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**SYSTEMATIC REVIEWS**

# Health status and risk for depression among the elderly: a meta-analysis of published literature

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## Abstract

**Objective:** the goal of this study was to determine the relationship between health status, including self-rated health status and chronic disease, and risk for depression among the elderly.
**Method:** MEDLINE, EMBASE and The Cochrane Library Database were used to identify potential studies. The studies were classified into cross-sectional and longitudinal subsets. For each study, the numbers of the total participants, cases (for cross-sectional study) or incident cases (for longitudinal study) of depression in each health status group were extracted and entered into Review Manager 4.2. The quantitative meta-analysis of cross-sectional studies and that of longitudinal studies were performed, respectively. For prevalence and incidence rates of depression, odds risk and relative risk (RR) were calculated, respectively.
**Results:** the quantitative meta-analysis showed that, compared with the elderly without chronic disease, those with chronic disease had higher risk for depression (RR: 1.53, 95% confidence intervals (CI): 1.20–1.97). Compared with the elderly with good self-rated health, those with poor self-rated health had higher risk for depression (RR: 2.40, 95% CI: 1.94–2.97).
**Conclusions:** despite the methodological limitations of this meta-analysis, both poor self-rated health status and the presence of chronic disease are risk factors for depression among the elderly. In the elderly, poor self-reported health status appears to be more strongly associated with depression than the presence of chronic disease.

**Keywords:** *health status, depression, risk, meta-analysis, elderly*

## Introduction

Depression is a major contributor to healthcare costs associated with older populations, and is projected to be the leading cause of disease burden in older populations by the year 2020 [1, 2]. The prevalence of depression in patients aged ≥65 years may be as high as 40% in hospitalised and nursing home patients, and 8–15% in community settings [3]. The prognosis of these depressive states is poor. A meta-analysis of outcomes at 24 months estimated that only 33% of subjects were well, 33% were depressed and 21% had died [4]. Moreover, studies of depressed adults indicated that those with depressive symptoms, with or without depressive disorder, had poorer functioning, comparable to or worse than that of people with chronic medical conditions such as heart and lung disease, arthritis, hypertension and diabetes [5–7]. In addition to poor functioning, depression increased the perception of poor health, the utilisation of medical services and healthcare costs [7–9].

Poor health status, including poor self-rated health status and the presence of chronic disease, is commonly viewed as a risk factor for depression among the elderly. Some previous studies showed that individuals with chronic disease had higher risk for depression than those without, and that individuals with poor self-rated health had higher risk for depression than those with good self-rated health [10, 11]. However, some studies conducted the conclusion that health status was not associated with depression in the elderly [13, 14]. Moreover, a recent systematic review and meta-analysis showed that the odds ratio (OR) of poor health status as a function of increased depression was non-significant (OR = 1.8, 95% confidence intervals (95% CI) = 0.5–12.8)

Table 1. Characteristics of 16 cross-sectional studies, which compared the prevalence of depression between different health status groups, included in the meta-analysis

