INTRODUCTION

It is increasingly recognised that the incidence of some diseases is a serious

worldwide public health concern in terms of their prevention, control and treatment. Such problems impose significant negative effects on socioeconomic, cultural and health status of different communities, leading to devastating impacts on mental health status, which doubles the problem for patients and the people around them, and consequently results in irreparable consequences on countries' health systems.¹ HIV/AIDS is a spectrum of conditions that induce disorders in the human body's immune system, creating numerous sociocultural problems in communities, imposing huge costs on health systems and resulting in mental disorders in infected individuals. According to a report released by WHO, 36.9 million individuals were infected with HIV/AIDS across the world by the end of 2017.² It has been reported that more than 60% of the population infected with HIV/AIDS live in countries located in sub-Saharan Africa.³ Despite a report on new cases of infections showing a stable condition in African countries, the number of people with HIV/AIDS has increased in these countries.⁴ Many studies have demonstrated that most individuals affected with HIV/AIDS experience higher rates of anxiety, depression and frustration than ordinary people, especially when hospitalised due to HIV/AIDS complications.⁵ Among these disorders, depression has been reported as the second mental disorder in the world, being prevalent among patients with HIV/AIDS, making their life difficult and causing social rejection.^{6,7} Depression can also have several negative impacts on patients' performance, social relationships and parenting, and in some serious cases, results in behaviours such as committing

suicide. It can also prolong the HIV/AIDS medical procedure, which often imposes heavy costs on health systems and individuals.^{8–10} In this respect, the findings of the survey by Owora¹¹, a 6-year cohort study, revealed that 22%–36% of people living with HIV/AIDS in the USA suffer from major depression every year.

Recent surveys on depression among patients with HIV/AIDS in developed countries have also suggested that the prevalence rate in the USA was 13.74% in 2018,¹² whereas it was 35.4% in Spain in 2012¹³ and about 22% in Australia in 2003.¹⁴ Moreover, in developing countries such as Mexico, the prevalence rate was 27% in 2017,⁵ and 59.9% and 80.6% in Brazil and China, respectively, also in 2017.^{15 16} On the other hand, the prevalence rate was reported to be 6.2% in 2018¹⁷ and 28.51% in 2017 in underdeveloped countries such as Uganda and Cameroon.¹⁸

Betancur *et al*¹⁵ shed light on the quality of life, depression and anxiety in a population infected with HIV/AIDS in Brazil. The results of this investigation revealed that 59.5% of the population had symptoms of depression and 44.7% had symptoms of moderate to severe anxiety. The findings of a study in Nigeria by Egbe *et al*¹⁹ suggested that women with HIV/AIDS had been much more affected with higher rates of depression compared with men. Another study by Elbadawi and Mirghani²⁰ demonstrated that depression was more prevalent among patients with HIV/AIDS, especially in women with lower levels of education, as well as married and widows, and those who had not used postdiagnostic counselling services in Sudan.

The distinction between the present study and other similar studies is that most surveys have been carried out on limited variables affecting the prevalence rate of depression in patients with HIV/AIDS, and most importantly no study has been conducted on this issue globally. The present study was the first comprehensive systematic literature review conducted in such a wide scope.

Since complications caused by depression in patients living with HIV/AIDS often influence various socio-economic aspects as well as public health, it is necessary to adopt new policies and have agenda for thoughtful planning in order to maintain the physical and mental well-being of these individuals. This needs detailed statistics and reports on the prevalence rates along with effective factors in this domain at a global level. Moreover, in line with the economy of a country, the cost of care for patients in severe stages of depression can be significantly reduced if well planned during the prevention or early stages. Accordingly, the findings of this study could help policymakers in dealing with this problem. In any case, it is necessary to determine the exact burden of this disorder after being affected with HIV/AIDS and its prevalence rate at a global level in order to reduce or eliminate its consequences in infected people. Thus, the present study sought to

determine the global prevalence rates of depression in patients with HIV/AIDS using a systematic review and meta-analysis.

METHODOLOGY

The current research was registered in PROSPERO (International Prospective Register of Systematic Reviews) at the University of York, and is available at http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42019119137.

