

Title: The Prevalence of Anxiety in General Hospital Inpatients: A Systematic Review and Meta-Analysis

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ABSTRACT

Objective

To determine the prevalence of anxiety in general hospital inpatients by conducting a systematic review and meta-analysis of all relevant published studies.

Method

We searched Ovid Medline, Ovid Embase and Ovid PsycINFO from inception to December 2020. We included studies of the prevalence of anxiety symptoms of clinically significant severity (using cut-off scores on rating scales) and of the prevalence of anxiety disorders (using diagnostic interviews) in general hospital inpatients. Two independent reviewers assessed articles and extracted data. The review is registered with PROSPERO, number CRD42020189722.

Results

We included 32 studies. Pooled prevalence estimates in random-effects meta-analyses were: anxiety symptoms 28% (95% CI 19% to 38%, 95% prediction interval 5% to 72%), any anxiety disorder 8% (95% CI 5% to 12%, 95% prediction interval 2% to 33%), panic disorder 3% (95% CI 2% to 4%, 95% prediction interval 1% to 8%), generalized anxiety disorder 5% (95% CI 3% to 8%, 95% prediction interval 1% to 23%). There was high heterogeneity in prevalence, little of which was explained in exploratory analyses of a limited number of potential determinants.

Conclusion

Anxiety symptoms of clinically significant severity affect more than one in four inpatients and anxiety disorders affect nearly one in ten.

KEYWORDS:

Anxiety; Prevalence, General hospital inpatient; Systematic review; Meta-analysis

1. Introduction

Psychiatric comorbidities complicate the medical care of general hospital inpatients [1, 2]. Anxiety is one such comorbidity. The presence of comorbid anxiety not only indicates distress, but is also associated with increased use of healthcare resources and poorer outcomes [3].

In order to better understand and manage comorbid anxiety in general hospital inpatients, and to plan Consultation-Liaison Psychiatry provision, we need to know its prevalence in that population. Whilst there are systematic reviews of the prevalence of anxiety in populations with specific medical diagnoses [4], we are not aware of any reviews of its prevalence in the inpatient population.

We therefore aimed to determine the prevalence of anxiety in general hospital inpatients by conducting a systematic review of all the relevant published studies. We included studies that aimed to estimate either: (a) the prevalence of anxiety symptoms, in which the presence of anxiety symptoms of clinically significant severity was determined using cut-off scores on symptom rating scales; or (b) the prevalence of anxiety disorders, in which the presence of any anxiety disorder or of specific anxiety disorders was determined using diagnostic interviews.

2. Method

2.1 Design

We conducted a systematic review and meta-analysis, using procedures that accorded with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [5, 6]. We registered the study protocol with PROSPERO (number CRD42020189722).

2.2 Search strategy

We identified studies by searching Ovid Medline, Ovid Embase and Ovid PsycINFO (from 1946, 1974 and 1806 respectively) to December 2020. Searches were run for the combination of ‘prevalence’, ‘general hospital inpatient’ and ‘anxiety’ using both standardized subject terms and free text terms, including synonyms and alternative spellings. All references were exported (to Endnote X9, Thomson Reuters, New York, NY) and duplicates were removed following the method described by Falconer [7]. We provide full details of the searches used in the Appendix. We also manually searched the reference lists of review articles obtained through the electronic searches.

2.3 Selection criteria – relevance

We included studies (in any language) if they met all of the following criteria: (1) the study clearly aimed to estimate the prevalence of current anxiety in the inpatients of a whole general hospital or specified units within the hospital; (2) all study participants (or a clear subgroup) were adults aged 16 or older; (3) the prevalence of either anxiety symptoms (determined using a standard and widely used rating scale) or anxiety disorders (determined using a diagnostic interview) was reported or could be calculated using data from the paper.

We excluded studies if they only included patients with specific medical diagnoses or specific demographic characteristics.

2.4 Selection criteria – methodological quality

We only included studies that met all of the following basic methodological quality criteria: (1) the study sample was obtained using a random or consecutive sampling method (to minimize participant selection bias); (2) data were available for analysis on at least 70% of the eligible patients (also to minimize participant selection bias); (3) the study clearly defined ‘anxiety’ by using either a specified cut-off score or standard diagnostic criteria (to allow the summary and synthesis of findings) [8, 9].

We only included studies that met these criteria because meta-analyses of low quality studies may yield misleading results [10]. We used quality criteria rather than a quality scale score because a study could potentially achieve a high score on a quality scale but still have a high risk of bias from one aspect of its methods [11].

2.5 Data extraction

Two researchers independently screened the titles and abstracts of all articles identified by the searches, using Endnote and Excel, to determine whether each might meet our selection criteria. If an article was considered to be potentially relevant, two researchers reviewed the full text, with the help of a translator where necessary. Any disagreements about whether to include an article were resolved by discussion with a third researcher. For each included study the following data were independently extracted using a specially designed, standardized data extraction form: country in which the study took place; hospital units from which participants were recruited; participant inclusion criteria; sample size; age and sex of participants; rating scale and cut-off score used to define the presence of anxiety symptoms; interview and diagnostic criteria used to determine the presence of anxiety disorders as well as whether a hierarchical approach was taken; timing of the anxiety assessment after admission to hospital; prevalence of anxiety symptoms or anxiety disorders in the study sample (for cohort studies, we extracted the prevalence of anxiety at the first time point only).

2.6 Data synthesis and analysis

We were able to synthesize data on the prevalence of anxiety symptoms, any anxiety disorder, and the specific anxiety disorders panic disorder and generalized anxiety disorder. There were insufficient data on other specific anxiety disorders (for example, phobias) for us to produce meaningful summaries.

We used forest plots to display the study-specific prevalences (proportions with exact binomial 95% confidence intervals) of anxiety symptoms and anxiety disorders (any anxiety disorder, panic disorder and generalized anxiety disorder) in each study. We used the logit transformation to express each of the prevalence estimates as a log-odds and conducted meta-analyses using random-effects models. We used random-effects models because underlying prevalences (i.e. the prevalences if each study was of infinite size) are likely to vary from study to study according to factors, both measured and unmeasured, that differ between them [12]. The random-effects model assumes that underlying study-specific prevalences (when expressed as log odds) follow a normal distribution characterized by a mean and standard deviation, rather than taking a single value. For each meta-analysis we report the (back-transformed) mean, which may be considered to be the 'typical prevalence', with a 95% confidence interval to quantify its precision. We also report the 95% prediction interval, which is the interval within which 95% of underlying study-specific prevalence estimates are predicted to lie.

We assessed heterogeneity using Cochran's Q tests and I^2 statistics. We also conducted exploratory analyses to investigate the following potential sources of heterogeneity in the prevalences of anxiety symptoms and of any anxiety disorder: mean (or median where mean was not available) age of study participants; percentage of female participants; year of study publication; and the use of DSM or ICD diagnostic criteria (for any anxiety disorder only). We plotted (using bubble plots) prevalences

against each potential source of heterogeneity and used meta-regression to estimate associations with the prevalences on the log odds scale.

