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▶ **To cite this version:**

Marianna Virtanen, Solja T Nyberg, G David Batty, Markus Jokela, Katriina Heikkilä, et al.. Perceived job insecurity as a risk factor for incident coronary heart disease: systematic review and meta-analysis.. BMJ / BMJ (CLINICAL RESEARCH ED); Br Med J; British Medical Journal; Brit Med J, 2012, 347, pp.f4746. 10.1136/bmj.f4746 . inserm-01154089

**HAL Id: inserm-01154089**

**https://inserm.hal.science/inserm-01154089**

Submitted on 21 May 2015

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*BMJ* 2013;347:f4746 doi: 10.1136/bmj.f4746 (Published 8 August 2013)


RESEARCH

# Perceived job insecurity as a risk factor for incident coronary heart disease: systematic review and meta-analysis

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Marianna Virtanen *professor*[1], Solja T Nyberg *statistician*[1], G David Batty *reader in epidemiology*[2 3], Markus Jokela *senior research fellow*[4], Katriina Heikkilä *specialist researcher*[1], Eleonor I Fransson *senior lecturer*[5 6 7], Lars Alfredsson *professor of epidemiology*[6 8], Jakob B Bjorner *professor*[9], Marianne Borritz *researcher*[10], Hermann Burr *scientist*[11], Annalisa Casini *postdoctoral researcher*[12], Els Clays *assistant professor*[13], Dirk De Bacquer *professor*[13], Nico Dragano *professor*[14], Marko Elovainio *professor*[15], Raimund Erbel *professor of medicine*[16], Jane E Ferrie *senior research fellow*[2 17], Mark Hamer *principal research associate*[2], Karl-Heinz Jöckel *professor*[18], France Kittel *professor of health psychology and research methodology*[12], Anders Knutsson *professor of public health*[19], Markku Koskenvuo *professor of epidemiology*[20], Aki Koskinen *statistician*[1], Thorsten Lunau *researcher*[14], Ida E H Madsen *researcher*[9], Martin L Nielsen *senior registrar*[10], Maria Nordin *lecturer in sociology*[21], Tuula Oksanen *assistant chief medical officer*[1], Krista Pahkin *team leader*[2], Jan H Pejtersen *senior researcher*[22], Jaana Pentti *statistician*[1], Reiner Rugulies *professor of psychosocial work environment research*[9 23], Paula Salo *professor*[1 24], Martin J Shipley *statistician*[2], Johannes Siegrist *professor*[14], Andrew Steptoe *British Heart Foundation professor of psychology*[2], Sakari B Suominen *professor*[25 26 27], Töres Theorell *professor emeritus*[7], Salla Toppinen-Tanner *team leader*[1], Ari Väänänen *adjunct professor*[1], Jussi Vahtera *professor of public health*[1 26 28], Peter J M Westerholm *professor emeritus*[29], Hugo Westerlund *professor of epidemiology*[7], Natalie Slopen *postdoctoral fellow*[30 31], Ichiro Kawachi *professor of social epidemiology*[30], Archana Singh-Manoux *research director*[2 32], Mika Kivimäki *professor of social epidemiology*[1 2 4], For the IPD-Work Consortium

[1]Finnish Institute of Occupational Health, FI-00250 Helsinki, Finland; [2]Department of Epidemiology and Public Health, University College London, London, UK; [3]Centre for Cognitive Ageing and Cognitive Epidemiology, University of Edinburgh, Edinburgh, UK; [4]Institute of Behavioral Sciences, University of Helsinki, Helsinki, Finland; [5]School of Health Sciences, Jönköping University, Jönköping, Sweden; [6]Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden; [7]Stress Research Institute, Stockholm University, Stockholm, Sweden; [8]Centre for Occupational and Environmental Medicine, Stockholm County Council, Stockholm, Sweden; [9]National Research Centre for the Working Environment, Copenhagen, Denmark; [10]Department of Occupational and Environmental Medicine, Bispebjerg University Hospital, Copenhagen, Denmark; [11]Federal Institute for Occupational Safety and Health (BAuA), Berlin, Germany; [12]School of Public Health, Université Libre de Bruxelles, Brussels, Belgium; [13]Department of Public Health, Ghent University, Ghent, Belgium; [14]Institute for Medical Sociology, Medical Faculty, University of Düsseldorf, Düsseldorf, Germany; [15]National Institute for Health and Welfare, Helsinki, Finland; [16]Department of Cardiology, West-German Heart Center Essen, University Duisburg-Essen, Essen, Germany; [17]School of Community and Social Medicine, University of Bristol, Bristol, UK; [18]Institute for Medical Informatics, Biometry, and Epidemiology, University Duisburg-Essen, Germany; [19]Department of Health Sciences, Mid Sweden University, Sundsvall, Sweden; [20]Department of Public Health, University of Helsinki, Finland; [21]Department of Psychology, Umeå University, Umeå, Sweden; [22]Danish National Centre for Social Research, Copenhagen, Denmark; [23]Department of Public Health and Department of Psychology, University of Copenhagen, Copenhagen, Denmark; [24]Department of Psychology, University of Turku, Turku, Finland; [25]Folkhälsan Research Center, Helsinki, Finland; [26]Department of Public Health, University of Turku, Finland; [27]Nordic School of Public Health, Gothenburg, Sweden; [28]Turku University Hospital, Turku, Finland; [29]Occupational and Environmental Medicine, Uppsala University, Uppsala, Sweden; [30]Department of Society, Human Development and Health, Harvard School of Public Health, Boston, MA, USA; [31]Center for the Developing Child, Harvard University, Cambridge, MA, USA; [32]Inserm U1018, Centre for Research in Epidemiology and Population Health, Villejuif, France

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## Abstract

**Objective** To determine the association between self reported job insecurity and incident coronary heart disease.

**Design** A meta-analysis combining individual level data from a collaborative consortium and published studies identified by a systematic review.

**Data sources** We obtained individual level data from 13 cohort studies participating in the Individual-Participant-Data Meta-analysis in Working Populations Consortium. Four published prospective cohort studies were identified by searches of Medline (to August 2012) and Embase databases (to October 2012), supplemented by manual searches.

**Review methods** Prospective cohort studies that reported risk estimates for clinically verified incident coronary heart disease by the level of self reported job insecurity. Two independent reviewers extracted published data. Summary estimates of association were obtained using random effects models.

