Job insecurity as a risk factor for diabetes: a collaborative analysis of 140 825 workers

Running head: Job insecurity and incident diabetes

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ABSTRACT (242 words)

Background: Although job insecurity has been associated with some health outcomes its relationship with incident diabetes has not been studied. This meta-analysis of cohort studies examined job insecurity as a risk factor for incident diabetes.

Methods: Our analyses included unpublished individual participant data from 8 cohort studies identified via two open access data archives and 11 European cohort studies from the Individual-Participant-Data Meta-analysis in Working Populations Consortium. Study-specific estimates of the association between job insecurity at baseline and incident diabetes over the follow-up period were pooled using meta-analysis to produce a summary risk estimate.

Results: The 19 studies included up to 140 825 participants from Australia, Europe and the USA with a mean follow-up of 9.4 years and 3954 incident cases of diabetes. Exposure to high compared to low job insecurity was associated with an age- and sex-adjusted odds ratio for incident diabetes of 1.19 (95% confidence interval 1.09-1.30). In 15 studies with baseline data for all covariates (socioeconomic status, obesity, physical activity, alcohol and smoking) the multivariable-adjusted odds ratio was slightly attenuated 1.12 (1.01-1.24). Heterogeneity between the studies was low to moderate (age- and sex-adjusted I^2=24%, p=0.165; multivariable-adjusted I^2=27%, p=0.162). The multivariable-adjusted association in analyses restricted to high quality studies, in which the diabetes diagnosis was ascertained from electronic medical records or clinical screening, was 1.19 (95% confidence interval 1.04-1.35).

Interpretation: Health care personnel should be aware that workers reporting job insecurity may be at a modest increased risk of diabetes.

Key words: incident diabetes, job insecurity, meta-analysis, prospective, individual participant data

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The increasing use of temporary contracts, zero-hours contracts and other forms of flexible employment have made job insecurity a feature of much previously secure employment in high income countries.[1] In addition to impacts on social circumstances, the health consequences of job insecurity are becoming recognised.[2] Most evidence to date has relied on self-reported health outcomes, such as mental and physical health symptoms.[3-5] In addition, there is indicative evidence of associations between job insecurity and cardiovascular risk factors, such as dyslipidaemia and weight gain,[6] and a recent individual participant meta-analysis of 170,000 workers demonstrated an association between job insecurity and clinically verified incident coronary events.[7]

The prevalence of diabetes has increased steadily over recent decades, mostly due to rising rates of overweight and obesity, and ageing populations.[8,9] There is indirect evidence to suggest an association between job insecurity and incident diabetes because previous studies show an association between job insecurity and subsequent increase in body mass index.[6] High body mass index, in turn, is a strong risk factor for diabetes.[10,11] However, a comprehensive search of the literature (*Web Appendix 1*) revealed no published studies examining the association between job insecurity and diabetes.

To address this gap in the literature, we undertook an analysis of unpublished, individual participant data obtained from international open-access data archives and a consortium of cohort studies. This allowed us, for the first time, to quantify the prospective association between job insecurity and subsequent incident diabetes in a large dataset that included a wide variety of workers and countries.

Methods

Unpublished individual-participant data

Our analyses included unpublished individual-level data on job insecurity and incident diabetes from 19 prospective cohort studies. Of these, 8 studies with public data were identified from collections at the Inter-University Consortium for Political and Social Research (http://www.icpsr.umich.edu/icpsrweb/ICPSR/) and the UK Data Service (http://ukdataservice.ac.uk/).[12-19] All of these studies are general population samples,[12-17] except the Wisconsin studies, which are random samples of graduates from Wisconsin high schools and their siblings.[18,19] The remaining 11 cohort studies [21-30] are from the 'Individual-Participant-Data Meta-analysis in Working Populations' (IPD-Work) Consortium.[31] Of these, four are general population samples,[20-22,24] and the rest either public sector workers or employees in private companies.[23,25-30] For further details see *Web Appendix 2, eTable 1.*

Assessment of job insecurity

Job insecurity was measured once at baseline in all 19 cohorts. In studies from the open access datasets this was via a single question which asked about the level of insecurity in the present job [12,13,16-19] or about satisfaction with job security.[14,15] For studies in the IPD-Work Consortium job insecurity was measured via a single question on the level of insecurity in the present job,[27,28] or by questions on fear of layoff or unemployment (*Table 1*).[20-26,29,30] In all studies the exposure was dichotomised into high versus low job insecurity as previously.[7] Prevalence of high job insecurity ranged from 6.3% in MIDUS [16] to 40.3% in the Whitehall II study.[28]