We conducted the statistical analysis in R v3.5.2 using the “meta” package v4.18-0 and the “metafor” v2.4-0 package [13-15].

3. Results

3.1 Literature overview

Our initial screening of 20 416 titles and associated abstracts yielded 4927 articles for full paper review. We considered 96 of these to be relevant. Of these 96 articles, 33 (34%), describing 32 separate studies, met our quality criteria (see Figure 1 and Appendix) [16-48].

[Figure 1 about here]

The studies were mostly small in size (sample sizes ranged from 45 to 2009, median 210) and were conducted in a variety of hospital units (there were no studies of the prevalence of anxiety in the inpatients of a whole general hospital). The samples commonly excluded certain categories of patients, such as those with cognitive impairment and those who were very physically unwell. Some studies excluded patients if they had been admitted following a suicide attempt or had known psychiatric disorders. Study reports often lacked information on when during the admission the anxiety assessments were conducted; in those that did include this information the timing ranged from the first day to the third week of hospital admission (see Tables 1 and 2).

3.2 Prevalence of anxiety symptoms (rating scale studies)

12 of the 32 studies (total 6234 participants) used rating scales to determine the prevalence of clinically significant anxiety symptoms (see Table 1). Six studies used the anxiety subscale of the Hospital Anxiety and Depression Scale, two used the Generalized Anxiety Disorder-7 scale, two used the Zung Self-Rating Anxiety Scale and two used the State-Trait Anxiety Inventory.

[Table 1 about here]

The prevalence of clinically significant anxiety symptoms ranged from 11% to 62% (see Figure 2). The pooled prevalence was 28% (95% CI 19% to 38%, 95% prediction interval 5% to 72%). There was considerable statistical heterogeneity ($I^2=98%$); that is, there was large variation between the studies' prevalence estimates that was unlikely to have occurred by chance.

[Figure 2 about here]

3.3 Prevalence of anxiety disorders (diagnostic interview studies)

The remaining 20 studies (total 4294 participants) used diagnostic interviews to determine the presence of anxiety disorders (see Table 2). Ten studies used diagnostic criteria from the Diagnostic and Statistical Manual of Mental Disorders (DSM), four used criteria from the International Classification of Diseases (ICD), one used the Automated Geriatric Examination for Computer Assisted Taxonomy (AGECAT) and one used the CATEGO system. A summary of the DSM and ICD diagnostic criteria (which differ between these two main systems and between the different versions of the systems) is provided in the Appendix.

Some studies explicitly used a hierarchical approach to diagnosis (for example, only diagnosing anxiety if depression was not also present), some clearly did not (that is, they allowed participants to receive multiple diagnoses where appropriate) and others were unclear about how they had addressed this issue (see Table 2).

[Table 2 about here]

16 studies (total 3982 participants) reported on the prevalence of any anxiety disorder. The specific disorders included within any anxiety disorder differed between studies, but in most cases included both panic disorder and generalized anxiety disorder (see Table 2). Prevalence estimates for any

anxiety disorder ranged from 2% to 29% (see Figure 3). The pooled prevalence of any anxiety disorder was 8% (95% CI 5% to 12%, 95% prediction interval 2% to 33%, $I^2=92\%$).

[Figure 3 about here]

The prevalence of panic disorder (10 studies, total 2530 participants) ranged from 0% to 6% (see Figure 4). The pooled prevalence was 3% (95% CI 2% to 4%, 95% prediction interval 1% to 8%, $I^2=48\%$).

[Figure 4 about here]

The prevalence of generalized anxiety disorder (11 studies, total 2649 participants) ranged from 0% to 21% (see Figure 5). The pooled prevalence was 5% (95% CI 3% to 8%, 95% prediction interval 1% to 23%, $I^2=86\%$).

[Figure 5 about here]

3.4 Exploration of heterogeneity

The bubble plots of the prevalence of anxiety symptoms and the prevalence of any anxiety disorder against mean (or median where mean was not available) age of study participants, percentage of female participants, year of study publication and use of DSM or ICD diagnostic criteria are shown in the Appendix Figures 1-7. For the studies of anxiety symptoms, there was no statistical evidence that age ($p=0.715$), percentage of female participants ($p=0.247$) or year of publication ($p=0.532$) explained the between-study variability in prevalence. For the studies of any anxiety disorder, there was no statistical evidence that either age ($p=0.257$) or percentage of female participants ($p=0.500$) were associated with prevalence. More recent publication year was associated with a higher

prevalence of any anxiety disorder (odds ratio 1.06 per year increase, 95% CI 1.02 to 1.10, $p=0.004$), although there was still substantial residual heterogeneity ($I^2=85\%$). Studies that used ICD criteria reported a lower prevalence than those that used DSM criteria (odds ratio 0.30, 95% CI 0.13 to 0.71, $p=0.006$), again with high residual heterogeneity ($I^2=89\%$).

4. Discussion

4.1 Main findings

To the best of our knowledge, this is the first systematic review of the prevalence of anxiety in the general hospital inpatient population. We included 32 studies conducted in a variety of general hospital units; 12 studies of the prevalence of anxiety symptoms using cut-off scores on symptom rating scales and 20 studies of the prevalence of anxiety disorders using diagnostic interviews. The pooled prevalence of anxiety symptoms was 28% and the pooled prevalence of any anxiety disorder was 8%. For specific anxiety disorders, the pooled prevalence of panic disorder was 3% and the pooled prevalence of generalized anxiety disorder was 5%.

4.2 Discussion of findings

Perhaps not surprisingly, our estimate of the pooled prevalence of anxiety symptoms in general hospital inpatients (28%) is much higher than reported in studies of the general population. For example, large community studies have reported prevalence estimates of approximately 14% using the anxiety subscale of the Hospital Anxiety and Depression Scale (cut-off ≥ 8) and 9% using the Generalized Anxiety Disorder-7 scale (cut-off ≥ 8) [49, 50].

Our estimate of the pooled prevalence of any anxiety disorder, whilst also fairly high (8%), may not in fact be much higher than that found in the general population. For example, a systematic review of the global literature reported an average prevalence in the general population of approximately 7% [51]. Similarly, our pooled prevalence estimates of 3% and 5% for panic disorder and generalized anxiety disorder respectively are only modestly higher than 1-2% one-year general population prevalences [52].

Why might it be that general hospital inpatients have a much higher prevalence of anxiety symptoms than the general population, but not a much higher prevalence of anxiety disorders? We suggest

three potential reasons: First, anxiety symptoms caused by acute illness and hospital admission are unlikely to meet the stringent diagnostic criteria for anxiety disorders, especially those criteria pertaining to duration. For example, the DSM-III-R and DSM-IV criteria for generalized anxiety disorder require symptoms to have been present for at least six months and the DSM-III-R and DSM-IV criteria for panic disorder require that the patient not only has recurrent panic attacks, but also at least one month of persistent concern about future panic attacks. Second, diagnostic criteria often require that anxiety is deemed by the interviewer to be 'unrealistic' or 'excessive'. Hence people who are medically ill and have been admitted to hospital may be considered by the interviewer to have 'understandable' anxiety and consequently given a diagnosis of adjustment disorder, rather than of anxiety disorder. Third, most of the diagnostic criteria for anxiety disorders require the interviewer to judge that the patient's symptoms are 'not due to a general medical disorder'. Such judgements are difficult to make and may potentially lead to undercounting of physical symptoms toward the presence of an anxiety disorder.