**Results** The literature search yielded four cohort studies. Together with 13 cohort studies with individual participant data, the meta-analysis comprised up to 174 438 participants with a mean follow-up of 9.7 years and 1892 incident cases of coronary heart disease. Age adjusted relative risk of high versus low job insecurity was 1.32 (95% confidence interval 1.09 to 1.59). The relative risk of job insecurity adjusted for sociodemographic and risk factors was 1.19 (1.00 to 1.42). There was no evidence of significant differences in this association by sex, age (<50 *v* ≥50 years), national unemployment rate, welfare regime, or job insecurity measure.

**Conclusions** The modest association between perceived job insecurity and incident coronary heart disease is partly attributable to poorer socioeconomic circumstances and less favourable risk factor profiles among people with job insecurity.

## Introduction

Intensified global economic competition is characterised by labour market deregulation, workplace downsizing, restructuring of companies in all sectors, and increased use of flexible forms of employment. These changes have modified patterns of employment such that jobs are becoming increasingly unstable and insecure.[1-3] Recent global financial crises have resulted in job insecurity becoming commonplace[4 5] and for many, a chronic stressor.[6]

Evidence for an association between job insecurity and health is accumulating, although much of the research is limited to cross sectional studies and self reported outcomes, such as psychological distress, physical symptoms, and poor self rated health.[7-10] Coronary heart disease (CHD) remains a major public health issue. Psychosocial factors, such as work stress, have been implicated in its aetiology for decades,[11-14] but surprisingly few published studies examined the relation between job insecurity and CHD.[15-19] Of them, the two largest studies[16 18] found job insecurity to be associated with higher, albeit statistically non-significant, risk of incident CHD. Other studies were small in scale and revealed discordant findings.[15-19]

Psychosocial factors typically have modest effects on CHD.[20] Thus, it is possible that the existing studies have not been large enough to detect a potentially modest effect of job insecurity. The relation is also suggested to vary by employee age, sex, or study context—that is, the national unemployment rate[3] and type of welfare regime[8]—all of which are linked to factors that could increase the fear of adverse consequences, such as lack of re-employment opportunities and economic insecurity.[7 21]

To deal with these limitations, we conducted a systematic review and meta-analysis to summarise all available prospective evidence on perceived job insecurity and incident CHD. Our meta-analysis included individual participant data from 13 European cohort studies,[20] and published studies retrieved by systematic review. This meta-analysis enabled us to quantify the association between job insecurity and incident, clinically verified CHD in a large variety of employee populations and more precisely than has previously been possible. In addition, the large sample size allowed us to carry out analyses stratified by sex, age group, national unemployment rate, type of welfare regime, and type of job insecurity assessed.

## Methods

### Search strategy

We conducted this meta-analysis according to the MOOSE (meta-analysis of observational studies in epidemiology) guidelines.[22] We performed a systematic computerised search of the literature using "all fields" of Medline (PubMed; of articles indexed by August 2012) and Embase (by October 2012). We used the following search terms without restrictions: "job and insecurity" and "[coronary and heart and disease] or [cardiovascular and disease] or CVD or CHD or health." In addition, we scrutinised the reference list of all identified publications. We also searched cited references of these retrieved articles using the Institute of Scientific Information Web of Science (to October 2012) to identify all studies citing the included studies. Titles and abstracts were independently reviewed by two people (MV, MKi) to retrieve potentially relevant studies on the basis of a broad range of criteria for exposure (work exposure) and outcome (health) to further determine eligibility. Selected articles were reviewed (by MV, MKi) to determine whether they met the inclusion criteria.

### Study selection criteria

Studies meeting the following criteria were included in the meta-analysis: published in English; prospective design (cohort study) with individual level exposure and outcome data; examined the effect of self reported job insecurity (excluding indirect exposures such as organisational downsizing, anticipated factory closure, or contractual insecurity—that is, temporary employment)[23]; no prevalent CHD at baseline; and reported either estimates of relative risk, odds ratios, or hazard ratios with 95% confidence intervals, or data to calculate these.

### Data extraction from published studies

We extracted the following information from each retrieved article: name of first author, start of follow-up for CHD (year), study location (country), population, number of participants, number of CHD events, mean follow-up time, mean age or age

Correspondence to: M Virtanen marianna.virtanen@ttl.fi

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**Web figure:** Sub-group analysis of the association between job insecurity and coronary heart disease, multivariable adjusted. P for difference gives the statistical significance of group differences based on heterogeneity index. Welfare regime: Scandinavian (Denmark, Finland, Sweden); Anglo-Saxon (UK, US); Bismarckian (Belgium, Germany)

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range, proportion of women, method of assessment of job insecurity, method of assessment of CHD, and covariates included in the adjusted models.

### Data from IPD-Work Consortium studies

In a second approach, we included individual level data from the 13 European prospective cohort studies that represent the Individual-Participant-Data Meta-analysis in Working Populations (IPD-Work) Consortium.[20 24] Each constituent study in the consortium was approved by the relevant local or national ethics committee and all participants gave informed consent to participate. The IPD-Work data comprised 114 033 employed men and women free of prevalent CHD with data for sex, age, job insecurity, and CHD outcome.

One of the published studies, the Whitehall II study, is also part of the IPD-Work Consortium.[19] However, because the main outcome in the published study included incident angina cases, and the results were not reported by sex or age group, we pooled its data with the unpublished studies and re-analysed the data at the individual level.

### Assessment of contextual factors

We used data on the national unemployment rate at the time of the baseline survey (mean rate if there were multiple years of data collection), from the International Labour Organization database (http://laborsta.ilo.org). The mean unemployment rate (7%) across studies was chosen as the threshold to define high and low unemployment rate. The welfare typology was based on an earlier review that examined the association between flexible employment and health.[8] The studies in our meta-analysis belonged to Scandinavian (Denmark, Finland, Sweden), Anglo-Saxon (United Kingdom, United States), and Bismarckian (Belgium, Germany) welfare regimes.

### Statistical analysis

We used a two stage approach. In the first stage, we analysed the individual participant level data (IPD-Work) to generate hazard ratios and 95% confidence intervals at the study level within each of the 13 studies that used Cox proportional hazards models. We tested the proportional hazards assumption in the IPD-Work data and found no evidence for violation (all P>0.20). In the second stage, conventional meta-analytical methods[25] were used to combine the results from the IPD-Work analyses and the estimates of the four literature based publications in which the associations were reported as hazard ratios,[18] relative risks,[16] or odds ratios.[15 17] Because CHD incidence was low (<10%) in the two cohorts reporting odds ratios, these estimates can be considered as close approximations of the relative risk. They were therefore combined with hazard ratio and relative risk estimates.

