Prevalence of depression among physicians: A comprehensive meta-analysis

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ABSTRACT

Depression among medical personnel is recognized worldwide as a serious problem, yet quantitative syntheses of prevalence studies are rare. We proceeded quantify and understand prevalence variation among physicians at the global levels.

For this meta-analysis, we searched 6 databases, including: PsycINFO, Web of Science, PubMed, ProQuest using a comprehensive search strategy to identify prevalence of the physicians' depression studies in the literature, published from inception of 1979. Studies reporting estimates of depression prevalence in physicians were included in the analyses. Studies quality was assessed with a prevalence risk of bias tool. Meta-regression was used to explore heterogeneity of the moderators we included in the analysis.

Of the 3,156 studies initially identified, 33 were eligible for inclusion. These studies were geographically diverse (15 countries). The pooled prevalence rate for overall elder abuse was .243 (CI [.188; .306]; $p < .001$). Meta-analysis of studies that included overall abuse revealed heterogeneity. Significant associations were found between overall prevalence estimates and region, but not for sampling allocation and severity of depression.

In this meta-analysis, the summary estimate of the prevalence of depression among physicians is 24.3%, ranging from 2% to 65.3 % depending on the region from the studies.

Further research is needed to identify effective strategies for preventing and treating depression among physicians.

Keywords: depression, physicians, depression prevalence, meta-analysis, mental health

INTRODUCTION

Being a physician is often thought as one of the most rewarding, respectable and safety professions, but it is also known to be one of the most stressful with high probability of long-term negative impact on the physician's mental health and wellbeing. Medical profession is exposed to many stressors, such as the burden imposed by expectations of a high degree of professionalism, responsibility for patients' healthcare and for an efficient communication with these, as well as the maintenance of a good relationship colleagues and concerns about medical errors and malpractice litigation. On the other hand, hardworking bureaucracy, large workload, irregular working hours, competitiveness of training programs, pressure of patient and service

demands and poor work-life balance are factors that explain the elevated prevalence of mental disorder and depression among physicians (1,2). Evidence shows the common mental health issues that physicians are struggling with are burnout (3), anxiety (4), depression and suicidal ideation (5,6). Although depression and mental health status is a current concern in broad domains, actual research of occupational health brings evidence regarding higher prevalence of common mental disorders among physicians compared with the general population (4) and other professions (7,8).

In addition, prevalence rates of depression vary across gender, medical specialty, geographical location, age and other variables. Many studies showed that as physicians' prevalence of depression has

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higher rates the first years of practice, compared to those who passed the residency (9,10) and prevalence of depression among rural doctors is higher than among those from urban areas (11). Women doctors tend to be more depressed than male doctors (12,13) and is more likely that specialties with higher level of energy consuming and additional stress (i.e. emergency, oncology) to have elevated rates of depression (14,15). However, the prevalence of depressive symptoms has been inconsistent across studies. For example, the prevalence estimates among physicians is in the range between 20% and 29.9% for medical students (3,16); between 20% and 39% for residents, fellows and interns (17,18,19); and finally for physicians the range of depression prevalence is between 10% to 59% (20,21). Moreover, a significant amount of studies reports a cumulative prevalence of depression for all levels of medical training (i.e. residents and physicians; students, residents and physicians or nurses and physicians) (22,23).

Given these inconsistencies, a reliable estimate of the prevalence of depression could enable us to understand the basic information about depression among this population and severity of the depression. However, as far as we know, from this field, only one meta-analytic study focused on prevalence of depression among resident physicians (24), which bring comprehensive understanding about depression in medical domain. As literature shows, there is a significant difference between these groups of medical professions: physicians, residents/trainees and students, this is why, our paper expands the systematic reviews, by evaluating the prevalence of depression only to physicians who passed the residency level. Therefore, the first objective of this meta-analysis is to address this gap in the literature and to provide a quantitative analyze of the available data of the cross-sectional studied, regarding the prevalence of depression among physicians, followed by a second objective, to investigate the impact of region regarding the prevalence, as well as the impact of studies' sampling and severity of depression.