4.3 Reasons for heterogeneity in prevalences

We found substantial statistical heterogeneity in the study-specific prevalences, with large I^2 and wide prediction intervals. We were only able to investigate a small number of the potential sources of this heterogeneity, as explained below. In the exploratory analyses that we did conduct, we were unable to identify factors that explained the heterogeneity in the prevalences of anxiety symptoms. We did find that more recent publication year was associated with a modestly higher reported prevalence of any anxiety disorder, perhaps reflecting a greater interest in anxiety disorders in recent years rather than an increasing population prevalence [52]. We also found that studies which used ICD diagnostic criteria reported a lower prevalence of any anxiety disorder than those that used DSM criteria, which may be related to the use of more systematic interviews to identify DSM disorders. However, the residual heterogeneity remained high in all our investigations, indicating

that neither of these factors explained a material amount of the heterogeneity in the prevalences of any anxiety disorder.

Our findings from these explorations of the potential sources of heterogeneity should be interpreted with considerable caution, due to the inherent limitations of such analyses [10]. Furthermore, there are a number of other potential sources of heterogeneity that we were unable to investigate. These include: the country in which the study was conducted; the type of hospital unit from which participants were recruited; the choice of rating scale and cut-off in studies of anxiety symptoms; whether a hierarchical approach to diagnosis was used in interview studies (which may lead to a diagnosis of depression overshadowing a diagnosis of anxiety disorder) [53]; and the timing of the assessment of anxiety after admission to hospital [37]. We were unable to analyze these variables because either: (a) the categories of studies derived for analysis were too small (for example, the majority of countries were represented by only a single study) or (b) there were too many missing data (for example, the majority of studies did not report the timing of the anxiety assessment).

4.4 Methodological quality including risk of bias

Despite meeting our basic quality criteria, many of the studies we included still had methodological shortcomings. In particular, many of the samples studied were potentially biased by the exclusion of certain categories of patients, such as those who were very physically unwell and those who had known psychiatric disorders. Furthermore, the reporting of study methods was often unclear and important aspects of study design, such as when during the admission the anxiety assessments were conducted and whether a diagnostic hierarchy was employed, were frequently missing.

4.5 The challenges of systematically reviewing studies of anxiety prevalence in general hospital inpatients.

We encountered a number of challenges in doing this review. The way that articles are indexed in publication databases, and the inconsistent use of language within the titles and abstracts of the articles, made it exceptionally difficult to search for relevant studies. Whilst there are commonly used standardized subject terms and obvious free text search terms for 'anxiety', searching for 'general hospital inpatients' and 'prevalence' is more difficult. To find studies of inpatients, we needed to use multiple additional search terms such as 'hospital' and 'medical center' because many studies are not indexed using the term 'inpatient'. Similarly, authors have sometimes used words such as 'incidence' or 'occurrence' to mean 'prevalence' so we also needed to add these search terms.

The use of a number of different rating scales and diagnostic criteria also made it difficult to compare and summarize studies. The studies of the prevalence of anxiety symptoms used a variety of scales, which differ in the aspects of anxiety that they measure. For example, some scales (such as the Zung Self-Rating Anxiety Scale) include a number of physical symptoms, whereas others (such as the anxiety subscale of the Hospital Anxiety and Depression Scale) do not. The studies of the prevalence of anxiety disorders mostly used the ICD and DSM classification systems. However, whilst these diagnostic systems are comparable for many psychiatric disorders, they differ both between each other and over time in their approach to anxiety disorders [54]. For example, they have included different specific disorders within the overall category of anxiety disorders and have had different approaches to the diagnosis of panic disorder (for details see Appendix).

4.6 Strengths and limitations of this review

The strengths of this review include: (a) a comprehensive, sensitive search of the published literature with no restriction on language; (b) clearly defined inclusion and exclusion criteria for studies in order to minimize bias in study selection; (c) the inclusion of only studies that met basic quality criteria.

The main limitations are: (a) the likely inability to find all potentially relevant studies due to limitations in article titles, abstracts and indexing; (b) the exclusion of studies that were designed to address a different research question but happened to include a prevalence estimate (for example, clinical trials and questionnaire validation studies) (c) 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 only poorly reported; (d) the absence of data on several of the more specific anxiety disorders such as phobias; (e) the limited ability to statistically investigate many potential sources of heterogeneity.

4.7 Other literature

We are not aware of any previous systematic review of the prevalence of anxiety in the general hospital inpatient population. However, we did find a meta-review of systematic reviews which summarized the findings of systematic reviews of the prevalence of anxiety in patients with diagnoses of multiple sclerosis, cardiovascular disease, cancer, respiratory disease, diabetes and other chronic illnesses [4]. The authors of this meta-review concluded that anxiety is more prevalent in populations with chronic physical illnesses than in healthy populations which is consistent with our finding of a higher prevalence of anxiety in the general hospital inpatient setting.

4.8 Implications for clinical practice

The finding that more than a quarter of general hospital inpatients have anxiety symptoms is important, as it may be a marker of patients' unaddressed fears and concerns. Whilst anxiety disorders, as defined by diagnostic criteria, are less prevalent than anxiety symptoms, they still affect nearly one in ten inpatients. There is an argument therefore for the better identification of patients with anxiety by systematic screening, and review of the need for treatment, either during the hospital stay or after discharge.

4.9 Implications for future research

Although we found a number of studies of the prevalence of anxiety in general hospital inpatients, the usefulness of the data they provided was limited by their methodological shortcomings. There is consequently a need for better study design and reporting. A particularly important issue is the need for greater clarity and consistency in the criteria used to determine if symptoms are attributed to a diagnosis of anxiety disorder, to the patient's medical condition or to their adjustment to stressors. The high heterogeneity observed between the studies could not be adequately explained by the available data and provides a topic for future research. We also need more studies of patient populations defined by clinical setting rather than by medical diagnosis, in order to inform the planning of Consultation-Liaison Psychiatry services.

4.10 Conclusions

Anxiety is common in general hospital inpatients. Anxiety symptoms of clinically significant severity affect more than one in four inpatients and anxiety disorders affect nearly one in ten. These estimates suggest both considerable patient suffering and the potential complication of medical care. We conclude that anxiety in general hospital inpatients deserves greater attention from both clinicians and researchers.

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Disclosures

None.