Ascertainment of incident diabetes

In all studies from the open access datasets, incident diabetes over the follow-up period was defined as the first self-report of diabetes. Incident diabetes was ascertained in the Whitehall II study using gold standard WHO criteria: a 75 g oral glucose tolerance test with diabetes defined as fasting glucose ≥7.0 mmol/L, or 2 hour post-load glucose ≥11.1 mmol/L, except for those reporting doctor-diagnosed diabetes or use of diabetes medication.[32] In all other IPD-Work studies incident diabetes was defined as the first record of diabetes, diagnosed according to ICD-10 code E11. This information was collected from hospital admission, hospital discharge and mortality registers with mention of diabetes in any of the diagnosis codes. Additionally, in the Finnish studies,[23,24,27] participants were defined as incident diabetes cases the first time they were eligible for diabetes medication in the national drug reimbursement register. The date of diabetes diagnosis was defined as the date of the first record in any of the above-mentioned sources over the study follow-up period. Mean incidence of diabetes per 10 000 person-years ranged from 9 Wolf-N [29] to 85 ACL [12](*Table 2*).

Participants with evidence of prevalent diabetes at study baseline were excluded from the analyses. Prevalent diabetes was defined using information from any of the following: hospital records, baseline oral glucose tolerance test, self-report from the baseline questionnaire, or drug reimbursement register (Finnish studies only).

Assessment of covariates

Confounders of the association between job insecurity and incident diabetes include age, sex, socioeconomic position, obesity, and reporting or common-method bias for studies in which

both exposure and outcome are self-reported. All studies included in the analysis provided data on participants' age, sex, socioeconomic status (based on participants' highest occupational grade or educational qualification and classified as low, intermediate, and high) and obesity, defined as a body mass index above 30kg/m^2. Other risk factors for diabetes, which may be associated with job insecurity and so act as potential confounders of the association; physical activity (low, intermediate, high), smoking (current, ex, or never smoker), and alcohol consumption (abstainers, moderate, intermediate, or heavy drinkers) were similarly pre-defined and harmonised across the studies. Data were not available on obesity for Still Working and BHPS;[14,27] on alcohol for PUMA;[26] and on obesity, physical inactivity and alcohol for COPSOQ-I,[20] so these studies were not included in the multivariable-adjusted models.

Statistical analysis

Our analyses included 19 prospective cohort studies in which job insecurity was measured once at baseline and subsequent incident diabetes was measured over the follow-up period. As not all of the studies included an exact date of diabetes diagnosis, logistic regression was used in all studies to calculate study-specific odds ratios (95 % confidence intervals) as the measure of association between job insecurity and subsequent incident diabetes.[33]

Meta-analysis was used to produce a common risk estimate.[34] As there was no significant heterogeneity between the study-specific estimates, the meta-analyses were undertaken using fixed effect models. Heterogeneity of the study-specific estimates was examined using the I^2 statistic (higher values denote greater heterogeneity).[35]

Age and sex-adjusted study-specific effect estimates of the association between job insecurity and incident diabetes are presented as a preliminary analysis. The main analysis is based on multivariable models additionally adjusted for socioeconomic status, obesity, physical activity, alcohol and smoking. To examine whether the association between job insecurity and incident diabetes differed between sub-groups of studies and participants, we stratified the analyses by method of diabetes ascertainment (self-reported, electronic medical records or clinical examination); study quality (assessed as low or high using the Cochrane Risk of Bias Tool for cohort studies [36], see *Web Appendix 3, eTable2*); age (<50 years, ≥50years); sex (women, men); socioeconomic status (low, intermediate, high); and study location (Europe, USA).

We used Stata (MP version 13.1) to analyse data from the open access studies and to compute the results of all the meta-analyses. SAS (version 9.2) was used to analyse study-specific data from the IPD-Work studies.