Awareness of the real rates of depression among physicians as well as the effects they are likely to be on individuals, families, and the health service more broadly (25) including quality of patient healthcare and profession errors (26,27). This evaluation of the evidence base yells the real necessity for action regarding the mental disorders of physicians, a demand for a greater focus on physicians' mental health within training programs, a new crafting of workplaces and organizational support.

On the other hand, there are broader systemic issues in medicine practice such as stigma, regulatory practices, and concerns around confidentiality

and registration, that also affect the context physicians might act to help-seeking or disclosure through traditional pathways. These features make physicians a unique population and suggest that the type of approach might differ from other groups.

METHOD

Search strategy

Studies were collected through searches of electronic databases PsycINFO, Web of Science, PubMed, ProQuest, from the incept of 1989 to December 2019. A search strategy was developed for each database with a combination of free text and MeSH terms for controlling vocabulary. The following comprehensive search string was entered into the databases: “doctor*” OR “medical professionals” OR “medical practitioner*” OR “physician*” AND “depression” OR “mental health” OR “mental state” AND “prevalence” OR “incidence” OR “rate”. Also, it was manually searching for citations in reference lists of the relevant articles and additional web-based search on Google Scholar for grey literature. The search was limited to those published in English language and human science, and each study from the final results was screened by title and abstract.

Selection and eligibility criteria

The selected studies were screened in two stages: screening of titles and abstracts followed by the retrieval and screening of full-text articles using the eligibility criteria recommended by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (28) in Figure 1. If more than one publication reported on a single study, the study that provided the most relevant data was selected for the meta-analytic final analysis.

Studies were included if they were applying the following conditions: the population of interest comprised physicians of any specialty, working in primary, secondary, or tertiary care settings; studies that clearly delimited the population if interest from others (i.e. nurses, residents, interns, trainees, fellows, students or auxiliary personnel). Therefore, studies that did not report prevalence separately (i.e. nurses vs. physicians, residents vs. physicians) were excluded; studies that reported estimates prevalence of depression at a national or region level (i.e. provinces, districts or cities); studies reported the prevalence of depression of the physicians at any severity level, by any method of assessment (i.e. interview, assessment tool) or by any period of presence of the depression (i.e. current or history); studies with cross-sectional design.

Risk of bias

The quality assessment of the studies was performed with Risk of Bias Tool (29) designed to assess population-based prevalence studies. The tool assesses the study methodological quality in terms of both external and internal validity by examining:

External validity with four items: Was the study's target population a close representation of the national population?; Was the sampling frame a true or close representation of the target population?; Was some form of random selection used to select the sample, or was a census undertaken?; Was the likelihood of non-response bias minimal?

Internal validity has six items as follows: Were data collected directly from the subjects (as opposed to a proxy)?; Was an acceptable case definition used in the study?; Was the study instrument that measured the parameter of interest shown to have reliability and validity?; Was the same mode of data collection used for all subjects?; Was the length of the shortest prevalence period for the parameter of interest appropriate?; Were the numerator(s) and denominator(s) for the parameter of interest appropriate?

Each of the studies was rated into dichotomous ratings: low risk and high risk. An overall score was calculated by summing all the items rated with low risk. Thus, higher scores indicated lower risk of bias and stronger method quality (see Table 2) as it follows: 8 or more "yes" answers - low risk of bias; 6 to 7 "yes" answers – moderate risk of bias; and 5 or fewer "yes" answers – high risk of bias.

Moderator variables

We conducted categorical moderator analyses testing the following variables: depression severity, region and design. Severity of depression refers to the level of the symptomatology that every study report and it is clustered by the following data reports: unknown - for the studies that do not present any data of depression level; low - for the data that report depression as symptoms, troublesome, borderline, tendency, at risk or mild; medium - for data that present depression as clinical, positive at screening, moderate, mild-to-moderate; high – for depression that is presented as major, extreme, severe or moderate-to-severe.

The second moderator, region, is clustered by geographical location and regional classification of the studies, according to World Health Organization (WHO) regions (30). One study country (31) is not part of WHO classification and could not be assigned to any WHO classification and it is named as Other.

The third moderator variable, design, refers to the sampling procedure, randomized or convenience sampling.