The minimally adjusted model was adjusted for age and stratified by sex. Multivariable adjusted models, combining men and women, were additionally adjusted for sex, socioeconomic status, smoking, alcohol consumption, body mass index, physical activity, total cholesterol, systolic blood pressure or hypertension, and diabetes (where data were available). We examined heterogeneity of the estimates using the $I^2$ statistic and presented the summary estimates of the random effects analysis for the results.

To examine effect modification, we stratified the analysis of the association between job insecurity and CHD by sex, age group (<50 years *v* ≥50 years),[20] and study level contextual factors—that is, national unemployment rate (≤7% *v* >7%), type of welfare regime (Scandinavian, Anglo-Saxon, Bismarckian),[8] and type of exposure measure (perceived job insecurity in the present job *v* perceived threat of lay-off or employment insecurity). Statistical significance of subgroup differences was determined on the basis of heterogeneity between subgroup estimates. We used SAS (version 9.2) to analyse study specific data, and the results of the meta-analyses were computed using Stata (MP version 11.1).

## Results

### Literature search

The search strategy identified 362 unique citations of which 29 were selected for further review (fig 1⇓). Twenty five citations did not meet the inclusion criteria and were excluded. Of these, 17 were reviews[2-39] and one was a meta-analysis of the health consequences of self reported job insecurity in which CHD was not separately analysed.[9] The excluded papers also included two editorials,[4 40] one glossary,[41] one study based on ecological analysis,[42] one study where the outcome was total mortality,[43] and two cross sectional studies.[44 45] Thus, four published studies met the inclusion criteria and were included in the present meta-analysis.[15-18]

From a manual search of the references of the retrieved relevant publications (including reviews) and the cited reference search of the articles that were selected for meta-analysis, we found 47 potentially relevant new articles and books. These new articles included 25 narrative or systematic reviews,[11-66] two meta-analyses,[3 67] seven editorials or commentaries,[68-74] and five books and book chapters.[21-78] Self reported job insecurity and health was the main topic of five narrative or systematic reviews,[79-83] one meta-analysis,[7] one editorial,[84] and one study with a summary score of cardiovascular risk factors as an outcome instead of CHD.[85] In this search procedure, we found no new individual studies meeting the inclusion criteria.

### Study characteristics

The number of participants in the four published studies and 13 IPD-Work studies was up to 174 438 (table 1⇓), with 1892 events of incident CHD occurring during the mean follow-up period of 9.7 years (range 3.2-21.2). Although two studies were initiated in the 1980s, the baseline assessment for the remaining prospective studies was between 1992 and 2004. Six studies were from Denmark,[17-90] three from Finland,[91-93] two from the US,[16 18] two each from Sweden[94 95] and Germany,[15 96] and one each from the UK[97] and Belgium.[98]

### Assessment of job insecurity

Table 2⇓ presents the assessment of job insecurity across studies. Job insecurity was measured using a global single item question on the level of insecurity in the present job,[15-97] or by questions on a fear of lay-off or unemployment,[94-90] all dichotomised as high versus low job insecurity. In one published study,[17] a four item multidimensional dichotomised scale was used with questions on fear of job loss, a transfer to another job, new technology, and re-employment prospects. Prevalence of job insecurity varied between 9.6% in the Blue Collar Study[15] and 40.6% in the Whitehall II study.[97]

### Ascertainment of CHD

CHD diagnosis was ascertained from hospital records or national death registers in all unpublished and published studies except in two IPD-Work studies (table 1). In the Belstress study,[98] disease events were registered by the human resources department and occupational health service. In the

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Heinz-Nixdorf Recall study,[96] possible cases were first identified by annual surveys and, in case of any suspicion of a cardiac event or in case of death, medical records were retrieved and the case validated by an expert panel at the local university hospital. In the remaining IPD-Work Consortium studies, date of diagnosis, hospital admission due to myocardial infarction, or date of death from CHD was used to define incident disease, as done previously.[20]

CHD cases were recorded according to criteria from the MONICA (Multinational monitoring of trends and determinants in cardiovascular disease) project, or codes from ICD-9 or ICD-10 (international classification of diseases, 9th or 10th revisions). We included all non-fatal myocardial infarctions that were recorded as I21-I22 (ICD-10) or 410 (ICD-9) and coronary deaths recorded as I20-I25 (ICD-10) or 410-414 (ICD-9) as the main diagnosis. Participants were followed from baseline to the earliest of the following dates: incident CHD event, death, or end of the registry follow-up. In two published studies (Nurses' Health Study,[16] Women's Health Study[18]), self reported CHD events or those reported by next of kin were verified by medical records.

## Assessment of covariates

All unpublished and published studies provided data on participants' age, sex, and socioeconomic status. Depending on the study, covariates for the adjusted models included these sociodemographic factors only[18] or sociodemographic factors and health risk behaviours.[86-91] Covariates in other studies included sociodemographic factors, health risk behaviours, and either self reported or biological CHD risk factors that were clinically verified (that is, blood pressure or hypertension, diabetes, or cholesterol level) and that also varied between studies (table 1).[15-98] In the IPD-Work datasets, job insecurity and health risk behaviours (smoking [current, ex-smoker, or never smoker], physical activity [sedentary, active, or other], alcohol use [non-drinkers, moderate, intermediate, or heavy drinkers], and body mass index [underweight, normal, overweight, and obesity classes 1 to 3], were predefined and harmonised across the studies.[20 99] In the IPD-Work cohorts, socioeconomic status was based on the participant's highest occupational grade or educational qualification, and classified as low, intermediate, and high.

## Job insecurity and incident CHD

Figure 2⇓ shows the results from the random effects meta-analysis for the age adjusted association between job insecurity and incident CHD among men (15 studies) and women (13 studies) with 174 438 participants and 1892 events of incident CHD. In the sex stratified analysis, women from two studies (the Heinz-Nixdorf Recall Study and Copenhagen Psychosocial Questionnaire version 2) were excluded owing to the low number of events (≤2) during follow-up, leaving an analytical maximum sample of 171 930 and 1890 events in this analysis. High job insecurity was associated with higher incidence of CHD among men (relative risk 1.24; 95% confidence interval 0.98 to 1.57), although the association was not significant. Among women, the relative risk of CHD for high job insecurity was 1.47 (1.07 to 2.02). The overall estimate suggested a relative risk of 1.32 (1.09 to 1.59) for high job insecurity among men and women. Some degree of heterogeneity was detected ($I^2$=40.7% for the overall estimate (P=0.014), $I^2$=43.7% among men (P=0.036), and $I^2$=37.3% among women (P=0.085)).