Search in electronic databases

To meet the study objectives, the international electronic databases of Web of Science, PubMed, Scopus, Cochrane Library, Google Scholar and Embase were searched to find relevant articles using medical subject headings (MeSH) and specific keywords. To this end, ‘Depression, Depressive Symptom, and Emotional Depression’ were searched for depression in MeSH. The keywords ‘Human Immunodeficiency Virus, Human Immunodeficiency Viruses, Human T-Cell Lymphotropic Virus Type III, Human T-Cell Leukemia Virus Type III, Lymphadenopathy-Associated Virus, AIDS Virus, AIDS Viruses, and Acquired Immune Deficiency Syndrome Virus’ were searched for HIV. This systematic review focused on original articles published in English from 2000 to October 2018. Following the electronic search, a total of 1652 articles were identified. It should be noted that only studies published from 2000 were employed in this review to evaluate the global prevalence rates of depression in patients living with HIV/AIDS in the current century, since HIV/AIDS was on a rising trend during this period. The selected articles were then entered into the EndNote software and the duplicates were eliminated.

Study selection

There were two stages for article selection. First, two independent authors initially screened and reviewed the articles. They examined articles’ titles and abstracts, and removed irrelevant cases on the basis of the inclusion and exclusion criteria. A total of 370 relevant articles remained for further review. During the second stage, the full-text articles were independently analysed to determine their eligibility. Finally, a total of 118 articles were selected (figure 1).

Inclusion criteria

Articles were included if they were original research written in the English language, published between January 2000 and October 2018, with status, had full-text available, had observational designs that include cross-sectional, cohort, case–control, descriptive and prospective designs, and reported the prevalence of depression among patients with HIV/AIDS and the prevalence rate on the basis of a set of data.

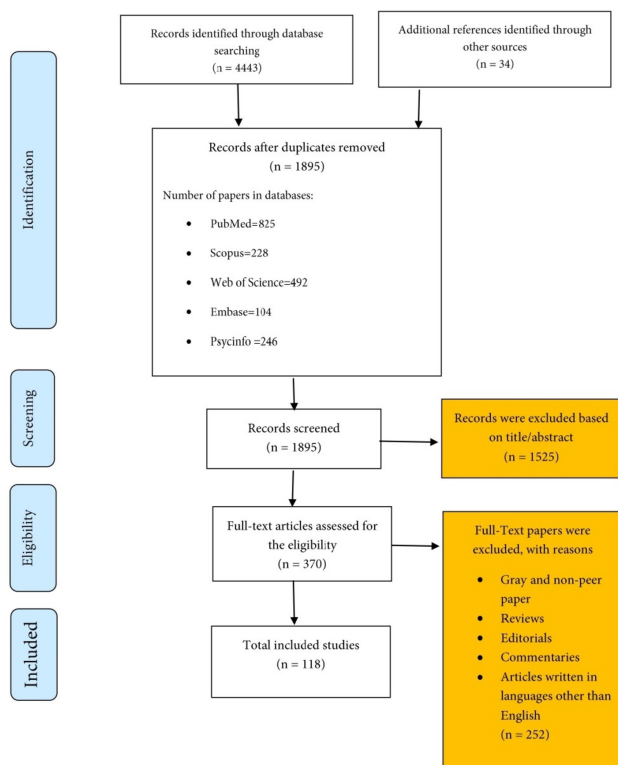


Figure 1 Flow diagram of the review process (Preferred Reporting Items for Systematic Reviews and Meta-Analyses).

Exclusion criteria

Articles written in languages other than English, published before January 2000, with study designs such as review, letters to editors, editorials, commentaries, expert opinions, case studies, case series, books, book chapters, brief reports, randomised controlled trials and thesis, addressing therapy, follow-up, drug and clinical decision-making, and reporting invalid figures or tables, or with difficulties in calculating prevalence were excluded.

Quality of studies

To evaluate the selected articles, the 22-item ‘Strengthening the Reporting of Observational Studies in Epidemiology’ was used as a research instrument. According to the items in this instrument, the relevant articles were categorised into three groups in terms of their quality, that is, low (1–7), medium (8–16) and high (17–22). The evaluation was also conducted independently by two authors, and possible disagreements were settled through discussions with a third author.²¹

Data extraction

An initial data extraction form was developed. Then, the data including general information (author, publication date, journal and conference title, publisher’s name, type of study, and quality of study) along with specific information (sample size, prevalence rate of depression, number of male/female participants, country of origin, continent, six WHO regions, level

of education, marital status and type of questionnaire) were extracted from the selected articles (online supplementary table 1).

