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Review article

Global trends in the prevalence and incidence of depression:a systematic review and meta-analysis

Darío Moreno-Agostino [a,*], Yu-Tzu Wu [a], Christina Daskalopoulou [a], M. Tasdik Hasan [a,b], Martijn Huisman [c,d], Matthew Prina [a]

[a] Department of Health Service and Population Research, King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, UK
[b] Department of Psychological Sciences, University of Liverpool, UK
[c] Amsterdam UMC, Vrije Universiteit Amsterdam, Department of Epidemiology and Biostatistics, Amsterdam Public Health Research Institute, Amsterdam, the Netherlands
[d] Department of Sociology, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands

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ABSTRACT

Background: There is mixed evidence regarding the change in the prevalence of depression in the general population over time. This study aimed to synthesise the evidence on studies that use equivalent approaches in equivalent populations across different time points.
Methods: A systematic review was conducted to identify studies focused on the change over time in depression incidence and prevalence in the general population. A random-effects meta-analysis was performed to obtain a pooled effect for the change in the prevalence estimates between the first and last time points considered. Subgroup and meta-regression analyses were used to ascertain differences in the effect sizes by gender, age group, prevalence type, elapsed time between cross-sections, and depression operationalisation.
Results: 19 studies provided information on the change in depression prevalence over time, whereas none provided such information regarding incidence. The pooled odds ratio (OR) and confidence interval (CI) were estimated by using 17 studies: *OR*=1.35 (95% *CI*: 1.14, 1.61). Similar pooled effects were obtained for females and males, separately. The high heterogeneity across studies was not explained by any of the design variables considered. No evidence for publication bias was found.
Limitations: The review included published articles up to August 2018, and the information of studies with more than two time points was summarised in a single estimate of change.
Conclusions: There is a predominant increasing trend in the likelihood of experiencing depression over time that seems not to be explainable by study design differences or publication bias alone.

Introduction

Depression is amongst the leading causes of disability worldwide (Institute for Health Metrics and Evaluation, 2020). A recent report by the World Health Organization (2017) ranked it as the largest contributor to global disability, affecting around 322 million people and being responsible for 7.5% of all years lived with disability. Depression has a major impact on people's quality of life (Lepine and Briley, 2011), and it is also the main determinant of suicide deaths, an element that is often ignored in the global burden of disease estimates (Vigo et al., 2016). Yet, the majority of people with depression still do not receive an adequate treatment (Thornicroft et al., 2017), and preventive efforts face similar or greater difficulties (Cuijpers et al., 2012; Ormel et al., 2019). Thus, ascertaining to what extent there has been a change in depression trends can have important implications for public health burden.

Previous research has evidenced an increasing trend in the prevalence of depression in the general population (Compton et al., 2006; Mehta et al., 2015; Noorbala et al., 2017; Weinberger et al., 2017). However, it is unknown to what extent this reflects true changes in the incidence and prevalence of depression, or rather reflects a true increase in the understanding, awareness, diagnosis, and treatment of this condition (Baumeister et al., 2015; Herrman et al., 2019). Moreover, other

* Corresponding author at: Darío Moreno-Agostino, King's College London, Institute of Psychiatry, Psychology and Neuroscience, David Goldberg Centre, De Crespigny Park, London SE5 8AF, UK
E-mail address: dario.moreno@kcl.ac.uk (D. Moreno-Agostino).

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studies have reported stable depression trends with no evidence of relevant changes over time (Arthur et al., 2019; Markkula et al., 2017; Murphy et al., 2000a; Patten et al., 2015), and similar results have been reported when looking at higher-order categories comprising but not limiting to depression, such as "mood disorders" (de Graaf et al., 2012) or "psychiatric disorders" (Kessler et al., 2005).

In addition to the heterogeneity of the aforementioned studies, there is also a high heterogeneity in studies designs. For instance, different studies focus on different populations (different age groups and countries), employ different depression operationalisations (major depressive episode or disorder vs depressive symptomatology), and/or report different estimates (e.g. lifetime, 12-months or 1-month prevalence).

Synthesising the evidence on studies that use equivalent approaches in equivalent populations across different time points may provide relevant insights on whether there has been a change in depression prevalence or incidence over time. To synthesise the findings of such studies and investigate any potential impact of the various methodological approaches, we conducted this systematic review and meta-analysis.

Methods

The systematic review was registered in the PROSPERO international prospective register of systematic reviews (protocol number CRD42018102879). The MOOSE (Stroup et al., 2000) indications were followed and the checklist is provided in the Supplementary Material.

Search strategy and selection criteria

The literature search was performed in Embase, Medline and PsycINFO databases (OVID interface) using the search strategy (depression OR depressive) AND (prevalence OR incidence OR epidemiology) AND (trend*). Articles were searched from the first available record to August 2018.

Studies meeting the following characteristics were included: 1) population-based studies reporting primary research including repeated surveys of two or more independent study populations or analyses using administrative data; 2) studies using similar sampling methods at the different time points; 3) studies investigating changes in the prevalence or incidence of depression in the general population over time; 4) studies using appropriate depression screening tools and diagnostic standards consistently across time points.

The exclusion criteria were: 1) systematic reviews or meta-analyses on depression trends; 2) studies focusing on subgroups such as medical students, pregnant women, veterans, or patients with other chronic conditions; 3) studies estimating prevalence of depression from baseline and follow-up waves of longitudinal cohorts. Two reviewers carried out the title/abstract screening (YTW and CD, researchers) and full text review (YTW and DMA, researchers). Any discrepancy was assessed by a third reviewer (MP, researcher).

Data analysis

Information on study design (sample size, depression measurement, the elapsed time between cross-sections, the year of the first assessment), characteristics of study population (percentage of women, age of the targeted population, and the country of the sample) and results (crude and adjusted estimates at different time points and effect sizes of changes over time) were extracted from each study. One reviewer (DMA) extracted the data from all studies.

Quality assessment of the included studies was carried out using a combination of the National Heart, Lung, and Blood Institute Study Quality Assessment Tool for Case Series Studies (National Institutes of Health, 2020) and the Joanna Briggs Institute Critical Appraisal Tool for Case Series studies (Moola et al., 2017), as individual scales could not fully capture all the sources of biases in studies of trends. The quality assessment checklist is provided in the Table S1 (Supplementary Material).