Meta-analytic procedures

Meta-analysis was conducted to synthesize the prevalence estimate for depression among physicians and its moderator variables. Statistical analysis based on pooled estimate of prevalence rates were calculated from raw data of number of cases with depression and study sample. The pooled estimates were calculated using DerSimonian and Laird's method for random, rather than fixed effects models, given it is likely that the true prevalence rate varies from study to study (32). All analyses were done using Comprehensive Meta-Analysis (CMA) V3. Software (33). Furthermore, the proportion depressed physicians will be transformed into a logit event rate effect size with a corresponding standard error (34). We calculated the pooled estimates and the 95% confidence interval (CI) and considered non-overlapping CIs as an indication of statistically significant differences. To determine the extent of variation between the studies, we did heterogeneity tests with Higgins' I^2 statistic to measure what proportion of the variance in observed effects reflects variation in true effect (32). We did not classify I^2 as low, moderate or high, considered it as being a mistake. I^2 is a proportion, not an index of absolute dispersion, therefore it cannot specify about the amount of variance (35). For example - in our case - a higher value of I^2 corresponds to a smaller amount of dispersion.

We did not proceed to inspect the funnel plots and assess both the degree of publication bias and its effect on the study findings. The Duval and Tweedie's Trim and Fill method is not applicable in prevalence meta-analysis. There is no need to test if a prevalence value is significantly different from any other value, therefore the probability that a prevalence study is not published just because it is not statistically significant makes no sense (35).

Subgroup analyses were performed to investigate the sources of heterogeneity and meta-regression. These analyses tested individual associations between the pooled estimates using categorical covariates: severity coded as low, moderate and high; region coded in conformity with WHO classification; and design coded as random or convenience. Covariates were entered into a multivariate meta-regression model.

RESULTS

Characteristics of included studies

Of the 3,156 studies, 2,220 potentially relevant full-text articles were screened by title and abstract. From these, we identified 131 that have had the potential to provide data on depressive prevalence among physicians and were full text assessed.

Among these, 27 examined other prevalence in correlation with other variables, 38 provided an overall prevalence data a mix of medical population (i.e. nurses and physicians; residents and physicians; students, residents and physicians), 21 had a different design as systematic review or randomized controlled trial, 10 studies had lack of prevalence data, and two studies were published in different journal with a slightly different title but with same study sample and outcome. After excluding ineligible studies, 33 studies that provided the inclusion criteria data were included in the qualitative and quantitative processes as shows Figure 1.

The 33 studies selected for meta-analysis were geographically diverse and included 15 countries, clustered in 4 WHO regions: two studies as Eastern Mediterranean Region; 14 studies as European Region; 8 studies as Region of the Americas; 8 studies as Western Pacific; and one study coded as Other because Taiwan is not part of any WHO region classification. Moreover, 10 studies had randomized samples and the rest of them had convenience sample. The severity of depression that we identified was: 8 studies with high depression; 10 studies with moderate depression; 7 studies with low depression; and 8 studies in which we could not identify information about the lever of depression.

From the total of 64,691 participants, 18,762 were allocated randomly, 20,721 participants were

from the Europe region and 10,987 were assessed as depressed physicians at different levels of severity.

Risk of bias of the included studies

The quality of each study was assessed Figure 2. A maximum quality score of 9 was achieved in 1 of the 33 studies; 14 studies were scored as low risk of bias; 15 studies were scored as moderate; and 4 as high risk of bias. Regarding to external validity, the majority of studies used a convenience sampling ($n = 22$) and almost half of samples ($n = 14$) have a likelihood of less than 75% of non-participation. The internal validity source of risk of bias was provided by 23 studies with no refer of the lowest level of depression; and 11 studies did not specify a standard criterion for depression. Overall, 12% of the studies have a high risk of bias.

Prevalence of depression among physicians

The main meta-analytical results are displayed in Figure 3. The prevalence of depression varied substantially among studies, from 2.0% (CI [.018-.022]; $p < 0.0001$) to 65.3% (CI [.628-.676]; $p < 0.0001$). The mean prevalence is .243 (CI [.188; .306]; $p < .001$). The set of studies was heterogeneous for overall depression ($Q = 6526.54$, $p < .001$), suggesting differences in the effect sizes exist within this set of studies. Higgins' I^2 showed that 99% of the variance comes

FIGURE 1. Prisma flow chart of study selection

from a source other than sampling error. The variance of true effect sizes is $T^2 = .901$ and the standard deviation of true effects is $T = .949$ displayed in Table 2.