Statistical analysis

To evaluate the prevalence rates in this review, the random-effects (DerSimonian and Laird) model for meta-analysis with the results shown on a forest plot at 95% CI was used. The I^2 test for heterogeneity was also administered along with a meta-regression analysis based on publication date and sample size. Sensitivity analysis was then conducted to ensure the stability of the results. Next, sample size, country of origin, publication date, gender, type of study and quality of study were employed in a subgroup analysis. Moreover, a cumulative meta-analysis was fulfilled based on publication date and sample size. Publication bias was ultimately analysed using Egger’s test, and the data were analysed using Stata (V.14) and Comprehensive Meta-Analysis Software.

RESULTS

The findings of the present study were obtained according to the items of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses,²² as illustrated in figure 1. After the initial search, a total of 4477 articles were retrieved from five different databases together with additional sources. Following the removal of duplicates, 1895 articles remained in the study. Then, 1325 articles were crossed out after reviewing their abstracts and full texts, resulting in 370 full-text articles. After the review of the articles, a total of 252 articles were deleted for some other reasons. Finally, 118 relevant articles, published between 2000 and October 2018, were selected for final review with regard to the inclusion and exclusion criteria (online supplementary table 1).

Distribution of articles based on publication date

The total prevalence in publishing articles on depression among patients with HIV/AIDS from 2000 to October 2018 is presented in figure 2. The findings revealed that no article was published on this topic between 2000 and 2002 and that the number of published articles showed an ascending trend from 2003 to 2018. The years 2015 and 2017, each with 17 published articles, were denoted to have the largest number of articles published (online supplementary figure 1).

Overview of global prevalence rates of depression

Following the extraction of the main data from 118 selected articles based on the Excel form and the initial data analysis, the total number of individuals suffering from moderate to severe depression was reported at about 14942 patients out of a total sample size of 51143. Data analysis based on the random-effects (DerSimonian and Laird) model also showed that

