Recognition of Depression by Non-psychiatric Physicians—A Systematic Literature Review and Meta-analysis

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BACKGROUND: Depression, with up to 11.9% prevalence in the general population, is a common disorder strongly associated with increased morbidity. The accuracy of non-psychiatric physicians in recognizing depression may influence the outcome of the illness, as unrecognized patients are not offered treatment for depression.

OBJECTIVES: To describe and quantitatively summarize the existing data on recognition of depression by non-psychiatric physicians.

METHODS: We searched the following databases: MED-LINE (1966–2005), Psych INFO (1967–2005) and CINAHL (1982–2005). To summarize data presented in the papers reviewed, we calculated the Summary receiver operating characteristic (ROC) and the summary sensitivity, specificity and odds ratios (ORs) of recognition, and their 95% confidence intervals using the random effects model.

MEASUREMENTS AND MAIN RESULTS: The summary sensitivity, specificity, and OR of recognition using the random effects model were: 36.4% (95% CI: 27.9–44.8), 83.7% (95% CI: 77.5–90.0), and 4.0 (95% CI: 3.2–4.9), respectively. We also calculated the Summary ROC. We performed a metaregression analysis, which showed that the method of documentation of recognition, the age of the sample, and the date of study publication have significant effect on the summary sensitivity and the odds of recognition, in the univariate model. Only the method of documentation had a significant effect on summary sensitivity, when the age of the sample and the date of publication were added to the model.

CONCLUSION: The accuracy of depression recognition by non-psychiatrist physicians is low. Further research should focus on developing standardized methods of documenting non-psychiatric physicians' recognition of depression.

BACKGROUND

Depression, with up to 11.9% prevalence in the general population,[1,2] is a common disorder strongly associated with increased morbidity.[3] It has been estimated that in 2020 depression will become the second leading cause of disability,[4] which emphasizes the importance of its early detection and treatment. The accuracy of non-psychiatric physicians in recognizing depression may influence the outcome of the illness, as unrecognized patients are not offered treatment for depression. Currently, less than half of patients with depression are recognized by their primary care physicians, even after 5 years of follow-up.[5] Moreover, studies show that among recognized depressed patients only a few receive appropriate care, which may further lead to poor outcome of depression and increased health service use and mortality rates in these patients.[6,7]

There are many potential reasons for the underrecognition and undertreatment of depression; patient, provider, and system barriers have been identified. Patients reduce the likelihood of being diagnosed by presenting with somatic rather than emotional complaints[8–10] and may resist a diagnosis of depression or anxiety by attributing their symptoms to physical causes.[11,12] Provider barriers include concerns about potential patient stigma,[13,14] time pressures,[14] a belief that such diagnoses are burdensome,[15] inadequate knowledge about diagnostic criteria or treatment options,[6] lack of a psychosocial orientation,[16–18] and inadequate insight into different cultural presentations of mental disorders.[19] System barriers include productivity pressures, limitations of third-party mental health coverage, restrictions on specialist, drug, and psychotherapeutic care,[13,14] lack of a systematic method for detecting and managing such patients,[20] and inadequate continuity of care.[13]

The accuracy of recognition of depression by attending physicians can be assessed using measures such as sensitivity, specificity, and odds ratio, when the clinical diagnosis made by the physician is compared to a gold standard diagnosis of depression. The estimates of these measures reported in the literature vary according to the method used

to document the clinical diagnosis made by physicians and the definition of gold standard.

The main objectives of this literature review and meta-analysis were to describe and quantitatively summarize existing data on recognition of depression by non-psychiatric physicians in adult outpatients and inpatients. To our knowledge, this is the first systematic review of studies on recognition of depression by non-psychiatric physicians.

METHODS

Search Strategy

The search was conducted by MC (MSc in Epidemiology) using OVID search engine (2000–2005 version). MEDLINE (1966–2006), Psych INFO (1967–2006), CINAHL (1982–2006), and EMBASE (1986–2006) databases were searched for the following keywords: "depression" or "depression disorder" and "detection" or "recognition" or "identification" or "diagnosis". Letters, editorials, reviews, and case-reports were excluded. The search was limited to studies with subjects of ages 18 and more and written in English or French. This search yielded 7,105 papers.

Inclusion and Exclusion Criteria

Titles and abstracts of these papers were reviewed to identify those of potential relevance, based on the following inclusion criteria:

1. The study samples were adult patients attending primary care facilities, hospital emergency departments or outpatient clinics, or admitted to hospital in either medical or surgical wards.

2. A gold standard diagnosis of depression was made by a study psychiatrist or by research staff, using a structured clinical interview or a rating scale with a specified cut point.

3. A clinical diagnosis of depression (or other method of recognition, such as antidepressant prescription, referral to a mental health specialist, or identification of depressive symptoms) was made by a non-psychiatric physician.