Results

Sample characteristics

The 8 cohort studies from the open access data archives included a total of 44 770 working women and men with data on age, sex, socioeconomic status, job insecurity, and diabetes. The 11 cohorts from the IPD-Work consortium included a further 96 055 working women and men with suitable data, bringing the total to a maximum of 140 825 (mean age 42.2 years; 81 816 women; 59 009 men). Among these, 3954 incident cases of diabetes occurred over a mean follow-up of 9.4 years (range 5.9 to 21.1). While two studies were initiated in 1986,[12,27] baseline assessment for the remaining studies was between 1991 and 2009. Studies were from

Australia,[15] Denmark,[20-22,25,26] Finland,[23,24,27] Sweden,[29,30] UK,[13,14,17,28] and USA [12,16,18,19] (*Web Appendix 2, eTable1*).

Association between job insecurity and incident diabetes

Age- and sex-adjusted study-specific effect estimates of the association between job insecurity and incident diabetes for all 19 studies are presented in Figure 1A. Multivariable analyses, additionally adjusted for socioeconomic status, obesity, physical activity, alcohol and smoking, are presented in Figure 1B for the 15 studies (108,523 participants; 2850 incident diabetes cases) with data on all covariates.[12,13,15-19,21-25,28-30] High job insecurity at baseline was associated with a higher incidence of diabetes; pooled odds ratio 1.19 (95% CI 1.09-1.30) in the age- and sex-adjusted analyses, and 1.12 (1.01-1.24) in the multivariable-adjusted analyses. Heterogeneity between the study-specific estimates was low to moderate (age and sex-adjusted I^2=24%, p=0.165; multivariable-adjusted I^2=27%, p=0.162). Sequential adjustment of the association between job insecurity and incident diabetes for socioeconomic status and the lifestyle covariates are presented in *Web Appendix 4, eTable3*.

Sub-group analyses are shown in *Figure 2*. No statistically significant differences were observed in the association between job insecurity and incident diabetes in multivariable-adjusted analyses stratified by method of diabetes ascertainment; study quality; age; sex; socioeconomic status; and study location (p-values for all sub-group differences >0.13). Odds ratios for sub-groups divided by method of diabetes diagnosis and study quality are identical as the diagnosis of diabetes is a key feature of high quality (electronic medical records or clinical examination [oral glucose tolerance test]) and low quality (self-report) studies. Although the correlation between diabetes identified via self-report and medical records is relatively high [37] and the

difference between the high and low quality studies not statistically significant, these analyses do provide stronger evidence in support of an association between job insecurity and incident diabetes in the high quality studies; multivariable-adjusted odds ratio 1.19 (95% CI 1.04-1.35).

Loss to follow-up ranged from <5% to 34% and length of follow-up from 4 to 21 years (*Web Appendix 2, eTable1*), but neither factor had an effect on the association between job insecurity and incident diabetes (*Web Appendix 4, eTable3*). Although the rate of unemployment at baseline varied from 4.6% to 11.3% (*Web Appendix 2, eTable1*), there was no evidence that the association between job insecurity and incident diabetes differed between the cohorts (*Web Appendix 4, eTable3*).

Interpretation

Main findings

Using data aggregated across 19 prospective cohorts which included 140 825 participants and 3954 incident cases of diabetes, we observed a 19% increase in the age- and sex-adjusted odds of incident diabetes among workers exposed to job insecurity. In the 15 studies with full covariate data, the multivariable-adjusted association was attenuated to 12%, but remained statistically significant; odds ratio 1.12, 95% CI 1.01-1.24. Most of this attenuation resulted from adjustment for the lower socioeconomic status among insecure workers.

Comparison with other studies

As we were unable to find any previous studies of job insecurity and incident diabetes, either cross-sectional or longitudinal, our study appears to be the first to report on this association. It is congruent with previous work showing that job insecurity is associated with weight gain, a risk factor for diabetes,[6] and with incident coronary heart disease, a complication of diabetes.[7] In the latter analyses,[7] insecure employees in the IPD-Work consortium cohort studies had an 19% excess multivariable-adjusted odds of incident myocardial infarction or coronary death; a strength of association the same as that for diabetes in high quality studies in the present analysis.

Limitations

Our study needs to be considered in view of several limitations. Although we were able to adjust our analyses for age, sex, socioeconomic status and obesity at baseline, data on other potential confounders and mediators, such as anxiety and weight gain over the follow-up period, were not available in most of the datasets. We cannot claim that this analysis includes all possible unpublished data. However, we were able to include a large, diverse sample of workers from 19 well-characterised prospective cohort studies which together cover the USA, Australia and several European countries, so our findings are likely to apply more widely to workers in other high income countries.