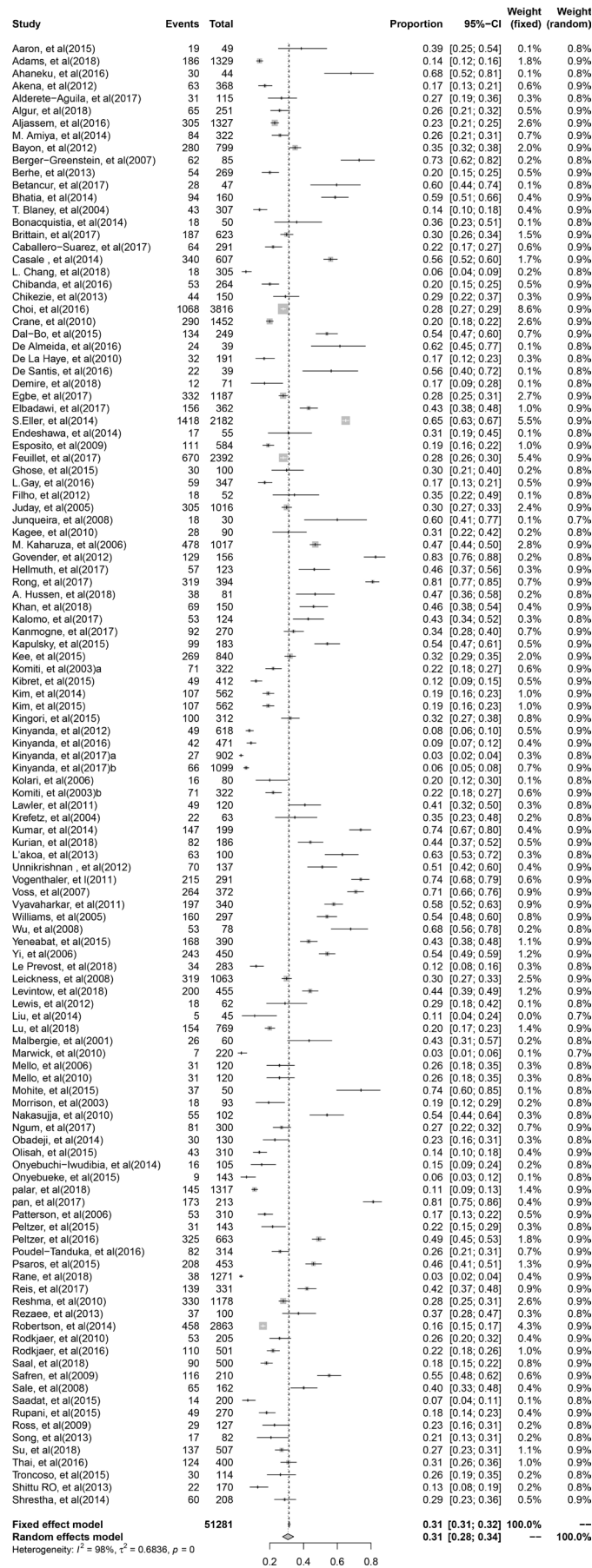


Figure 2 Forest plot of worldwide prevalence of depression in patients with HIV/AIDS.

the global prevalence rate of depression in patients affected with HIV/AIDS was 31% (95% CI 28% to 34%), with a 98% heterogeneity which was significant ($p < 0.001$) (figure 2).

Prevalence rate of depression based on continents

Based on the analysis carried out considering continents, as illustrated in online supplementary file 2, the areas are separated from each other on the basis of the colours of the guide chart, so countries with darker colours in each continent suggest higher prevalence rates of depression in patients with HIV/AIDS than the rest of the continents. Moreover, black spots in different sizes represent the number of articles published in each continent. At the bottom of the map, countries from each continent in which prevalence rates of depression are higher in patients with HIV/AIDS are reported. The dark spots display a high prevalence rate. For example, in Asia, countries such as India, China and Vietnam are the ones where the highest number of patients with HIV/AIDS suffering from depression could be found. Based on the results and the size of the black dots on the map, it is implied that the highest prevalence rate of depression in these patients is in South America at 44% (95% CI 35% to 53%) and the lowest is in Europe at 22% (95% CI 17% to 27%) (online supplementary figure 2).

Prevalence rate of depression based on six WHO regions

The results of this review showed the prevalence rate of depression in patients living with HIV/AIDS in six WHO regions, in which South-East Asia had the highest prevalence rate at 40% (95% CI 30% to 49%) and Africa had the lowest prevalence rate at 24% (95% CI 19% to 29%). No study had been conducted so far in the WHO Regional Office for the Eastern Mediterranean (online supplementary figure 3).

Prevalence rate of depression based on other subgroups

As seen in table 1, among the questionnaires used to evaluate the prevalence rate of depression in patients with HIV/AIDS, Beck Depression Inventory, which was used 35 times in the selected articles and showing a prevalence rate of depression of 34% (95% CI 28% to 41%), was the most commonly used questionnaire. Similarly, the Center for Epidemiologic Studies Depression Scale, which was used 34 times and showing a prevalence rate of 38% (95% CI 30% to 45%), was another questionnaire employed in the selected articles. 'Other' questionnaires ($n=13$) shown in table 1 indicate that they are researcher-made questionnaires and are not related to credible organisations and institutions. The findings presented in table 1 suggest that 99 studies out of 118 articles are cross-sectional, 15 articles are of cohort type, 3 articles are case-control and 1 article is prospective. The prevalence rate of depression in cross-sectional studies, which were the most frequent ones, was 32% (95% CI 28% to 36%).

Furthermore, the findings demonstrated that 54 articles were of high quality, and 45 and 19 articles were of medium and low quality, respectively (table 1).

Prevalence rate of depression based on gender

Among the 31 selected articles and analyses conducted on men and women living with HIV/AIDS, the global prevalence rate of depression in infected men was 8% higher than in women. Overall, the results suggest a significant relationship between the prevalence rate of depression among individuals with HIV/AIDS and gender ($p=0.004$) (figure 3).