Eighty-one studies of potential relevance were retained for review. The reference lists of the papers selected were searched and another 2 studies of potential relevance were retained for review. From the 85 reviewed papers, we excluded 49 for the following reasons:

1. In 13 studies, no gold standard diagnosis of depression was used to evaluate the validity of physicians' recognition of depression.[21–33]

2. Twenty-three studies evaluated the recognition of depression by nurses or the recognition of depression was attributed to a health care team (including physicians, nurses, social workers, etc).[34–56] The large body of literature looking at the recognition of depression by other health professionals than physicians justifies a separate review of this subject.

3. In 7 studies, recognition of depression by physicians was evaluated in training cases (vignettes of patients, actors, or videotaped patients).[18,57–62]

4. Two studies were randomized controlled trials that evaluated educational programs for improving recognition of depression by physicians.[63,64]
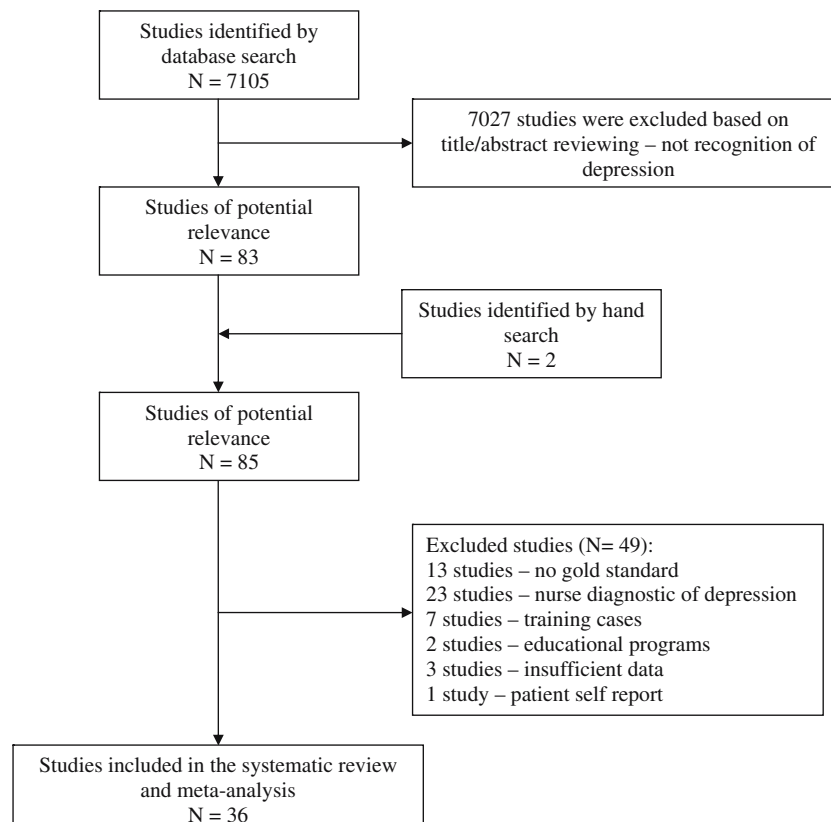

Figure 1. The systematic review flow

Table 1. Studies that Used the Chart Review Method (Sample Characteristics, Physician Specialties, and Methods)