REFERENCES

- [1] Campbell SE, Seymour DG and Primrose WR. A systematic literature review of factors affecting outcome in older medical patients admitted to hospital. *Age and ageing* 2004;33:110-115.
- [2] Levenson JL, Hamer RM and Rossiter LF. Relation of psychopathology in general medical inpatients to use and cost of services. *Am J Psychiatry* 1990;147:1498-503.
- [3] Roy-Byrne PP, Davidson KW, Kessler RC, Asmundson GJ, Goodwin RD, Kubzansky L, et al. Anxiety disorders and comorbid medical illness. *General Hospital Psychiatry* 2008;30:208-225.
- [4] Remes O, Brayne C, van der Linde R and Lafortune L. A systematic review of reviews on the prevalence of anxiety disorders in adult populations. *Brain and Behavior* 2016;6:e00497.
- [5] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71.
- [6] Rethlefsen ML, Kirtley S, Waffenschmidt S, Ayala AP, Moher D, Page MJ, et al. PRISMA-S: an extension to the PRISMA Statement for Reporting Literature Searches in Systematic Reviews. *Syst Rev* 2021;10:39.
- [7] Falconer J. 2018.
- [8] Loney PL, Chambers LW, Bennett KJ, Roberts JG and Stratford PW. Critical appraisal of the health research literature: Prevalence or incidence of a health problem. *Chronic Diseases in Canada* 1998;19:170-176.
- [9] Walker J, Holm Hansen C, Martin P, Sawhney A, Thekkumpurath P, Beale C, et al. Prevalence of depression in adults with cancer: A systematic review. *Annals of Oncology* 2013;24:895-900.
- [10] Higgins JPT TJ, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). *Cochrane Handbook for Systematic Reviews of Interventions* version 6.2 (updated February 2021). Cochrane, 2021.
- [11] Juni P, Witschi A, Bloch R and Egger M. The hazards of scoring the quality of clinical trials for meta-analysis. *JAMA* 1999;282:1054-60.
- [12] Stroup DF, Berlin JA, Morton SC, Olkin I, Williamson GD, Rennie D, et al. Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis Of Observational Studies in Epidemiology (MOOSE) group. *JAMA* 2000;283:2008-12.
- [13] R Core Team. *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing, 2020.
- [14] Schwarzer G. An R package for meta-analysis. *R news* 2007;7:40-45.
- [15] Viechtbauer W. Conducting meta-analyses in R with the metafor package. *Journal of Statistical Software* 2010;36:1-48.
- [16] Cardoso G, Alexandre J and Rosa A. Depression, anxiety and alcohol abuse in a gastroenterology intensive care unit: Prevalence and detection. *Clinical Practice and Epidemiology in Mental Health* 2010;6:47-52.
- [17] Esteghamat SS, Moghaddami S, Esteghamat SS, Kazemi H, Kolivand PH and Gorji A. The course of anxiety and depression in surgical and non-surgical patients. *International Journal of Psychiatry in Clinical Practice* 2014;18:16-20.
- [18] Gorini A, Giuliani, M., Raggio, L., Barbieri, S., Tremoli, E. Depressive and Anxiety Symptoms Screening in Cardiac Inpatients: A Virtuous Italian Approach to Psychocardiology. *Int J Environ Res Public Health* 2020;17:12.

- [19] Huang M, Liu Y, Wang J, Mo L, Wang Y, Chen L, et al. High rates of depression anxiety and suicidal ideation among inpatients in general hospital in china. *International Journal of Psychiatry in Clinical Practice* 2019;No Pagination Specified.
- [20] Koc Z and Sener A. Distress symptoms, anxiety, depression level, and self-care ability of oncology inpatients in a Region of Turkey. *European Journal of Oncology* 2017;22:76-87.
- [21] Li L, Wang BQ, Gao TH and Tian J. [Assessment of psychological status of inpatients with head and neck cancer before surgery]. *Zhonghua Er Bi Yan Hou Tou Jing Wai Ke Za Zhi = Chinese Journal of Otorhinolaryngology Head & Neck Surgery* 2018;53:21-26.
- [22] Mazeraud A, Polito, A., Sivanandamoorthy, S., Porcher, R., Heming, N., Stoclin, A., Hissem, T., Antona, M., Blot, F., Gaillard, R., Chretien, F., Annane, D., Bozza, F. A. B., Siami, S., Sharshar, T., Groupe d'Explorations Neurologiques en, Reanimation. Association Between Anxiety and New Organ Failure, Independently of Critical Illness Severity and Respiratory Status: A Prospective Multicentric Cohort Study. *Crit Care Med* 2020;48:1471-1479.
- [23] Meyer T, Klemme H and Herrmann-Lingen C. Prevalence and effects of depressive and anxiety symptoms in internal medicine inpatients during the first year after hospital discharge. *Zeitschrift fur Psychosomatische Medizin und Psychotherapie* 2002;48:174-191.
- [24] Rincon HG, Granados M, Unutzer J, Gomez M, Duran R, Badiel M, et al. Prevalence, detection and treatment of anxiety, depression, and delirium in the adult critical care unit. *Psychosomatics: Journal of Consultation and Liaison Psychiatry* 2001;42:391-396.
- [25] Sahan E, Unal, S. M., Kirpinar, I. Can we predict who will be more anxious and depressed in the COVID-19 ward? *Journal of Psychosomatic Research* 2021;140:110302.
- [26] Tecchio C, Bonetto C, Bertani M, Cristofalo D, Lasalvia A, Nichele I, et al. Predictors of anxiety and depression in hematopoietic stem cell transplant patients during protective isolation. *Psychooncology* 2013;22:1790-7.
- [27] Tian J, Li L, Tao CL, Hao RY, Huang FH, Ge XH, et al. A glimpse into the psychological status of E.N.T inpatients in China: A cross-sectional survey of three hospitals in different regions. *World Journal Of Otorhinolaryngology - Head And Neck Surgery* 2019;5:95-104.
- [28] Abiodun OA and Ogunremi OO. Psychiatric morbidity in medical and surgical wards of a Nigerian general hospital. *J Psychosom Res* 1990;34:409-14.
- [29] Alexander PJ, Dinesh N and Vidyasagar MS. Psychiatric morbidity among cancer patients and its relationship with awareness of illness and expectations about treatment outcome. *Acta Oncologica* 1993;32:623-6.
- [30] Arolt V, Driessen M and Dilling H. The Lubeck General Hospital Study. I: Prevalence of psychiatric disorders in medical and surgical inpatients. *Int J Psychiatry Clin Pract* 1997;1:207-16.
- [31] Burn WK, Davies KN, McKenzie FR, Brothwell JA and Wattis JP. The prevalence of psychiatric illness in acute geriatric admissions. *International Journal of Geriatric Psychiatry* 1993;8:171-174.
- [32] Dogar IA, Khawaja IS, Azeem MW, Awan H, Ayub A, Iqbal J, et al. Prevalence and risk factors for depression and anxiety in hospitalized cardiac patients in Pakistan. *Psychiatry* 2008;5:38-41.
- [33] Dyster-Aas J, Willebrand M, Wikehult B, Gerdin B and Ekselius L. Major depression and posttraumatic stress disorder symptoms following severe burn injury in relation to lifetime psychiatric morbidity. *Journal of Trauma and Acute Care Surgery* 2008;64:1349-56.
- [34] Feldman E, Mayou R and Hawton K. Psychiatric disorder in medical in-patients. *Quarterly Journal of Medicine* 1987;63:405-412.

