The prevalence of depression in general hospital inpatients: a systematic review and meta-analysis of interview-based studies

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Abstract

Background. Comorbid depression in the medically ill is clinically important. Admission to a general hospital offers an opportunity to identify and initiate treatment for depression. However, we first need to know how common depression is in general hospital inpatients. We aimed to address this question by systematically reviewing the relevant literature. **Methods.** We reviewed published prevalence studies in any language which had used diagnostic interviews of general hospital inpatients and met basic methodological quality criteria. We focussed on interview-based studies in order to estimate the proportion of patients with a diagnosis of depressive illness. **Results.** Of 158 relevant articles, 65 (41%) describing 60 separate studies met our inclusion criteria. The 31 studies that focussed on general medical and surgical inpatients reported prevalence estimates ranging from 5% to 34%. There was substantial, highly statistically significant, heterogeneity between studies which was not materially explained by the covariates we were able to consider. The average of the reported prevalences was 12% (95% CI 10–15), with a 95% prediction interval of 4–32%. The remaining 29 studies, of a variety of specific clinical populations, are described. **Conclusions.** The available evidence suggests a likely prevalence high enough to make it worthwhile screening hospital inpatients for depression and initiating treatment where appropriate. Further, higher quality, research is needed to clarify the prevalence of depression in specific settings and to further explore the reasons for the observed heterogeneity in estimates.

Introduction

Depression frequently accompanies physical illness (Vos *et al.* 2012). It is clinically important because it is associated with worse physical symptoms, poorer quality of life and greater functional disability (Katon, 1996; Egede, 2007). Patients with depression also spend more time in hospital, are less likely to adhere to medical treatments, and consequently incur higher healthcare costs (DiMatteo *et al.* 2000). Despite its importance, the management of depression comorbid with physical illness is often suboptimal with low rates of detection and treatment (Katon & Sullivan, 1990; Hirschfeld *et al.* 1997; Kessler *et al.* 1999; Balestrieri *et al.* 2002; Cepoiu *et al.* 2008; Walker *et al.* 2014).

Admission to a general hospital therefore provides an important opportunity to improve the management of comorbid depression. Detection can be improved by incorporating systematic screening into hospital admission procedures and treatment can be initiated where appropriate (Beach *et al.* 2015). However, in order to plan such a management strategy we need to know how common depression is in general hospital inpatients. Surprisingly, we currently lack a clear answer to this basic question. This is largely because previous systematic reviews of the prevalence of depression have focussed on study populations with specific physical diseases such as cancer, rather than on specific clinical settings such as general hospital wards (Thombs *et al.* 2006*a*, *b*; Delville & McDougall, 2008; Craig *et al.* 2009; Davydow *et al.* 2009; Poynter *et al.* 2009; Kouwenhoven *et al.* 2011; Mitchell *et al.* 2011; Shanmugasegaram *et al.* 2012; Castro-de-Araujo *et al.* 2013; Singer *et al.* 2013; Walker *et al.* 2013; Wilder Schaaf *et al.* 2013; Wiseman *et al.* 2013).

We therefore aimed to conduct a systematic review of studies of the prevalence of depression in general hospital inpatients. We focussed on interview-based studies in order to estimate the proportion of patients with a definite diagnosis of depressive illness.

Methods

Search strategy and selection criteria

We performed a systematic review of studies of the prevalence of depression in general hospital inpatients, using procedures that accorded with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Moher *et al.* 2009). We identified studies by searching EMBASE, Medline and PsycINFO (from 1974, 1946 and 1967 respectively) to December 2015. Searches were run for the combination of 'prevalence', 'general hospital inpatient' and 'depression' using both standardised subject terms and free text terms, including synonyms and alternative spellings. We provide full details of the searches used in the online appendix. We also manually searched the reference lists of review articles obtained through the electronic searches.

We judged studies to be relevant to the review if they met all the following criteria: (1) the study clearly aimed to estimate the prevalence of depression (i.e. studies that were designed to address a different research question but happened to include a prevalence estimate, such as clinical trials or questionnaire validation studies, were not included); (2) all study participants were adults (aged 16 or older); (3) all study participants (or a clearly defined subgroup for which there was an estimate of depression prevalence) were general hospital inpatients at the time of depression assessment; (4) the presence of depressive illness was determined using a diagnostic interview. We only included primary studies (i.e. not reviews) for which we could obtain the full paper to allow data extraction. No language restrictions were applied.

When selecting publications to include in the review, we also applied quality criteria to the reported study methods. In order to ensure a consistent and transparent approach to this quality assessment, we used a checklist based on the work of Loney *et al.* (Loney *et al.* 1998; Walker *et al.* 2013). We used a checklist rather than a continuous scale to ensure that all the key aspects of the study methods met basic quality criteria (Juni *et al.* 1999). The basic methodological standards required for inclusion were: (1) the study sample was obtained using a random or consecutive sampling method; (2) data were available for analysis on at least 70% of the eligible patients (either as reported by the authors or derived from presented data); (3) depressive illness was defined using standard diagnostic criteria: major depression from the Diagnostic and Statistical Manual of Mental Disorders (DSM), depressive episode from the International Classification of Diseases (ICD) or similar (World Health Organization, 1992; American Psychiatric Association, 1994, 2013). The first two of these criteria aimed to minimise selection bias, and the third aimed to ensure that estimates could be compared across studies.

Data collection

We screened the titles and abstracts of all articles identified by the searches to determine whether each might meet the selection criteria. We then reviewed the full text of the article, with the help of a translator where necessary, if there was any possibility that it might be relevant and would meet our quality criteria. This process (including a screening of titles and abstracts) was conducted independently by two researchers with reference to a third researcher to resolve disagreements.

Two researchers independently extracted the following data from all the articles included in the review, using a specially designed, standardised data extraction form: country in which the study took place; age, sex and clinical characteristics of participants; sample size; type of depression interview used and profession of interviewer; diagnostic criteria used to determine the presence of depressive illness; prevalence of depression in the sample (for cohort studies, we extracted the prevalence of depression at the first time point only).

Clinical analysis

Two researchers reviewed the data extracted on participants' clinical characteristics in order to assess their similarity across studies. We found that there was high clinical heterogeneity, indicating that a meta-analysis of all the studies would not yield meaningful results. Whilst some studies had recruited general medical and surgical inpatients, others had recruited inpatients with very specific clinical characteristics and therefore were of samples unrepresentative of the general hospital inpatient population. In order to deal with this clinical heterogeneity, we restricted our statistical analysis to studies of general medical and surgical inpatients. The studies of more specific patient groups are described in our results and online appendix in order to provide the reader with a comprehensive overview of the relevant literature.

Statistical analysis

We used forest plots to display the proportion (with exact binomial 95% confidence intervals) of participants diagnosed with depression in each study (Newcombe, 1998).

We used random-effects models to describe the prevalence of depression in general medical and surgical inpatients. This is because it is implausible that the underlying study-specific prevalence of depression (i.e. the prevalence that would be observed were a study of infinite size) is exactly the same for each study. Prevalence is likely to vary from study to study according to factors, both measured and unmeasured, that differ between them (Stroup *et al.* 2000). Random effects models assume that the populations investigated in each study are themselves drawn from a wider population of populations and that the underlying study-specific prevalences in these populations therefore follow a statistical distribution, rather than taking a single value.

As is common for proportions, we used the logit transformation expressing each of the prevalences as a log-odds. Accordingly, our random-effects models assume that the logit transformed prevalences follow a normal distribution with a mean and standard deviation. This mean can be thought of as a 'typical' prevalence, while the standard deviation quantifies the underlying between-study variability in prevalences. This variability is summarised by a 95% prediction interval, which is the interval within which 95% of underlying study-specific prevalences are predicted to lie (for a thorough discussion of this topic see Guddat *et al.*) (Guddat *et al.* 2012). As such it differs from a 95% confidence interval which quantifies the precision of the mean of the study-specific prevalences (with the mean defined after logit transformation).