Severity, region and design moderators were entered into a meta-regression for their variance contribution to depression prevalence rates. The moderators were analyzed categorically to assess group

differences in prevalence. The sources of the variation were investigated with bivariate analyses. Region was significantly associated with depression prevalence among physicians $Q = 17.72$; $p < .00014$. The last 2 covariates severity and design could not be significantly associated with depression ($p = .7728$; respectively $p = .2415$) suggesting that variation between sample allocation and the level of de-

Study ID			External validity				Internal validity						Risk of bias
			I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	
Adams et al., 2009													Moderate risk
Assunção et al., 2014													Low risk
Bourne et al., 2015													Low risk
Burbeck et al., 2002													Moderate risk
Caplan, 1994													High risk
Chambers & Belcher, 1994													Moderate risk
Chambers & Campbell, 1996													High risk
Clayton et al., 1980													Moderate risk
Compton & Frank, 2011													High risk
da Silva et al., 2016													Low risk
Fang et al., 2018													Low risk
Frank & Dingle, 1999													Moderate risk
Gong et al., 2014													Low risk
Hao et al., 2016													Low risk
Hayes et al., 2017													Low risk
Huang et al., 2015													Low risk
Khan et al., 2018													Low risk
Khuwaja et al., 2004													Moderate risk
Lazarescu et al., 2018													Moderate risk
Magnavita et al., 2008													Low risk
Magnavita & Fileni, 2013													Low risk
Ruitenburt et al., 2012													Moderate risk
Saijo et al., 2014													Moderate risk
Shanafelt et al., 2009													Moderate risk
Sheikh et al., 2018													Moderate risk
Shen et al., 2012													Low risk
Sugiura-Ogasawara et al., 2012													Moderate risk
Thommasen et al., 2001													Moderate risk
Vaglum & Falkum, 1999													Low risk
van Steijn et al., 2019													High risk
Wada et al., 2010													Moderate risk
Wang et al., 2010													Low risk
Wurm et al., 2016													Moderate risk
Yes													

FIGURE 2. Risk of bias summary

TABLE 1. Characteristics of the sample of studies included in the meta-analysis

Study ID	Country	Sample Allocation	WHO Region	Medical Specialty	Assessment Tool	Sample size (No.)	Depression No.	Women (%)	Level of depression
Adams et al., 2009 (36)	England	Convenience	European Region	General practice and psychiatry	-	1254	580	39.3	Unknown
Assunção et al., 2014 (37)	Brasil	Random	Region of the Americas	Mixed	-	216	26	53.7	Unknown
Bourne et al., 2015 (38)	UK	Convenience	European Region	-	PHQ-9	7926	852	47.5	High
Burbeck et al., 2002 (39)	UK	Convenience	European Region	Accident and Emergency	SCL-D	350	63	16.6	Unknown
Caplan, 1994 (40)	US	Convenience	Region of the Americas	General practice	HADS	322	112	ns	Medium
Chambers & Belcher, 1994 (41)	UK	Convenience	European Region	-	-	653	88	18.8	Low
Chambers & Campbell, 1996 (42)	UK	Convenience	European Region	Mixed	HADS	610	159	22	Medium
Clayton et al., 1980 (43)	US	Convenience	Region of the Americas	-	Interview	111	43	100	High
Compton & Frank, 2011 (1)	Canada	Random	Region of the Americas	Mixed	2 item self-report	3213	745	37	Unknown
da Silva et al., 2016 (44)	Brasil	Convenience	Region of the Americas	-	PHQ-9	217	108	NS	High
Fang et al., 2018 (21)	China	Convenience	Western Pacific	Otorhinolaryngology	SDS	379	221	NS	Low
Frank & Dingle, 1999 (45)	US	Random	Region of the Americas	Mixed	NS	4501	808	100	Unknown
Gong et al., 2014 (46)	China	Random	Western Pacific	Mixed	SDS	2641	743	42.06	Unknown
Hao et al., 2016 (47)	China	Random	Western Pacific	-	CES-D	931	291	54.56	Low
Hayes et al., 2017 (48)	Ireland	Random	European Region	Mixed	DASS-21	945	184	39.5	Medium
Huang et al., 2015 (31)	Taiwan	Convenience	Other	Mixed	ICD-9CM	15150	300	16.43	Unknown
Khan et al., 2018 (49)	UK	Convenience	European Region	Mixed	STPI	593	214	35.1	High
Khuwaja et al., 2004 (50)	Pakistan	Convenience	Eastern Mediterranean Region	Family medicine	AKUADS	397	155.00	38	Unknown
Lazarescu et al., 2018 (51)	France	Convenience	European Region	Radiology	GHQ-12	166	60	46	Low
Magnavita et al., 2008 (52)	Italy	Convenience	European Region	Radiology	GAD	314	53	20.1	Low
Magnavita & Fileni, 2013 (53)	Italy	Convenience	European Region	Radiology	GAD	654	287	30.3	Low
Ruitenburger et al., 2012 (4)	Netherlands	Convenience	European Region	Mixed	BSI	216	58	48	High
Saijo et al., 2014 (54)	Japan	Convenience	Western Pacific	Mixed	PHQ-9	488	198	19.9	Medium
Shanafelt et al., 2009 (55)	US	Convenience	Region of the Americas	Surgery	PRIME-MD	7905	2349	13.3	Low
Sheikh et al., 2018 (56)	Pakistan	Convenience	Eastern Mediterranean Region	-	HADS	268	106	47	Medium