Due to the absence of incidence estimates after the review, we focus this section on the studies on prevalence. In order to obtain a pooled effect size of depression prevalence change over time, our analysis mainly focused on odds ratio (*OR*) estimates comparing the prevalence at the latest and first (reference) time points. If the information was not provided in the publication, we calculated the *OR* based on the prevalence estimates reported in the publications. For studies including more than two time points, we considered the first and last time points to assess the change over time. For studies only reporting gender-specific prevalence, we computed prevalence for the overall population based on the percentage of men and women at specific time points.

A random-effects meta-analysis approach was carried out to calculate the pooled estimates of the overall population (DerSimonian and Laird, 1986). Meta-regression models were used to analyse whether differences in study designs and characteristics of study populations could account for the heterogeneity. We performed separate meta-regressions including a single predictor at a time: 1) the age group of the sample considered, categorised as children or adolescents (<18 years old), adults (18+), or middle-age and older adults (45+) [we could not consider a separate group with older adults (e.g. 65+) due to the low number of studies focusing on this population]; 2) the prevalence type, categorised as 12 month prevalence vs one month or less, including in this latter group a study in which prevalence was assessed referring to "Usually" (Fleming et al., 2014) as the period of time assessed; 3) the elapsed time between the first and last cross-sections of the study, categorised as 1-5 years, 6-10 years, 11-15 years, and 16+ years; and 4) the depression operationalisation, distinguishing between studies that conceptualised and measured the presence of depressive symptoms vs those that considered the fulfilment of diagnostic criteria for major depressive episode (MDE) or disorder. To investigate potential gender differences in the pooled effects, we performed a subgroup analysis using the OR estimates by gender provided in the studies or calculated with the first step of the abovementioned approach.

Finally, we investigated the existence of publication bias using Egger's test (Egger et al., 1997). All analyses were performed with Stata 14.2 SE version (StataCorp, 2015). Rayyan software (Ouzzani et al., 2016) was used for the title/abstract screening stage, and an EndNote library was created with the screened articles for full text review and data extraction.

Results

The initial research identified 7,397 publications from all databases published between 1937 and 2018, thus covering a period of 81 years. After removing duplicates, there were 5,715 publications for title/abstract screening and 42 studies were identified for full text review. Only two of them focused on the change in the incidence over time, but were excluded due to absence of specific information on depression (Filatova et al., 2017) or the use of different sampling procedures across time points (Murphy et al., 2000b). Among the remaining 40 studies, which focused on prevalence estimates, 21 were excluded due to different reasons. Details on the selection process can be found in the PRISMA flow depicted in Figure 1.

All 19 studies included for qualitative synthesis were focused on prevalence changes over time. Eight of them focused on a wide range of ages (e.g. 15+, 18+, or 20-81 years old), six focused on children and adolescents (<18 years old), four on middle-aged and older adults (45+ years old), and one on young adults (20-30 years old). Eight studies were conducted in Europe, particularly in Scandinavian countries (n=5); four in North America; four in Oceania; two in Asia; and one in South America. Details on the included studies are shown in Table 1. Eight studies reported adjusted estimates of the change in the prevalence of depression or depressive symptomatology, but variables used for adjustment largely varied across studies. Most of the adjusted estimates

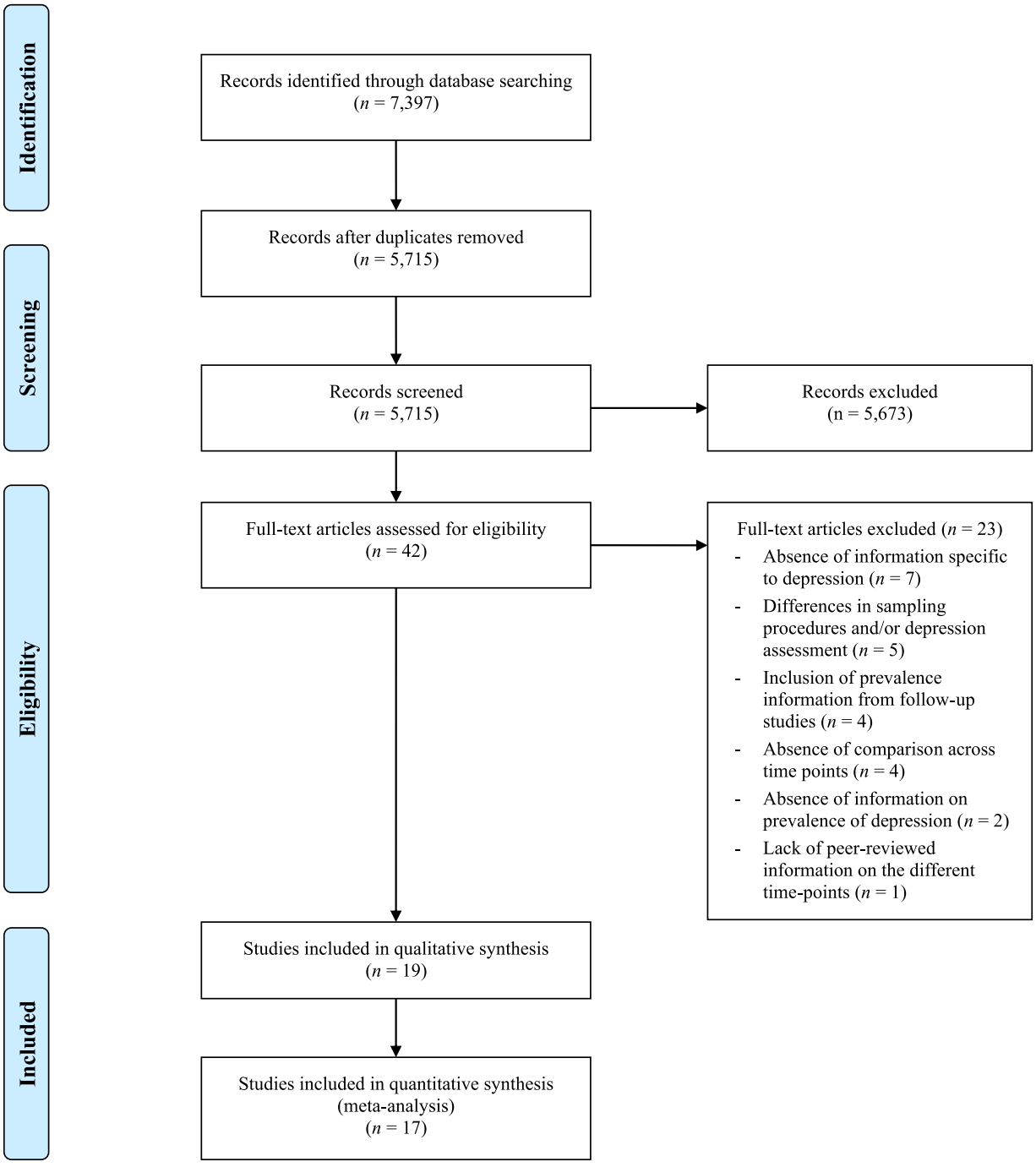

Figure 1. PRISMA flow diagram.

showed an increasing trend in the depression prevalence over time, although in many cases the effect found was not statistically significant. Detailed information on the adjusted estimates is shown in Table S2 (Supplementary Material).