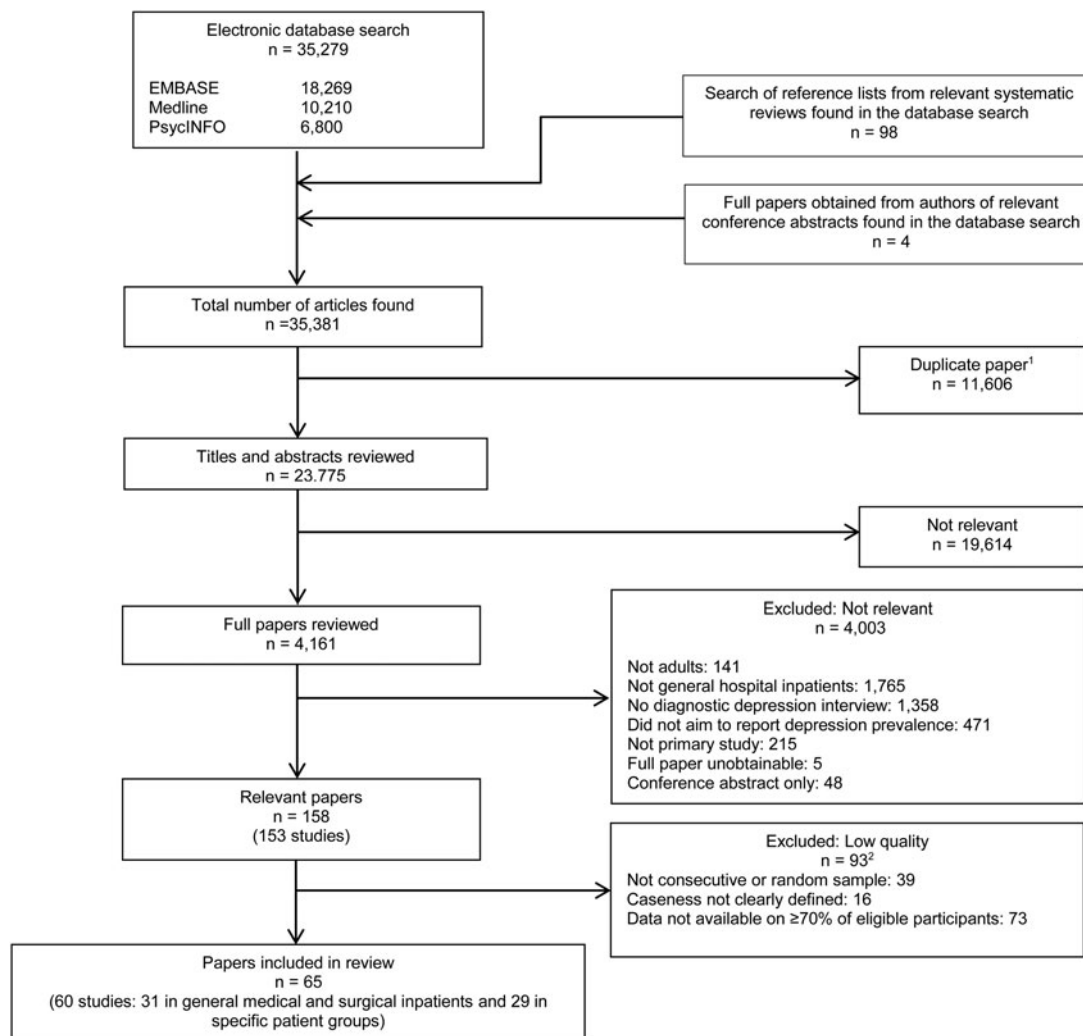We used the inverse variance method of DerSimonian and Laird to estimate between-study heterogeneity in underlying depression prevalence and the I-squared measure which represents the proportion of total variance attributable to this heterogeneity (Higgins *et al.* 2003). The assumption that underlying prevalences are normally distributed after logit transformation was not contradicted by our data.

We investigated potential sources of the heterogeneity that we observed between the studies' prevalence estimates (that is, the large amount of between-study variability compared with the total variability) by considering some of the known differences between the studies. To this end, we inspected scatter plots of depression prevalence against year of study publication, sample size, average (or another available measure for central tendency) participant age, and percentage of female participants. We used forest plots to compare depression prevalence in studies grouped by use of DSM major depression *v.* other diagnostic criteria for depression, and national income of the country where the study took place (we used income groupings because the studies had been done in too many different countries to group by country) (The World Bank, 2015). Where evidence of an association with depression prevalence was apparent, we performed a mixed-effects meta-regression and present its I-squared statistic, odds ratio and *p* value for the association (Thompson & Higgins, 2002). We did not present funnel plots for bias assessment because in the presence

of heterogeneity, there is no reason to expect a funnel shape (Terrin *et al.* 2005). Statistical analysis was performed in R v3.2.2 using the 'meta' package v3.8-0 (Schwarzer *et al.* 2014; R Core Team, 2015). Graphs were produced in R and Stata v14 (StataCorp, College Station, TX, USA).

Results

Our initial screening of 23 775 titles and abstracts yielded 4161 articles for full paper review. We considered 158 of these to be relevant to the review. Of these 158 articles, 65 (41%), describing 60 separate studies, met our quality criteria and were included (see Figs 1, 2 and online appendix) (Heeren & Rooymans, 1985; Feldman *et al.* 1987; Yellowlees *et al.* 1987; Starkstein *et al.* 1988; Hardman *et al.* 1989; O'Riordan *et al.* 1989; Seltzer, 1989; Abiodun & Ogunremi, 1990; Kigamwa, 1991; Koenig *et al.* 1991, 1993, 1997; Lazaro *et al.* 1991, 1995; Kathol & Wenzel, 1992; Kok *et al.* 1992, 1995; Snyder *et al.* 1992; Thalassinos

Fig. 1. Prevalence of depression in general hospital inpatients: systematic review flowchart.

Study	N depressed	N study	Prevalence	95% CI
Abiodun (1990)	31	275	0.11	[0.08; 0.16]
Aghanwa (2002)	7	31	0.23	[0.10; 0.41]
Alexander (1993)	8	60	0.13	[0.06; 0.25]
Annagur (2013)	7	47	0.15	[0.06; 0.28]
Arnold (1996 [epileptic seizures])	5	27	0.19	[0.06; 0.38]
Arnold (1996 [psychogenic seizures])	3	14	0.21	[0.05; 0.51]
Arolt (1997)	25	400	0.06	[0.04; 0.09]
Atesci (2004)	16	117	0.14	[0.08; 0.21]
Baubet (2011)	14	49	0.29	[0.17; 0.43]
Blomstedt (1996)	2	27	0.07	[0.01; 0.24]
Blumel (2005)	3	47	0.06	[0.01; 0.18]
Dogar (2008)	52	100	0.52	[0.42; 0.62]
Dyster-Aas (2008)	12	73	0.16	[0.09; 0.27]
Feldman (1987)	26	382	0.07	[0.04; 0.10]
Fenton (1994)	59	215	0.27	[0.22; 0.34]
Fritzsche (2003)	4	72	0.06	[0.02; 0.14]
Hardman (1989)	4	126	0.03	[0.01; 0.08]
Heeren (1985)	6	87	0.07	[0.03; 0.14]
Hosaka (1999a)	14	65	0.22	[0.12; 0.33]
Jenkins (1994)	9	190	0.05	[0.02; 0.09]
Kathol (1992)	43	128	0.34	[0.25; 0.42]
Kayhan (2013)	52	603	0.09	[0.07; 0.11]
Kigamwa (1991)	26	200	0.13	[0.09; 0.18]
Kishi (1994)	13	60	0.22	[0.12; 0.34]
Koenig (1991 [older subgroup])	44	332	0.13	[0.10; 0.17]
Koenig (1991 [younger subgroup])	26	116	0.22	[0.15; 0.31]
Koenig (1993)	10	76	0.13	[0.06; 0.23]
Koenig (1997)	76	460	0.17	[0.13; 0.20]
Kok (1992, 1995)	5	188	0.03	[0.01; 0.06]
Koroglu (2010)	17	110	0.15	[0.09; 0.24]
Kugaya (2000)	4	107	0.04	[0.01; 0.09]
Kumar (2012)	30	120	0.25	[0.18; 0.34]
Lazaro (1991)	9	95	0.09	[0.04; 0.17]
Lazaro (1995)	5	108	0.05	[0.02; 0.10]
Linka (1999, 2000)	11	100	0.11	[0.06; 0.19]
Lykouras (1996)	16	107	0.15	[0.09; 0.23]
Madianos (2001)	2	45	0.04	[0.01; 0.15]
Marchesi (2004)	50	719	0.07	[0.05; 0.09]
Moayedoddin (2013)	69	557	0.12	[0.10; 0.15]
Nair (1997)	12	230	0.05	[0.03; 0.09]
Ng (1995)	29	52	0.56	[0.41; 0.70]
O'Riordan (1989)	5	111	0.05	[0.01; 0.10]
Pakriev (2009)	53	323	0.16	[0.13; 0.21]
Palmu (2010)	4	107	0.04	[0.01; 0.09]
Petrak (2003)	18	313	0.06	[0.03; 0.09]
Prieto (2002)	18	220	0.08	[0.05; 0.13]
Regvat (2011)	3	50	0.06	[0.01; 0.17]
Seltzer (1989)	18	97	0.19	[0.11; 0.28]
Sharma (2002)	27	154	0.18	[0.12; 0.24]
Silverstone (1996)	24	313	0.08	[0.05; 0.11]
Singer (2013)	31	502	0.06	[0.04; 0.09]
Snyder (1992)	1	42	0.02	[0.00; 0.13]
Soeiro (2008)	74	253	0.29	[0.24; 0.35]
Starkstein (1988)	15	79	0.19	[0.11; 0.29]
Thalassinos (1992)	5	100	0.05	[0.02; 0.11]
Topitz, Wancata (2015, 2000)	132	993	0.13	[0.11; 0.16]
Turner (2011)	4	53	0.08	[0.02; 0.18]
Uwakwe (2000)	24	106	0.23	[0.15; 0.32]
Yan (2013)	54	784	0.07	[0.05; 0.09]
Yellowlees (1987)	6	50	0.12	[0.05; 0.24]
Zhao (2014)	58	460	0.13	[0.10; 0.16]
Zhong (2010)	48	513	0.09	[0.07; 0.12]