Study ID	Country	Sample Allocation	WHO Region	Medical Specialty	Assessment Tool	Sample size (No.)	Depression No.	Women (%)	Level of depression
Shen et al., 2012 (57)	China	Convenience	Western Pacific	Primary-care	SDS	451	143	60.8	Medium
Sugiura-Ogasawara et al., 2012 (58)	Japan	Convenience	Western Pacific	Obstetrics/ Gynecology	K6	1301	109	39.74	Medium
Thommasen et al., 2001 (11)	Canada	Random	Region of the Americas	Family medicine	BDI	129	41	26	High
Vaglum & Falkum, 1999 (13)	Norway	Random	European Region	Mixed	GHQ	836	96	ns	Medium
van Steijn et al., 2019 (59)	Netherlands	Convenience	European Region	Pediatrics	HADS	307	27	66.4	Medium
Wada et al., 2010 (60)	Japan	Random	Western Pacific	Mixed	QIDS-SR	3862	340	27.7	High
Wang et al., 2010 (61)	China	Random	Western Pacific	Mixed	CES-D	1488	971	57.6	Medium
Wurm et al., 2016 (62)	Austria	Convenience	European Region	-	MDI	5897	607	44.5	High

pression did not explain the heterogeneity in the observed depression or depressive symptom prevalence estimates (Figure 4). The proportion of the true variation that is explained by the covariance is $R^2 = .3522$ (Table 3). That means the model can explain 35.22% of the variance between studies and 58.22% of the variance is the variance that can not be explained by the model. The region with the highest increment is region of Western Pacific ($R^2 = .2681$).

DISCUSSIONS

This is thought to be the first meta-analysis to investigate the prevalence of depression among physicians, others than residents, fellows or last year students. Using meta-analytical methods, we pooled the prevalence estimates of depression reported in 33 studies published between 1980 and 2019. The studies varied in terms of sample selection, level of depression, assessment tools, and nationality. The 33 studies selected for meta-analysis were geographically diverse and included 15 countries: 1 from Austria, 2 from Brazil, 2 from Canada, 5 from China, 6 from UK, 1 from France, from Ireland, 2 from Italy, 3 from Japan, 2 from Netherlands, 1 from Norway, 2 from Pakistan, 1 from Taiwan and 4 from USA. Prevalence rates for overall depression that were reported in studies included 10,978 individuals of 64,691 physicians.

This study has investigated two main questions: (1) what is the prevalence of depression among physicians, and (2) does region, level of depression or type of sampling selection influence the prevalence of depression? Our meta-analytical results indicate the pool prevalence of depression among physicians is 24.3%. The current study is in line with other studies on the prevalence of depression (3,24,63), aggregating prevalence data from various resources to obtain an overall prevalence estimate. The results were based on heterogeneous data.