Author/ Year	Sample size (% depressed)	Age (years)	Physician specialties	Methods			
				Method of sampling	Blinding of physicians	Criterion measure for depression	Method and criteria of recognition of depression by physician
Asch 2003[86]	1,140 (39.3%)	Not specified	HIV specialists, general internists, gynecologists	Sampling rates	Yes	CIDI (DSM-IV)	*Criteria:* diagnosis of depression
Balestrieri 2002[87]	309 (63%)	45–65	Medical and surgical physicians	Not specified	Yes	CIDI-PHC	*Criteria:* any of the following –prescription of psychotropic drugs – any statements about the presence of depression – referral to psychiatrist
Bertakis 2001[73]	508 (25.6%)	Not specified	Family practice physicians and general internal medicine residents	Consecutive	Not specified	BDI—cut point of 9	*Criteria:* diagnosis of depression
Callahan 1997[88]	508 (25.6%)	19–92	Family practice and general internal medicine residents	Consecutive	Yes	BDI —cut point of 9	*Criteria:* diagnosis of depression
Crawford 1998*[76]	318 (19.5%)	>65	General practitioners	Consecutive	Not specified	Short CARE scale— cut point of 6	*Criteria:* active treatment = antidepressant or referral to psychiatrist, psychiatric nurse or social services.
Garrard 1998[89]	3410 (16.4%)	>65	All specialties	Consecutive	Yes	GDS—cut point of 11	*Criteria:* – diagnosis of depression – one or more visits to a mental health specialist – prescription for one or more antidepressant medication
Lichtenberg 1993[90]	150 (34%) 90 Female 60 Male	>60	Emergency physicians	Consecutive	Yes	GDS—cut point of 10	*Criteria:* any of the following – diagnosis of depression – use of word depression' – use of words descriptive of depression ('blue', 'sad', 'dysphoric')
McCusker 1996*[103]	94 (52.1%)	>60	Primary care physicians	Random`	Yes	GDS—cut point of 11	*Criteria:* any of the following – note of depression – prescription of antidepressant medication
Meldon 1997[104]	101 (29.7%)	>65	Emergency physicians	Consecutive	Yes	SRDS—cut point of 4	*Criteria:* referral to mental health evaluation
Meldon 1997[105]	259 (27%)	>65	Emergency physicians	Convenience sample	Yes	KS—cut point of 4	*Criteria:* any of the following – diagnosis of depression – a mental health referral or consultation – any notation of depression or depressive symptoms
Nuyen 2005[78]	191 (28.8%)	>18	General practitioners	Random	Not specified	CIDI (DSM-IV)	*Criteria:* code of depression in the Dutch National Survey database
Perez-Stable 1990[91]	265 (26.4%)	18–69	Not specified	Not specified	Yes	DIS—DSM III	*Criteria:* any of the following – diagnosis of depression – term 'depression' or 'depressed' mentioned – prescription of antidepressant medication
Pouget 2000[92]	401 (22.4%)	>75	Not specified	Alternate	Yes	15-item GDS— cut point of 6	*Criteria:* any of the following – depressed mood mentioned in the discharge diagnoses – depressed mood mentioned in the discussion section – antidepressant or benzodiazepine prescribed at discharge

Table 1. (continued)

Author/ Year	Sample size (% depressed)	Age (years)	Physician specialties	Methods			
				Method of sampling	Blinding of physicians	Criterion measure for depression	Method and criteria of recognition of depression by physician
Rapp 1988[93]	150 (15.3%)	>65	Not specified	Random	Yes	SADS – evaluated using Research Diagnostic Criteria (RDC)	*Criteria*: any of the following – a formal diagnosis of depression – use of the word 'depressed' in the chart – use of words descriptive of depression, such as 'dysphoric', 'sad', or 'despondent' – any stated need for initiation or continuation of treatment for emotional or mental distress
Volkers 2004[74]	237 (23.2%)	>55	General practitioners	Random	Not specified	CIDI (DSM-IV)	*Criteria*: diagnosis of depression, depressive symptoms (down/depressed feelings) in the electronic medical record database
Whooley 1997[94]	429 (15.8%)	39–67	Attending physicians and resident physicians	Consecutive	Yes	DIS—Quick DIS-III-R	*Criteria*: any of the following – term 'depression' or 'depressed' was noted – referral of the patient to a psychiatrist for further evaluation of depressive symptoms
Zung 1983[95]	1086 (13.2%)	>20	Family practitioners	Random	Yes	SRDS—cut point of 55	*Criteria*: notations regarding depression and its treatment

*These studies presented results for both methods.

BDI = Beck Depression Inventory, CARE = Comprehensive Assessment and Referral Evaluation, CIDI = Composite International Diagnostic Interview, CIDI-PHC = Composite International Diagnostic Interview–Primary Care, DIS = Diagnostic Interview Schedule, DSM = Diagnostic and Statistical Manual of Mental Disorders, GDS = Geriatric Depression Scale, KS= Koenig Scale, SADS = Schedule for Affective Disorders and Schizophrenia, SRDS = Zung Self Rating Depression Scale

5. In 3 studies,[65–67] data were not available to calculate at least the overall sensitivity.
6. In one study,[68] recognition of depression was based on patients' self-report on antidepressant medication, with no reference to the specialty of the physician who prescribed the medication (possibly prescribed by psychiatrists).

The flow chart of the systematic review is presented in Figure 1.

The papers selected based on our inclusion and exclusion criteria were independently reviewed by 2 reviewers with training in Epidemiology using a review form and guidelines developed by the authors. Data abstracted included: study design, study setting, method of selecting the sample, age and gender of the sample, sample size used in the analysis, specialties and number of physicians participating in the study, blinding of physicians, criterion measure for diagnosing depression, data source for diagnosing depression, data source and indicators of recognition, and results (sensitivity, specificity, positive predictive value, negative predictive value, crude odds ratio, other) either presented in the study or possibly calculated from the data available.

Quality Assessment

Differences in data abstraction between the 2 reviewers were discussed and resolved by the authors. We reviewed the following aspects of study quality: selection of a clinically relevant cohort, the consistent use of a good gold standard, blinding of physicians to the gold standard results, and incomplete reporting.[69]

In all the studies reviewed, the authors consistently used a gold standard tool for detecting depression symptoms or diagnosing depression. Moreover, details pertaining to the validity and reliability of the tool used were included.