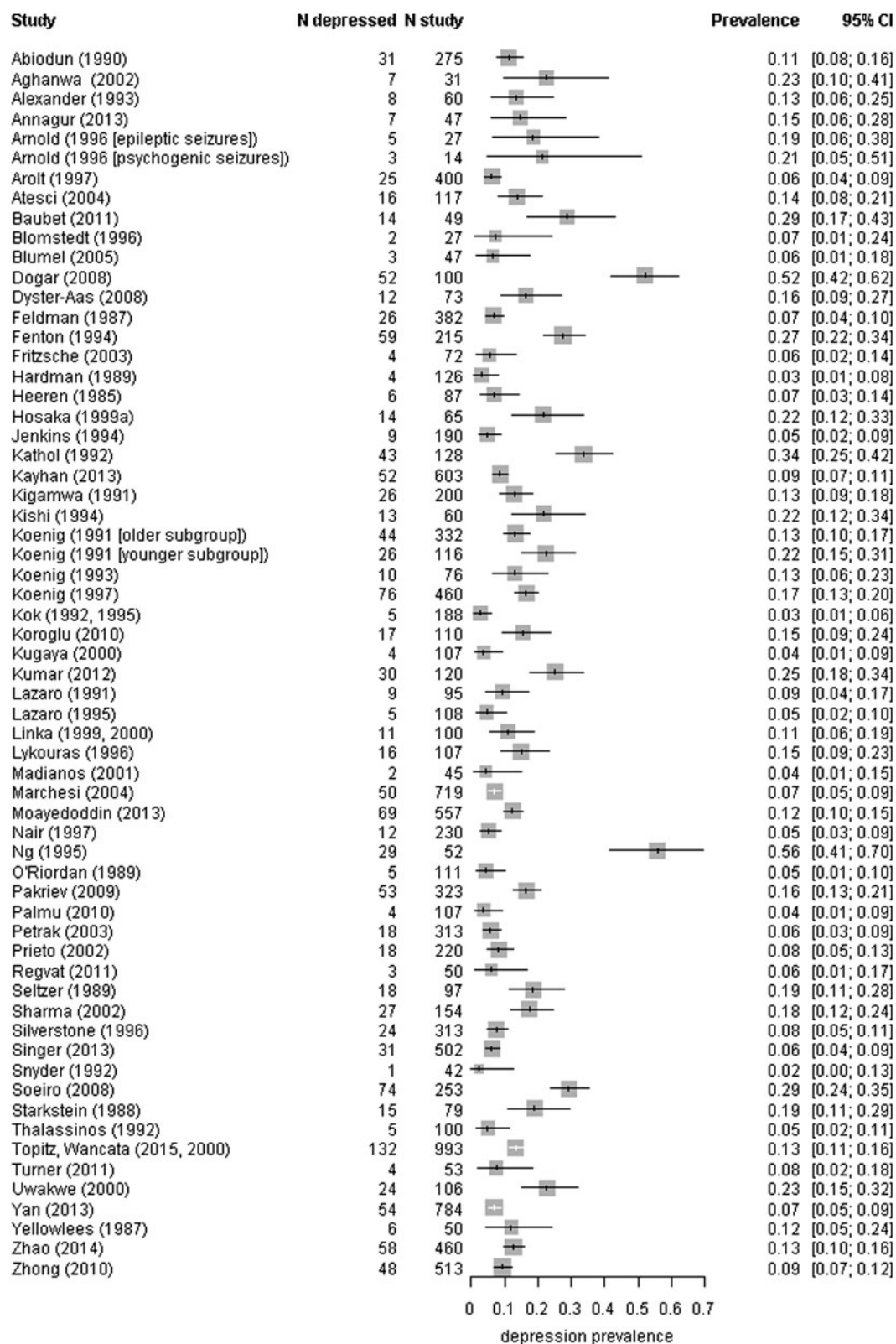0 0.1 0.2 0.3 0.4 0.5 0.6 0.7

depression prevalence

Fig. 2. Prevalence of depression in all studies included in the systematic review.

et al. 1992; Alexander *et al.* 1993; Fenton *et al.* 1994; Jenkins *et al.* 1994; Kishi *et al.* 1994; Ng *et al.* 1995; Arnold & Privitera, 1996; Arolt & Driessen, 1996; Blomstedt *et al.* 1996; Lykouras *et al.* 1996; Silverstone, 1996; Arolt *et al.* 1997; Nair & Pillay, 1997; Hosaka *et al.* 1999; Linka *et al.* 1999, 2000; Kugaya *et al.* 2000; Uwakwe, 2000; Wancata *et al.* 2000; Madianos *et al.* 2001; Aghanwa & Ndububa, 2002; Prieto *et al.* 2002; Sharma *et al.* 2002; Fritzsche *et al.* 2003; Petrak *et al.* 2003; Atesci *et al.* 2004;

Marchesi *et al.* 2004; Blumel *et al.* 2005; Dogar *et al.* 2008; Dyster-Aas *et al.* 2008; Soeiro *et al.* 2008; Pakriev *et al.* 2009; Koroglu & Tural, 2010; Palmu *et al.* 2010, 2011; Zhong *et al.* 2010; Baubet *et al.* 2011; Kumar *et al.* 2012; Regvat *et al.* 2011; Turner *et al.* 2011; Annagür *et al.* 2013; Kayhan *et al.* 2013; Moayedoddin *et al.* 2013; Singer *et al.* 2013; Yan *et al.* 2013; Zhao *et al.* 2014; Topitz *et al.* 2015).

These studies had been conducted in 29 countries (see online appendix for map) and had included a total of 12 540 participants (median sample size 109, range 27–993).

A variety of interviews and associated diagnostic criteria were used. The most commonly used interview (16 studies) was the Structured Clinical Interview for DSM-IV (SCID) and the most commonly used diagnostic criteria (used in 47 studies) were those for DSM major depression (American Psychiatric Association, 1994; First *et al.* 1996). The majority of studies (40) had employed a psychiatrist or clinical psychologist to conduct the diagnostic interviews.

The study sample was of general medical or surgical inpatients (or both) in 31 of the studies (median sample size 215, range 65–993, with a total of 9305 participants; see Table 1) (Feldman *et al.* 1987; Seltzer, 1989; Abiodun & Ogunremi, 1990; Kigamwa, 1991; Koenig *et al.* 1991, 1993, 1997; Lazaro *et al.* 1991, 1995; Kathol & Wenzel, 1992; Kok *et al.* 1992, 1995; Thalassinos *et al.* 1992; Fenton *et al.* 1994; Jenkins *et al.* 1994; Arolt & Driessen, 1996; Silverstone, 1996; Arolt *et al.* 1997; Nair & Pillay, 1997; Hosaka *et al.* 1999; Linka *et al.* 1999, 2000; Uwakwe, 2000; Wancata *et al.* 2000; Sharma *et al.* 2002; Marchesi *et al.* 2004; Soeiro *et al.* 2008; Pakriev *et al.* 2009; Koroglu & Tural, 2010; Zhong *et al.* 2010; Kumar *et al.* 2012; Kayhan *et al.* 2013; Moayedoddin *et al.* 2013; Yan *et al.* 2013; Topitz *et al.* 2015). These studies reported prevalence estimates for depression that ranged from 5% to 34% (see Fig. 3). The high heterogeneity observed between study findings (I-squared 90%) indicated that no single estimate was sufficient to describe the prevalence of depression in general medical and/or surgical inpatients. Our random-effects model assumed that the underlying study-specific prevalences followed a normal distribution (on the log-odds scale). The mean of this distribution corresponded to a prevalence of 12% (95% CI 10–15%) with 95% of all populations predicted to have an underlying depression prevalence between 4% and 32% (the prediction interval).

In our investigations of potential sources of this observed heterogeneity visual inspection of the scatter and forest plots suggested that percentage of female participants, study sample size, the income band of the country in which the study was done, and the diagnostic criteria used (but not year of study publication or average participant age), may all be associated with the observed prevalence of depression. We therefore tested the association of these variables with depression prevalence. We found that when expressed as an odds, studies with a higher percentage of female participants reported a lower prevalence of depression (OR 0.82 per 10 percentage points increase in female participants, 95% CI 0.71–0.95, $p = 0.007$). Studies with larger sample sizes reported lower prevalences (OR 0.82 per doubling in size, 95% CI 0.68–0.99, $p = 0.043$). There were also non-significant associations with national income in the country in which the study was done ($p = 0.292$), and the diagnostic criteria used for depression ($p = 0.154$). Notably, in all our investigations the residual heterogeneity remained high (all I-squared >88%, see online appendix for scatter plots and forest plots) meaning that a very high proportion of the heterogeneity remained unaccounted for by the variables we considered.

In addition to the 31 studies of general medical and/or surgical patients, we identified 29 studies (median sample size 72, range 27–502, with a total of 3235 participants) of inpatients who were in a variety of specialist units (such as endocrinology or haematology) or had very specific clinical characteristics (such as a diagnosis of systemic sclerosis) (Heeren & Rooymans, 1985; Yellowlees *et al.* 1987; Starkstein *et al.* 1988; Hardman *et al.* 1989; O'Riordan *et al.* 1989; Snyder *et al.* 1992; Alexander *et al.* 1993; Kishi *et al.* 1994; Ng *et al.* 1995; Arnold & Privitera, 1996; Blomstedt *et al.* 1996; Lykouras *et al.* 1996; Kugaya *et al.* 2000; Madianos *et al.* 2001; Aghanwa & Ndububa, 2002; Prieto *et al.* 2002; Fritzsche *et al.* 2003; Petrak *et al.* 2003; Atesci *et al.* 2004; Blumel *et al.* 2005; Dogar *et al.* 2008; Dyster-Aas *et al.* 2008; Palmu *et al.* 2010, 2011; Baubet *et al.* 2011; Regvat *et al.* 2011; Turner *et al.* 2011; Annagür *et al.* 2013; Singer *et al.* 2013; Zhao *et al.* 2014). These studies reported prevalence estimates ranging from 2% to 56%. They are described in detail in the online appendix.