Meta-regressions based on year

According to the findings in figure 4, the slope of regression line, which is negative, shows that the prevalence rate of depression among patients with HIV/AIDS has a descending trend based on year and decreases by 3% annually. Thus, there is a significant relationship between year and prevalence rate of depression ($p=0.001$).

Publication bias

The results of the analysis performed to assess publication bias are presented in a funnel plot in figure 5. Obviously, the distribution of articles in the figure is symmetric in shape, suggesting that there is no publication bias in this study. Moreover, we conducted Egger's test, the result of which was reported to be less than 1 ($p=0.70$), showing that no publication bias was observed.

DISCUSSION

This study was the first systematic review and meta-analysis in which the global prevalence rate of depression among patients living with HIV/AIDS was examined. The results of this study estimated the prevalence rate of depression in these patients to be 31%. The analysis of the articles in this domain showed that the prevalence rate of depression among patients with HIV/AIDS in most developed countries was lower than the average obtained in recent years in this study. For example, in the articles published in the USA, 13.74% of 1329 individuals living with HIV/AIDS were suffering from depression.¹² Moreover, another study in this country reported a prevalence rate of depression of 11.45% among 1327 infected individuals.²³ In this regard, several studies were conducted in France and Ukraine, in which the prevalence rates of depression were about 28.1% and 26%, respectively.^{24 25} The low prevalence rates of depression in these countries could be attributed to governmental support for these patients, people's social and cultural awareness, as well as advancements in health status. Surveys conducted in developing or underdeveloped countries in recent years have continuously reported statistics higher and lower than the average shown in the present study. For example, the prevalence rate of depression in an article

Table 1 Worldwide prevalence of depression in patients with HIV/AIDS based on questionnaire, type of study and quality of study

Subgroup	Effect size and 95% interval					Test of null (two-tailed)					Heterogeneity		
	Studies (n)	Point estimate	Lower limit	Upper limit	Z value	P value	Z value	P value	Q value	df (Q)	P value	I ²	
Questionnaire	35	0.346	0.284	0.413	-4.35	<0.001	-4.35	<0.001	1057.41	34	<0.001	96.78	
	34	0.380	0.306	0.459	-2.95	0.003	-2.95	0.003	2681.24	33	<0.001	98.77	
	2	0.204	0.023	0.734	-1.12	0.261	-1.12	0.261	56.80	1	<0.001	98.24	
	3	0.087	0.027	0.246	-3.75	0.000	-3.75	0.000	89.90	2	<0.001	97.78	
	2	0.391	0.226	0.586	-1.10	0.273	-1.10	0.273	47.64	1	<0.001	97.90	
	7	0.288	0.181	0.425	-2.95	0.003	-2.95	0.003	232.38	6	<0.001	97.42	
	4	0.224	0.191	0.262	-11.94	<0.001	-11.94	<0.001	3.29	3	0.349	8.81	
	4	0.317	0.163	0.524	-1.74	0.082	-1.74	0.082	155.07	3	<0.001	98.07	
	4	0.180	0.102	0.300	-4.46	<0.001	-4.46	<0.001	46.25	3	<0.001	93.51	
	13	0.255	0.214	0.300	-9.24	<0.001	-9.24	<0.001	261.28	12	<0.001	95.41	
	10	0.240	0.151	0.361	-3.90	<0.001	-3.90	<0.001	337.76	9	<0.001	97.34	
Type of study	1	0.170	0.134	0.213	-11.10	<0.001	-11.10	<0.001	0.00	0	1.000	0.00	
	3	0.282	0.079	0.645	-1.20	0.231	-1.20	0.231	52.57	2	<0.001	96.20	
	15	0.230	0.161	0.318	-5.35	<0.001	-5.35	<0.001	1018.57	14	<0.001	98.63	
	99	0.324	0.288	0.361	-8.63	<0.001	-8.63	<0.001	4851.69	98	<0.001	97.98	
Quality of study	4	0.300	0.251	0.353	-7.8	<0.001	-7.8	<0.001	2484.45	53	<0.001	97.87	
	19	0.318	0.235	0.415	-3.57	<0.001	-3.57	<0.001	934.60	18	<0.001	98.07	
	45	0.315	0.267	0.367	-6.56	<0.001	-6.56	<0.001	2630.03	44	<0.001	98.33	

BDI, Beck Depression Inventory; CES-D, Center for Epidemiologic Studies Depression Scale; DASS-21, Depression, Anxiety and Stress Scale-21; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders; EPDS, Edinburgh Postnatal Depression Scale; HADS, Hospital Anxiety and Depression Scale; HAM-D, Hamilton Depression Rating Scale; HSC, Hopkins Symptom Checklist; ICD-10, International Statistical Classification of Diseases-10; PHQ-9, Patient Health Questionnaire.