The authors of all the studies reviewed indicated the method of sampling the patients (consecutive or randomized sampling) and the health care settings where the patients were recruited. The age or gender distribution, as well as the prevalence of depression in the samples recruited from different health care settings vary considerably.

In 11 studies,[70–80] the authors did not specify if the physicians were blinded to the gold standard diagnosis (incomplete reporting). The rest of the studies included references to the blinding of physicians or the chart review.

To determine whether the quality of the studies may influence the conclusions of our literature review and meta-analysis, we performed a sensitivity analysis that explored the following aspects of study quality:

1. Method of sampling—selecting patients in a nonrandom manner may lead to selection bias.
2. Characteristics of the study sample (prevalence of depression, age and gender distribution)—the variation of these characteristics by study setting may introduce spectrum bias.[81]

3. Blinding of physicians—the physicians' awareness of the gold standard diagnosis may improve the accuracy of recognition, leading to incorporation bias.[82]

Statistical Analysis

We calculated missing sensitivities, specificities, and crude odds ratios (OR) using data reported in the papers reviewed. We used the random effects model[83] to calculate the summary diagnostic odds ratios, sensitivity, and specificity. Because there was evidence of varying cut points (Spearman: −0.635, p=0.0005), we also plotted our main measure and recalculated the overall sensitivity using receiver operating characteristic (ROC) curves.[84]

We performed the Cochrane's Q test[85] to assess the presence of heterogeneity among results reported in studies included in our systematic literature review and meta-analysis. We performed a univariate metaregression analysis, testing 7 potential sources of heterogeneity: the method of documentation (chart review vs physician diagnosis), blinding of physicians (physicians were blinded vs blinding status was not specified), the gold standard diagnostic tools used (structured clinical interview vs diagnostic scale with a specific cut point), method of sampling (random vs other), age (55 and over vs all ages and younger patients only), gender of sample (62% and more vs less than 62% female), date of study publication (after 1998 vs 1998 and before) and prevalence of depression (less than 25% vs 25% or more). The categories of the last 3 covariates were created using the median value as cut point. These analyses were performed using the STATA statistical software (STATA/SE 8.1 for Windows).

RESULTS

We included 36 studies in our systematic review (Tables 1, 2, 3, and 4) Twenty-three papers reported only sensitivity[72–74,78–80,86–102]. For 10 of these studies, we calculated the specificity and the diagnostic OR.[72,73,80,87,89,91,93,99–101] In 8 papers, both the sensitivity and specificity of recognition were presented.[75,77,103–108] Eleven papers reported other measures (such as positive predictive value, agreement expressed as percentage or kappa correlation coefficient, and identification index),[70,76,77,79,103,104,106,107,109,110] and we calculated the sensitivity, specificity, and OR of recognition using data presented in 5 of them.[70,76,77,79,109] One paper included in our systematic review[105] reported a sensitivity of 0% and a specificity of 98.9%. We considered these results outliers and decided to exclude them from our analysis.

Twenty-seven (75%) of the studies included in our systematic review and meta-analysis were conducted in primary care,[70–79,80,86,88,89,94–100,102,103,107–110] 3 studies were conducted in the emergency department,[90,104,105] three studies included patients admitted to the hospital,[87,92,93] and three studies included outpatients attending specialty clinics.[70,91,101]

Overall, we found high specificity (83.7%, 95% CI: 77.5–90.0, Table 5), but lower sensitivity (36.4%, 95% CI: 27.9–44.8) with a resulting diagnostic OR of 4.0 (95% CI: 3.2–4.9). The sensitivity varied across the method of assessment (Table 5), with physician diagnosis (PD) method having higher pooled

Table 2. Studies that used the Chart Review Method (Results)

Author/Year	Main results			
	Sens. (%)	Spec. (%)	DOR	Other†
Asch 2003[86]	46			
Balestrieri 2002[87]	32.5	92.1*	5.5*	
Bertakis 2001[73]	27.7	89.1*	3.1*	
Callahan 1997[88]	27.7			
Crawford 1998*[76]	25.8*	89.8*	3*	
Garrard 1998[89]	52%	77.4*	3.7*	
Lichtenberg 1993[90]	Overall: 27 Female: 40 Male: 10			
McCusker 1996*[103]	26	92	3.8*	PPV=50% Overall agreement:78%
Meldon 1997[104]	13*	89*	1.2*	
Meldon 1997[105]	0	98.9	0	
Nuyen 2005[78]	28.8			
Perez-Stable 1990[91]	35.7	81.5*	2.4*	
Pouget 2000[92]	16.7			
Rapp 1988[93]	8.7	95.2*	1.9*	
Volkers 2004[74]	20.8			
Whooley 1997[94]	8.8			
Zung 1983[95]	15			

Sensitivities (Sens.), specificities (Spec.) and crude diagnostic odds ratios (DOR) not reported by the authors were computed from the data available.
†*PPV = positive predictive value*

sensitivity than those using chart review (CR). Papers published after 1998 had higher pooled sensitivity than those before 1998 (Table 5). When we calculated the overall sensitivity, based on summary ROC curves, we found a sensitivity of 42.3% (Fig. 2).