Discussion

This is the first systematic review of studies of the prevalence of depression in general hospital inpatients. The 60 studies that we found had been conducted in 29 countries and included a total of 12 540 participants. They reported a wide range of prevalence estimates. We reduced the clinical heterogeneity by focussing on the 31 studies of general medical and/or surgical inpatients. However, even in these studies, the estimated prevalence ranged from 3% to 34%. There was also a high degree of heterogeneity, indicating that even 'general medical and/or surgical inpatients' cannot be considered as a single population, but rather as a number of different populations, each with a different prevalence of depression. These populations had a median prevalence of depression of 12% and we can predict that 95% of them have a prevalence between 4% and 32%. This median prevalence of 12% is more than twice that in the general population, for which international studies suggest an average 12-month prevalence of approximately 5% (Kessler & Bromet, 2013).

Our analyses were unable to adequately explain the observed heterogeneity in prevalence estimates. The only variables that we found to be significantly associated with the prevalence of depression were sample size and the proportion of female patients in the study samples. As these explained only a trivial amount of the heterogeneity and the latter association was not in the expected direction (a higher proportion of female patients was associated with a lower prevalence of depression), we judge this finding to be of questionable importance. Our inability to explain the observed heterogeneity indicates that it resulted from variables we were unable to investigate as they had not been consistently reported in the publications we reviewed. These unreported variables might be at the population, healthcare system, patient or methodological level. At the population level, it is likely that national and local prevalence of depression in the general population varies. At the healthcare system level, hospital type (e.g. university, community), funding systems, admission pathways and medical staffing vary substantially. At the patient level, it is likely that the characteristics of patients admitted to general hospitals and specifically to general medical and surgical (as opposed to sub-speciality) wards varies. Methodologically, there are likely to be unreported variations in how the studies were done. These include how the patients were sampled (e.g. who was excluded), how the diagnosis of depression was made (e.g. the

Table 1. Studies of the prevalence of depression in general medical and surgical inpatients included in the systematic review

Study	Setting	Inclusion criteria	Sample size	Age	% female	Depression interview (interviewer)	Caseness definition	Depression prevalence (%)
Abiodun & Ogunremi, 1990 (Nigeria[a])	Four medical & surgical wards in a general hospital	Aged ⩾16, well enough to participate, English or Yoruba speaker	275	Age[b] (mean) Medical: 40 Surgical: 38.9	44%	Present State Examination (psychiatrist)	Neurotic depression (ICD-9)	11.3*
Arolt & Driessen, 1996, Arolt et al. 1997 (Germany[c])	Seven internal medicine & eight surgical wards (not highly specialised wards) in one university and one community hospital	Well enough to participate, not suffering from severe psycho-organic symptoms	400 (200 medical, 200 surgical)	Age (mean, s.d.): Medical: 62.5, 17.9 Surgical: 59.7, 20.0	Medical: 50.5% Surgical: 53.0%	Composite International Diagnostic Interview (psychiatrist)	Major depression (DSM-III-R)	Medical: 6.5 Surgical 6.0
Feldman et al. 1987 (UK[c])	Admissions under the care of three general medical teams in a university teaching hospital	Aged ⩾17 (after 6 weeks of study aged 17–70), in hospital ⩾24 h, living in local health district, not admitted post-suicide attempt, not too confused or unwell to participate	382	Not stated	Not stated	Stage 1: General Health Questionnaire (cut-off ⩾5), 2 additional questions about nervous illness (positive response to either) Stage 2: Present State Examination (not stated)	Depression (CATEGO computer programme, inclusive approach)	6.8*
Fenton et al. 1994 (Canada[c])	Medical wards (not coronary care or medical intensive care) in a university-affiliated community acute care hospital	Aged ⩾65, living in local health district, English or French speaker, no cancer diagnosis, no aphasia, not suffering from moderate-severe cognitive impairment	215	Age (mean, s.d.): 76, 6.9	54%	Diagnostic Interview Schedule (psychiatrist)	Major depression (DSM-III, actuarial approach)	27.4
Hosaka et al. 1999 (Japan[c])	Two mixed (medical/surgical) wards in a general hospital	No dementia or disturbed consciousness, not currently having chemotherapy, no operation in the last 2 weeks	65	Age (mean, s.d.): Males: 54.9, 15.4 Females: 58.9, 15.5	32.3%	Clinical interview (psychiatrist)	Major depression (DSM-IV)	21.5
Jenkins et al. 1994 (UK[c])	General surgical wards in a university hospital	Aged 16–80, elective or emergency admission, pre-surgery, well enough to participate, able to read & speak English	190	Not stated	Not stated	Stage 1: General Health Questionnaire (cut-off ⩾12) Stage 2: Composite International Diagnostic Interview (psychiatrist)	Major depression (DSM-III)	4.7*

Kathol & Wenzel, 1992 (USA[c])	Medical wards & medical subspecialty units	Likely to stay in hospital ≥3 days, no obvious memory difficulties, not requiring intensive care unit treatment, able to speak English	128	Age (mean): 56	21%	Stage 1: Hamilton Anxiety Scale and Hamilton Depression Rating Scale (cut-off ≥6 on either) Stage 2: Structured Diagnostic Assessment Questionnaire (trained interviewer)	Major depression (DSM-III)	33.6*
Kayhan et al. 2013 (Turkey[d])	General and subspecialty medical and surgical wards[e] in a tertiary university hospital	Aged ≥18, hospitalised for ≥2 days, medically fit for participation, no mental retardation psychotic disorder or delirium, not in perinatal period	603	Age (mean, s.d.): 51.07, 15.72	49.6%	Structured Clinical Interview for DSM-IV (psychiatrist)	Major depression (DSM-IV)	8.6
Kigamwa, 1991 (Kenya[a])	Eight general medical wards in a national hospital	Well enough to participate, not admitted post-overdose	200	Not stated	Not stated	Stage 1: Self-Reporting Questionnaire (cut-off >8) Stage 2: Standardised Psychiatric Interview modified version (not stated)	Depressive illness (ICD-9)	13
Koenig et al. 1991 (USA[c])	Medical & neurological services (not intensive care unit) in a VA hospital for male veterans	Aged ≤39 or ≥70, score ≥15 on MMSE, well enough to participate, no severe communication problems	448 (116 younger, 332 older)	26% aged 26–39 74% aged 70–102	0%	Diagnostic Interview Schedule (psychiatrist)	Major depression (DSM-III-R, aetiologic approach)	Younger: 22.4, Older: 13.3
Koenig et al. 1993 (USA[c])	General medicine & cardiology services (not coronary care or intensive care units) in a university hospital	Aged ≥60, hospitalised for ≥48–72 h, not too sedated or cognitively impaired to participate	76 (20 general medicine, 56 cardiology)	Age (mean, s.d.): General medicine 69.9, 6.0 Cardiology 69.7, 6.5 Range: 60–89	General medicine 70% Cardiology 37.5%	Clinical interview (geropsychiatrist)	Major depression (DSM-III-R, inclusive approach)	13.1
Koenig et al. 1997 (USA[c])	General medicine, cardiology & neurology wards (not coronary care or intensive care units) in a university hospital	Aged ≥60, hospitalised for 3–7 days, not too medically unwell or cognitively impaired to participate, no severe communication problems, not transferred from nursing home/other ward	460	Age (mean): 69.7	52.2%	Interview based on the Diagnostic Interview Schedule (psychiatrist)	Major depression (DSM-IV, etiologic approach)	16.5

(*Continued*)

Table 1. (Continued.)