We measured job insecurity using single items which were not uniform across the studies. In common parlance job insecurity is understood to refer to employed workers who feel threatened by unemployment, a broad concept around which the single-item measures in our meta-analyses appear to coalesce.[38,39] Low to moderate heterogeneity, as indicated by the I^2 statistics suggests effects that differ little between the studies. However, the use of single, rather

than multi-item questionnaires at one point in time only to measure job insecurity may result in an underestimation of the association between job insecurity and health-related outcomes,[40] a limitation which may also apply to our study. Previous work has also shown that chronic or repeated exposure to job insecurity is more harmful to health than exposure to job insecurity at one point in time.[41]

Ascertainment of diabetes varied between the studies. Only the Whitehall II study administered a repeated oral glucose tolerance test, the gold standard. This enabled the study to detect both diagnosed and undiagnosed diabetes. The remaining studies, based on health records or self-reports, will have missed undiagnosed diabetes cases. In Whitehall II, the age and sex-adjusted odds ratio for the association between job insecurity and diabetes was 1.19; the same as the overall estimate for all the studies (1.19).

Conclusion

Our findings suggest that self-reported job insecurity is associated with a modest increased risk of incident diabetes. These findings are most appropriately interpreted in a public health context in which small long-term effects on common disease outcomes can have high relevance. Ideally in such situations policy responses should take a population level approach to exposure reduction. Health care personnel should also be aware job insecurity may be associated with a modest increased risk of diabetes.

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Author Contributions: 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. JEF and MV undertook the systematic search of the literature. MJ searched the relevant open-access datasets. JEF wrote the first draft of the paper with MV and MKi. MJ and IEHM performed the statistical analysis. MKi, TT, RR and ND obtained funding for the IPD-Work Consortium. MJ had full access to all the open access data, and MJ, IEHM and MKi had full access to all IPD-Work Consortium data. They take responsibility for the integrity of the previously unpublished data and the accuracy of the data analysis. JEF is the guarantor of this work and had final responsibility for the decision to submit for publication.

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Table 1. Measurement and prevalence of self-reported job insecurity by cohort study

Study name (Acronym)	Measurement	Response scale	Cut-point defining cases	Prevalence of job insecurity %
Open-access datasets				
American's Changing Lives (ACL)[12]	*"Sometimes people lose jobs they want to keep. How likely is it that during the next couple of years you will involuntarily lose your main job?"*	*"Not at all likely", "not too likely", "somewhat likely", or "very likely"?*	Somewhat likely, or very likely	19.1
British Birth Cohort Study 1970 (BCS)[13]	*"Would you say your current job is…"*	*"Very secure", "fairly secure", "not very secure"*	Not very secure	7.3
British Household Panel Survey (BHPS)[14]	*"I'd like you to tell me from this card which number best describes how satisfied or dissatisfied you are with that particular aspect of your own present job -- Your job security"*	*1 = "Completely dissatisfied"; 4 = "Neither satisfied nor dissatisfied"; 7 = "Completely satisfied"*	< 4	15.0
Household, Income and Labour Dynamics in Australia survey (HILDA)[15]	*"Please pick a number between 0 and 10 to indicate how satisfied or dissatisfied you are with the following aspects of your job -- Your job security? The more satisfied you are, the higher the number you should pick. The less satisfied you are, the lower the number."*	*0 to 10*	< 5	13.5
Midlife in the United States (MIDUS)[16]	*"If you wanted to stay in your present job, what are the chances that you could keep it for the next two years?"*	*1 = "Excellent", 2 = "Very good", 3 = "Good", 4 = "Fair", 5 = "Poor"*	≥ 4	6.3
National Child Development Study 1958 (NCDS)[17]	*"Would you say your current job is…"*	*"Very secure", "fairly secure", "not very secure"*	Not very secure	10.9
Wisconsin Longitudinal Study of Graduates (WLSG)[18]	*"On a scale from one to ten, what chance do you think there is that you will lose your job completely in the next two years?"*	*1 to 10*	≥ 5	17.2
Wisconsin Longitudinal Study of Siblings (WLSS)[19]	*"On a scale from one to ten, what chance do you think there is that you will lose your job completely in the next two years?"*	*1 to 10*	≥ 5	16.4
IPD-Work datasets				
Copenhagen Psychosocial Questionnaire Version 1	*"Are you worried about becoming unemployed?"*	*Yes-no*	Yes	18.8