Figure 3⇓ shows the study specific results with multivariable adjustment. The Women's Health Study was excluded from this analysis, because neither health behaviour nor biological risk factor covariates were provided in the published article. This exclusion left a sample of 143 572 with 1617 events. The overall estimate adjusted for age and sex was 1.32 (95% confidence interval 1.08 to 1.62) without the Women's Health Study (data not shown in the figure). After adjustment for all covariates, the overall relative risk of job insecurity was 1.19 (1.00 to 1.42, P=0.055; with $I^2$=24.6%, P=0.170). The estimate was reduced by 41% compared with the minimally adjusted relative risk.

## Stratified analyses

We examined whether the multivariable adjusted association between job insecurity and incident CHD was different between men and women, younger and older participants, across country specific contexts (based on the national unemployment rate and welfare regime), and whether the association varied according to the type of job insecurity assessed (web fig). In the age stratified analyses, the published Nurses' Health Study[16] was included in the analyses of older employees, because only a small minority of participants were younger than 50 years. The Blue Collar Study[15] was included in the analyses of younger employees whereas for the Copenhagen City Heart Study,[17] age stratified results for men and women were provided. Among participants aged 50 or more, the adjusted relative risk was 1.26 (95% confidence interval 1.02 to 1.57). As indicated by the overlapping point estimates and confidence intervals for the subgroups and the accompanying heterogeneity statistics, there was no clear evidence to suggest effect modification by age or other subgroup variables examined (P>0.10 for all subgroup differences; web fig).

## Job insecurity and CHD risk factors

The overall prevalence of job insecurity was 16.3% (table 3⇓; table 2 shows the prevalence of each individual study). Participants with low socioeconomic status were more likely to report job insecurity. Regarding CHD risk factors, insecure participants were less likely to be physically active (33.9% *v* 37.3%) and had a higher prevalence of hypertension (22.1% *v* 20.1%) and hypercholesterolaemia (51.1% *v* 46.6%) than secure participants. Differences in smoking, alcohol use, body mass index, and diabetes were relatively small.

# Discussion

We aggregated results from published and unpublished studies within the context of a meta-analysis. The findings from 17 cohorts show that self reported job insecurity is associated with a small elevated risk of incident CHD, which was partly attributable to lower socioeconomic status and established risk factors for CHD. We found no statistical evidence to suggest effect modification of the association between job insecurity and CHD by sex, age, study context, or the type of job insecurity assessed.

## Strengths and limitations

To our knowledge, with more than 170 000 participants and 1800 incident cases of CHD, this is the largest study of job insecurity and incident CHD and provides the most comprehensive synthesis of evidence on this issue so far. Unlike meta-analyses of published studies, we were able to include unpublished studies in our meta-analysis, although the meta-analysis on unpublished data was restricted to studies participating in the IPD-Work Consortium.

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Because our data were based on US and European working populations, the generalisability of the findings to other contexts such as Asia or Africa is unclear. Our measurement of job insecurity was obtained at a single point in time and did not include assessment of the severity or the expected consequences of a potential job loss. In addition, chronic exposure to a stressor is usually more harmful than a one-off exposure, and previous studies have shown that chronic or repeated exposure to job insecurity or unstable labour market status might be more harmful to health than exposure to job insecurity at one time point only.[6-101] Thus, our findings might underestimate the job insecurity-CHD association.

An important limitation, shared by all observational studies, is that we cannot make conclusions about causality. We are also unable to exclude residual confounding by imprecisely measured socioeconomic circumstances or CHD risk factors, or unmeasured confounding factors such as mental disorders—for example, depression—which might provide an alternative explanation for our findings. Depression could contribute to the job insecurity-CHD association in different ways. Depressed individuals may perceive their work environment, including their job security, more negatively; they may find it more difficult to obtain a secure job; job insecurity may also increase the risk of depression which, in turn, is a risk factor for developing CHD. Depression, negative mood, and perception of stress have been argued to represent the same underlying construct.[102] However, it was not possible to investigate these processes in the present meta-analysis.

The number and content of the covariates in the fully adjusted models differed between studies, which could have caused some imprecision in the effect estimates. Finally, our systematic review was limited to English language publications, and we did not attempt to include all unpublished studies.

## Comparison with previous studies

Earlier reviews and meta-analyses have found associations of self reported job insecurity with physical and psychological symptoms and self reported diseases,[7-9] but our study is the first systematic review and meta-analysis of the prospective association between job insecurity and incident, clinically verified CHD. Four published studies—which are also included in our meta-analysis—suggest a higher risk of CHD among employees reporting high job insecurity,[15-18] although three of them observed no statistically significant associations.[15-18] In our meta-analysis, an association between job insecurity and CHD was found among employees aged 50 years or more, although the formal statistical test did not support the difference between the age groups.

Our meta-analysis, which includes both published and unpublished data, adds to the two existing large scale studies[16 18] because it includes non-US employees in a wide range of occupations and is not limited to health professionals. In our meta-analysis, the association was also more precisely estimated because of larger numbers in the analysis.

Earlier evidence has suggested that long term job insecurity might be more devastating to health than a short term, transient exposure to job insecurity,[6-101] although this effect was not possible to examine in the present study. However, not only the type of job contract but also other sources of insecurity—such as downsizing of personnel or a company closure—could have an adverse effect on employee health.[28] Secondly, for an employee, the severity of a potential job loss may depend on the degree of dependence on the present job.[7 21] If re-employment prospects are poor, job insecurity may be more stressful and more likely to actually lead to long term unemployment. These hypotheses should be examined in future studies.

## Interpretation of the findings

The exact mechanisms underlying the job insecurity-CHD association are unknown, although the adjustment for socioeconomic status and CHD risk factors attenuated the relation between job insecurity and CHD. This attenuation indicated that these factors might either confound or mediate the association. One hypothesised mechanism is health risk behaviours, characterised by smoking, heavy alcohol use, physical inactivity, and overweight,[14] which are also associated with low socioeconomic status. However, apart from lower physical activity, our analyses provided limited evidence to support health risk behaviours as the primary explanation for the job insecurity-CHD association. One further underlying mechanism could involve biological risk factors—such as hypertension, dyslipidaemia, and type 2 diabetes—we found a slightly higher prevalence of hypertension, type 2 diabetes, and hypercholesterolaemia among participants with job insecurity than among those who did not report job insecurity.