| Study | Country | Participants (*N*) | From population | Age (years) | Gender (male %) | Criteria for depression | Exclusion criteria | Cases of depression |
|---|---|---|---|---|---|---|---|---|
| Al-Shammari 1999 [20] | Saudi Arabia | 7,970 | Community | >60 | 62 | 30-GDS ≥20 | – | 670 |
| Blay 2007 [11] | Brazil | 6,961 | Community | >60 | 34 | The Short Psychiatric Evaluation Schedule (six-item version)≥20 | – | 2,722 |
| Brody 2001 [21] | USA | 151 | Community | ≥60 | 32.4 | SCID-IV | – | 49 |
| Carvalhais 2008 [22] | Brazil | 1,499 | Community | ≥60 | 38.8 | GHQ-12≥4 | – | 578 |
| Chen 2005 [23] | China | 1,600 | Community | ≥60 | 47.1 | GMS-AGECAT | – | 95 |
| Chi 2005 [24] | China | 917 | Community | ≥60 | 47.5 | 15-GDS ≥8 | Cognitive impairment | 113 |
| Chong 2001 [25] | China | 1,500 | Community | ≥65 | 53.4 | GMS-AGECAT | – | 287 |
| Chow 2004 [26] | China | 245 | Nursing home | ≥65 | 37.1 | 15-GDS ≥8 | Cognitive impairment | 71 |
| Diem 2007 [27] | USA | 4,177 | Community | ≥69 | 0 | 15-GDS ≥6 | Taking antidepressant | 200 |
| Friedman 2007 [28] | USA | 926 | Primary care | ≥65 | 25.7 | MINI, major depressive | Cognitive impairment | 119 |
| Lindesay 1990 [29] | UK | 890 | Community | ≥65 | 40.1 | CATEGO/IDor ≥8 | – | 120 |
| McDougall 2007 [30] | UK | 2,640 | Community settings and not | ≥65 | 35.6 | GMS-AGECAT | – | 346 |
| Pitkala 2003 [31] | Finland | 650 | Community | 75, 80, 85 | 29.7 | Zung score >45 points | – | 98 |
| Sonnenberg 2000 [32] | Netherlands | 3,056 | Community | 55–85 | 48.4 | CES-D Scale score≥16 | – | 455 |
| Stek 2004 [33] | Netherlands | 599 | Community | ≥65 | 37 | 15-GDS>5 | – | 77 |
| Wang 1999 [34] | Chinese | 1,421 | Community | ≥65 | 44.2 | GDS-S score≥8 | Dementia, chronic psychosis | 191 |

CES-D Scale: Center for Epidemiologic Studies Depression Scale; GMS-AGECAT: Geriatric Mental State Schedule Automated Geriatric Examination for Computer-Assisted Taxonomy; GDS: Geriatric Depression Scale; GHQ-12: General Health Questionnaire [46] in its 12-item version; MINI: Mini International Neuropsychiatric Interview; SCID-IV: Structured Clinical Interview for DSM-IV.

[15]. Therefore, it is still unclear whether poor health status is a risk factor for depression in the elderly or not.

Depression is a critically important issue for the elderly and those working with the elderly. As the population of elderly persons increases, the number of elderly depressive individuals is expected to rise [16, 17]. Therefore, it is important to investigate the risk for depression in the elderly. Although poor health status is generally viewed as risk for depression in the elderly, it has not been confirmed. So we decided to conduct a meta-analysis in order to measure the magnitude of the association between health status and risk for depression in the elderly.

## Methods

### Search method

This was one part of a best-evidence research on depression in the elderly. In the research, we collected literature through searching MEDLINE (from the beginning of 1966), EMBASE (from the beginning of 1980) and The Cochrane Library (1990 to August 2007). The search terms (provided by Cochrane Center) included depression, elderly patients (≥55 years) and clinical trials. Four researchers selected literature which involved clinical trials, depression (diagnostic criteria in formal depression scale) and elderly patients (≥55 years). The literatures, which were not clinical trials, unrelated with depression, or not including elderly patients, were rejected. The literature selection included three stages: (i) review the title and then reject the articles and retain those which would be potentially included; (ii) review the title and abstract of the articles that were retained in the first stage, then reject the articles and retain those which would be potentially included; (iii) read the full text of the articles that were retained in the second stage, then reject the literature and retain those which would be included. Finally, 6,420 articles were retained in the third stage and were classified into four subgroups according to the objective of the research programme: aetiology or epidemiology related, diagnostics related, therapeutics related and prognosis related. The search terms, search results and classification of literature were reported previously [18, 19]. The selection and classification of literature were performed by the four researchers, and each article was independently selected and classified by two researchers; discrepancies were addressed through discussion. In this meta-analysis, we measured the magnitude and shape of the association between health status and depression in the elderly, so only the aetiology- or epidemiology-related subgroup might be potentially included. The inclusion criteria and exclusion criteria were listed as follows.