(COPSOQ-I)[20]				
Copenhagen Psychosocial Questionnaire Version 2 (COPSOQ-II)[21]	*"Are you worried about becoming unemployed?"*	*"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
Danish Work Environment Cohort Study (DWECS)[22]	*"Are you worried about becoming unemployed?"*	*Yes-no*	Yes	17.4
Finnish Public Sector Study (FPS)[23]	*"Does your job involve a threat of layoff?"*	*"Very much"/ "rather much"/ "to some degree" / "rather little" /"very little"*	Very much/ rather much/ to some degree	11.3
Health and Social Support (HeSSup)[24]	*"Does your job involve a threat of long-term unemployment?"*	*"Very much"/ "rather much"/ "to some degree" / "rather little" / "very little"*	Very much/ rather much/ to some degree	12.9
Intervention Project on Absence and Well-being (IPAW)[25]	*"Are you worried about becoming unemployed?"*	*Yes-no*	Yes	27.5
Burnout, Motivation and Job Satisfaction Study (PUMA)[26]	*"Are you worried about becoming unemployed?"*	*Yes-no*	Yes	12.6
Still Working[27]	*"How secure is your present job?"*	*"Very secure" /"rather secure" /"cannot say" /"rather insecure" /"very insecure"*	Very Insecure/rather insecure	11.6
Whitehall II[28]	*"How secure do you feel in your present job?"*	*"Very secure" /"secure" /"insecure" /"very insecure"*	Very insecure/ insecure	40.3
Work, Lipids, Fibrinogen-Norrland (WOLF-N)[29]	*"Are you worried about becoming laid off?"*	*Yes-no*	Yes	28.5
Work, Lipids, Fibrinogen-Stockholm (WOLF-S)[30]	*"Are you worried about becoming laid off?"*	*Yes-no*	Yes	24.4

Table 2. Characteristics of participants and assessment of incident diabetes in the 19 cohort studies

Study (Country)	Number participants	% Women	Mean age baseline Years (SD)	Mean follow-up* Years (SD)	Incident diabetes measure†	Number diabetes events	Incidence /10 000 person years
Open-access datasets							
ACL (USA)	1460	52.6	44.4 (13.7)	12.7 (4.2)	QS	158	85.2
BCS (UK)	6473	48.0	33.8 (1.9)	4.0 (0.2)	QS	51	19.9
BHPS (UK)	14 584	52.4	34.1 (11.1)	6.5 (4.0)	QS	256	27.6
HILDA (Australia)	4859	47.8	41.4 (12.6)	4.0 (0.1)	QS	77	39.6
MIDUS (USA)	2797	52.2	44.8 (10.9)	8.9 (0.4)	QS	173	69.4
NCDS (UK)	7693	48.1	42.0 (0.0)	8.3 (0.4)	QS	207	32.5
WLSG (USA)	4924	50.2	54.1 (0.5)	11.2 (0.3)	QS	438	79.7
WLSS (USA)	1980	51.0	51.2 (6.3)	11.2 (0.4)	QS	157	70.6
IPD-Work datasets							
COPSOQ-I (Denmark)	1694	48.2	40.7 (10.5)	12.6 (2.0)	EMR	45	21.1
COPSOQ-II (Denmark)	3305	52.6	42.6 (10.2)	5.9 (0.6)	EMR	21	10.7
DWECS (Denmark)	4941	48.9	41.4 (10.8)	9.8 (1.4)	EMR	62	12.9
FPS (Finland)	46 051	81.0	44.5 (9.4)	9.6 (1.1)	EMR	1169	26.4
HeSSup (Finland)	15 434	55.7	39.2 (10.2)	7.0 (0.4)	EMR	111	10.3
IPAW (Denmark)	1665	67.2	41.9 (10.6)	12.4 (1.8)	EMR	44	21.4
PUMA (Denmark)	1865	82.7	42.7 (10.3)	10.9 (1.4)	EMR	27	13.3
Still Working (Finland)	6566	20.5	40.9 (9.2)	21.1 (4.5)	EMR	521	37.7
Whitehall II (UK)	4361	29.4	50.3 (4.9)	10.2 (2.2)	CE	306	68.6
WOLF-N (Sweden)	4593	16.7	43.9 (10.3)	11.6 (1.2)	EMR	48	9.0
WOLF-S (Sweden)	5580	43.3	41.5 (11.0)	14.5 (1.9)	EMR	83	10.3
Total	**140 825**		**42.2 (10.4)**	**9.4 (4.0)**		**3954**	**30.0**