We could not compute the estimates for two of the studies (Shi et al., 2011; Wiens et al., 2017) due to lack of enough information; the corresponding authors were contacted and either were unable to provide that information due to no longer having access to the data, or did not respond. Therefore, these studies were excluded from subsequent analyses, with 17 studies remaining for further analysis. Although most of the studies considered two time points, eight of them provided information on a higher number, ranging from 3 to 7 time points. Two estimates were drawn from the study by Wiberg et al. (2013), since the authors analysed separately samples of older adults aged 70 and 75 years old. Thus, the final number of estimates in the meta-analysis was 18. More than half of these estimates (Compton et al., 2006; Fleming et al., 2014; Jeuring et al., 2017; Mehta et al., 2015; Park et al., 2015; Sawyer et al., 2018; Spiers et al., 2012; Thorisdottir et al., 2017; Von Soest and Wichstrom, 2014; Wittayanukorn et al., 2014) showed an increasing trend in depression over time. Eight estimates, corresponding to eight studies (Baumeister et al., 2015; Hawthorne et al., 2008; Lundin et al., 2017; Markkula et al., 2017; Sourander et al., 2008; Wang and Tian, 2018; Wiberg et al., 2013), showed stable prevalence over time.

In line with the majority of the results, the random-effects meta-analysis with the 18 estimates showed an increase in the odds of depression over time, with a pooled effect size of *OR*=1.35 (95% *CI*:

Table 1
Details of the included studies.

Study	Country	Time points	Target population age	Sample size	% women	Depression assessment	Depression operationalization	Prev. type	Results	Change
Baumeister et al., 2015	Germany (West Pomerania)	t1 1997-2001 t2 2008-12	20-81	nt1=4,228 nt2=4,251	%t1=50.9 % t2=50.1	Composite International Diagnostic Screener (CID-S) and Depression and Exhaustion Scale (DEEX)	Depressive symptoms: the top tertile of the Depression and Exhaustion Scale (DEEX)	Point prev.	Prev. (95% CI): t1=28.8 [27.4, 30.3] t2=30.1 [28.7, 31.6]	↗
Compton et al., 2006	USA	t1 1991-92 t2 2001-02	18+	nt1=42,862 nt2=43,093	% t2=52.08 [c]	Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM-IV Version (AUDADIS-IV)	MDE: meeting criteria for DSM-IV MDE during the 12 months preceding the interview	12 m	Prev. (95% CI): t1=3.33 [3.13, 3.53] t2=7.06 [6.67, 7.45]	↗
Fleming et al., 2014	New Zealand	t1 2007 t2 2012	U (~13-17)	n_{t1}=9,107 n_{t2}=8,500	$\%_{t1}$=46.0 $\%_{t2}$=54.4	Reynolds Adolescent Depression Scale, Short Form (RADS-SF)	Symptoms of depression: RADS-SF≥28	Unclear ("Usually")	Prev. (95% CI): t1=10.6 [9.7, 11.4] t2=12.8 [11.6, 13.9]	↗
Hawthorne et al., 2008	Australia (South Australia)	t1 1998 t2 2004	15+	nt1=3,010 nt2=3,015	%t1=51.4 % t2=50.9	Primary Care Evaluation of Mental Disorders (PRIME-MD), mood module	Major depression: fulfilment of DSM-IV criteria	2 wk	Prev.: t1=6.8 t2=8.0	=
Jeuring et al., 2017	Netherlands	t1 1992 t2 2002 t3 2012	55-64	nt1=944 nt2=964 nt3=957	%t1=51.5 % t2=52.1 % t3=51.4	Center for Epidemiological Studies Depression Scale (CES-D) and Diagnostic Interview Schedule (DIS)	MDD: CES-D≥16 and DIS positive score	12 m	Prev.: t1=2.1 t2=3.9 t3=3.8	↗=
Lundin et al., 2017	Sweden (Stockholm County)	t1 2000 t2 2010	20-30	nt1=2,590 nt2=1,108	%t1=50.9 % t2=50.0	Major Depression Inventory (MDI)	Depression: DSM-IV scoring algorithm in MDI manual	2 wk	Prev.: t1=5.44 t2=5.35	=
Markkula et al., 2017	Chile	t1 2003 t2 2010	18+	nt1=3,616 nt2=7,549	%t1=50.8 % t2=51.9	Composite International Diagnostic Interview (CIDI), short form, MDE module	MDE: minimum of 5 symptoms (at least one of them dysphoria or anhedonia)	12 m	Prev. (95% CI): t1=20.5 [18.3, 22.7] t2=18.4 [16.5, 20.2]	=
Mehta et al., 2015	USA	t1 2005-06 t2 2007-08 t3 2009-10 t4 2011-12	18+	nt1=4,836 nt2=5,447 nt3=5,573 nt4=4,949	%t1=51.5 % t2=51.4 % t3=55.6 % t4=50.7	Patient Health Questionnaire-9 (PHQ-9)	Major depression: 5+ of 9 depression criteria during the same 2-week period most of the day, nearly every day, including depressed mood or loss of interest	2 wk	Prev. (95% CI): t1=2.33 [1.64, 3.01] t2=N/A t3=3.49 [2.84, 4.03] t4=3.79 [3.01, 4.57]	↗=
Park et al., 2015	South Korea	t1 2001 t2 2011	55-64	nt1=1,256 nt2=1,066	%t1=59.5 % t2=59.9	CIDI	MDD: fulfilment of DSM-IV criteria	12 m	Prev.: t1=2.1 t2=3.6	↗
Sawyer et al., 2018	Australia	t1 1998 t2 2013-14	6-17	nt1=3,597 nt2 5,359	%t1=50.2 % t2=48.7	Diagnostic Interview Schedule for Children-version IV (DISC-IV), MDD module	MDE: severe impairment in 1+ functional domains or moderate impairment in 2+ domains	12 m	Prev. (95% CI): t1=2.1 [1.7, 2.7] t2=3.2 [2.7, 3.8]	=
Shi et al., 2011			16+	n=38,979 [a]	N/A			12 m		=