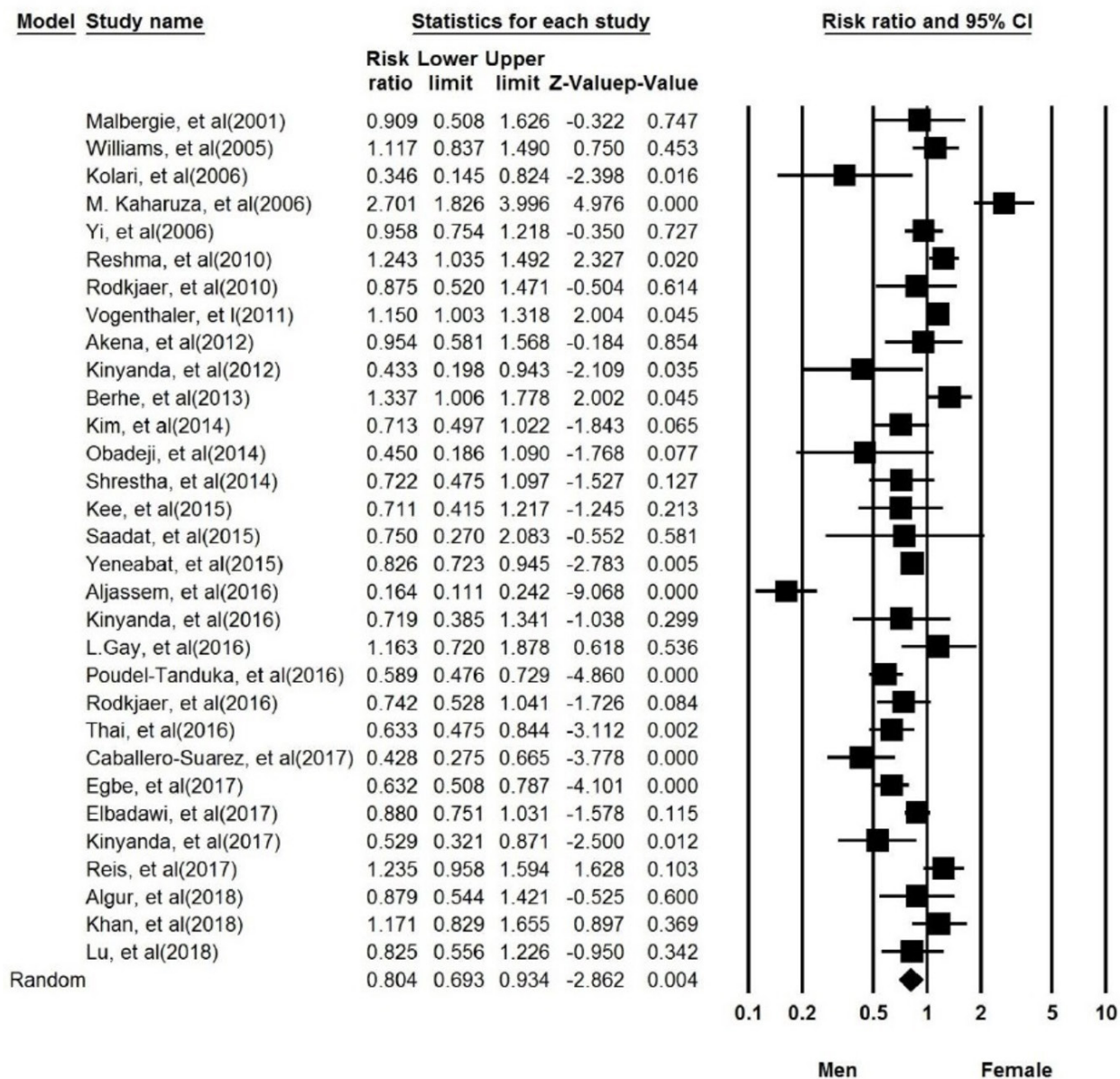


Figure 3 Risk ratio of depression in patients with HIV/AIDS based on gender.