Our results were heterogeneous. On metaregression, the method of documentation, age of the sample, and date of publication showed a statistically significant effect on the summary sensitivity (Table 6). These results indicate that the summary sensitivity of studies that used as method of documentation the physician diagnosis, were published after 1998 and had a sample of younger or all ages of patients was higher by 14.5%, 11.8%, and 12.3%, respectively, compared to those that used as method of documentation the chart review, were published in 1998 or before, and had a sample of patients aged 55 and more.

Only age of the sample and date of publication explained the heterogeneity of our pooled odds ratios. Studies that were published after 1998 and had a sample of younger or all ages of patients reported higher odds ratios of recognition compared to studies that were published in 1998 or before and had a sample of patients aged 55 and more (Table 7).

We performed a multivariate metaregression, including in the model 3 variables that had a significant effect on summary sensitivity or the pooled odds ratios in the univariate analysis: method of documentation, age of the sample, and date of publication. The multivariate analysis showed that the summary sensitivity of studies that used as method of documentation the physician diagnosis was 12.5% higher compared to those that used as method of documentation the chart review, when controlled for age of the sample and date of publication (Table 7).

Table 3. Studies that Used the Physician Diagnosis Method (Sample Characteristics, Physician Specialties, and Methods)

Author/Year	Sample size (% depressed)	Age (years)	Physician specialties	Methods			
				Method of sampling	Blinding of physicians	Criterion measure for depression	Method and criteria of recognition of depression by physician
Aragones 2004[96]	306 (39.2%)	18–70	General practitioners	Consecutive	Yes	SRDS—cut point of 55	*Criteria*: answers of "yes" and "possible yes" on the questionnaire asking about patients' depression
Balestrieri 2004[109]	2093 (13.5%)	Not specified	Primary care practitioners	Consecutive	Yes	PHQ—cut point=9	*Criteria*: the physician filled out a form indicating the patient's current depression, current antidepressant treatment and previous episodes of depression
Becker 2004[110]	431 (19.9%)	18–80	Primary care doctors	Consecutive	Yes	PHQ-9 (cut point not specified)	*Criteria*: rated patients as cases of depression
Berardi 2005[72]	361 (44.3%)	>14	Primary care physicians	Random	Yes	WHO ICD-10 Symptom Checklist for Depression	*Criteria*: clinical diagnosis of depression
Bowers 1990[75]	101 (14.8%)	≥ 70	General practitioner	Consecutive	Not specified	Diagnostic interview for depression (DSM-III-R)	*Criteria*: moderate and severe depression
Coyne 1995[97]	143 (100%)	Mean age 39.7	Family physicians	Consecutive	Not specified	SCID (DSM-III-R)	*Criteria*: affirmative response to the question regarding patients' state of depression
Crawford 1998*[76]	318 (19.5%)	>65	General practitioners	Consecutive	Not specified	Short CARE scale—cut point of 6	*Criteria*: in a face-to-face interview physicians were asked if their patients were depressed or prone to depression
Christensen 2003[108]	301 (30.2)	Mean age 38.8	General practitioners	Consecutive	Yes	SCAN	*Criteria*: GPs were asked whether the patient suffered from depression
Klinkman 1998[77]	372 (21.7%)	Mean age 39.6	Family physicians	Consecutive	Not specified	SCID (DSM-III-R)	*Criteria*: clinically significant depression
Katon 2004[98]	4385 (12%)	Mean age 59	Not specified	Consecutive	Yes	PHQ-9—cut point of 5	*Criteria*: – diagnosis of depression – antidepressant treatment – specialty mental health visit
McCusker 1996*[103]	94 (52.1%)	>60	Primary care physicians	Random	Yes	GDS—cut point of 11	*Criteria*: any of the following – note of depression – prescription of antidepressant medication
Meldon 1997 (a)*[104]	101 (29.7%)	>65	Emergency physicians	Consecutive	Yes	SRDS—cut point of 4	*Criteria*: note of depressive symptoms.
Passik 1998[70]	1105 (35.8%)	Majority 50–70	Oncologists	Not specified	Not specified	SRDS—cut point of 50	*Criteria*: scores 4 to 10 on the physician rating scale
Pfaff 2005[99]	916 (23.8%)	>60	General practitioners	Consecutive	Yes	CES-D—cut point of 16	*Criteria*: presence of symptoms of depression
Pond 1990[100]	133 (14.3%)	70–84	General practitioners	Random	Yes	GDS—cut point of 10	*Criteria*: note of depressive symptoms.
Shulman 2002[101]	101 (43.6%)	45–84	Neurologists	Consecutive	Not specified	BDI—cut point 10	*Criteria*: depressive symptoms reported by physicians