(continued on next page)

Table 1 (*continued*)

Study	Country	Time points	Target population age	Sample size	% women	Depression assessment	Depression operationalization	Prev. type	Results	Change
	Australia (South Australia)	t1 2002 t2 2003 t3 2004-05 t4 2006-07 t5 2008 t6 2009				Kessler Psychological Distress 10 item scale (K10)	Depression: self-report of depression diagnostic by doctor or being under treatment for depression		Prev.: t1=6.0 t2=6.9 t3=7.3 t4=6.7 t5=6.8 t6=5.8	
Sourander et al., 2008	Finland (catchment area of Turku University Hospital, southwest Finland)	t1 1989 t2 1999 t3 2004	8	nt1=986 nt2=825 nt3=870	%t1=51.7 % t2=51.5 % t3=50.1	Children's Depression Inventory (CDI), without suicide question	Depressive symptoms: CDI≥17	2 wk	Prev.[e]: t1=6.6 t3=8.2	=
Spiers et al., 2012	England	t1 1993 t2 2000 t3 2007	16-78	nt1=8,670 nt2=6,799 nt3=6,815	%t1=50.1 %t2= 50.1 % t3=50.7 [b]	Clinical Interview Schedule-Revised (CIS-R)	Depressive episode or disorder: fulfilment of ICD-10 criteria for depressive episode or recurrent depressive disorder	1 m	Prev.[e]: t1=2.2 t3=3.1	↗
Thorisdottir et al., 2017	Iceland	t1 2006 t2 2009 t3 2010 t4 2012 t5 2014 t6 2016	14-15	nt1=7,232 nt2=7,377 nt3=7,125 nt4=7,202 nt5=6,966 nt6=7,041	%t1=50.1 % t2=50.8 % t3=50.3 % t4=50.1 % t5=50.8 % t6=49.6	9 items from the depression dimension Symptom Check List 90 (SCL-90)	Depressed mood symptoms (high symptom level): top 5% score at the first time point	1 wk	Prev.[e]: t1=4.9 t6=8.85	↗
Von Soest & Wichstrom, 2014	Norway	t1 1992 t2 2002 t3 2010	16-17	nt1=2,994 nt2=3,438 nt3=2,813	%t1=48.5 % t2=49.6 % t3=48.2 [d]	Depressive Mood Inventory	Depressive symptoms: mean score of 3+	2 wk	Prev.[e]: t1=5.8 t3=9.3	↗
Wang & Tian, 2018	China	t1 2008 t2 2011 t3 2012 t4 2013 t5 2015	45+	nt1=1,916 nt2=15,587 nt3=2,026 nt4=16,327 nt5=18,590	%t1=48.6 % t2=52.2 % t3=52.5 % t4=52.5 % t5=51.6	10 questions of CES-D	Depressive symptoms: CES-D≥10	1 wk	Prev.: t1=33.61 t2=37.13 t3=34.95 t4=31.52 t5=32.69	=
Wiberg et al., 2013	Sweden (Gothenburg)	t1 1976-77 t2,70y. o. 2000-01 t2,75y. o. 2005-06	70 & 75	nt1,70y. o.=404 nt2,70y. o.=579 nt1,75y. o.=303 nt2,75y. o.=753	%t1,70y. o.=56.2 %t2,70y. o.=60.5 t1,75y. o.=61.4 t2,75y. o.=57.4	Comprehensive Psychopathological Rating Scale (CPRS)	Major depression: 5+ out of 9 symptom clusters according to DSM-IV criteria in previous month	1 m	Prev.[e]: 70 years old: t1=3.3 t2=3.9 75 years old: t1=4.5 t2=4.9	=
Wiens et al., 2017	Canada	t1 2000-01 t2 2002-03 t3 2004-05 t4 2007-	12-19	nt1=17,261 nt2=7,491 nt3=8,397 nt4=5,073 nt5=6,725 nt6=2,369 nt7=4,398	N/A	CIDI, short form	MDE: algorithm-based predictive score based on the response profile	12 m	N/A	

(*continued on next page*)

Table 1 (*continued*)

Study	Country	Time points	Target population age	Sample size	% women	Depression assessment	Depression operationalization	Prev. type	Results	Change
		08 t5 2009-10 t6 2011-12 t7 2013-14								
Wittayanukorn et al., 2014	USA	t1 2005-06 t2 2007-08 t3 2009-10	18+	n=13,320 [a]	N/A	Patient Health Questionnaire (PHQ-9)	Depressive symptoms: PHQ≥5	2 wk	Prev.: t1=20.92 t2=25.39 t3=25.66	↗

Note. CI: confidence interval; m: month; MDD: Major Depressive Disorder; MDE: Major Depressive Episode; N/A: Not available; prev.: prevalence; U: unclear; wk: week; ↗: increasing trend; =: stable trend.

[a] Only information on the overall sample available

[b] Weighted data (non-weighted data not available)

[c] Information provided by the author(s)

[d] Results correspond to age standardised estimates

[e] The estimates provided in the original manuscripts were disaggregated by gender; the prevalence estimates presented here were calculated by the authors of this manuscript, and the direction of the change is based on the computed odds ratio and its 95% CI.

1.14, 1.61), along with a high heterogeneity across studies (I^2=95.8%, p<.001). This information is depicted in a forest plot in Figure 2.