- [35] Fritzsche K, Ott J, Zschocke I, Scheib P, Burger T and Augustin M. Psychosomatic liaison service in dermatology. Need for psychotherapeutic interventions and their realization. *Dermatology* 2001;203:27-31.
- [36] Jenkins P, Jamil N, Taylor B and Hughes LE. Why don't surgeons refer to psychiatrists? Psychological morbidity in acute surgical admissions. *New Trends in Experimental and Clinical Psychiatry* 1994;10:93-95.
- [37] Kathol RG and Wenzel RP. Natural history of symptoms of depression and anxiety during inpatient treatment on general medicine wards. *Journal of General Internal Medicine* 1992;7:287-93.
- [38] Kayhan F, Cicek E, Uguz F, Karababa IF and Kucur R. Mood and anxiety disorders among inpatients of a university hospital in Turkey. *General Hospital Psychiatry* 2013;35:417-422.
- [39] Keller M, Sommerfeldt S, Fischer C, Knight L, Riesbeck M, Lowe B, et al. Recognition of distress and psychiatric morbidity in cancer patients: A multi-method approach. *Annals of Oncology* 2004;15:1243-1249.
- [40] Kigamwa A. Psychiatric morbidity and referral rate among medical in-patients at Kenyatta National Hospital. *East Afr Med J* 1991;68:383-8.
- [41] Köroğlu G and Tural Ü. The prevalence of comorbid psychiatric disorders among inpatients with medical illness and their effects on quality of life and functioning. *Yeni Symposium* 2010;48:54-62.
- [42] Lykouras L, Adrachta D, Kalfakis N, Oulis P, Voulgari A, Christodoulou G, et al. GHQ-28 as an aid to detect mental disorders in neurological inpatients. *Acta Psychiatrica Scandinavica* 1996;93:212-216.
- [43] Madianos MG, Papaghelis M, Ioannovich J and Dafni R. Psychiatric disorders in burn patients: A follow-up study. *Psychotherapy and Psychosomatics* 2001;70:30-37.
- [44] Marchesi C, Brusamonti E, Borghi C, Giannini A, Di Ruvo R, Minneo F, et al. Anxiety and depressive disorders in an emergency department ward of a general hospital: A control study. *Emergency Medicine Journal* 2004;21:175-9.
- [45] Palmu R, Suominen K, Vuola J and Isometsä E. Mental disorders among acute burn patients. *Burns* 2010;36:1072-9.
- [46] Palmu R, Suominen K, Vuola J and Isometsä E. Mental disorders after burn injury: A prospective study. *Burns* 2011;37:601-9.
- [47] Prieto JM, Blanch J, Atala J, Carreras E, Rovira M, Cirera E, et al. Psychiatric morbidity and impact on hospital length of stay among hematologic cancer patients receiving stem-cell transplantation. *Journal of Clinical Oncology* 2002;20:1907-17.
- [48] Silverstone PH. Prevalence of psychiatric disorders in medical inpatients. *Journal of Nervous and Mental Disease* 1996;184:43-51.
- [49] Johansson R, Carlbring P, Heedman A, Paxling B and Andersson G. Depression, anxiety and their comorbidity in the Swedish general population: point prevalence and the effect on health-related quality of life. *PeerJ* 2013;1:e98.
- [50] Hoglund P, Hakelind C and Nordin S. Severity and prevalence of various types of mental ill-health in a general adult population: age and sex differences. *BMC Psychiatry* 2020;20:209.
- [51] Baxter AJ, Scott KM, Vos T and Whiteford HA. Global prevalence of anxiety disorders: a systematic review and meta-regression. *Psychol Med* 2013;43:897-910.
- [52] Penninx BW, Pine DS, Holmes EA and Reif A. Anxiety disorders. *Lancet* 2021;397:914-927.

- [53] Zimmerman M and Chelminski I. Generalized anxiety disorder in patients with major depression: is DSM-IV's hierarchy correct? *Am J Psychiatry* 2003;160:504-12.
- [54] Suris A, Holliday R and North CS. The Evolution of the Classification of Psychiatric Disorders. *Behav Sci (Basel)* 2016;6.

Table 1: Studies of the prevalence of clinically significant anxiety symptoms in general hospital inpatients

Study	Hospital unit(s)	Inclusion criteria	Sample size	Age	% female	Anxiety rating-scale	Cut-off score used	Timing of assessment after admission	Prevalence of clinically significant anxiety symptoms (%)
Cardoso 2010 (Portugal)	Gastroenterology intensive care	Aged ≥ 18 ; intensive care unit stay ≥ 24 hours; cognitively able to complete assessment.	65	Mean 57.2, SD 15.8	41.5	Hospital Anxiety and Depression Scale, Anxiety Subscale	≥ 8	Within 72 hours	29
Esteghamat 2014 (Iran)	Internal medicine & general surgery	Aged ≥ 18 ; hospitalized for ≤ 24 hours; no psychological or mental disabilities, decreased consciousness or cognitive impairment.	359	Mean 49.18, SD 19.49	56.3	Hospital Anxiety and Depression Scale, Anxiety Subscale	≥ 11	Within 24 hours	39
Gorini 2020 (Italy)	Cardiology	All patients included.	2009	Mean 64.0, SD 14.6 ^a	29.02 ^a	Generalized Anxiety Disorder-7	≥ 8	Not reported	16
Huang 2019 (China)	Medical & surgical sub-specialties ^b	Physically and mentally able to complete self-report questionnaire; not being discharged on survey day.	1329	Mean 52.7, SD 16.5	41.9	Generalized Anxiety Disorder-7 (Chinese version)	≥ 10	Not reported	15

Koc 2017 (Turkey)	Oncology	Aged ≥ 18 ; literate; physically and mentally able to take part.	356	Mean 54.6, SD 16.7	42.7	Hospital Anxiety and Depression Scale, Anxiety Subscale	≥ 11	Not reported	62
Li 2018 (China)	Head and neck surgical oncology	Aged ≥ 18 ; awaiting surgery; no heart disease, diabetes, kidney disease or psychiatric illness; no family history of psychiatric illness.	228	Mean 48.5, SD 11.6	71.1	Zung Self-Rating Anxiety Scale	$\geq 50^c$	Not reported	36
Mazeraud 2020 (France)	Medical-surgical intensive care	Breathing spontaneously; not admitted for suicide attempt; no delirium or impaired consciousness; no history of altered neuro-cognition; French speaking.	391	Median 63, Range 49-74	40.7	State-Trait Anxiety Inventory	≥ 40	Within 12 hours	52
Meyer 2002 (Germany)	Internal medicine	Sufficient knowledge of German; no severe cognitive impairment.	575	Mean 58.7, SD 15.1	42.8	Hospital Anxiety and Depression Scale, Anxiety Subscale	≥ 11	Not reported	18
Rincon 2001 (Colombia)	Medical, surgical & coronary critical care	Verbal communication not impaired by structural cerebral damage or excessive sedation.	95	Mean 61, SD 14.3 ^d	38.5 ^{d*}	Hospital Anxiety and Depression Scale, Anxiety Subscale	≥ 10	First day of admission	24
Şahan 2021 (Turkey)	Coronavirus-19	No Alzheimer's disease or psychosis; no hearing disability; Turkish speaking.	281	Mean 55.0, SD 14.9	49.1	Hospital Anxiety and Depression Scale, Anxiety Subscale	≥ 10	Not reported	35