**Table 2**. Characteristics of 12 prospective longitudinal studies, which compared incidence of depression between different health status groups, included in the meta-analysis

| Study | Number of subjects at | | Age (years) | Gender (male %) | Criteria for depression | Exclusion criteria at baseline | Length of follow-up (months) | Cases of incident depression *N* (%) | Country |
|---|---|---|---|---|---|---|---|---|---|
| | Base | Follow-up | | | | | | | |
| de Beurs 2001 [14] | 1,642 | 1,642 | 55–89 | 49.9 | CES-D Scale score >16 | Depression, MMSE score<16 | 36 | 73 (4.45) | Netherlands |
| Forsell 2000 [35] | 1,777 | 903 | ≥75 | 23 | DSM-IV criteria | Depression, anxiety, psychosis | 36 | 29 (3.2%) | Sweden |
| Geerlings 2000 [36] | 325 | 234 | 55–85 | 48 | CES-D Scale score>16 plus five points >5 | Depression | 36 | 40 (14.1) | Netherlands |
| Giltay 2006 [37] | – | 229 | 64–84 | 100 | Zung SDS≥50 | Depression | 60 | 75 (32.7%) | Netherlands |
| Harris 2006 [38] | – | 945 | ≥65 | 41 | GDS≥5 | GDS≥5 dementia | 24 | 79 (8.4%) | UK |
| Kennedy 1990 [39] | – | 1,243 | ≥65 | 46 | CES-D Scale score>16 plus five points above baseline | CES-D Scale score>16 | 24 | 163 (13.1%) | USA |
| Livingston 2000 [40] | 141 | 79 | 65–95 | 23 | Short CARE (clinical depression criteria) | Limitations in activities of daily living, depression, dementia | 36 | 19 (24.1%) | UK |
| Meller 1997 [41] | 358 | 263 | ≥85 | | AGECAT (HAMD) | – | 12 | 45 (17.1%) | Germany |
| Robert 2000 [42] | 2,164 | 2,147 | 50–95 | 23 | DSM-IV | Depression | 60 | 215 (4.2%) | USA |
| Schoevers 2000 [43] | 3,747 | 1,940 | 65–84 | 38 | AGECAT criteria (level 3.5) | Depression | 36 | 309 (14.1%) | Netherlands |
| Stek 2006 [44] | 334 | 141 | ≥85 | 37 | 15- GDS>4 | Cognitive impairment | 46 | 56 (39.7%) | Netherlands |
| Steunenberg 2006 [12] | – | 1,511 | 55–85 | 50 | CES-D Scale score>16 | Depression, MMSE score<16 | 72 | 255 | Netherlands |

CES-D Scale: Center for Epidemiologic Studies Depression Scale; DSM: Diagnostic and Statistical Manual of Mental Disorders; Short CARE: shortened Comprehensive Assessment and Referral Evaluation; GDS: Geriatric Depression Scale; AGECAT: Automatic Geriatric Examination for Computer-Assisted Taxonomy; MMSE: Mini-Mental State Examination; SDS: Self-rating Depression Scale; HAMD: hamilton depression scale.

## Inclusion criteria

(i) Cross-sectional and longitudinal studies where all participants were ≥55 years (the age at the end of follow-up for longitudinal study); (ii) original research reported in English; (iii) with the complete information on the prevalence or incidence of depression in different health status groups; (iv) and use of an acceptable definition of depression. We accepted the diagnostic category of depression as applied by the authors of each study, which included the following: (i) the presence of depressive disorder, depressive symptoms or 'psychological distress', as defined by scores above a cut point for abnormality on a standard mood scale; (ii) severity of depressive disorder, depressive symptoms or psychological distress, as defined by scores on a standard mood scale; and (iii) the presence of major depression or minor depression (or dysthymia) according to Diagnostic and Statistical Manual of Mental Disorders (DSM)-IIIR, DSM-IV or other standard psychiatric diagnostic criteria.

## Exclusion criteria

Studies were excluded if they had any of the following: limited to specific patient characteristics, such as convenience sampling; retrospective recruitment; or if there was only unstructured assessment of mood.