Our analyses were based on self reported job insecurity. There is debate as to whether job insecurity reflects the objective situation or an individual's subjective appraisal of that situation.[9-82] Concordance between subjective job insecurity and insecurity measured in an objective manner—for example, by personnel downsizing[103] or a temporary job contract[104]—has been reported, suggesting a degree of validity for self reported job insecurity.

## Conclusions and unanswered questions

This meta-analysis provides evidence of a modest association between job insecurity and incident CHD. This association was found to be partly attributable to the poorer socioeconomic circumstances and less favourable profile of risk factors among people with job insecurity.

Several questions need further investigation. The extent to which other health conditions, such as mental disorders, contribute to the excess risk associated with job insecurity and CHD, remains unclear. In addition, job insecurity only represents part of the psychosocial work environment. Factors such as increased workload and decreased job control could partly mediate the effect of job insecurity on CHD, while other psychosocial factors (including support from supervisors, coworkers, and family members) could act as buffers.[15-79] Another question is whether indirect, "objective" indicators of job insecurity (such as downsizing or temporary employment), financial insecurity, and a poor psychosocial work environment (such as high effort or demands, low control, and low social support at work) have additional health consequences.[105]

In summary, our findings suggest that perceived job insecurity seems to be, at best, a modest risk factor for CHD at the population level. However, we cannot rule out the possibility that it could still be harmful for coronary health in certain contexts, particularly for vulnerable individuals.

Contributors: MV was the principal investigator of this paper and along with MKi developed the hypothesis and study design and supervised this study. SN, MV, MJ, and IM performed statistical analysis. All authors contributed to study concept and design, analysis and interpretation of data, and drafting or critical revision of the manuscript for important intellectual content, or in addition, data acquisition. MKi, TT, RR, and ND obtained funding for the IPD-Work Consortium. SN and MKi had full access to all IPD-Work Consortium data in the study and take

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**What is already known on this topic**

Coronary heart disease remains a major public health problem; psychosocial factors, such as work stress, have been implicated in its cause

Although job insecurity has been linked to self reported symptoms of poor health, the relation between perceived job insecurity and incident coronary heart disease is unclear

**What this study adds**

This systematic review and meta-analysis summarised results from four published and 13 unpublished prospective studies on self reported job insecurity and coronary heart disease providing the most comprehensive synthesis of this issue so far

Summary estimates across these studies suggest a modest association between perceived job insecurity and incident coronary heart disease

This association was partly attributable to the worse socioeconomic circumstances and less favourable risk factor profiles among people reporting high job insecurity

responsibility for the integrity of the unpublished data and the accuracy of the data analysis. MV is guarantor.

Funding: The IPD-Work Consortium is supported by the EU New OSH ERA Research Program (funded by the Finnish Work Environment Fund, Finland; Swedish Research Council for Working Life and Social Research, Sweden; German Social Accident Insurance, Germany; and Danish Work Environment Research Fund), Academy of Finland (grants 132944 and 258598), and BUPA Foundation (grant 22094477). Funding bodies for each participating cohort study are listed on their websites. The sponsors had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of this manuscript.

Competing interests: All authors have completed the Unified Competing Interest form atwww.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare: support from the EU New OSH ERA Research Program, Academy of Finland, and BUPA Foundation for the submitted work; MKi is supported by the Medical Research Council (grant K013351) and the Economic and Social Research Council, UK, and the US National Institutes of Health (grants R01HL036310 and R01AG034454); AS is a British Heart Foundation professor; GDB is a Wellcome Trust Fellow; no other relationships or activities that could appear to have influenced the submitted work.

Ethical approval: Ethical approval was obtained for all studies providing individual participant data for the meta-analysis. All participants gave informed consent to participate.

Data sharing: No additional data available.

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**Accepted:** 23 July 2013

Cite this as: *BMJ* 2013;347:f4746

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# Tables

**Table 1| Overview of studies investigating the association between job insecurity and coronary heart disease**

| Study, year of entry | Study site | Population group, participants (No) | CHD events (No) | Incidence(per 10 000 person years) | Follow-up (years)* | Age at entry (years)† | Proportion (%) of women | CHD measure | Covariates in multivariable adjusted model | National unemployment rate (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Published studies** | | | | | | | | | | |
| BCS,[15] 1982 | West Germany | Blue collar metal industry employees (n=263) | 21 | 122.8 | 6.5 | 40.8 (9.7) | 0 | MI or sudden cardiac death; clinical and record verification | Age, BMI, systolic blood pressure, LDL-cholesterol, status inconsistency, work pressure, immersion | 3.8 (men) |
| NHS,[16] 1992 | US | Registered nurses from 11 largest US states (n=36 910) | 154 | 10.4 | 4 | 55.2 (secure), 54.8 (insecure) | 100 | Non-fatal or fatal CHD; self reported or reported by next of kin, record verified | Age, smoking, alcohol intake, BMI, hypertension, diabetes, hypercholesterolemia, menopausal status, current use of post-menopausal hormones, aspirin use, past use of oral contraceptives, saturated fat intake, vitamin E intake, physical activity, parental history of MI, education, marital status, husband's education | 7.0 (women) |
| CCH,[17] 1993 | Denmark | Random sample of residents in Copenhagen (n=1146) | 104 | 64.8 | 14 | 30-67 | 52 | Hospital admission or death due to CHD; register based | Age, SES, and coronary risk factors (physical activity, smoking, BMI, systolic blood pressure) | 8.1 |
| WHS,[18] 1998 | US | Health professionals (90% nurses; n=22 086) | 170 | 7.7 | 10 | 57.2 (5.2) | 100 | Non-fatal or fatal MI; self reported or reported by next of kin, record verified | Age, race, study drug randomisation, education, income | 4.6 (women) |
| **Unpublished studies** | | | | | | | | | | |
| Still Working,[91] 1986 | Finland | Employees in a forestry products manufacturer (n=6610) | 538 | 38.4 | 21.2 (4.3) | 40.9 (9.2) | 21 | Hospital admission due to non-fatal MI or CHD death; register based | Age, sex, SES, smoking, physical activity, alcohol intake | 5.4 |
| Wolf-S,[94] 1992 | Sweden | Employees working in private and public companies in Stockholm county (n=5640) | 116 | 14.3 | 14.4 (2.1) | 41.5 (11.0) | 43 | Hospital admission due to non-fatal MI or CHD death; register based | Age, sex, SES, smoking, physical activity, BMI, alcohol intake, diabetes, systolic blood pressure, total cholesterol | 7.3 |
| Belstress,[98] 1994 | Belgium | Employees in 25 large companies in public administration (n=14 230) | 85 | 18.7 | 3.2 (1.0) | 45.6 (6.0) | 0 | Hospital admission due to non-fatal MI or CHD death; occupational health service records | Age, sex, SES, smoking, physical activity, BMI, alcohol intake, diabetes, systolic blood pressure, total cholesterol | 7.4 (men) |