Tecchio 2013 (Italy)	Bone marrow transplant	Aged ≥ 16 ; undergoing first autologous or allogenic hematopoietic stem cell transplant; no major psychiatric disorder or mental retardation; full understanding of spoken & written Italian.	107	Median 51, Range 16-70	38.3	State-Trait Anxiety Inventory	Male ≥ 55 , Female ≥ 61 (scores in 95 th percentile of normative sample)	Not reported	11
Tian 2019 (China)	Ear Nose & Throat	Aged ≥ 18 ; not an emergency admission; no cognitive impairment, coma, severe depression, drug addiction or mental disturbance; medically stable.	439	Department 1: Mean 41.7, SD 13.2 Department 2: Mean 49.7, SD 17.1 Department 3: Mean 42.2, SD 13.8	43.3*	Zung Self-Rating Anxiety Scale	≥ 50 ^c	Within 1-2 days	16

^a Demographic data for 2006 participants; ^b Oncology, cardiology, respiratory medicine, rehabilitation, geriatrics & gerontology, general practice, pain management, rheumatology, hepatic surgery, thyroid & breast surgery; ^c Cut-off relates to index score; ^d Demographic data for 96 participants (only 95 completed anxiety assessment). SD = Standard Deviation. * Calculated using data from paper. If a study reported the prevalence of anxiety symptoms using more than one cut-off, we used the prevalence related to the recommended cut-off.

Table 2: Studies of the prevalence of anxiety disorders in general hospital inpatients

Study	Hospital unit(s)	Inclusion criteria	Sample size	Age	% female	Anxiety interview (interviewer)	Diagnostic criteria	Hierarchy used	Timing of assessment after admission	Prevalence of anxiety disorders (%)		
										Any	Panic disorder	GAD
Abiodun 1990 (Nigeria)	Medicine & surgery	Aged ≥ 16 ; well enough to participate; English or Yoruba speaker.	275	Medicine: Mean 40 Surgery: Mean 38.9	44*	Psychiatric interview including Present State Examination (psychiatrist)	ICD-9	Unclear	Not reported	7 ^{a*}	-	-
Alexander 1993 (India)	Oncology	Well enough for interview.	60	Mean 53.2, SD 13.9	40*	Clinical interview (psychiatrist)	DSM-III-R	Unclear	Within 3-7 days	-	3	-
Arolt 1997 (Germany)	Internal medicine & surgery	Well enough to participate; not suffering from severe psycho-organic syndromes.	400	Medicine: Mean 62.5, SD 17.9 Surgery: Mean 59.7, SD 20.0	Medicine : 50.5 Surgery: 53.0	Clinical interview including Composite International Diagnostic Interview (psychiatrist) ^b	ICD-10	Yes	Not reported	2 ^c	-	-
Burn 1993 (UK)	Acute geriatric medicine	Aged > 65; no speech disorder or severe deafness.	100	Mean 82, Range 69-99	64*	Geriatric Mental State (trained interviewer)	AGECAT	Yes	Not reported	7 ^d	-	-
Dogar 2008 (Pakistan)	Cardiology	Not specified.	100	Mean 52.2, SD 11.12	40*	Clinical interview (not stated)	DSM-IV	No	Not reported	-	-	21*

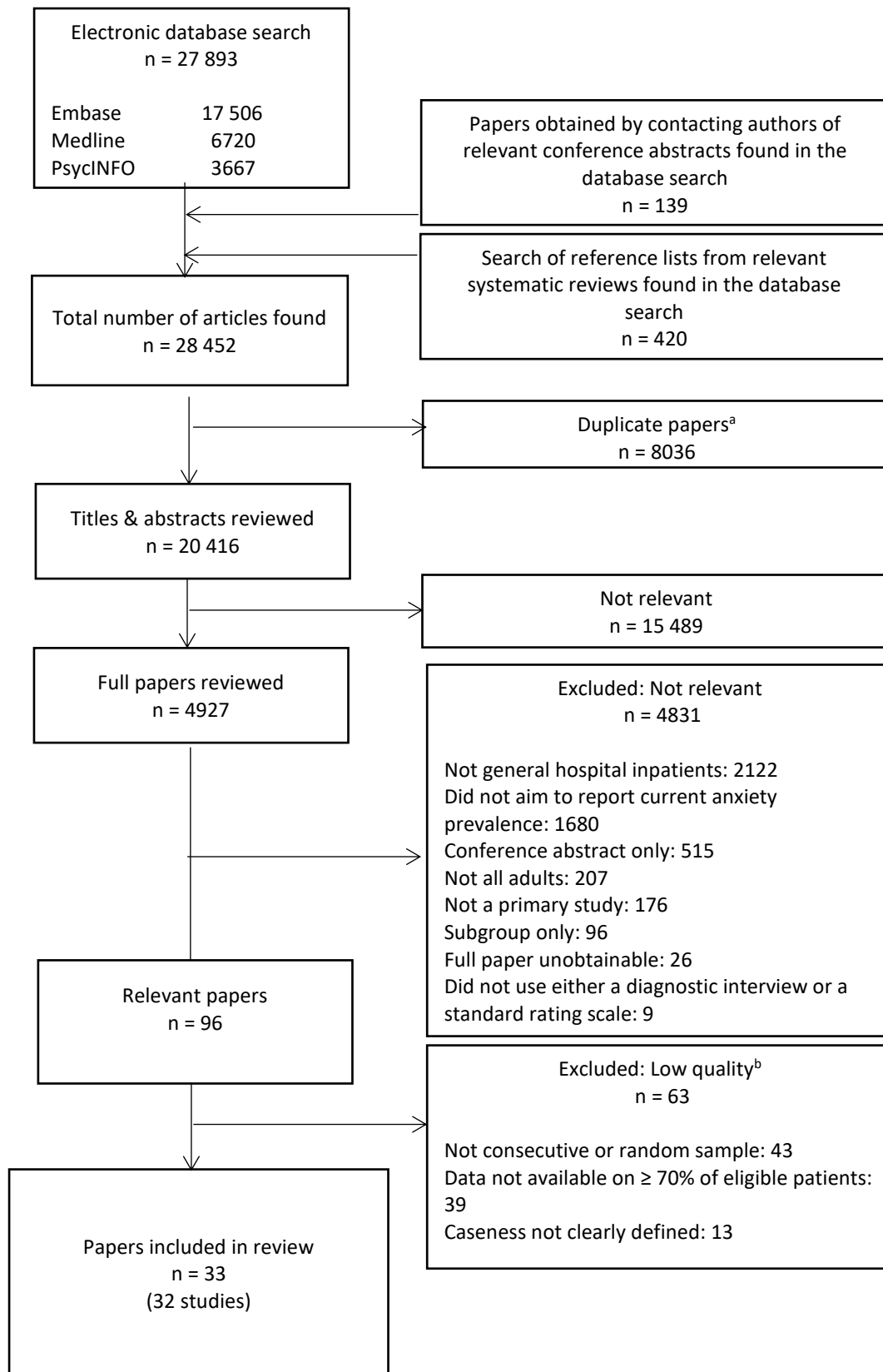
Dyster-Aas 2008 (Sweden)	Burns	Aged ≥ 18 ; $\geq 5\%$ burns or hospitalized for > 1 day; Swedish speaker; no documented cognitive impairment.	73	Mean 43.4, SD 15.6	27.4*	Structured Clinical Interview for DSM-IV (psychiatrist or trained interviewer)	DSM-IV	No	Not reported	29 ^e	3	-
Feldman 1987 (UK)	General medicine	Aged ≥ 18 ; hospitalized for ≥ 24 hours; not admitted due to suicide attempt; well enough to participate.	382	Not reported	Not reported	Stage 1: General Health Questionnaire 30 (cut-off ≥ 5) & 2 additional questions Stage 2: Present State Examination (not stated)	CATEGO ^f	Unclear	Not reported	7 ^{g*}	-	-
Fritzsche 2001 (Germany)	Dermatology	Aged ≥ 16 ; hospitalized for ≥ 48 hours; cognitively & physically able to participate; adequate German.	77	Mean 51.6, SD 17.96 ^h	59	Structured Diagnostic Interview for Mental Illness (research assistant)	ICD-10	Unclear	Not reported	3 ^c	-	-
Jenkins 1994 (UK)	General surgery	Aged 16-80; elective or emergency admission; pre-surgery; well enough to participate; able to read & speak English.	197	Not reported	Not reported	Stage 1: General Health Questionnaire (cut-off ≥ 12) Stage 2: Semi-structured Interview (psychiatrist) ^b	DSM-III	No	Within 24 hours	16 ⁱ	0*	2*
Kathol 1992 (USA)	Medicine & medical subspecialties	Likely to stay in hospital ≥ 3 days; no obvious memory difficulties; not requiring intensive care unit treatment; able to speak English.	128	Mean 56	21*	Stage 1: Hamilton Anxiety Scale & Hamilton Depression Rating Scale	DSM-III	No	Within 24 hours	4 ^j	2*	2*