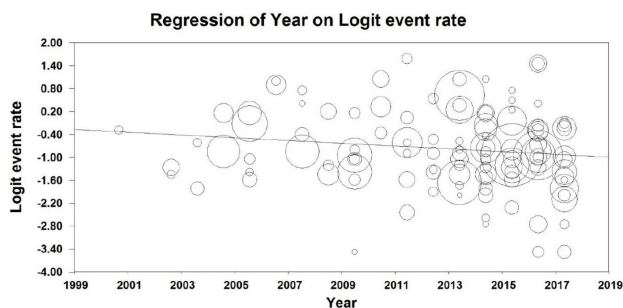


Figure 4 Meta-regressions based on year.

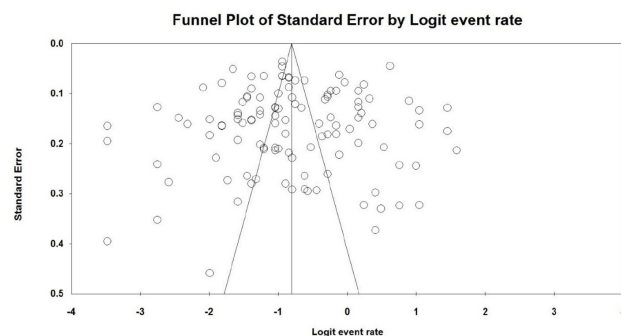


Figure 5 Funnel plot to assess publication bias.

published in India was 44.08% among 186 patients suffering from HIV/AIDS,²⁶ whereas it was 45.5% for 123 patients in Thailand.²⁷ Some studies conducted in Africa have also shown that the prevalence rate of depression is 28.2% among those diagnosed with HIV/AIDS,¹⁹ while another survey in the same country has reported a prevalence rate of 6.2%.¹⁷ Thus, the prevalence rate of depression in these countries has not been stable. The findings of the present study suggest a significant relationship between gender and depression ($p=0.004$) and that the prevalence rate of depression appears to be higher in men than in women. Moreover, the findings of another survey conducted in India on 150 patients have shown that the prevalence rate of depression is higher in men than in women, which is in line with the results of the present study.²⁸ In contrast, the results of an investigation in Africa by Kinyanda *et al*²⁹ on 902 patients with HIV/AIDS revealed that men are more subjected to depression than women.²⁹ The findings of the present study also suggest a significant relationship between year and the prevalence rate of depression ($p=0.001$); the prevalence rate of depression in individuals living with HIV/AIDS is on an annual decrease. Similarly, two studies conducted in South Africa in different years have shown prevalence rates of 56.3% and 20% in 2014 and 2016, respectively.^{30,31}

Limitations

The main constraints of this study were the lack of information in some countries, increasing the likelihood of inaccuracies in reporting the incidence of depression in patients with AIDS in those regions and continents. This could be a suggestion for future studies and research. On the other hand, the results of the present study have a high level of heterogeneity; most studies were cross-sectional, some of them used convenience sampling, while some others applied cluster sampling methods. Consequently, caution should be taken in applying the findings to future policies and plans.

CONCLUSION

The purpose of the present systematic review and meta-analysis was to evaluate the global prevalence rates of depression in patients living with HIV/AIDS. This study is the first one to examine depression from various aspects. Based on the findings of this study, the prevalence rates of depression among patients in developing and underdeveloped countries appear to be higher than the values reported in developed countries and the average obtained in the present study. This could be a significant issue for policymakers in this area, due to the negative consequences of depression, including the lack of motivation for treatments, lifelong therapeutic processes, social rejection, as well as additional costs imposed on patients and their families. The findings of this study could help improve

decision-making process and make the required data available for planning and providing better care services for those in need.

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