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**Table 1 (continued)**

| Study, year of entry | Study site | Population group, participants (No) | CHD events (No) | Incidence(per 10 000 person years) | Follow-up (years)* | Age at entry (years)† | Proportion (%) of women | CHD measure | Covariates in multivariable adjusted model | National unemployment rate (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Whitehall II,[97] 1995 | UK | London based, civil service employees (n=4866) | 97 | 23.2 | 8.6 (1.8) | 50.4 (5.0) | 30 | Hospital admission due to non-fatal MI or CHD death; register based | Age, sex, SES, smoking, physical activity, BMI, alcohol intake, diabetes, systolic blood pressure, total cholesterol | 8.4 |
| Wolf-N,[95] 1996 | Sweden | Employees of private and public companies in Jämtland and Västernorrland counties (n=4666) | 132 | 24.6 | 11.5 (1.3) | 44.0 (10.3) | 17 | Hospital admission due to non-fatal MI or CHD death; register based | Age, sex, SES, smoking, physical activity, BMI, alcohol intake, diabetes, systolic blood pressure, total cholesterol | 7.5 |
| IPAW,[86] 1996 | Denmark | Employees of a pharmaceutical company, municipal technical services, and municipal nursing homes in Copenhagen (n=1685) | 20 | 10.3 | 11.5 (1.5) | 41.9 (10.6) | 67 | Hospital admission due to non-fatal MI or CHD death; register based | Age, sex, SES, smoking, alcohol intake | 6.2 |
| COPSOQ-I,[87] 1997 | Denmark | Population based random sample (n=1696) | 33 | 16.6 | 11.7 (1.7) | 40.7 (10.5) | 48 | Hospital admission due to non-fatal MI or CHD death; register based | Age, sex, SES, smoking | 6.1 |
| HeSSup,[92] 1998 | Finland | Age stratified, population based, random sample (n=15 644) | 62 | 5.7 | 7.0 (0.4) | 39.3 (10.2) | 56 | Hospital admission due to non-fatal MI or CHD death; register based | Age, sex, SES, smoking, physical activity, BMI, alcohol intake, diabetes, hypercholesterolaemia, hypertension | 11.3 |
| PUMA,[88] 1999 | Denmark | Employees in the human service sector (n=1822) | 17 | 9.3 | 10.0 (1.1) | 42.6 (10.3) | 83 | Hospital admission due to non-fatal MI or CHD death; register based | Age, sex, SES, smoking, physical activity, BMI, alcohol intake | 5.1 |
| FPS,[93] 2000 | Finland | Public sector employees (10 towns, 21 hospitals; n=47 064) | 250 | 5.5 | 9.7 (0.9) | 44.6 (9.4) | 81 | Hospital admission due to non-fatal MI or CHD death; register based | Age, sex, SES, smoking, physical activity, BMI, alcohol intake, diabetes, hypertension | 9.3 |
| HNR,[96] 2000 | Germany | Random sample of residents in the metropolitan Ruhr area (n=1770) | 38 | 26.5 | 8.1 (1.3) | 53.3 (4.8) | 41 | Non-fatal MI or sudden cardiac death; MI self reported, ECG, enzyme based, record verified | Age, sex, SES, smoking, physical activity, BMI, alcohol intake, diabetes, systolic blood pressure, total cholesterol | 8.6 |
| DWECS,[89] 2000 | Denmark | Population based random sample (n=4967) | 45 | 10.3 | 8.8 (1.1) | 41.4 (10.8) | 49 | Hospital admission due to non-fatal MI or CHD death; register based | Age, sex, SES, smoking, physical activity, BMI, alcohol intake | 4.6 |
| COPSOQ-II,[90] 2004 | Denmark | Population based random sample (n=3373) | 10 | 5.9 | 5.0 (0.4) | 42.8 (10.2) | 53 | Hospital admission due to non-fatal MI or CHD death; register based | Age, sex, SES, smoking, physical activity, BMI, alcohol intake, diabetes, hypertension | 5.3 |

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**Table 1 (continued)**

| Study, year of entry | Study site | Population group, participants (No) | CHD events (No) | Incidence(per 10 000 person years) | Follow-up (years)* | Age at entry (years)† | Proportion (%) of women | CHD measure | Covariates in multivariable adjusted model | National unemployment rate (%) |
|---|---|---|---|---|---|---|---|---|---|---|

BMI=body mass index; MI=myocardial infarction; LDL=low density lipoprotein; SES=socioeconomic status; BCS=Blue Collar Study; NHS=Nurses' Health Study; CCH=Copenhagen City Heart Study; WHS=Women's Health Study; WOLF-S=Work, Lipids, Fibrinogen-Stockholm; Belstress=Belgian Job Stress Project; WOLF-N=Work, Lipids, Fibrinogen-Norrland; IPAW=Intervention Project on Absence and Well-being; COPSOQ-I=Copenhagen Psychosocial Questionnaire Version 1; HeSSup=Health and Social Support Study; PUMA=Burnout, Motivation and Job Satisfaction Study; FPS=Finnish Public Sector Study; HNR=Heinz-Nixdorf Recall Study; DWECS=Danish Work Environment Cohort Study; COPSOQ-II=Copenhagen Psychosocial Questionnaire Version 2.

*Mean (standard deviation).

†Mean (standard deviation) or range.