## Data extraction and checking

For the longitudinal study, information about the country of study, group size at baseline and follow-up, age, proportion of men relative to women, depression criteria, exclusion criteria at baseline, length of follow-up and number of incident cases of depression in each group was abstracted from each report. For the cross-sectional study, information about the country of study, group size, age, proportion of men relative to women, depression criteria, exclusion criteria and number of cases of depression in each group was abstracted from each report. Every paper included in the meta-analysis was

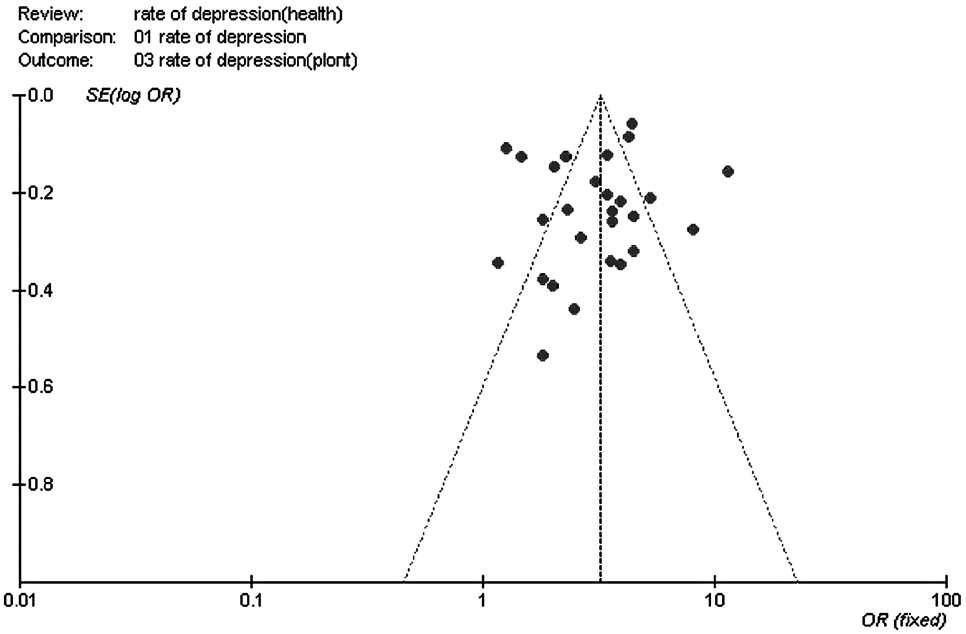


**Figure 1**. Funnel plot of the 28 studies included in the meta-analysis.

read and the data were independently extracted and cross-checked by two authors; discrepancies were addressed through discussion.

### Statistical analysis

Data were entered into the RevMan 4.2 meta-analysis programme (Cochrane Collaboration, Oxford, UK; see http://www.cc-ims.net/RevMan/current.htm). The meta-analysis of cross-sectional studies has the advantage of huge sample size and easily shows the association between health status and prevalence of depression, and the meta-analysis of longitudinal studies has the advantage of easily conducting a causality conclusion. We conducted the meta-analysis of cross-sectional and that of longitudinal studies, respectively. In the meta-analysis of cross-sectional studies, for prevalence rates of depression, odds risk (OR) and 95% confidence intervals (95% CI) were calculated. Results have been summarised using conventional Forest plots and ORs, stratified by features of the studies included. In the meta-analysis of longitudinal studies, for incidence rates of depression, relative risk (RRs) and 95% CIs were calculated. Results have been summarised using conventional Forest plots and RRs, stratified by features of the studies included. Summary ORs and RRs were estimated using a random effects model.

## Results

### The search

Our search found 1,027 potential aetiology- or epidemiology-related literature. Nine hundred thirty-two of the 1,027 articles were rejected as obviously unsuitable studies (unrelated with health status) and 95 were retained. Sixty-seven of these 95 articles were rejected for a variety of reasons, including (i) no usable data and (ii) no recognised instrument used for diagnosis. Twenty-eight studies were retained and included in the review [11, 12, 14, 20–44].

### Included studies

Characteristics of the 28 studies (including 12 longitudinal [12, 14, 35–44] and 16 cross-sectional studies [11, 20–34] available for meta-analysis) are summarised in Tables 1 and 2.

### Data synthesis

We assessed publication bias using the funnel plot (Figure 1). The funnel plot of ORs (under a fixed effects model) was from the 28 studies in Tables 1 and 2. In the absence of publication bias, the points should be symmetrical about the vertical line at the pooled ORs. The reasonably symmetrical points suggested the absence of publication bias.