* Mean follow-up time for studies in the Open Access datasets is calculated from the time until the first report of diabetes or the end of follow-up

† Incident diabetes measures QS = self-reported via repeat questionnaire surveys; EMR = Electronic medical records; CE = Clinical examination (oral glucose tolerance test)

Figure 1A – Age and sex-adjusted study specific estimates for the association between job insecurity and diabetes (19 cohorts n=140 825 participants and 3954 incident cases of diabetes)

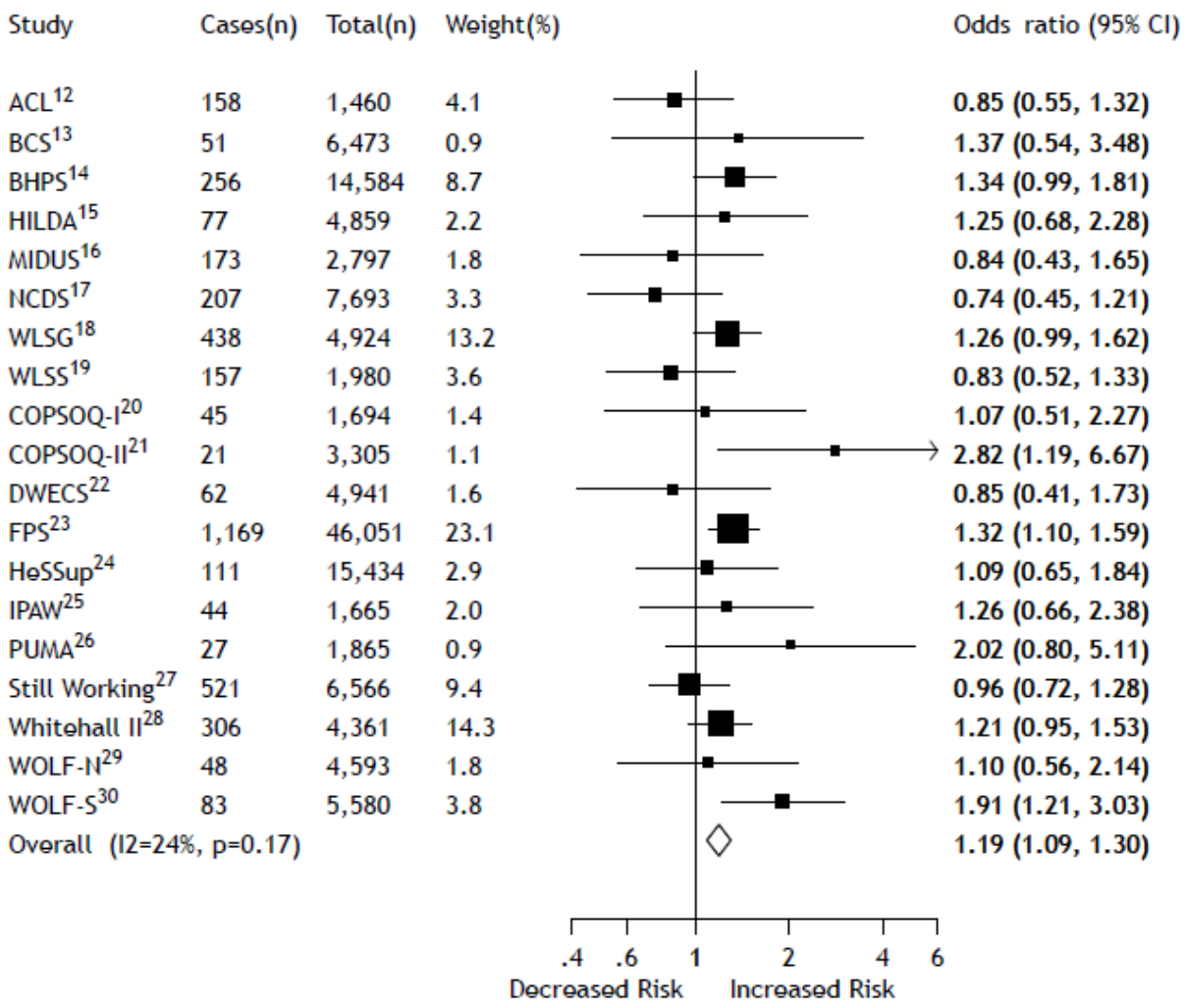
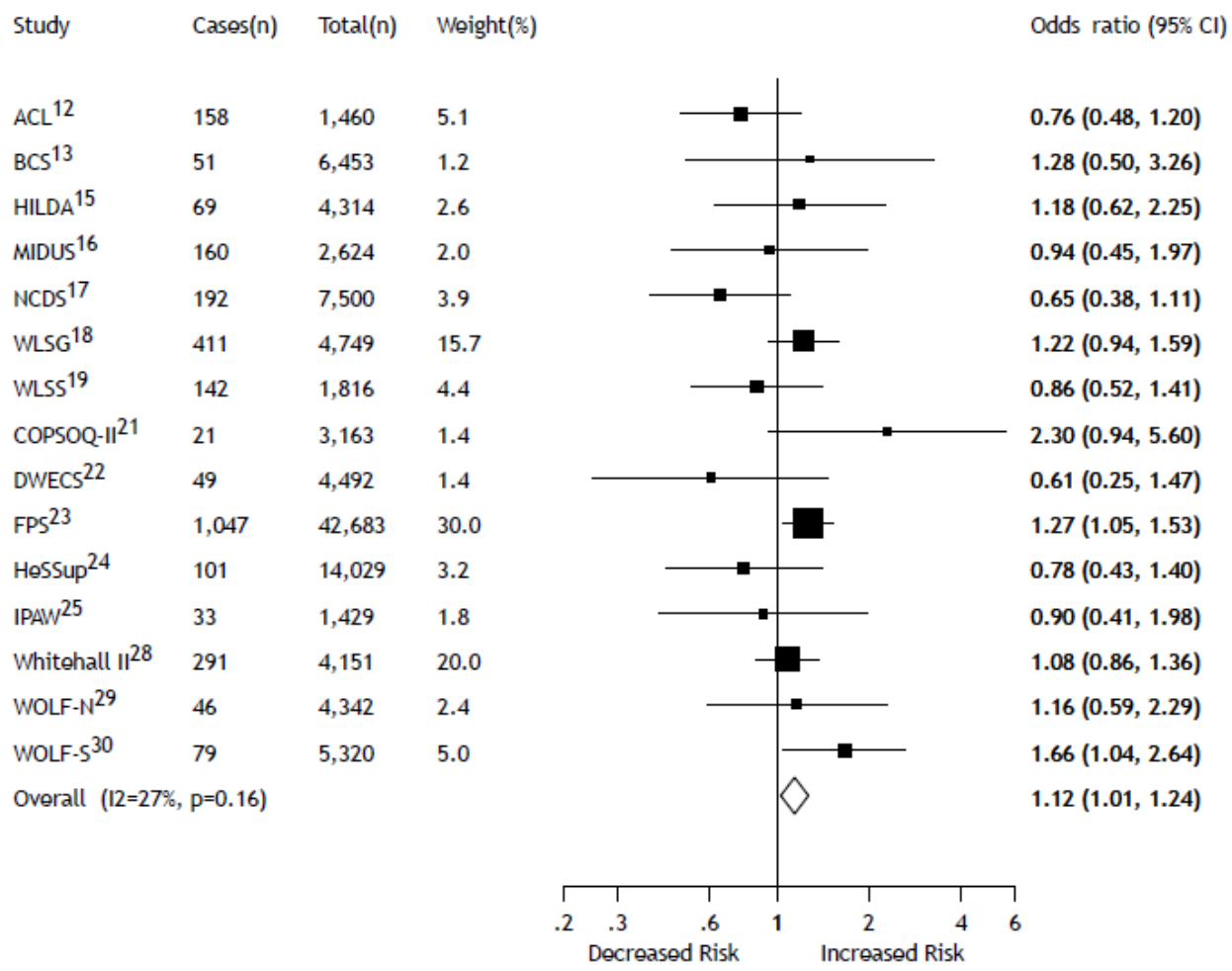
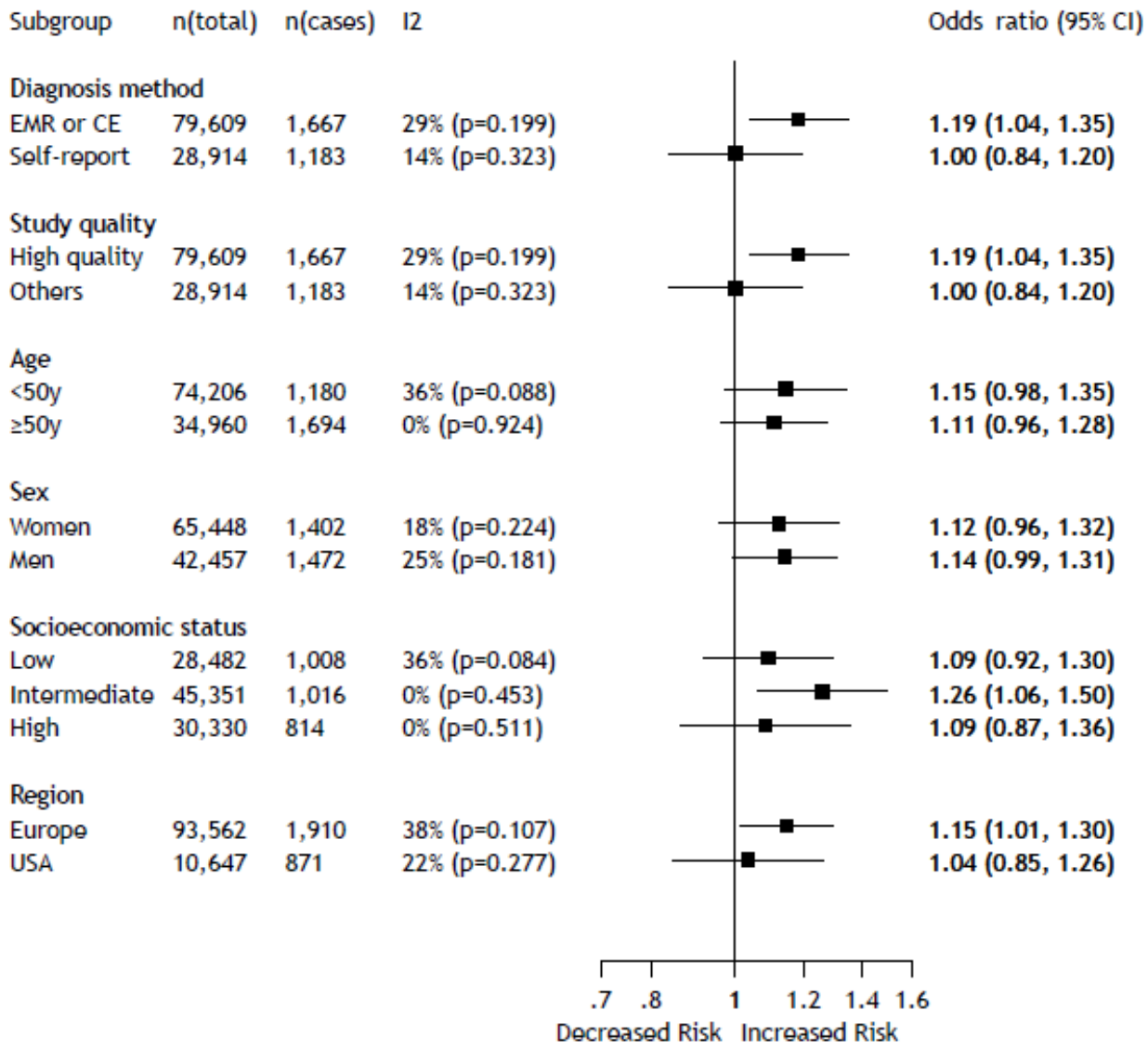


Figure 1B – Multivariable-adjusted* study specific estimates for the association between job insecurity and diabetes (15 cohorts with all covariates n=108,523 participants and 2850 incident cases of diabetes)



*Adjusted for age, sex, socio-economic status, obesity, physical activity, alcohol and smoking

Figure 2. Multivariable-adjusted* sub-group analyses of the association between job insecurity and incident diabetes (15 cohorts, n=108,523, 2850 incident cases of diabetes)



*Adjusted for age, sex, socio-economic status, obesity, physical activity, alcohol and smoking

† EMR = Electronic Medical Records; CE = Clinical Examination (oral glucose tolerance test)