The results of the random-effects meta-regression models, which were performed to explain the heterogeneity across studies, are detailed in Table 2. Age group, the prevalence type (12-month vs ≤1-month), the elapsed time between the first and last time points, and the

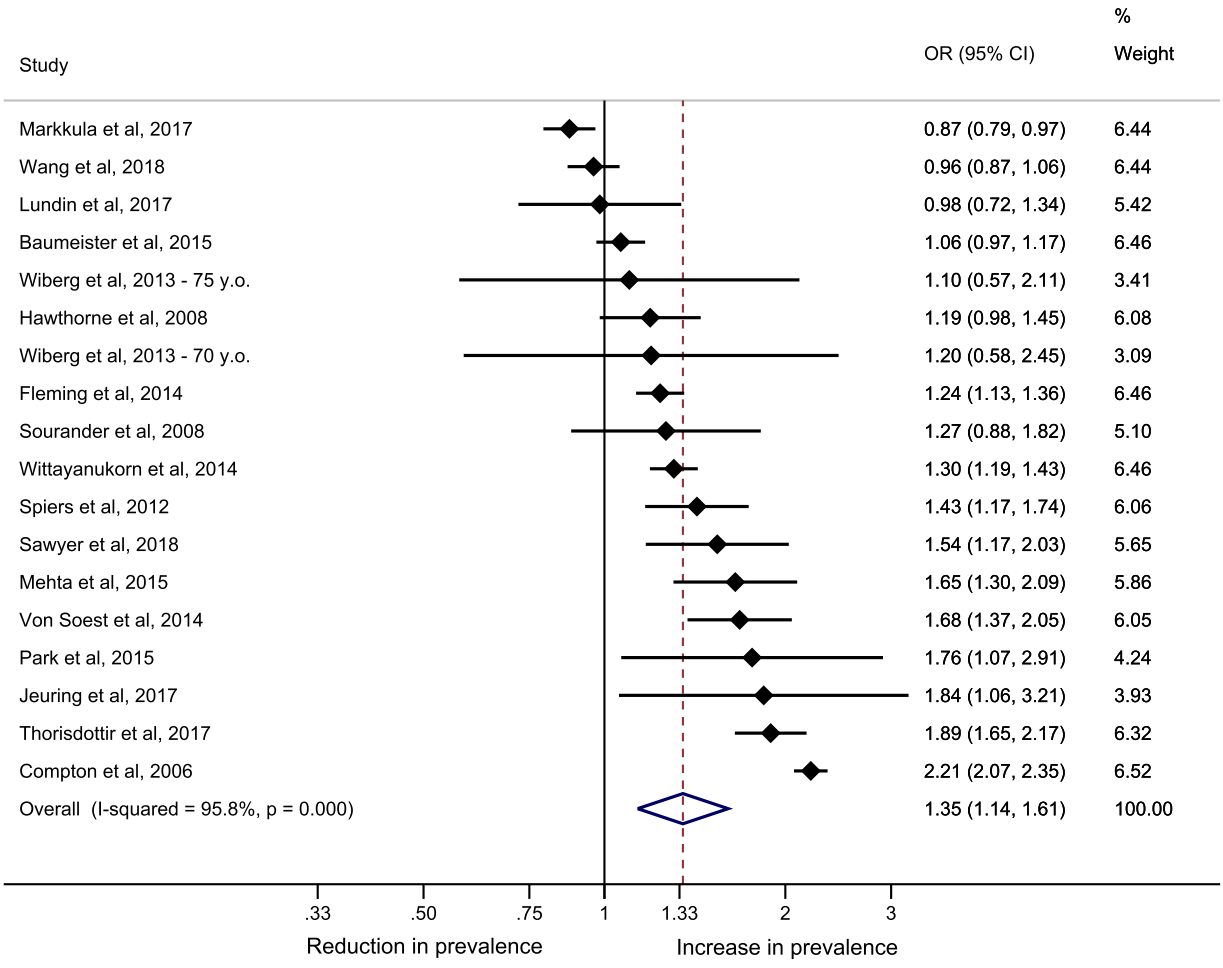

Figure 2. Forest plot of the random-effects meta-analysis.

Table 2
Random-effects meta-regression results.

Variable	β	Lower limit	Upper limit	*p*-value	Adjusted R^2	I^2 residual	τ^2
Age group (ref.: children)				0.562	-2.4%	95.8%	0.07
Adults	-0.16	-0.50	0.18	0.333			
Middle-age and older adults	-0.18	-0.61	0.26	0.162			
Prevalence type: 12-month (vs ≤ 1-month)	0.12	-0.19	0.42	0.425	-4.0%	95.3%	0.07
Elapsed time (ref.: 1-5 years)				0.932	-17.4%	96.2%	0.07
6-10 years	0.06	-0.42	0.55	0.786			
11-15 years	0.02	-0.51	0.56	0.925			
16+ years	0.16	-0.43	0.75	0.567			
MDE operationalisation (vs depressive symptomatology)	0.06	-0.24	0.36	0.677	-5.4%	95.3%	0.07

Note. MDE: Major depressive episode. β: meta-regression coefficient, τ^2: between-study variance.

operationalisation of depression (MDE vs depressive symptomatology) failed at explaining any portion of the heterogeneity across studies. The subgroup analysis performed with the estimates by gender provided by some of the studies (n=13) showed that the pooled estimates were very similar for males [*OR*=1.22 (95% *CI*: 1.04, 1.42)] and females [*OR*=1.24 (95% *CI*: 1.11, 1.39)]. The Egger's test (bias=-0.97, p=.658) did not provide evidence for publication bias.

We carried out a sensitivity analysis to ascertain the potential impact of not including two well-known studies on the change in the prevalence in psychopathology due to their focus on higher-order categories, as well as differences in the diagnostic criteria and assessment procedures used over time (de Graaf et al., 2012; Kessler et al., 2005). Details on this sensitivity analysis can be found in the Supplementary Material. Including these studies in the meta-analysis led to a pooled estimate of *OR*=1.27 (95% *CI*: 1.06, 1.51), I^2=96.5% ($p < .001$), showing an increase in the odds of depression over time in line with the main results.

Discussion

Our findings suggest that there is a predominant increasing trend in the prevalence of depression within populations. The exclusion of studies with different sampling procedures or depression assessments across time points reduces the room for the hypothesis that this overall increase in the prevalence of depression may be merely reflecting changes in the way in which depression rates are ascertained, changes in the help-seeking behaviours, or changes in the awareness by healthcare providers or researchers. This study also evidences a remarkable absence of research on the depression incidence change over time using the same sampling methods and depression assessments across time points. This absence seems to reflect the major difficulties of conducting such research due to the additional need of follow-ups in comparison to the studies focused on the change in the prevalence.