Table 3. (continued)

Author/Year	Sample size (% depressed)	Age (years)	Physician specialties	Methods			
				Method of sampling	Blinding of physicians	Criterion measure for depression	Method and criteria of recognition of depression by physician
Simon 1999[79]	948 (100%)	<65	Primary care physicians	Random	Not specified	CIDI (ICD-10 criteria)	*Criteria*: both recognition of psychological "caseness" and assignment of an appropriate diagnosis
Sliman 1992[106]	420 (25.2%)	16–94	Internal medical residents	Consecutive	Yes	BDI—cut point of 6	*Criteria*: a score of 7 or more on physician's rating
Stek 2004[102]	77 (100%)	>85	General practitioners	Consecutive	Yes	15-item GDS-S: cut point of 5	*Criteria*: note of depressive symptoms.
Thompson 2001[107]	18 414 (19.9%)	16–94	General practitioners	Consecutive	Yes	HAD scale—cut point of 8	*Criteria*: clinically significant depressive illness—mild, moderate or severe
Tiemens 1999[116]	709 (24.5%)	18–65	Primary care physicians	Random	Yes	CIDI-PHC	*Criteria*: score >2 on the Physician's Encounter Form
Wittchen 2001[80]	19106 (11.5%)	15–99	Primary care physicians	Consecutive	Not specified	DSQ—cut point of 8 (ICD-10) or 10 (DSM-IV)	*Criteria*: presence of depression

*These studies presented results for both methods.
BDI = Beck Depression Inventory, CARE = Comprehensive Assessment and Referral Evaluation, CES-D = Center for Epidemiological Studies Depression Scale, CIDI = Composite International Diagnostic Interview, CIDI-PHC = Composite International Diagnostic Interview–Primary Care, DSQ = Depression Screening Questionnaire, GDS = Geriatric Depression Scale, HAD = Hospital Anxiety and Depression Scale, ICD = International Classification of Diseases, PHQ = Personal Health Questionnaire, PHQ-9 = Patient Health Questionnaire, SCAN= Schedules for Clinical Assessment in Neuropsychiatry, SCID = Structural Clinical Interview for Depression, SRDS = Zung Self Rating Depression Scale

DISCUSSION

Recognition of depression by nonpsychiatric physicians has received increased attention from researchers as depression became one of the most prevalent diseases of the 21st century and an important public health issue. The assessment of validity of recognition is challenged by the variety of methods used to document recognition and to diagnose depression. In this systematic literature review, we qualitatively and quantitatively summarized the accuracy of recognition of depression using data presented in the papers reviewed. Further, we tried to identify sources of heterogeneity in the results reported.

The summary sensitivity showed that less than half of the depressed patients are recognized by their physicians. This is consistent with rates of depression detection reported in previous studies.[9] On the other hand, the summary specificities are reasonable (calculated using data reported in 22 studies) and are consistent with interrater agreement found in studies on the accuracy of psychiatrist interviews.[111]

Studies that used as method of documentation the physician diagnosis had a higher summary sensitivity compared to studies that used the chart review. This result is consistent with the conclusion of a study that compared the 2 methods,[103] showing that either physicians tend to diagnose depression more frequently when they are specifically asked about this possible diagnosis or documentation of depression recognition (including

diagnosis, treatment, and referral to a mental health specialist) in patients' charts is low. Moreover, the same study found that even if the sensitivity of recognition by physician diagnosis was higher, the specificity of this method of documentation was lower than the specificity of recognition by chart review. This may explain why the method of documentation did not affect the summary odds ratio in our metaregression analysis.

We also found that the sensitivity and odds of recognition of depression by physicians are significantly higher in younger or unselected patients than in older ones. Data reported in several studies included in our literature review show no significant association between recognition of depression and age[88,107] or higher recognition of depression in patients less than 35 compared to patients aged 65 and more,[112] which demonstrates the variability among studies. However, in the multivariate metaregression, the age and the sample had no effect on summary sensitivity and summary OR when controlled for method of documentation and date of publication.

Another notable finding of our meta-analysis is that studies published after 1998 tend to report higher sensitivities and odds ratios of recognition than those published in 1998 and before. This may suggest that the non-psychiatric physicians training in diagnosing depression has improved over the years. However, in the multivariate metaregression, the date of publication had no effect on summary sensitivity and summary OR when controlled for method of documentation and age of the sample.