Eleven of the included studies compared the prevalence of depression in the elderly between individuals with poor and good self-rated health [11, 20–24, 26–29, 33]. In the 11 studies, there were 16,552 and 8,630 individuals with good and poor self-rated health, respectively. There were 1,506 and 3,247 cases of depression in groups with good and poor self-rated health, respectively. After pooling these 11 studies, individuals with poor self-rated health had higher prevalence of depression than those with good self-rated health (OR: 4.08, 95% CI: 3.25–5.12; Figure 2). Ten of the included studies compared the prevalence of depression between individuals with and without chronic disease [11, 20, 22, 25, 28–32, 34]. There were 15,321 and 9,090 individuals in groups with and without chronic disease, respectively. There were 4,535 and 1,358 cases of depression in groups with and without chronic disease, respectively. After pooling these 10 studies, individuals with chronic disease

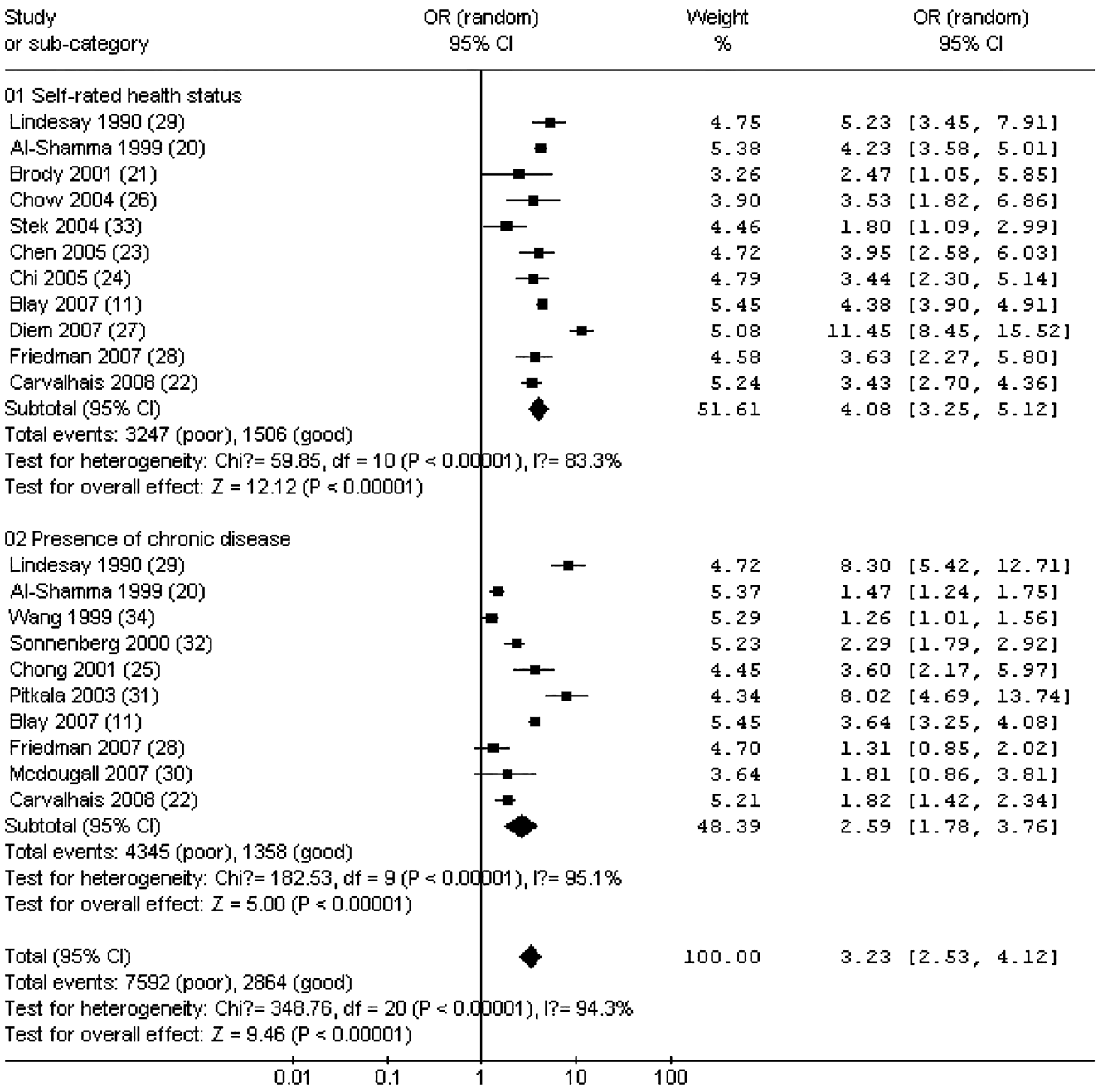


**Figure 2**. A Forest plot of odds risk (OR) from the 16 studies, which compared the prevalence of depression between different health status groups, included in the meta-analysis.

had higher prevalence of depression than those without chronic disease (OR: 2.59, 95% CI: 1.78–3.76; Figure 2).

Six of the included studies compared the incidence of depression between individuals with poor and good self-rated health [35, 37–41]. After pooling these six studies, individuals with poor self-rated health had higher incidence of depression than those with good self-rated health (RR: 2.40, 95% CI: 1.94–2.97; Figure 3). Eight of the included studies compared the incidence of depression between individuals with and without chronic disease [12, 14, 35, 36, 38, 42–44]. After pooling these eight studies, individuals with chronic disease had higher incidence of depression than those without chronic disease (RR: 1.53, 95% CI: 1.20–1.97; Figure 3).

## Discussion

We conducted the meta-analysis of cross-sectional studies and that of prospective longitudinal studies, respectively. The results were clear: both the presence of chronic disease and poor self-rated health status were risk factors for increased depression among the elderly, and poor self-reported health seemed more closely associated with de-