The present work highlights the great heterogeneity that exists across studies. Available research comprises diverse prevalence types that reflect the elapsing of different periods of time and that are based on different operationalisations and tools for assessing depression, as well as focused on different age groups. However, meta-regression showed that none of these aspects accounted for a substantial portion of that heterogeneity. Similarly, in line with previous research (Piccinelli and Wilkinson, 2000), most of the studies that provided disaggregated information showed that the prevalence for depression was higher in women than in men. Nevertheless, the results of the subgroup analysis suggested that there are no gender differences with regards to the way prevalence estimates have increased over time. Despite the cross-sectional differences, the increasing trend seems to be similar across genders. Although the results of the subgroup and meta-regression analyses may reflect a lack of statistical power due to the relatively low number of studies within each category compared, the high remaining heterogeneity suggests that, instead of a single universal rate of change in the depression prevalence, there seems to be variation in that rate across populations. Some of the included studies discuss the potentially explanatory role of economic changes, most specifically the economic crisis that started in 2008 and came with an increase of financial and housing insecurity, economic pressure, and inequality (Mehta et al., 2015; Park et al., 2015; Thorisdottir et al., 2017). Considering that most of the estimates included in the meta-analysis compared a period before 2008 with another including or after 2008, this could partly explain the finding of a predominant increasing depression trend. Moreover, differences in the strength and duration of the impact of the crisis across different countries, socioeconomic levels, and demographic groups, along with differences in rates of change in the depression awareness in the population (Compton et al., 2006), could account for part of the heterogeneity found.

Regarding the included studies, we found a lack of evidence from geographic areas such as Africa and, to a lesser extent, Latin America and Asia. In the same line, only one of the included studies was conducted in a low- and middle-income country (Wang and Tian, 2018). This lack of evidence does not only reflect the cost of conducting population-based studies as the ones that were included in this review, but also the persisting divide in mental health research (Saxena et al., 2006). Adding to that, it is important to note that, since most of the estimates included in this meta-analysis correspond to high-income countries, the results may not be generalisable to low- and middle-income countries, which in turn comprise more than 80% of the world's population (World Bank, 2020).

To the best of our knowledge, this is the first study to systematically review and meta-analyse the evidence on the change in the prevalence and incidence of depression in the population by selecting studies with similar implementation methods. By using this selection criteria, the room for alternative explanations (e.g. non-equivalence of the populations, or changes in the depression assessment) is reduced. Moreover, by using the provided prevalence estimates to compute the *OR*s in the cases in which this information was not available, we were able to account for the evidence from studies that would not have been possible to include otherwise, thus enriching the resulting synthesis and widening its generalisability.

Nevertheless, the present study must be interpreted in the light of several limitations. First, we only considered studies published in indexed, peer-reviewed journals. Although it is likely that most of the studies fulfilling the inclusion criteria were published in such journals, it is possible that the search procedure left out evidence from other sources (i.e. "grey literature") such as journals with different characteristics or other kind of reports and records. Second, the evidence search and selection criteria implemented were targeted at studies that provided information on prevalence or incidence of depression (or the change in these estimates) in at least two independent samples over time, employing equivalent sampling and measurement procedures. It is possible that this strategy left out studies focused on higher-order categories that comprised but did not limit to depression (e.g. mood disorders or psychiatric disorders). In order to ascertain the potential impact of this strategy on the resulting pooled estimate, we conducted a sensitivity analysis including the depression prevalence estimates of two well-known population-based studies that were not included in the main meta-analysis (de Graaf et al., 2012; Kessler et al., 2005), whose

estimates we had to calculate using information from different sources. We found similar results, even if the more recent estimates were likely to be comparatively deflated due to the use of more astringent diagnostic criteria (Greenberg et al., 2003), thus potentially biasing the results by showing a decreasing trend that might be explained by differences in the depression assessment. Third, even if the plausibility of some alternative explanations such as the abovementioned is reduced due to the selection criteria of this review, our study does not allow ruling out other potential explanations. For instance, increases in the community awareness of depression could lead to higher rates even in equivalent conditions, and future research may consider this potentially explanatory factor (Baxter et al., 2014; Compton et al., 2006). Fourth, to facilitate the comparability of the estimates across studies, we synthesised the information of those with more than two time points in a single estimate of change. It is expected that, by using this procedure, we lost a finer grained picture of the change in some cases. Our finding of an increasing trend does not provide evidence on the shape of the trend (e.g. it does not imply that the increase takes place in a continuous manner), but rather on the direction of that trend (i.e. the prevalence of depression has increased). However, due to the use of the information of the studies' first and last points, our approach may have overlooked the presence of curvilinear trends within the studies, being in turn summarised to the presence or absence of increase or decrease in the prevalence of depression over time. Future research with more complex meta-analytic designs may consider the interdependent comparisons among multiple time points within some studies.

The present study has implications for both research and public policy. Regarding research, first, it highlights the remarkable lack of research on the change in the depression incidence within populations. Thus, future research may use equivalent designs (i.e. reference populations, sampling methods, depression operationalisations and assessment tools) as previous incidence studies in the population of interest to ensure the comparability of the obtained estimates and assess their potential change over time. Second, this work underlines the importance of conducting quality research in countries with lower economic resources, since most of the available evidence to date refers to high-income countries. Moreover, there is need for studies that are able to unravel the potential causes of depression trends (e.g. changes in depression awareness, societal changes due to modernisation and individualisation, socioeconomic insecurity and inequality). Such studies may provide timely evidence on relevant targets to promote mental health and wellbeing.

Regarding public policy, our study emphasises the cruciality of globally prioritising narrowing the treatment gap and widening depression prevention (Cuijpers et al., 2012; Herrman et al., 2019; Thornicroft et al., 2017). Previous evidence has shown promising results of preventive interventions for depression, among them, those based on psychological interventions (van Zoonen et al., 2014) or even in the shape of physical activity (Mammen and Faulkner, 2013). Moreover, in order to optimise the effectiveness of such preventive attempts, a life course approach should be considered, including early life risks such as exposure to poor parenting or maladaptive personality traits and inadequate social skills (Ormel et al., 2019).

In conclusion, our study suggests the existence of an increasing trend within the population in the prevalence of depression, either in the shape of depressive symptomatology or MDE. If this trend does not cease, it is expected that the burden of depression, including detrimental effects on people's quality of life and mortality excess, keep growing. Therefore, this work further highlights the importance of efforts aimed at reducing the global burden of depression, preventing the onset of new cases, and closing the treatment gap existing in people that already experience this condition.

Contributors

Y-T.W. & C.D. performed the literature search and title/abstract screening. Y-T.W. & D.M.A. did the full-text review. D.M.A. performed the data extraction, data analyses, and wrote the first draft. M.P. supervised all the process. Y-T.W., C.D., M.T.H., M.H., & M.P. provided critical feedback and contributed to the interpretation of the findings and writing of the final manuscript. All authors read and approved the final manuscript.