Study	Setting	Inclusion criteria	Sample size	Age	% female	Depression interview (interviewer)	Caseness definition	Depression prevalence (%)
Kok *et al.* 1992, 1995 (Netherlands[c])	Medical & surgical wards in a university hospital	Aged ⩾65, hospitalised for ⩾2 days, physically able to participate, no severe communication problem	188	Age[b] (mean, S.D.): 74.0, 6.0	41.9%	Stage 1: Beck Depression Inventory (cut-off ⩾13), Geriatric Depression Scale (cut-off ⩾11), MMSE (cut-off <24) Stage 2: Geriatric Mental State Schedule (psychiatrist)	Major depression (DSM-III-R)	2.7*
Koroglu & Tural, 2010 (Turkey[d])	Internal medicine wards in a university hospital	Aged 18–75, no delirium, not suffering from terminal-stage cancer	110	Age (mean, S.D.): 47.2, 15.0	53.6%	Structured Clinical Interview for DSM-IV (not stated)	Major depression (DSM-IV)	15.5*
Kumar *et al.* 2012 (India[a])	Medical & surgical wards in a general hospital	Aged ⩾60, hospitalised for ⩾3 days, physically fit for interview, reliable informant available, not on drugs which could alter cognitive function	120	Age: 83.3% aged 60–75 16.7% aged >75	33%	Semi-structured interview (not stated)	Depression (ICD-10)	25
Lazaro *et al.* 1991 (Spain[c])	General internal medicine, gastroenterology, pulmonology, cardiology, general surgery, orthopaedic surgery & traumatology wards	Aged ⩾65, well enough to participate, no clear cognitive impairment, no severe communication problems	95	Age (mean, S.D.): Males: 75.0, 6.5 Females: 75.1, S.D. 6.7	51%*	Clinical Interview Schedule plus clinical interview if psychiatric diagnosis or MMSE <23 (psychiatrist)	Major depression (DSM-III-R)	10
Lazaro *et al.* 1995 (Spain[c])	Internal medicine, general surgery, traumatology & orthopaedic surgery wards	Aged ⩾70, no mental retardation, severe sensorial pathology chronic psychotic disorder, stroke or coma	108	Age (mean, S.D.): 78.6, 6.3	64.8%	Clinical interview (psychiatrist)	Major depression (DSM-III-R)	4.6
Linka *et al.* 1999, 2000 (Hungary[c])	Internal medicine department in a general hospital	Aged ⩾65, able to cooperate	100	Age (median, IQR): 73.0, 70.0–77.5	64%	Semi-structured interview based on DSM-IV criteria (psychiatrist)	Major depression (DSM-IV)	11.0*
Marchesi *et al.* 2004 (Italy[c])	Emergency ward (acute medical) & medical departments in a general hospital	Aged 16–65, mentally & physically able to participate, Italian speaker	719 (556 emergency, 163 medical)	Age (mean, S.D.): 41.8, 14.1	52.2%	Stage 1: General Health Questionnaire (cut-off >4) Stage 2: Mini International Neuropsychiatric Interview (psychiatrist)	Major depression (DSM-IV)	Emergency: 5.7 Medical 11.0

Moayedoddin et al. 2013 (Switzerland[c])	General internal medicine acute care facility in a university hospital	Aged 18–70, well enough to participate, French speaker, no psychotic symptoms or active substance addiction disorder	557	Age (mean, s.D.): 51.7, 14.0	45.6%	Structured Clinical Interview for DSM-IV (clinical psychologist)	Major depression (DSM-IV)	12.4
Nair & Pillay, 1997 (South Africa[d])	General medical, general surgical & gynaecological wards in an academic general hospital	Aged ⩾18, well enough to participate	230	Age (mean, range): 40, 18–82	57%	Stage 1: General Health Questionnaire (cut-off ⩾12), screening for abnormal mental state, past psychiatric history, substance abuse Stage 2: Structured Clinical Interview for DSM-IIIR (psychiatrist)	Major depression (DSM-III-R)	5.2*
Pakriev et al. 2009 (Russia[c])	Medical wards in a general hospital	Aged 18–59, hospitalised for ⩾72 h	323	37% aged 18–39 31% aged 40–49 32% aged 50–59	54.5%	Mini International Neuropsychiatric Interview (psychiatrist)	Depressive episode[f] (ICD-10 Diagnostic Criteria for Research)	16.4*
Seltzer, 1989 (UK[c])	Admissions under the care of general medical teams (not specialist units)	Aged 16–75, emergency admission, well enough to participate, not admitted following deliberate self-harm	97	Not stated	Not stated	Stage 1: General Health Questionnaire (cut-off >9) Stage 2 Clinical Interview Schedule (not stated)	Depressive illness (ICD-9)	18.6*
Sharma et al. 2002 (India[a])	Medical wards in a teaching hospital	Aged 20–60, no malignancy or neurological illness, well enough to participate, no history of psychiatric illness or substance abuse	154	Age[b] (mean, s.D.): 38.7, 12.1	25.6%	Stage 1: Beck Depression Inventory (cut-off >10) Stage 2: Schedule for Clinical Assessment in Neuropsychiatry (SCAN) (not stated)	Mild, moderate or severe depression (SCAN)	17.5*
Silverstone, 1996 (UK[c])	Medical wards in a university hospital	Emergency admission, hospitalised for ⩾7 days, able to communicate well enough for interview, score ⩾22 on MMSE	313	Age (mean, s.E.): DSM-IV diagnosis 65.4, 1.6 No DSM-IV diagnosis: 71.9, 0.9	49%*	Schedule for Clinical Assessment in Neuropsychiatry (not stated)	Major depression (DSM-IV)	7.7
Soeiro et al. 2008 (Brazil[d])	Medical & surgical wards in a tertiary university hospital	Aged ⩾18, hospitalised for ⩾2 days, not disorientated or confused	253	Age (mean, s.D., range) 47.1, 19.0, 18–85	43.1%	Mini International Neuropsychiatric Interview-Plus (trained interviewer)	Major depression (DSM-IV)	29.2

(*Continued*)

Table 1. (*Continued.*)

Study	Setting	Inclusion criteria	Sample size	Age	% female	Depression interview (interviewer)	Caseness definition	Depression prevalence (%)
Thalassinos *et al.* 1992 (France[c])	Internal medicine department of a university hospital	Aged >65, well enough to participate	100	Age (mean, s.D.): Male 77, 7 Female: 80, 7	71%	Diagnostic Interview Schedule (author)	Major depression (DSM-III)	5
Topitz *et al.* 2015, Wancata *et al.* 2000 (Austria[c])	2 community hospitals Total sample: Internal medical, surgical, gynaecological & physical rehabilitation wards ≥60 years: Internal medical & surgical wards	Aged ≥18, well enough to participate	993 (total sample) 244 (≥60 years)	Age (total sample): Not stated Age (≥60 years): 45.1% aged 60–69 32.4% aged 70–79 19.7% aged 80–89 2.9% aged ≥90	% female (total sample): Not stated % female (≥60 years) 55.70%	Clinical interview schedule (psychiatrist)	Total sample: Depression (DSM-III-R and score of ≥2 on a 5-point severity scale) ≥60 years: Major depression (DSM-III-R and score of ≥2 on a 5-point severity scale)	Total sample: 13.3 ≥60 years: 2.9
Uwakwe, 2000 (Nigeria[a])	Medical, surgical & gynaecological wards in a university teaching hospital	Aged ≥60	106	Age (mean, s.D.): 9.9, 8.4	38.7%	Geriatric Mental State Schedule (psychiatrist)	Depression (ICD-10)	22.6
Yan *et al.* 2013 (China[d])	General & subspecialty medical & surgical wards[g] in three tertiary general hospitals	Aged ≥18, well enough to participate, no obvious intellectual disorder	784	Age (mean, s.D., range) 46.4, 15.8, 18–84	48.7%	Mini International Neuropsychiatric Interview (psychiatrist)	Major depression (DSM-IV)	6.9
Zhong *et al.* 2010 (China[d])	All wards except infectious diseases & intensive care in two Class II hospitals & one Class III hospital[h]	Aged ≥18, no language barrier or severe illness obstructing communication, no obvious cognitive disability	513	Age (mean, s.D.): 53.7, 16.6	52.8%	Structured Clinical Interview for DSM-IV (psychiatrist)	Major depression (DSM-IV)	9.4

DSM, Diagnostic and Statistical Manual of Mental Disorders; ICD, International Classification of Diseases; MMSE, Mini Mental State Examination; VA, Veterans Affairs.

*Calculated using data from paper.

[a]Lower-middle income country.

[b]Demographic data only available on a larger sample of which subgroup was interviewed.

[c]High income country (World Bank classification).

[d]Upper-middle income country.

[e]Endocrinology, nephrology, haematology, gastroenterology, rheumatology, oncology, cardiology, chest disease, infectious diseases, dermatology, physical medicine and rehabilitation, neurology, general surgery, chest surgery, cardiovascular surgery, plastic and reconstructive surgery, urology, orthopaedics, otorhinolaryngology, neurosurgery and gynaecology and obstetrics.

[f]Depressive episode alone or as part of recurrent depressive disorder or bipolar disorder.

[g]Haematology, neurology, nephropathy, gastroenterology, dermatology, integrated Chinese and western medicine, cardiology, endocrinology, respiratory, medical oncology, hand surgery, thoracic surgery, orthopaedics, urinary surgery, neurosurgery, sports medicine, maxillofacial surgery, general surgery, tumour surgery, pancreatic surgery and obstetrics.