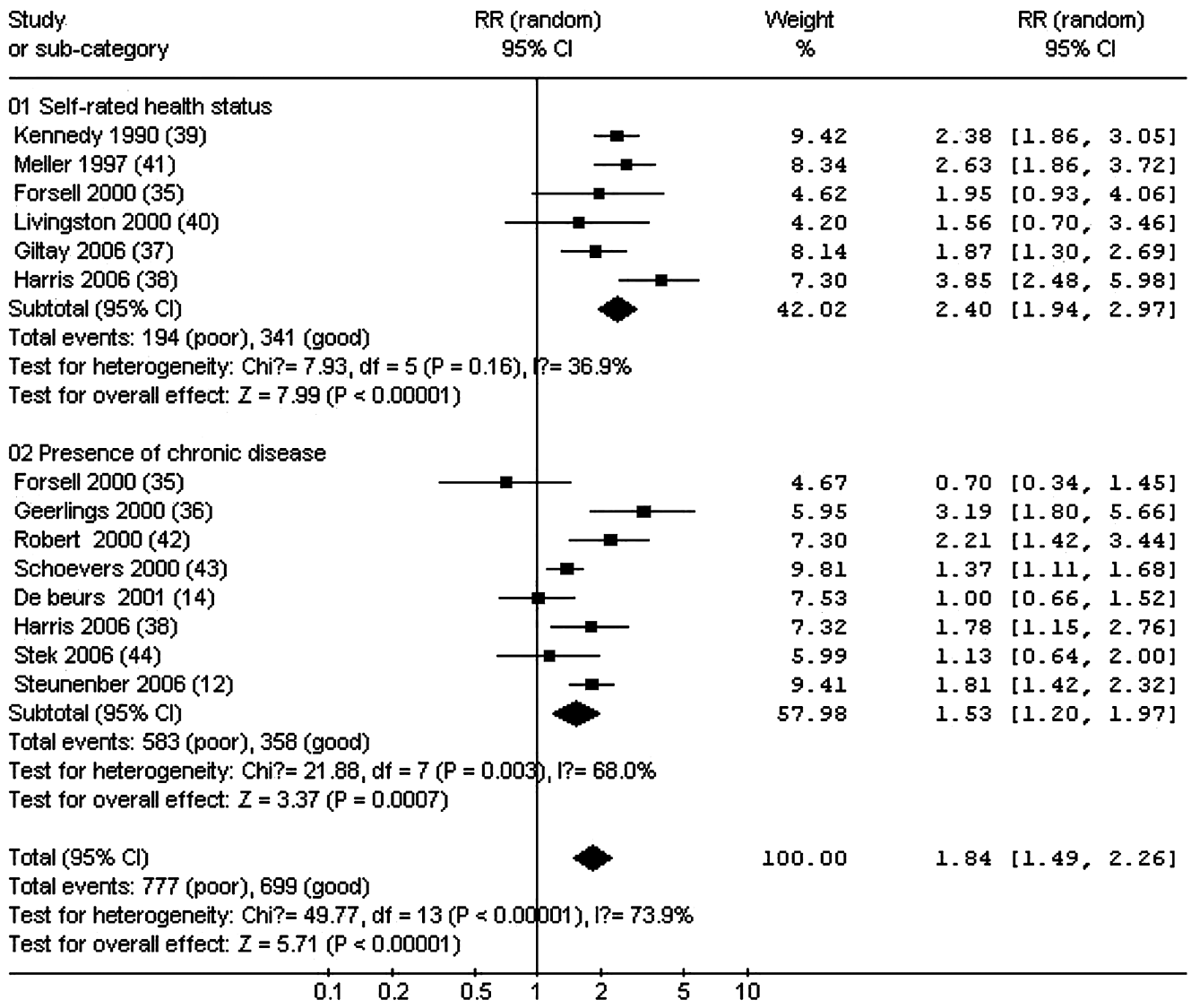


**Figure 3**. A Forest plot of relative risk (RR) from the 12 prospective longitudinal studies, which compared incidence of depression between different health status groups, included in the meta-analysis.

pression than the presence of chronic disease. This was a robust finding about relationship between health status and risk for depression among the elderly.

It is generally viewed that depressive symptoms and the presence of chronic disease are highly significantly correlated both in younger adults and in the elderly. Inferring causality in the relation between depression and presence of chronic diseases has been performed by many previous studies. Some studies found that depression was a risk factor for the development of chronic diseases; on the other hand, some studies found that the presence of chronic disease was an independent risk factor for increased depression. In the present study, we concluded that, in the elderly, there were significant relationships between depression and the presence of chronic disease from the meta-analysis of cross-sectional studies, and the meta-analysis of longitudinal studies showed that the presence of chronic disease was a risk factor for development of depression.

Poor self-rated health is more often viewed as a concomitant phenomenon of depression rather than an independent risk factor for increased depression. In the present study, the meta-analysis included cross-sectional studies showing the significant relationship between depression and poor self-rated health. Meanwhile, from the meta-analysis of longitudinal studies, we could conclude that, in the elderly, poor self-rated health was an important risk factor for development of depression. In the present study, poor self-rated health appeared to have a higher OR and RR than the presence of chronic disease; this might indicate that, for risk of depression, poor self-rated health status seemed more significant than the presence of chronic disease.