						(cut-off ≥ 6 on either) Stage 2: Structured Diagnostic Assessment Questionnaire (trained interviewer)						
Kayhan 2013 (Turkey)	General & subspecialty medicine & surgery	Aged ≥ 18 ; hospitalized for ≥ 2 days; well enough to participate; no mental retardation, psychotic disorder or delirium; not in perinatal period.	603	Mean 51.07, SD 15.72	49.6	Structured Clinical Interview for DSM-IV (psychiatrist)	DSM-IV	No	Not reported	24 ^e	3	8
Keller 2004 (Germany)	Surgical oncology	Aged ≥ 18 ; physically and mentally able to participate.	78	≤ 30 : 1.3% 31-50: 26.9% 51-70: 61.5% > 70: 10.3%	38.5	Structured Clinical Interview for DSM-IV (clinical psychologist)	DSM-IV	No	Not reported	3 ^e	-	-
Kigamwa 1991 (Kenya)	Medicine	Well enough to participate; not admitted after taking an overdose; fluent in English or Kiswahili.	200	Not reported	Not reported	Stage 1: Self Reporting Questionnaire (cut-off > 8) Stage 2: Standardized Psychiatric Interview (not stated)	ICD-9	Unclear	Not reported	4 ^k	-	-
Köroğlu 2010 (Turkey)	Internal medicine	Aged 18-75; no delirium; not suffering from terminal-stage cancer.	110	Mean 47.2, SD 15.0	53.6	Structured Clinical Interview for DSM-IV (not stated)	DSM-IV	No	Not reported	9 ^{l*}	1 [*]	3 [*]

Lykouras 1996 (Greece)	Neurology	Able to communicate & read.	107	Mean 43.7, Range 16-78	53.3*	Structured Clinical Interview for DSM-III-R (psychiatrist)	DSM-III-R	Unclear	Third, fourth or fifth day ^m	-	-	14*
Madianos 2001 (Greece)	Burns	Able to communicate well enough for interview.	45	Male: Mean 40.1, SD 13.5 Female: Mean 52.6, SD 20.9	44.4*	Structured Clinical Interview for DSM-III-R (psychiatrist)	DSM-III-R	Unclear	During third week	-	-	2
Marchesi 2004 (Italy)	Emergency medicine & medicine	Aged 18-65; mentally & physically able to participate; Italian speaker.	719	Emergency medicine: Mean 39.7, SD 13.7 Medicine: Mean 49.1, SD 12.8	Emergency medicine : 53.4 Medicine : 47.9	Stage 1: General Health Questionnaire-30 (cut-off > 4) Stage 2: Mini International Neuropsychiatric Interview (psychiatrist)	DSM-IV	Unclear	Not reported	17 ^{n*}	5*	9*
Palmu 2010, 2011 (Finland)	Burns	Aged ≥ 18; Finnish speaker; no cognitive or communication problems.	107	Mean 45.4, SD 16.4	29.9	Structured Clinical Interview for DSM-IV-TR (psychiatrist)	DSM-IV-TR	No	Not reported	16 ^e	6	0
Prieto 2002 (Spain)	Stem cell transplant	Aged ≥ 16; hospitalized for first stem cell transplant.	220	Mean 38.4, Range 16-65	41.4*	Structured psychiatric interview (psychiatrist)	DSM-IV	No	Within 48 hours	3 ^e	0	2
Silverstone 1996 (UK)	Medicine	Emergency admission; hospitalized for ≥ 7 days; able to communicate well enough for interview; MMSE score ≥ 22.	313	DSM-IV diagnosis: Mean 65.4, SE 1.6 No DSM-IV diagnosis: Mean 71.9, SE 0.9	49.2*	Schedule for Clinical Assessment in Neuropsychiatry (not stated)	DSM-IV	No	Seventh day	7 ^o	2*	3*

^a Anxiety states & Phobic state; ^b Different prevalence estimates were obtained using computer-generated diagnoses; ^c Anxiety disorders; ^d Anxiety diagnostic syndrome; ^e Any anxiety disorder; ^f Modified rules were used to include all symptoms rather than excluding those considered to be understandable; ^g Anxiety diagnosis; ^h Demographic data for 86 participants (only 77 completed anxiety assessment); ⁱ Panic disorder, Generalized anxiety disorder & Current anxiety; ^j Panic disorder & Generalized anxiety disorder; ^k Anxiety states; ^l Panic disorder, Generalized anxiety disorder & Anxiety disorder not otherwise specified; ^m GHQ-28 completed two to three days after admission and Structured Clinical Interview completed within two days of GHQ-28; ⁿ Panic disorder, Generalized anxiety disorder, Mixed anxiety-depressive disorder & Other anxiety disorders; ^o Panic disorder, Generalized anxiety disorder & Anxiety disorder due to medical disorder. AGE CAT = Automated Geriatric Examination for Computer Assisted Taxonomy, DSM = Diagnostic and Statistical Manual of Mental Disorders, GAD = Generalized anxiety disorder, ICD = International Classification of Diseases, MMSE = Mini-Mental State Examination, SD = Standard Deviation, SE = Standard Error. * Calculated using data from paper.