It is important to note that the majority of the studies, participants were assessed through self-report inventories that measured depressive symptoms, the gold-standard of clinical diagnostic for major depressive disorder. On this line, the sensitivity and specificity of these instruments for diagnosing depression do not vary substantially.

The countries where depression is the most prevalent are China and Japan, this is in concordance with other studies (63,64) and it is caused mostly by higher levels aggressiveness targeted on medical professionals, society stigmatization and relatively low remuneration, which may influence the mental health of physicians, expressed by depressive disorders (21,47,65). On the other hand, In Japan the short number of days off, and the shifts

FIGURE 3. Standardized event rates and forest plot of all the studies sample

TABLE 2. The main meta-analytical results

		ES (95% CI)			Test of null (2-Tail)			Heterogeneity				Tau Squared		
Model	Studies	Point estimate	LL	UL	Z-value	P-value	Q-value	df (Q)	P-value	I ²	Tau ²	SE	Variance	Tau
Fixed	33	0.223	0.219	0.227	-110.733	0.0000	6526.539	32	0.0000	99.510	0.901	0.363	0.132	0.949
Random	33	0.243	0.188	0.308	-6.822	0.0000								

TABLE 3. Statistics for the meta-regression model

Test of the model			Goodness of Fit			Total between-study variance		
Q - value	P - value	Tau ²	Tau	I ²	Q - value	P - value	R ² analog	
20.56	0.0084	0.5837	0.764	99%	2401.25	0.0000	0.3522	

Set	Covariate	Coefficient	Standard Error	95% Lower	95% Upper	Z-value	2-sided P-value
Region	Intercept	-3.9020	0.7662	-5.4037	-2.4002	-5.09	0.0000
	Region: Eastern	3.4745	0.9632	1.5867	5.3623	3.61	0.0003
	Region: European Region	2.5519	0.8618	0.8629	4.2409	2.96	0.0031
	Region: Region of the	3.1492	0.8791	1.4261	4.8723	3.58	0.0003
	Region: Western Pacific	3.2030	0.9127	1.4140	4.9919	3.51	0.0004
Severity	Severity: High	-0.0431	0.4281	-0.8822	0.7961	-0.10	0.9198
	Severity: Low	0.3391	0.4611	-0.5646	1.2429	0.74	0.4621
	Severity: Medium	-0.0148	0.4128	-0.8238	0.7942	-0.04	0.9714
	Design: Random	-0.4034	0.3444	-1.0785	0.2716	-1.17	0.2415

Q=17.72, df=4, p=0.0014

Q=1.12, df=3, p=0.7728

FIGURE 4. The impact of full meta-regression model

spent in overnight work and on-call are one of the main causes of depression (27,54,66) followed by low level of personal accomplishment (67).

Based on our study and compared with other groups of population, physicians have a higher prevalence of depression. These results indicate that the current status of mental health problems among physicians might have a negative impact on health care services and patient health-care. From a practical perspective our results bring an additional acknowledgment of the necessity of careful screening of and proper intervention in this mental health issue and should be implemented through medical institutions and facilitated by counselors in a timely and consistent manner.

Implications for future research are various. Although our literature search, found that previous studies about depression among physicians were mostly cross-sectional studies, future longitudinal investigations with dynamic study designs are highly recommended. Moreover, current studies on mental health problems among physicians mainly

focus on depression, anxiety, burnout and stress. Future studies are needed to investigate other mental health problems, such as obsessive-compulsive disorder, bipolar disorder or combination of depression and other comorbidities. As well, it is needed to investigate depression with others counter-productive behaviors, including absenteeism and poor job performance or with accidents and errors and consumption of substances. In addition, more stratified and subgroup analyses are suggested in future research to investigate mental health problems in a more comprehensive manner. Finally, there is a lack of prevention or treatment studies using randomized controlled trial design.

CONCLUSION

Investment in developing and assessing interventions target in depression of physicians must be a public health priority to help to reduce the effect of wick medical services, patients complains and for a healthier medical professional worldwide.

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