[h]'Class III (the highest class) hospitals are large comprehensive hospitals integrating the best comprehensive medical services with teaching, research and preventive medicine. They have over 501 hospital beds and are equipped with the most advanced medical equipment and technologies. Class II hospitals provide general medical services for several communities and undertake some training and scientific research tasks. They have 101–500 hospital beds.'
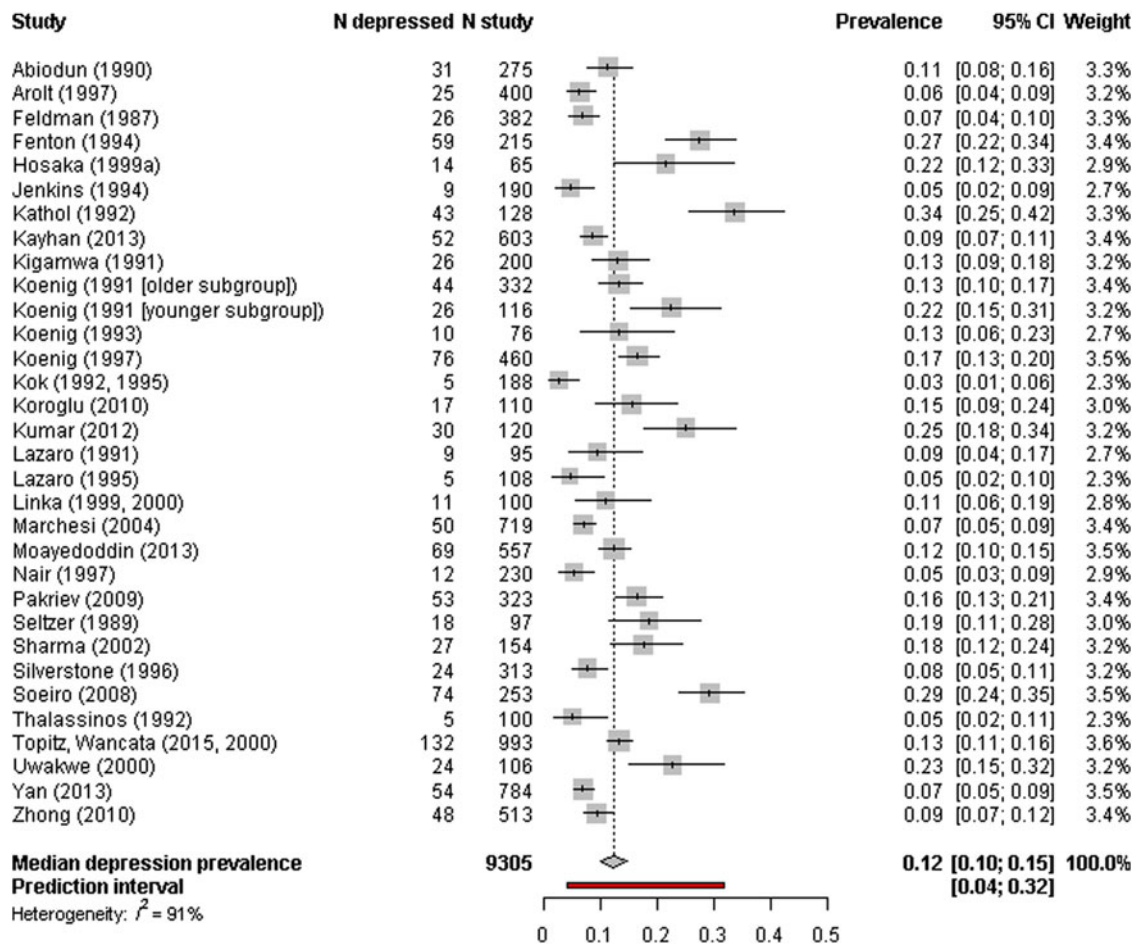
Fig. 3. Prevalence of depression in studies of general medical and surgical inpatients included in the systematic review.

details of how the diagnostic interviews were conducted, whether physical symptoms were counted toward the diagnosis of depression or not and exactly how the diagnostic criteria were applied) and when the assessment was done during the period of hospitalisation (e.g. soon after admission or later in the stay).

This review has strengths which include: (a) The use of clearly defined inclusion criteria for papers to minimise selection bias; (b) the focus on studies where the diagnosis of depression was made by interview; (c) the exclusion of studies with major design flaws (Stroup *et al.* 2000; Moher *et al.* 2009). It also has limitations which include: (a) a reliance on the published reports to assess studies' relevance and quality, which may potentially have led to us excluding studies that were in fact well conducted, but poorly reported; (b) our inability to investigate all potential sources of heterogeneity because of the limited potentially relevant data reported in the publications we reviewed.

Table 2. Suggestions for the design and reporting of future studies of the prevalence of depression in general hospital inpatients

	Design	Reporting
Setting	Pre-specified inclusion and exclusion criteria for hospitals and wards	Clear description of where the study took place (local population, healthcare funding system, hospital type, ward type, admission pathways)
Inclusion criteria	Pre-specified inclusion and exclusion criteria for patients	Clear reporting of the numbers of patients who took part, were excluded or declined to participate
Sample size	Large enough to adequately address the research question posed by the study, based on a sample size calculation	Description of the planned sample size and how it was calculated
Depression Interview	Use of a standard diagnostic interview for depression	Description of who administered the interview, at what time-point during admission and any deviations from its usual procedure
Caseness definition	Use of standard diagnostic criteria for depression	Description of any alterations to the diagnostic criteria that were used in the study
Findings	Pre-specified analysis plan	Prevalence reported with 95% confidence intervals

Given the importance of the question we addressed in this review, we found a remarkably small literature, much of which was published some time ago. Furthermore, our quality assessments indicated that much of that literature was of poor quality. Common shortcomings were poor sampling strategies and the use of unclear case definitions for depressive disorder. Even the methodologically better studies selected for inclusion in this review were mostly small in size (median sample size 109) by epidemiological standards. There is consequently a clear and pressing need for better quality studies of the prevalence of depression in medical inpatients. If these are to inform service planning these should aim both to determine the prevalence of depression in specific settings (such as National Health Service hospitals in the UK) and to clarify the determinants of the substantial apparent variations in prevalence noted in this review. Suggestions for the design of future studies are given in Table 2.

Despite the limitations of the available evidence, we can reasonably conclude that depression is sufficiently common in medical inpatients to make planning for its systematic management worthwhile. This management should include systematic identification of depression during hospital admissions, monitoring of depression once identified (during the hospital admission and thereafter, to determine whether it resolves post-discharge) and the initiation of treatment when it is persistent (Mayou *et al.* 1988; Kathol & Wenzel, 1992). Few hospitals currently have such systems. The approach we have tested for depression management in cancer patients provides a potential model for how we might improve depression care in all medical settings (Walker & Sharpe, 2014).

References

Abiodun OA and Ogunremi OO (1990) Psychiatric morbidity in medical and surgical wards of a Nigerian general hospital. *Journal of Psychosomatic Research* **34**, 409–414.

Aghanwa HS and Ndububa D (2002) Specific psychiatric morbidity in liver cirrhosis in a Nigerian general hospital setting. *General Hospital Psychiatry* **24**, 436–441.

Alexander PJ, Dinesh N and Vidyasagar M (1993) Psychiatric morbidity among cancer patients and its relationship with awareness of illness and expectations about treatment outcome. *Acta Oncologica* **32**, 623–626.

American Psychiatric Association (1994) *Diagnostic and Statistical Manual of Mental Disorders 4th Edition, DSMIV*. Washington, DC: American Psychiatric Association.

American Psychiatric Association (2013) *Diagnostic and Statistical Manual of Mental Mental Disorders Fifth Edition, DSM-5*. Washington, DC: American Psychiatric Association.

Annagür BB, Tazegül A and Gündüz S (2013) Do psychiatric disorders continue during pregnancy in women with hyperemesis gravidarum: a prospective study. *General Hospital Psychiatry* **35**, 492–496.

Arnold LM and Privitera MD (1996) Psychopathology and trauma in epileptic and psychogenic seizure patients. *Psychosomatics* **37**, 438–443.

Arolt V and Driessen M (1996) Alcoholism and psychiatric comorbidity in general hospital inpatients. *General Hospital Psychiatry* **18**, 271–277.

Arolt V, Driessen M and Dilling H (1997) The lubeck general hospital study. I: prevalence of psychiatric disorders in medical and surgical inpatients. *International Journal of Psychiatry in Clinical Practice* **1**, 207–216.

Atesci FC, Baltalarli B, Oguzhanoglu NK, Karadag F, Ozdel O and Karagoz N (2004) Psychiatric morbidity among cancer patients and awareness of illness. *Supportive Care in Cancer* **12**, 161–167.

Balestrieri M, Bisoffi G, Tansella M, Martucci M and Goldberg DP (2002) Identification of depression by medical and surgical general hospital physicians. *General Hospital Psychiatry* **24**, 4–11.

Baubet T, Ranque B, Taïeb O, Bérezné A, Bricou O, Mehallel S et al. (2011) Mood and anxiety disorders in systemic sclerosis patients. *La Presse Médicale* **40**, e111–e119.

Beach SR, Walker J, Celano CM, Mastromauro CA, Sharpe M and Huffman JC (2015) Implementing collaborative care programs for psychiatric disorders in medical settings: a practical guide. *General Hospital Psychiatry* **37**, 522–527.

Blomstedt GC, Katila H, Henriksson M, Ekholm A, Jaaskelainen JE and Pyykko I (1996) Depression after surgery for acoustic neuroma. *Journal of Neurology, Neurosurgery & Psychiatry* **61**, 403–406.

Blumel MB, Gibbons FA, Kanacri CA, Kerrigan BN and Florenzano UR (2005) Depressive symptoms after an acute myocardial infarction. *Revista Medica de Chile* **133**, 1021–1027.

Castro-de-Araujo LF, Barcelos-Ferreira R, Martins CB and Bottino CM (2013) Depressive morbidity among elderly individuals who are hospitalized, reside at long-term care facilities, and are under outpatient care in Brazil: a meta-analysis. *Revista Brasileira de Psiquiatria* **35**, 201–207.