Figure 1: The prevalence of anxiety in general hospital inpatients: systematic review flowchart



^a Duplicates of the same paper due to searching multiple databases and reference lists.

^b Papers could be excluded for one or more quality reason.

Figure 2: Prevalence of clinically significant anxiety symptoms in general hospital inpatients

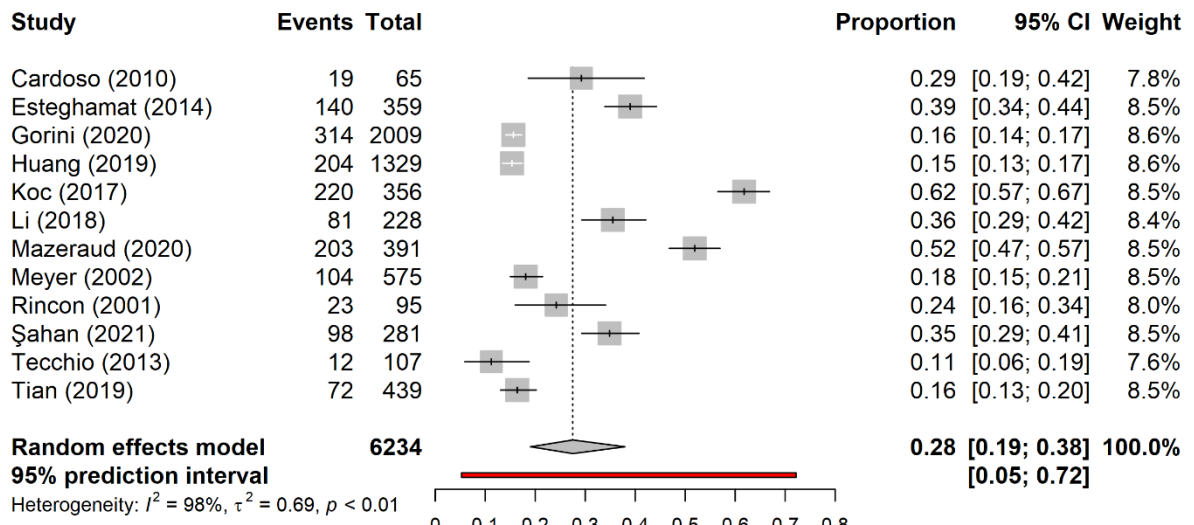


Figure 3: Prevalence of any anxiety disorder in general hospital inpatients

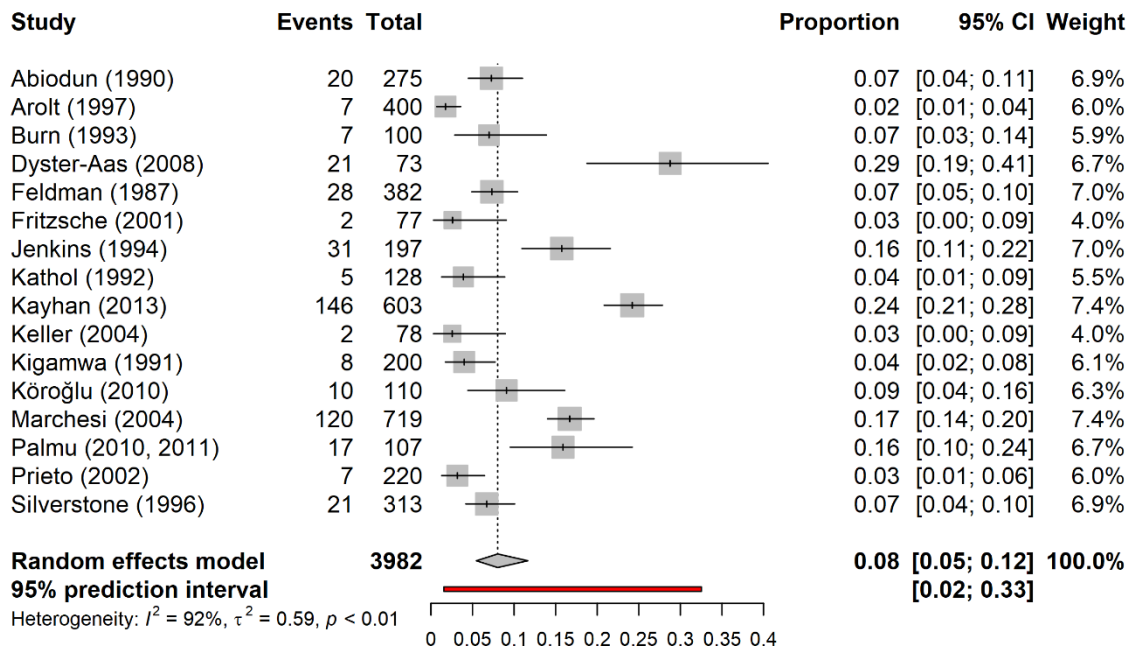


Figure 4: Prevalence of panic disorder in general hospital inpatients

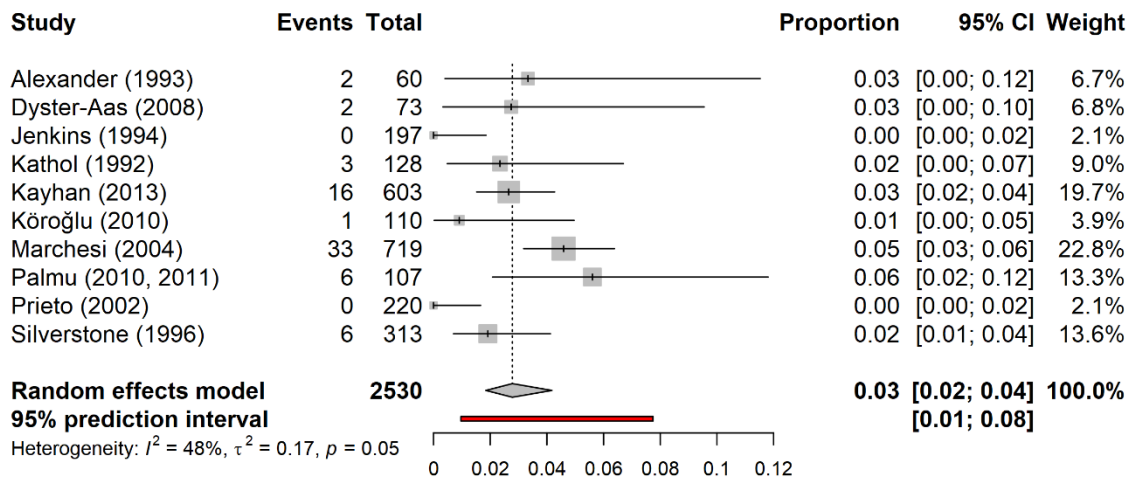


Figure 5: Prevalence of generalized anxiety disorder in general hospital inpatients