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**Table 2| Study specific measurement and prevalence of self reported job insecurity**

| Study | Measurement | No of items | Scale | Cut-point defining cases | Prevalence (%) |
|---|---|---|---|---|---|
| BCS[15] | Job insecurity in one's own job | 1 | High to low | High | 9.6 |
| NHS[16] | My job security is good | 1 | Strongly disagree, disagree, agree, strongly agree | Strongly disagree, disagree | 17.6 |
| CCH[17] | Are you worried that you 1) become unemployed? 2) are transferred to other job? 3) become superfluous due to new technology? 4) have difficulties to find a new job if unemployed with the qualifications that you have? | 4 | Yes/no (to each item) | High in the sum score (details not available) | Not available |
| WHS[18] | My job security is good | 1 | Strongly disagree, disagree, agree, strongly agree | Strongly disagree, disagree | 19.4 |
| Still Working[91] | How secure is your present job? | 1 | Very secure, rather secure, cannot say, rather insecure, very insecure | Very insecure, rather insecure | 11.6 |
| Wolf-S[94] | Are you worried about becoming laid off? | 1 | Yes/no | Yes | 24.3 |
| Belstress[98] | My employment security is good | 1 | Strongly disagree, disagree, agree, strongly agree | Strongly disagree, disagree | 11.6 |
| Whitehall II[97] | How secure do you feel in your present job? | 1 | Very secure, secure, insecure, very insecure | Very insecure, insecure | 40.6 |
| Wolf-N[95] | Are you worried about becoming laid off? | 1 | Yes/no | Yes | 28.5 |
| IPAW[86] | Are you worried about becoming unemployed? | 1 | Yes/no | Yes | 27.7 |
| COPSOQ-I[87] | Are you worried about becoming unemployed? | 1 | Yes/no | Yes | 18.9 |
| HeSSup[92] | Does your job involve a threat of long term unemployment? | 1 | Very much, rather much, to some degree, rather little, very little | Very much, rather much, to some degree | 13.0 |
| PUMA[88] | Are you worried about becoming unemployed? | 1 | Yes/no | Yes | 12.5 |
| FPS[93] | Does your job involve a threat of lay-off? | 1 | Very much, rather much, to some degree, rather little, very little | Very much, rather much, to some degree | 11.3 |
| HNR[96] | Employment security is poor (yes/no). How much does it distress you? | 1(2) | Yes/no; very much, quite much, to some extent, not at all | Yes; very much, quite much, to some extent | 11.8 |
| DWECS[89] | Are you worried about becoming unemployed? | 1 | Yes/no | Yes | 17.3 |
| COPSOQ-II[90] | Are you worried about becoming unemployed? | 1 | To a very high extent, to a high extent, partially, to a low extent, to a very low extent | To a very high extent, to a high extent, partially | 24.9 |

BCS=Blue Collar Study; NHS=Nurses' Health Study; CCH=Copenhagen City Heart Study; WHS=Women's Health Study; WOLF-S=Work, Lipids, Fibrinogen-Stockholm; BELSTRESS=Belgian Job Stress Project; IPAW=Intervention Project on Absence and Well-being; WOLF-N=Work, Lipids, Fibrinogen-Norrland; COPSOQ-I=Copenhagen Psychosocial Questionnaire Version 1; HeSSup=Health and Social Support; PUMA=Burnout, Motivation and Job Satisfaction Study; DWECS=Danish Work Environment Cohort Study; FPS=Finnish Public Sector Study; HNR=Heinz-Nixdorf Recall Study; COPSOQ-II=Copenhagen Psychosocial Questionnaire Version 2.

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**Table 3| Distribution of sociodemographic factors and CHD risk factors, according to level of self reported job insecurity**

| Characteristic (no of studies with data available for analysis) | Self reported level of job insecurity | |
|---|---|---|
| | Secure (overall prevalence 83.7%) | Insecure (overall prevalence 16.3%) |
| Age (n=15)*† | 47.9 (9.0) | 47.7 (9.1) |
| Sex (n=15)* | | |
| Female | 100 592 (69.4) | 19 615 (69.6) |
| Male | 44 269 (30.6) | 8553 (30.4) |
| Socioeconomic status (n=15)* | | |
| High | 23 608 (16.5) | 2934 (10.5) |
| Intermediate | 91 662 (64.3) | 18 658 (66.9) |
| Low | 27 388 (19.2) | 6310 (22.6) |
| Smoking (n=15) | | |
| Not smoking or ex-smoker | 108 858 (79.2) | 20 660 (77.9) |
| Current smoker | 28 654 (20.8) | 5847 (22.1) |
| Alcohol use (n=13) | | |
| None or average | 95 432 (88.6) | 17 809 (89.2) |
| Heavy | 12 270 (11.4) | 2154 (10.8) |
| Physical activity (n=13) | | |
| High | 50 902 (37.3) | 8836 (33.9) |
| Low or moderate | 85 659 (62.7) | 17 195 (66.1) |
| Body mass index (n=12)† | 25.6 (4.1) | 25.9 (4.4) |
| Hypertension (n=10) | | |
| No | 99 807 (79.9) | 18 782 (77.9) |
| Yes | 25 175 (20.1) | 5330 (22.1) |
| Hypercholesterolaemia (n=8) | | |
| No | 44 002 (53.4) | 8921 (48.9) |
| Yes | 38 373 (46.6) | 9308 (51.1) |
| Diabetes (n=10) | | |
| No | 121 448 (97.3) | 23 213 (96.7) |
| Yes | 3320 (2.7) | 796 (3.3) |

Data are number (%) of participants unless otherwise stated.

*Data are available for all studies, but two published studies provided no information on the level of job insecurity.

†Mean (standard deviation).