Cepoiu M, McCusker J, Cole MG, Sewitch M, Belzile E and Ciampi A (2008) Recognition of depression by non-psychiatric physicians–a systematic literature review and meta-analysis. *Journal of General Internal Medicine* **23**, 25–36.

Craig A, Tran Y and Middleton J (2009) Psychological morbidity and spinal cord injury: a systematic review. *Spinal Cord* **47**, 108–114.

Davydow DS, Gifford JM, Desai SV, Bienvenu OJ and Needham DM (2009) Depression in general intensive care unit survivors: a systematic review. *Intensive Care Medicine* **35**, 796–809.

Delville CL and McDougall G (2008) A systematic review of depression in adults with heart failure: instruments and incidence. *Issues in Mental Health Nursing* **29**, 1002–1017.

DiMatteo MR, Lepper HS and Croghan TW (2000) Depression is a risk factor for noncompliance with medical treatment: meta-analysis of the effects of anxiety and depression on patient adherence. *Archives of Internal Medicine* **160**, 2101–2107.

Dogar IA, Khawaja IS, Azeem MW, Awan H, Ayub A, Iqbal J et al. (2008) Prevalence and risk factors for depression and anxiety in hospitalized cardiac patients in Pakistan. *Psychiatry* **5**, 38–41.

Dyster-Aas J, Willebrand M, Wikehult B, Gerdin B and Ekselius L (2008) Major depression and posttraumatic stress disorder symptoms following severe burn injury in relation to lifetime psychiatric morbidity. *Journal of Trauma – Injury, Infection and Critical Care* **64**, 1349–1356.

Egede LE (2007) Major depression in individuals with chronic medical disorders: prevalence, correlates and association with health resource utilization, lost productivity and functional disability. *General Hospital Psychiatry* **29**, 409–416.

Feldman E, Mayou R and Hawton K (1987) Psychiatric disorder in medical in-patients. *Quarterly Journal of Medicine* **63**, 405–412.

Fenton FR, Cole MG, Engelsmann F and Mansouri I (1994) Depression in older medical inpatients. *International Journal of Geriatric Psychiatry* **9**, 279–284.

First MB, Gibbon M, Spitzer RL and Williams JBW (1996) *User's Guide for the SCID-I, Structured Clinical Interview for DSM-IV Axis I Disorders, Research Version*. New York: Biometrics Research Department, New York State Psychiatric Institute.

Fritzsche K, Struss Y, Stein B and Spahn C (2003) Psychosomatic liaison service in hematological oncology: need for psychotherapeutic interventions and their realization. *Hematological Oncology* **21**, 83–89.

Guddat C, Grouven U, Bender R and Skipka G (2012) A note on the graphical presentation of prediction intervals in random-effects meta-analyses. *Systematic Reviews* **1**, 34.

Hardman A, Maguire P and Crowther D (1989) The recognition of psychiatric morbidity on a medical oncology ward. *Journal of Psychosomatic Research* 33, 235–239.

Heeren TJ and Rooymans HG (1985) Psychiatric disorders in elderly hospitalized patients: prevalence and recognition. *Tijdschrift voor Gerontologie en Geriatrie* 16, 53–59.

Higgins JP, Thompson SG, Deeks JJ and Altman DG (2003) Measuring inconsistency in meta-analyses. *British Medical Journal* 327, 557–560.

Hirschfeld RM, Keller MB, Panico S, Arons BS, Barlow D, Davidoff F *et al.* (1997) The National depressive and manic-depressive association consensus statement on the undertreatment of depression. *Journal of the American Medical Association* 277, 333–340.

Hosaka T, Aoki T, Watanabe T, Okuyama T and Kurosawa H (1999) Comorbidity of depression among physically ill patients and its effect on the length of hospital stay. *Psychiatry & Clinical Neurosciences* 53, 491–495.

Jenkins P, Jamil N, Taylor B and Hughes L (1994) Why don't surgeons refer to psychiatrists? Psychological morbidity in acute surgical admissions. *New Trends in Experimental & Clinical Psychiatry* 10, 93–95.

Juni P, Witschi A, Bloch R and Egger M (1999) The hazards of scoring the quality of clinical trials for meta-analysis. *Journal of the American Medical Association* 282, 1054–1060.

Kathol RG and Wenzel RP (1992) Natural history of symptoms of depression and anxiety during inpatient treatment on general medicine wards. *Journal of General Internal Medicine* 7, 287–293.

Katon W (1996) The impact of major depression on chronic medical illness. *General Hospital Psychiatry* 18, 215–219.

Katon W and Sullivan MD (1990) Depression and chronic medical illness. *Journal of Clinical Psychiatry* 51(suppl), 3–11.

Kayhan F, Cicek E, Uguz F, Karababa IF and Kucur R (2013) Mood and anxiety disorders among inpatients of a university hospital in Turkey. *General Hospital Psychiatry* 35, 417–422.

Kessler D, Lloyd K, Lewis G and Gray DP (1999) Cross sectional study of symptom attribution and recognition of depression and anxiety in primary care. *British Medical Journal* 318, 436–439.

Kessler RC and Bromet EJ (2013) The epidemiology of depression across cultures. *Annual Review of Public Health* 34, 119–138.

Kigamwa A (1991) Psychiatric morbidity and referral rate among medical in-patients at Kenyatta National hospital. *East African Medical Journal* 68, 383–388.

Kishi Y, Robinson RG and Forrester AW (1994) Prospective longitudinal study of depression following spinal cord injury. *Journal of Neuropsychiatry and Clinical Neurosciences* 6, 237–237.

Koenig HG, George LK, Peterson BL and Pieper CF (1997) Depression in medically ill hospitalized older adults: prevalence, characteristics, and course of symptoms according to six diagnostic schemes. *American Journal of Psychiatry* 154, 1376–1383.

Koenig HG, Meador KG, Shelp F, Goli V, Cohen HJ and Blazer DG (1991) Major depressive disorder in hospitalized medically ill patients: an examination of young and elderly male veterans. *Journal of the American Geriatrics Society* 39, 881–890.

Koenig HG, O'Connor CM, Guarisco SA, Zabel K and Ford SM (1993) Depressive disorder in older medical inpatients on general medicine and cardiology services at a university teaching hospital. *The American Journal of Geriatric Psychiatry* 1, 197–210.

Kok RM, Heeren TJ, Drenth EC, Janzing JG and de Wildt AG (1992) Psychiatric disorders in elderly patients admitted in a general hospital. *Nederlands Tijdschrift voor Geneeskunde* 136, 1913–1917.

Kok RM, Heeren TJ, Hooijer C, Dinkgreve MA and Rooijmans HG (1995) The prevalence of depression in elderly medical inpatients. *Journal of Affective Disorders* 33, 77–82.

Koroglu G and Tural U (2010) The prevalence of comorbid psychiatric disorders among inpatients with medical illness and their effects on quality of life and functioning. *Yeni Symposium: psikiyatri, noroloji ve davranis bilimleri dergisi* 48, 54–62.

Kouwenhoven SE, Kirkevold M, Engedal K and Kim HS (2011) Depression in acute stroke: prevalence, dominant symptoms and associated factors. A systematic literature review. *Disability and Rehabilitation* 33, 539–556.

Kugaya A, Akechi T, Okuyama T, Nakano T, Mikami I, Okamura H *et al.* (2000) Prevalence, predictive factors, and screening for psychologic distress in patients with newly diagnosed head and neck cancer. *Cancer* 88, 2817–2823.

Kumar KL, Kar S and Reddy PK (2012) Psychiatric comorbidity in geriatric inpatients. *Journal of Dr. NTR University of Health Sciences* 1, 81–85.

Lazaro L, de Pablo J, Nieto E, Vieta E, Vilalta J and Cirera E (1991) Psychiatric morbidity in elderly patients admitted to a general hospital. A day-prevalence study. *Medicina Clinica* 97, 206–210.

Lazaro L, Marcos T and Valdes M (1995) Affective disorders, social support, and health status in geriatric patients in a general hospital. *General Hospital Psychiatry* 17, 299–304.

Linka E, Bartko G, Agardi T and Kemeny K (1999) Dementia and depression in elderly population of a medical department. *Psychiatria Hungarica* 14, 39–45.

Linka E, Bartko G, Agardi T and Kemeny K (2000) Dementia and depression in elderly medical inpatients. *International Psychogeriatrics* 12, 67–75.

Loney PL, Chambers LW, Bennett KJ, Roberts JG and Stratford PW (1998) Critical appraisal of the health research literature: prevalence or incidence of a health problem. *Chronic Diseases in Canada* 19, 170–176.

Lykouras L, Adrachta D, Kalfakis N, Oulis P, Voulgari A, Christodoulou G *et al.* (1996) GHQ-28 as an aid to detect mental disorders in neurological inpatients. *Acta Psychiatrica Scandinavica* 93, 212–216.

Madianos MG, Papaghelis M, Ioannovich J and Dafni R (2001) Psychiatric disorders in burn patients: a follow-up study. *Psychotherapy and Psychosomatics* 70, 30–37.

Marchesi C, Brusamonti E, Borghi C, Giannini A, Di Ruvo R, Minneo F *et al.* (2004) Anxiety and depressive disorders in an emergency department ward of a general hospital: a control study. *Emergency Medicine Journal* 21, 175–179.