Table 4. Studies that Used the Chart Review Method (Results)

Author/Year	Main results			
	Sens.	Spec.	DOR	Other†
Aragones 2004[96]	72%			
Balestrieri 2004[109]	38.8%*	93.7%*	9.4*	Identification index=0.3
Becker 2004[110]	48.8%*	89.5%*	8.2*	Agreement kappa=0.4
Berardi 2005[72]	79.4%	48.2%*	3.6*	
Bowers 1990[75]	20%	90%	2.1*	
Coyne 1995[97]	27.9%			
Crawford 1998‡[76]	51.6%*	71.8%*	2.7* (PD)	Kappa of agreement=0.19 (0.08–0.29)
Christensen§ 2003[108]	40.6	94.7	6.76*	
Klinkman§ 1998[77]	34.9%	92.9%	4.7*	PPV=44.6%
Katon 2004[98]	51.1%			
McCusker 1996‡[103]	67%	81%	8.8*	PD: PPV=55%
				Overall agreement:78%
Meldon 1997 (a)‡[104]	27%	75%	1.1	PPV=32%
Passik 1998[70]	43.6%*	78.9%*	2.9*	Kappa of agreement=0.17
Pfaff 2005[99]	39.9%	81.2%*	2.8*	
Pond 1990[100]	21%	91.2%*	2.8*	
Shulman 2002[101]	35%	89.5%*	4.4*	
Simon 1999[79]	36%			
Sliman 1992[106]	46.2%	84.4%	4.6*	PPV=50% NPV= 82.3% Pearson's correlation coefficient=0.42
Stek 2004[102]	22%			
Thompson 2001[107]	36.1%	91.5%	6.1*	Kappa=0.31 (0.28, 0.33)
Tiemens 1999[116]	40.2%*	85.8%*	4.0*	Total percentage agreement: 86.6% Kappa=0.29
Wittchen 2001[80]	75% (DSM) 59% (ICD-10) 85.1%* (either DSM-IV or ICD-10)	60.4%* (either DSM-IV or ICD-10)	8.7* (either DSM-IV or ICD-10)	

*Sensitivities (Sens.), specificities (Spec.) and crude diagnostic odds ratios (DOR) not reported by the authors were computed from the data available.
†PPV = positive predictive value, NPV = negative predictive value
‡These studies presented results for both methods.
§*The sensitivity, specificity, and OR reported by the authors were weighted estimates. We calculated the crude estimates of sensitivity, specificity, and OR using data reported in the papers (Christensen 2003: 41.7%, 85.4% and 4.2, respectively ; Klinkman 1998: 61.7%, 88.3%, and 4.7, respectively). We used these crude estimates in our meta-analysis.*

We identified several limitations of our literature review and meta-analysis. First, the literature search was restricted to two languages. Is it possible that articles written in other languages than English or French were missed. Second, it was difficult to

Table 5. Summary Sensitivities, Specificities, and ORs of Recognition, with 95% CI (Random Effects Model)

	Sensitivity		Specificity	OR
All studies	N=38* 36.4 (27.9, 44.8)	N=25* 39.2 (28.0, 50.6)	N=25* 83.7 (77.5, 90.0)	N=25* 4.0 (3.3, 4.9)
CR method	N=15 26.6 (18.4, 34.9)	N=8 28.2 (16.6, 39.8)	N=8 88.1 (82.2, 94.0)	N=8 3.5 (2.9, 4.1)
PD method	N=23 42.9 (31.6, 54.1)	N=17 44.7 (30.4, 58.9)	N=17 81.6 (73.4, 89.8)	N=17 4.4 (3.5, 5.6)
Age 55+	N=15† 28.7 (19.8, 37.5)	N=11 31.4 (20.6, 42.1)	N=11 85.1 (80.1, 90.0)	N=11 2.9 (2.4, 3.7)
All ages	N=20 41.1 (28.3, 53.9)	N=12 46.7 (28.5, 64.9)	N=12 80.6 (68.9, 92.3)	N=12 4.5 (3.5, 5.8)
Published after 1998	N=19 42.1 (29.8, 54.4)	N=11 45.9 (27.6, 64.1)	N=11 82.5 (72.0, 93.0)	N=11 5.2 (4.1, 6.6)
Published in 1998 and before	N=19 30.2 (22.5, 37.8)	N=14 33.8 (25.9, 41.7)	N=14 84.8 (80.8, 88.9)	N=14 3.2 (2.6, 3.8)

*Three studies[76,103,104] contributed each with two sets of data.
†In three studies,[73,86,109] data on the age of the sample were not available.