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Declarations of Competing Interest

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2020.12.035.

References

Arthur, A., Savva, G.M., Barnes, L.E., Borjian-Boroojeny, A., Dening, T., Jagger, C., Matthews, F.E., Robinson, L., Brayne, C., Cognitive, F., Ageing Studies, C., 2019. Changing prevalence and treatment of depression among older people over two decades. Br J Psychiatry 1–6.

Baumeister, S.E., Schomerus, G., Schmidt, C.-O., Mockel, F., van den Berg, N., Hoffmann, W., Volzke, H., Grabe, H.J., 2015. Change in depressive symptoms and mental health-related quality of life in northeast Germany between 1997-2001 and 2008-2012. Int J Public Health 60, 33–39.

Baxter, A.J., Scott, K.M., Ferrari, A.J., Norman, R.E., Vos, T., Whiteford, H.A., 2014. Challenging the myth of an "epidemic" of common mental disorders: trends in the global prevalence of anxiety and depression between 1990 and 2010. Depress Anxiety 31, 506–516.

Compton, W.M., Conway, K.P., Stinson, F.S., Grant, B.F., 2006. Changes in the prevalence of major depression and comorbid substance use disorders in the United States between 1991-1992 and 2001-2002. American Journal of Psychiatry 163, 2141–2147.

Cuijpers, P., Beekman, A.T., Reynolds, C.F., 2012. Preventing depression: a global priority. JAMA 307, 1033–1034.

de Graaf, R., ten Have, M., van Gool, C., van Dorsselaer, S., 2012. Prevalence of mental disorders and trends from 1996 to 2009. Results from the Netherlands Mental Health Survey and Incidence Study-2. Soc Psychiatry Psychiatr Epidemiol 47, 203–213.

DerSimonian, R., Laird, N., 1986. Meta-analysis in clinical trials. Controlled Clinical Trials 7, 177–188.

Egger, M., Davey Smith, G., Schneider, M., Minder, C., 1997. Bias in meta-analysis detected by a simple, graphical test. BMJ 315, 629–634.

Filatova, S., Marttila, R., Koivumaa-Honkanen, H., Nordstrom, T., Veijola, J., Maki, P., Khandaker, G., Isohanni, M., Jaaskelainen, E., Moilanen, K., Miettunen, J., 2017. A comparison of the cumulative incidence and early risk factors for psychotic disorder in young adults in the Northern Finland Birth Cohorts 1966 and 1986. Epidemiology and Psychiatric Sciences 26, 314–324.

Fleming, T.M., Clark, T., Denny, S., Bullen, P., Crengle, S., Peiris-John, R., Robinson, E., Rossen, F.V., Sheridan, J., Lucassen, M., 2014. Stability and change in the mental health of New Zealand secondary school students 2007-2012: results from the national adolescent health surveys. Aust N Z J Psychiatry 48, 472–480.

Greenberg, P.E., Kessler, R.C., Birnbaum, H.G., Leong, S.A., Lowe, S.W., Berglund, P.A., Corey-Lisle, P.K., 2003. The economic burden of depression in the United States: how did it change between 1990 and 2000? J Clin Psychiatry 64, 1465–1475.

Hawthorne, G., Goldney, R., Taylor, A.W., 2008. Depression prevalence: Is it really increasing? Australian and New Zealand Journal of Psychiatry 42, 606–616.

Herrman, H., Kieling, C., McGorry, P., Horton, R., Sargent, J., Patel, V., 2019. Reducing the global burden of depression: a Lancet-World Psychiatric Association Commission. Lancet 393, e42–e43.

Institute for Health Metrics and Evaluation, 2020. GBD Compare. IHME, University of Washington, Seattle, WA.

Jeuring, H.W., Comijs, H.C., Deeg, D.J., Stek, M.L., Huisman, M., Beekman, A.T., 2017. Secular trends in the prevalence of major and subthreshold depression among 55-64-year olds over 20 years. Psychological Medicine. No Pagination Specified.