Mayou R, Hawton K and Feldman E (1988) What happens to medical patients with psychiatric disorder? *Journal of Psychosomatic Research* 32, 541–549.

Mitchell AJ, Chan M, Bhatti H, Halton M, Grassi L, Johansen C *et al.* (2011) Prevalence of depression, anxiety, and adjustment disorder in oncological, haematological, and palliative-care settings: a meta-analysis of 94 interview-based studies. *Lancet Oncology* 12, 160–174.

Moayedoddin B, Rubovszky G, Mammana L, Jeannot E, Sartori M, Garin N *et al.* (2013) Prevalence and clinical characteristics of the DSM IV major depression among general internal medicine patients. *European Journal of Internal Medicine* 24, 763–766.

Moher D, Liberati A, Tetzlaff J, Altman DG and Group P (2009) Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *British Medical Journal* 339, b2535.

Nair MG and Pillay SS (1997) Psychiatric disorder in a South African general hospital. Prevalence in medical, surgical, and gynecological wards. *General Hospital Psychiatry* 19, 144–148.

Newcombe RG (1998) Two-sided confidence intervals for the single proportion: comparison of seven methods. *Statistics in Medicine* 17, 857–872.

Ng K, Chan K and Straughan P (1995) A study of post-stroke depression in a rehabilitative center. *Acta Psychiatrica Scandinavica* 92, 75–79.

O'Riordan TG, Hayes JP, Shelley R, O'Neill D, Walsh J and Coakley D (1989) The prevalence of depression in an acute geriatric medical assessment unit. *International Journal of Geriatric Psychiatry* 4, 17–21.

Pakriev S, Kovalev J and Mozhaev M (2009) Prevalence of depression in a general hospital in Izhevsk, Russia. *Nordic Journal of Psychiatry* 63, 469–474.

Palmu R, Suominen K, Vuola J and Isometsa E (2010) Mental disorders among acute burn patients. *Burns* 36, 1072–1079.

Palmu R, Suominen K, Vuola J and Isometsa E (2011) Mental disorders after burn injury: a prospective study. *Burns* 37, 601–609.

Petrak F, Hardt J, Wittchen HU, Kulzer B, Hirsch A, Hentzelt F *et al.* (2003) Prevalence of psychiatric disorders in an onset cohort of adults with type 1 diabetes. *Diabetes/Metabolism Research and Reviews* 19, 216–222.

Poynter B, Shuman M, Diaz-Granados N, Kapral M, Grace SL and Stewart DE (2009) Sex differences in the prevalence of post-stroke depression: a systematic review. *Psychosomatics* 50, 563–569.

Prieto JM, Blanch J, Atala J, Carreras E, Rovira M, Cirera E et al. (2002) Psychiatric morbidity and impact on hospital length of stay among hematologic cancer patients receiving stem-cell transplantation. *Journal of Clinical Oncology* **20**, 1907–1917.

R Core Team (2015) R: A language and environment for statistical computing. Vienna, Austria.

Regvat J, Zmitek A, Vegnuti M, Kosnik M and Suskovic S (2011) Anxiety and depression during hospital treatment of exacerbation of chronic obstructive pulmonary disease. *Journal of International Medical Research* **39**, 1028–1038.

Schwarzer G, Carpenter J and Rucker G (2014) Meta-analysis with R. R package version 3.8-0.

Seltzer A (1989) Prevalence, detection and referral of psychiatric morbidity in general medical patients. *Journal of the Royal Society of Medicine* **82**, 410–412.

Shanmugasegaram S, Russell KL, Kovacs AH, Stewart DE and Grace SL (2012) Gender and sex differences in prevalence of major depression in coronary artery disease patients: a meta-analysis. *Maturitas* **73**, 305–311.

Sharma P, Avasthi A, Chakrabarti S and Varma S (2002) Depression among hospitalised medically ill patients: a two-stage screening study. *Journal of Affective Disorders* **70**, 205–209.

Silverstone PH (1996) Prevalence of psychiatric disorders in medical inpatients. *Journal of Nervous & Mental Disease* **184**, 43–51.

Singer S, Szalai C, Briest S, Brown A, Dietz A, Einenkel J et al. (2013) Co-morbid mental health conditions in cancer patients at working age-prevalence, risk profiles, and care uptake. *Psycho-Oncology* **22**, 2291–2297.

Snyder S, Reyner A, Schmeidler J, Bogursky E, Gomez H and Strain JJ (1992) Prevalence of mental disorders in newly admitted medical inpatients with AIDS. *Psychosomatics* **33**, 166–170.

Soeiro RE, Colombo ES, Ferreira MHF, Guimaraes PSA, Botega NJ and Dalgalarrondo P (2008) Religion and psychiatric disorders in patients admitted to a university general hospital. [Portuguese]. *Cadernos de Saude Publica* **24**, 793–799.

Starkstein SE, Robinson RG, Berthier ML and Price TR (1988) Depressive disorders following posterior circulation as compared with middle cerebral artery infarcts. *Brain* **111**, 375–387.

Stroup DF, Berlin JA, Morton SC, Olkin I, Williamson GD, Rennie D et al. (2000) Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis of observational studies in epidemiology (MOOSE) group. *Journal of the American Medical Association* **283**, 2008–2012.

Terrin N, Schmid CH and Lau J (2005) In an empirical evaluation of the funnel plot, researchers could not visually identify publication bias. *Journal of Clinical Epidemiology* **58**, 894–901.

Thalassinos M, Masson C, Rouillon F, Vinceneux P and Lemperiere T (1992) Mental disorders in elderly hospitalized patients. Epidemiological study in an internal medicine department. *Presse Medicale* **21**, 929–933.

The World Bank (2015) Country and Lending Groups.

Thombs BD, Bass EB, Ford DE, Stewart KJ, Tsilidis KK, Patel U et al. (2006a) Prevalence of depression in survivors of acute myocardial infarction. *Journal of General Internal Medicine* **21**, 30–38.

Thombs BD, Bresnick MG and Magyar-Russell G (2006b) Depression in survivors of burn injury: a systematic review. *General Hospital Psychiatry* **28**, 494–502.

Thompson SG and Higgins JP (2002) How should meta-regression analyses be undertaken and interpreted? *Statistics in Medicine* **21**, 1559–1573.

Topitz A, Benda N, Saumer G, Friedrich F, Konig D, Soulier N et al. (2015) Prevalence and recognition of depression among inpatients of non-psychiatric hospital departments. *Neuropsychiatry* **29**, 63–70.

Turner K, Piazzini A, Chiesa V, Barbieri V, Vignoli A, Gardella E et al. (2011) Patients with epilepsy and patients with psychogenic non-epileptic seizures: video-EEG, clinical and neuropsychological evaluation. *Seizure* **20**, 706–710.

Uwakwe R (2000) Psychiatric morbidity in elderly patients admitted to non-psychiatric wards in a general/teaching hospital in Nigeria. *International Journal of Geriatric Psychiatry* **15**, 346–354.

Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M et al. (2012) Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the global burden of disease study 2010. *Lancet* **380**, 2163–2196.

Walker J, Hansen CH, Martin P, Symeonides S, Ramessur R, Murray G et al. (2014) Prevalence, associations, and adequacy of treatment of major depression in patients with cancer: a cross-sectional analysis of routinely collected clinical data. *Lancet Psychiatry* **1**, 343–350.

Walker J, Holm Hansen C, Martin P, Sawhney A, Thekkumpurath P, Beale C et al. (2013) Prevalence of depression in adults with cancer: a systematic review. *Annals of Oncology* **24**, 895–900.

Walker J and Sharpe M (2014) Integrated management of major depression for people with cancer. *International Review of Psychiatry* **26**, 657–668.

Wancata J, Meise U and Sachs G (2000) Prevalence of psychiatric disorders in elderly inpatients of medical and surgical departments. *Psychiatrische Praxis* **27**, 170–175.

Wilder Schaaf KP, Artman LK, Peberdy MA, Walker WC, Ornato JP, Gossip MR et al. Virginia Commonwealth University A. I. (2013) Anxiety, depression, and PTSD following cardiac arrest: a systematic review of the literature. Resuscitation 84, 873–877.

Wiseman T, Foster K and Curtis K (2013) Mental health following traumatic physical injury: an integrative literature review. *Injury* **44**, 1383–1390.

World Health Organization (1992) *International Classification of Mental and Behavioural Disorders (ICD-10)*.

Yan ZY, Gu MJ, Zhong BL, Wang C, Tang HL, Ling YQ et al. (2013) Prevalence, risk factors and recognition rates of depressive disorders among inpatients of tertiary general hospitals in shanghai, China. *Journal of Psychosomatic Research* **75**, 65–71.

Yellowlees PM, Alpers J, Bowden J, Bryant G and Ruffin R (1987) Psychiatric morbidity in patients with chronic airflow obstruction. *Medical Journal of Australia* **146**, 305–307.

Zhao L, Li X, Zhang Z, Song C, Guo C, Zhang Y et al. (2014) Prevalence, correlates and recognition of depression in Chinese inpatients with cancer. *General Hospital Psychiatry* **36**, 477–482.

Zhong B, Chen H, Zhang J, Xu H, Zhou C, Yang F et al. (2010) Prevalence, correlates and recognition of depression among inpatients of general hospitals in Wuhan, China. *General Hospital Psychiatry* **32**, 268–275.