There has been a systematic review and meta-analysis focused on risk factors for depression among elderly community subjects. It was published 6 years ago and only included longitudinal studies. In the systematic review and meta-analysis, there were so few studies available (two stu-

dies compared subjects with and without chronic disease and no study compared subjects with poor and good self-rated health) for quantitative meta-analysis that a definite conclusion on the relationship between health status and risk for depression among elderly community subjects could not be conducted. Since there were relevant studies pulished among the recent years and cross-sectional studies were also included in our meta-analysis, our meta-analysis conducted a definite conclusion on the relationship between health status and risk for depression among the elderly.

Although we attempted to adhere to the guidelines for reporting meta-analyses of observational studies [45], this review did have some limitations. First, we did not hand search journals and made no attempt to identify unpublished studies, raising the possibility that some studies have been missed. Second, despite our extensive literature search, we only included MEDLINE, EMBASE and The Cochrane Library in our search, and other databases such as CINAHL and PsycINFO were not included. Moreover, the search was limited to articles published in English. Finally, there was heterogeneity among the included studies, which perhaps related to different definitions of depression in different studies and small study groups in some studies. Therefore, the random effects model, which had less precision than the fixed effects model, was used in the review. Consequently, the results of the meta-analysis for these risk factors must be interpreted cautiously.

## Key points

- Both poor self-rated health status and the presence of chronic disease are risk factors for depression among the elderly.

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## Conflicts of interest

There is no conflict of interest to declare.

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