Kessler, R.C., Demler, O., Frank, R.G., Olfson, M., Pincus, H.A., Walters, E.E., Wang, P., Wells, K.B., Zaslavsky, A.M., 2005. Prevalence and treatment of mental disorders, 1990 to 2003. N Engl J Med 352, 2515–2523.
Lepine, J.P., Briley, M., 2011. The increasing burden of depression. Neuropsychiatr Dis Treat 7, 3–7.
Lundin, A., Forsell, Y., Dalman, C., 2017. Mental health service use, depression, panic disorder and life events among Swedish young adults in 2000 and 2010: a repeated cross-sectional population study in Stockholm County, Sweden. Epidemiology and Psychiatric Sciences 1–9.
Mammen, G., Faulkner, G., 2013. Physical activity and the prevention of depression: a systematic review of prospective studies. Am J Prev Med 45, 649–657.
Markkula, N., Zitko, P., Pena, S., Margozzini, P., Retamal, C.P., 2017. Prevalence, trends, correlates and treatment of depression in Chile in 2003 to 2010. Social psychiatry and psychiatric epidemiology 52, 399–409.
Mehta, K., Kramer, H., Durazo-Arvizu, R., Cao, G., Tong, L., Rao, M., 2015. Depression in the US population during the time periods surrounding the great recession. Journal of Clinical Psychiatry 76, e499–e504.
Moola, S., Munn, Z., Tufanaru, C., Aromataris, E., Sears, K., Sfetcu, R., Currie, M., Qureshi, R., Mattis, P., Lisy, K., Mu, P.-F., 2017. Chapter 7: Systematic reviews of etiology and risk. In: Aromataris, E., Munn, Z. (Eds.), Joanna Briggs Institute Reviewer's Manual. The Joanna Briggs Institute.
Murphy, J.M., Laird, N.M., Monson, R.R., Sobol, A.M., Leighton, A.H., 2000a. A 40-year perspective on the prevalence of depression: The Stirling County Study. Archives of General Psychiatry 57, 209–215.
Murphy, J.M., Laird, N.M., Monson, R.R., Sobol, A.M., Leighton, A.H., 2000b. Incidence of depression in the Stirling County Study: Historical and comparative perspectives. Psychological Medicine 30, 505–514.
National Institutes of Health, 2020. Quality assessment tool for case series studies, National Institutes of Health. Bethesda.
Noorbala, A.A., Bagheri Yazdi, S.A., Faghihzadeh, S., Kamali, K., Faghihzadeh, E., Hajebi, A., Akhondzadeh, S., Esalatmanesh, S., Bagheri Yazdi, H.S., Abbasinejad, M., Asadi, A., 2017. Trends of mental health status in Iranian population aged 15 and above between 1999 and 2015. Archives of Iranian Medicine 20, S2–S6.
Ormel, J., Cuijpers, P., Jorm, A.F., Schoevers, R., 2019. Prevention of depression will only succeed when it is structurally embedded and targets big determinants. World psychiatry: official journal of the World Psychiatric Association 18, 111–112.
Ouzzani, M., Hammady, H., Fedorowicz, Z., Elmagarmid, A., 2016. Rayyan-a web and mobile app for systematic reviews. Syst Rev 5, 210.
Park, J.E., Lee, J.Y., Sohn, J.H., Seong, S.J., Cho, M.J., 2015. Ten-year trends in the prevalence and correlates of major depressive disorder in Korean near-elderly adults: a comparison of repeated nationwide cross-sectional studies from 2001 and 2011. Social psychiatry and psychiatric epidemiology 50, 1399–1406.
Patten, S.B., Williams, J.V.A., Lavorato, D.H., Fiest, K.M., Bulloch, A.G.M., Wang, J.L., 2015. The prevalence of major depression is not changing. Canadian Journal of Psychiatry 60, 31–34.
Piccinelli, M., Wilkinson, G., 2000. Gender differences in depression. Critical review. The British journal of psychiatry: the journal of mental science 177, 486–492.
Sawyer, M.G., Reece, C.E., Sawyer, A.C., Johnson, S.E., Lawrence, D., 2018. Has the prevalence of child and adolescent mental disorders in Australia changed between 1998 and 2013 to 2014? J Am Acad Child Adolesc Psychiatry 57, 343–350.
Saxena, S., Paraje, G., Sharan, P., Karam, G., Sadana, R., 2006. The 10/90 divide in mental health research: trends over a 10-year period. The British journal of psychiatry: the journal of mental science 188, 81–82.
Shi, Z., Taylor, A.W., Goldney, R., Winefield, H., Gill, T.K., Tuckerman, J., Wittert, G., 2011. The use of a surveillance system to measure changes in mental health in Australian adults during the global financial crisis. Int J Public Health 56, 367–372.
Sourander, A., Niemela, S., Santalahti, P., Helenius, H., Piha, J., 2008. Changes in psychiatric problems and service use among 8-year-old children: a 16-year population-based time-trend study. J Am Acad Child Adolesc Psychiatry 47, 317–327.
Spiers, N., Brugha, T., Bebbington, P., McManus, S., Jenkins, R., Meltzer, H., 2012. Age and birth cohort differences in depression in repeated cross-sectional surveys in England: The National Psychiatric Morbidity Surveys, 1993 to 2007. Psychological Medicine 42, 2047–2055.
StataCorp, 2015. Stata Statistical Software: Release 14. StataCorp LP, College Station, TX.
Stroup, D.F., Berlin, J.A., Morton, S.C., Olkin, I., Williamson, G.D., Rennie, D., Moher, D., Becker, B.J., Sipe, T.A., Thacker, S.B., 2000. Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis Of Observational Studies in Epidemiology (MOOSE) group. JAMA 283, 2008–2012.
Thorisdottir, I.E., Asgeirsdottir, B.B., Sigurvinsdottir, R., Allegrante, J.P., Sigfusdottir, I. D., 2017. The increase in symptoms of anxiety and depressed mood among Icelandic adolescents: time trend between 2006 and 2016. Eur J Public Health 27, 856–861.
Thornicroft, G., Chatterji, S., Evans-Lacko, S., Gruber, M., Sampson, N., Aguilar-Gaxiola, S., Al-Hamzawi, A., Alonso, J., Andrade, L., Borges, G., Bruffaerts, R., Bunting, B., de Almeida, J.M., Florescu, S., de Girolamo, G., Gureje, O., Haro, J.M., He, Y., Hinkov, H., Karam, E., Kawakami, N., Lee, S., Navarro-Mateu, F., Piazza, M., Posada-Villa, J., de Galvis, Y.T., Kessler, R.C., 2017. Undertreatment of people with major depressive disorder in 21 countries. The British journal of psychiatry: the journal of mental science 210, 119–124.
van Zoonen, K., Buntrock, C., Ebert, D.D., Smit, F., Reynolds, C.F., 3rd, Beekman, A. T., Cuijpers, 2014. Preventing the onset of major depressive disorder: a meta-analytic review of psychological interventions. Int J Epidemiol 43, 318–329.
Vigo, D., Thornicroft, G., Atun, R., 2016. Estimating the true global burden of mental illness. Lancet Psychiatry 3, 171–178.
Von Soest, T., Wichstrom, L., 2014. Secular trends in depressive symptoms among Norwegian adolescents from 1992 to 2010. Journal of Abnormal Child Psychology 42, 403–415.
Wang, Q., Tian, W., 2018. Prevalence, awareness, and treatment of depressive symptoms among the middle-aged and elderly in China from 2008 to 2015. Int J Health Plann Manage 3 03.
Weinberger, A., Gbedemah, M., Martinez, A., Nash, D., Galea, S., Goodwin, R., 2017. Trends in depression prevalence in the usa from 2005 to 2015: Widening disparities in vulnerable groups. Psychological Medicine, No Pagination Specified.
Wiberg, P., Waern, M., Billstedt, E., Ostling, S., Skoog, I., 2013. Secular trends in the prevalence of dementia and depression in Swedish septuagenarians 1976-2006. Psychological medicine 43, 2627–2634.
Wiens, K., Williams, J.V., Lavorato, D.H., Duffy, A., Pringsheim, T.M., Sajobi, T.T., Patten, S.B., 2017. Is the prevalence of major depression increasing in the Canadian adolescent population? Assessing trends from 2000 to 2014. Journal of Affective Disorders 210, 22–26.
Wittayanukorn, S., Qian, J., Hansen, R.A., 2014. Prevalence of depressive symptoms and predictors of treatment among U.S. adults from 2005 to 2010. General Hospital Psychiatry 36, 330–336.
World Bank, 2020. http://data.worldbank.org/country. Accessed January 24, 2020.
World Health Organization, 2017. Depression and Other Common Mental Disorders. Global Health Estimates, Geneva.