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# Figures

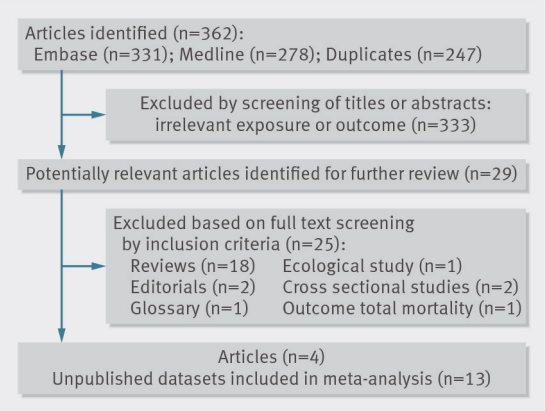



**Fig 1** Flow diagram of studies included in the meta-analysis

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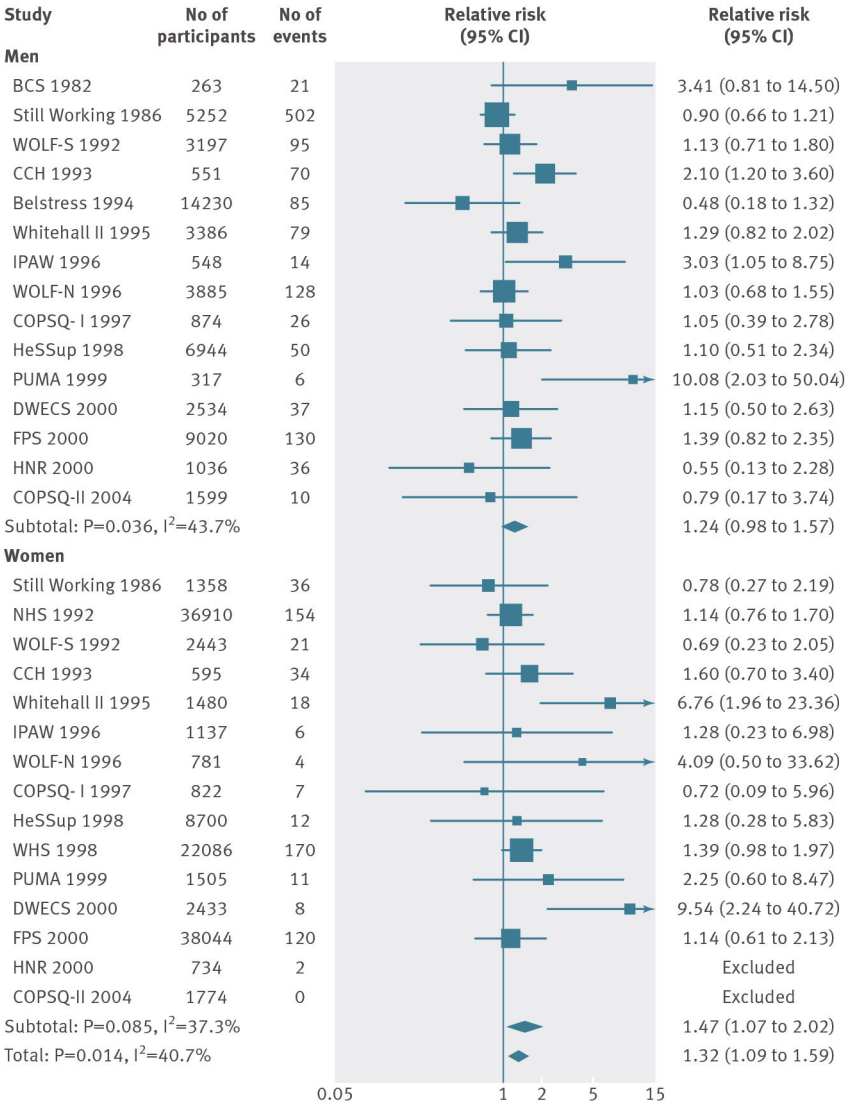



**Fig 2** Forest plot of individual studies investigating the association between job insecurity and incident CHD events among men and women, adjusted for age. Models adjusted for age (apart from the Blue Collar Study, in which only the fully adjusted model was available; and the Women's Health Study, in which the model was adjusted for age, race, and drug randomisation). BCS=Blue Collar Study[15]; Still Working[91]; NHS=Nurses' Health Study[16]; CCH=Copenhagen City Heart Study[17]; Whitehall II Study[97]; WHS=Women's Health Study[18]; WOLF-S=Work, Lipids, Fibrinogen-Stockholm[94]; BELSTRESS=Belgian Job Stress Project[98]; IPAW=Intervention Project on Absence and Well-being[86]; WOLF-N=Work, Lipids, Fibrinogen-Norrland[95]; COPSOQ-I=Copenhagen Psychosocial Questionnaire version 1[87]; HeSSup=Health and Social Support[92]; PUMA=Burnout, Motivation and Job Satisfaction Study[88]; DWECS=Danish Work Environment Cohort Study[89]; FPS=Finnish Public Sector Study[93]; HNR=Heinz-Nixdorf Recall Study[96]; COPSOQ-II=Copenhagen Psychosocial Questionnaire version 2[90]

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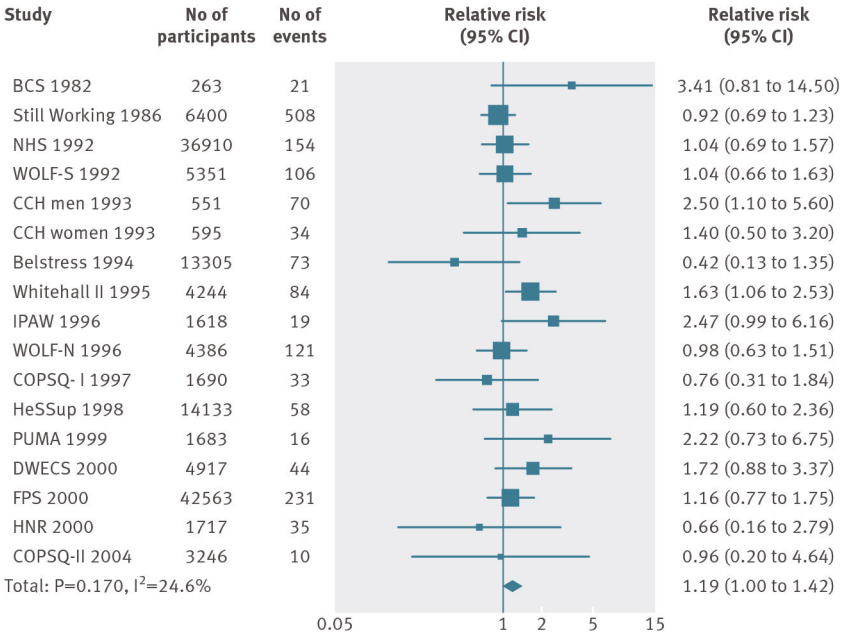



**Fig 3** Forest plot of studies investigating the association between job insecurity and incident CHD, adjusted for multivariable analysis. Multivariable adjustment: age, sex, socioeconomic status, smoking, alcohol use, physical activity, body mass index, hypertension, hypercholesterolaemia, and diabetes (adjusted factors varied by study; table 1 shows a detailed list of adjusted covariates in different studies). BCS=Blue Collar Study[15]; Still Working[91]; NHS=Nurses' Health Study[16]; CCH=Copenhagen City Heart Study[17]; Whitehall II Study[97]; WOLF-S=Work, Lipids, Fibrinogen-Stockholm[94]; BELSTRESS=Belgian Job Stress Project[98]; IPAW=Intervention Project on Absence and Well-being[86]; WOLF-N=Work, Lipids, Fibrinogen-Norrland[95]; COPSOQ-I=Copenhagen Psychosocial Questionnaire version 1[87]; HeSSup=Health and Social Support[92]; PUMA=Burnout, Motivation and Job Satisfaction Study[88]; DWECS=Danish Work Environment Cohort Study[89]; FPS=Finnish Public Sector Study[93]; HNR=Heinz-Nixdorf Recall Study[96]; COPSOQ-II=Copenhagen Psychosocial Questionnaire version 2.[90] The Women's Health Study[18] was excluded because no multivariable adjusted results were reported

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