assess the quality of the papers included, as there was a great variability in methods used. We abstracted and presented data regarding the sites of the studies, the method of sampling, the blinding of outcomes, and the specialties of physicians involved in these studies, to offer a view of the methodological quality of these studies that may have affected the validity of our results. Third, our subgroup analysis did not cover all the possible sources of heterogeneity (for example, the categorization in subgroups by the type of gold standard diagnostic tool used does not account for the variability in type of depression scales and cut points used). Fourth, many studies included as "missed" patients those with subthreshold depression, a category of depression in which treatment and placebo both have
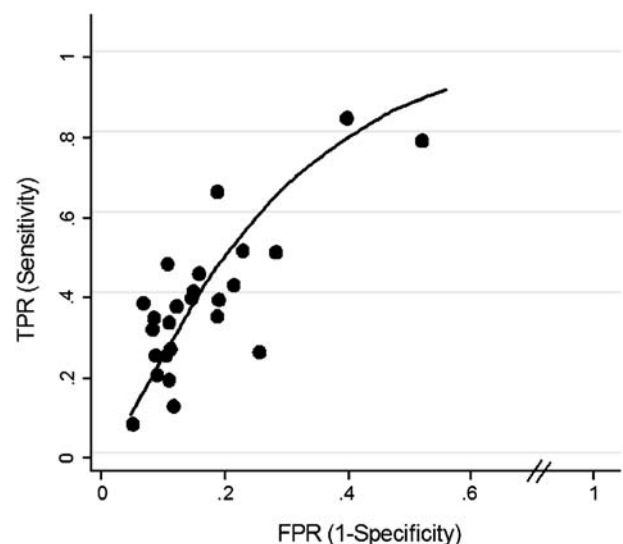

Figure 2. Summary ROC curve

similar high rates of remission[113] and which tend to be transient.[9] Fifth, there was no gradation on severity of depression. Studies have shown that patients with more severe forms of depression are more likely to be diagnosed.[9,79,80,107,114,115]

CONCLUSION

The overall sensitivity of recognition of depression by non-psychiatric physicians reported in our systematic literature review and meta-analysis was low, although non-psychiatric physicians had good specificity. A number of variables, including the method of documentation of recognition, age of the sample, and date of study publication, had an impact on the summary sensitivity. Moreover, the last 2 factors had a significant effect on the summary odds ratio of recognition, a measure of diagnostic accuracy.

A large number of potential barriers to recognition and treatment of depression have been identified. The specific reason studies consistently find low rates of sensitivities is unclear. Given the high prevalence of the disease and its

Table 6. Effect of Sources of Heterogeneity on Summary Sensitivity of Recognition and OR of Recognition (Univariate Metaregression)

Covariate	Sensitivity of recognition N=38*		OR of recognition N=25*	
	β–coefficient	p value	β-coefficient	p value
Method of documentation (physician diagnosis vs chart review)	**0.145**	**.004**	0.350	.125
Blinding of physicians (blinded vs not specified)	−0.030	.603	−0.047	.835
"Gold standard" diagnosis test (structured clinical interview vs depression scale)	0.024	.663	0.017	.936
Method of sampling (random vs other)	−0.053	.386	−0.095	.739
Gender (62% and more vs less than 62% female)	−0.005	.932	−0.098	.649
(Missing)	(5)		(4)	
Age (55 and over vs all ages and younger patients only)	**−0.123**	**.039**	**−0.499**	**.011**
(Missing)	(4)		(3)	
Date of publication (after 1998 vs in 1998 and before)	**0.118**	**.024**	**0.541**	**.003**
Prevalence of depression (less than 25% vs 25% or higher)	0.028	.637	−0.352	.070

*Three studies[76,103,104] contributed each with two sets of data.

Table 7. Effect of Sources of Heterogeneity on Summary Sensitivity of Recognition and OR of Recognition (Multivariate Metaregression)

Covariate	Sensitivity of recognition N=34*		OR of recognition N=22 *	
	β -coefficient	p value	β -coefficient	p value
Method of documentation (physician diagnosis *versus* chart review)	**0.125**	**.038**	−0.075	.748
Age (55 and over *versus* all ages and younger patients only)	−0.086	.131	−0.037	.079
Date of publication (after 1998 *versus* in 1998 and before)	0.052	.387	0.340	.096

*Three studies[76,103,104] contributed each with two sets of data. In three studies,[73,86,109] data on the age of the sample was not available.

significant impact on the overall health of patients, this question deserves further research. It would be helpful if there were a standardized method of documenting non-psychiatric physicians' recognition of depression. This method may be useful for studies that tests the efficacy of various educational programs designed to improve physicians' accuracy in diagnosing depression. Also, a standardized method of documenting recognition may improve the quality of studies that look at various factors which may affect recognition of depression, such as age, gender or ethnicity of patients, or physicians' characteristics.

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