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The joint contribution of cardiovascular disease and socioeconomic status to disability retirement: A register linkage study

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ABSTRACT

Background: Whether low occupational class amplifies the risk of disability retirement among employees with cardiovascular disease (CVD) is unknown. We examined this issue in two prospective cohort studies.
Methods: In the Finnish Public Sector Study and the Helsinki Health Study ($n = 50.799$ employees), prevalent CVD (coronary heart disease or stroke, $n = 1269$) was ascertained using records from national health registers, self-reported doctor-diagnosed diseases, and Rose Angina Questionnaire. Data linkage to national pension registers allowed the follow up of disability retirement among the participants for a mean of six years. We analysed the associations of occupational class and CVD with disability retirement using Cox regression, tested interactions between occupational class and prevalent CVD in predicting disability retirement by calculating the Synergy Index, and pooled the results from the two studies using fixed-effect meta-analysis.
Results: Compared with the participants from high occupational class and no CVD, the participants from the low occupational class without CVD had a 2.13-fold (95% CI 1.97–2.30), those with high occupational class and CVD a 2.18-fold (1.73–2.74); and those with both low occupational class and CVD a 4.49-fold (3.83–5.26) risk of disability retirement. A Synergy Index of 1.55 (1.16–2.06) suggested a greater than additive effect for low occupational class and CVD in combination.
Conclusions: Individuals with both low occupational class and CVD are at a particularly high risk of premature exit from the labour market due to work disability. These findings suggest that better preventive strategies are needed to improve prognosis in this risk group.

1. Introduction

The population is 'greying' in Europe; there were more than seven people of working age in 1950 to one out of labour force but due to increasing life expectancy and decreasing birth rate, the corresponding number will be fewer than two within the next 30 years [1]. There is a rapid decline in employment rates after age 55, health problems playing a major role in early exits. For example, the proportion of individuals outside the labour market due to health reasons at age 60 is about a third of all economically inactive at that age [2]. Better understanding of factors predicting disability retirement is important for interventions and preventive policies.

Cardiovascular diseases (CVD), such as ischemic heart disease and cerebrovascular diseases, remain among the leading causes of years of life lost worldwide [3]. Their impact is not only on mortality but also on work disability, which may often persist for a long period of time or even become a permanent condition [4]. As the workforce is aging, CVD is not uncommon in working-age populations, and due to more effective treatments, many CVD patients remain in employment despite illnesses [5]. However, CVD is a major risk factor for premature exit from the labour market, as indicated by work disability retirement [6–10].

There is also established evidence on socioeconomic inequalities in morbidity and mortality, due to CVD in particular [11,12], with individuals from low socioeconomic groups having significantly higher disease rates than those from high socioeconomic groups [12]. In addition,

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recurrent events or death as adverse outcomes among CVD patients have shown to be more common among those with lower socioeconomic status [13]. In agreement with this, an inverse socioeconomic gradient has been observed in the risk of disability retirement [14,15]. However, we are not aware of studies that have examined whether this gradient is similar for people with and without CVD. Most of the research on this topic has focused on the short-term effect of socioeconomic status on return to work in a patient group (e.g., CVD) hospitalized or functionally disabled [6,8,9]. Knowing not only the risk factors but also combinations of risk factors is important for policies aiming at reducing socioeconomic inequalities in health and functional capacity among working populations.

In this study we used data from two large occupational cohorts to examine the associations of occupational class and prevalent CVD with subsequent disability retirement. We assessed the extent to which a combination of low occupational class and CVD affect the risk of disability retirement over and above their independent effects [16].

2. Materials and methods

2.1. Populations and design

We used data from two Finnish cohort studies, the Finnish Public Sector Study (FPS) [17] and the Helsinki Health Study (HHS) [18]. The FPS examines the employees of 10 Finnish municipalities and 21 hospitals. The base cohort consisted of FPS employees of all ages who responded to the survey in 2004 ($n = 48.076$ provided informed consent, response rate 66%). Of these, 44,516 (93%) were alive and not on disability pension at the beginning of follow-up (2005) and provided data on occupational class, CVD, and all covariates. The mean follow-up was 6.3 (SD = 1.6) years. The FPS non-responders were slightly younger than the responders (mean age 45 versus 46 years), more often men (32% versus 20%) and more often from lower occupational classes (46% versus 43%). The HHS examines municipal employees of the City of Helsinki, Finland. The baseline survey was mailed to employees who turned 40, 45, 50, 55, or 60 in 2000, 2001 and 2002. Altogether, 6605 responded to the baseline survey and provided informed consent (response rate 67%). Of the responders, 6283 (95%) were alive and not on disability pension at the beginning of follow-up (the year following the survey) and provided data on occupational class, CVD and all covariates. The mean follow-up was 6.2 (SD = 1.7) years. The HHS non-responders were slightly younger than the responders (46% aged 40–45 versus 42%), more often men (28% versus 20%) and more often from lower occupational classes (57% versus 51%) [18].

2.2. Occupational class

For both cohorts, occupational class was derived from the employers' personnel registers, and assigned to one of four categories based on job titles: Managers and professionals such as teachers and physicians; semi-professionals such as nurses and foremen; routine non-manual workers such as clerical employees and child minders; and manual workers such as technical and cleaning staff. Of these, managers, professionals and semi-professionals were categorized into a high occupational class, and routine non-manual workers and manual workers into a low occupational class.

2.3. Cardiovascular disease

In the FPS, prevalent CVD included ischemic heart disease and cerebrovascular disease and those with CVD were defined as having at least one of the following: Special reimbursement for medication due to cardiac failure or coronary artery disease (from the register of the Social Insurance Institute of Finland); sickness absences or hospitalization with ICD-10 codes I20-I25, I46-I50, and I60-I69 between 2003 and 2004 (from the registers of the Social Insurance Institute of Finland and the National Institute of Health and Welfare); or a self-reported doctor-diagnosed cardiovascular disease (coronary thrombosis or angina) in the 2004 survey. The HHS defined prevalent CVD in a similar way, except that it included the Rose questionnaire [19,20] in the survey to define prevalent angina at baseline, and did not include self-reported doctor-diagnosed coronary thrombosis.

2.4. Work disability retirement

Information on work disability retirement (the dates of granted disability pensions) was obtained for both cohorts from the Finnish Centre for Pensions, the official pension register in Finland, and was linked to the survey data. The participants were followed up for the incidence of disability pension for a maximum of seven years, starting from the beginning of the year following the survey year. In Finland, allowance for work disability pension can be granted after 300 days of sickness absence and this can be either fixed-term (usually for a year at a time), or permanent.

2.5. Covariates

In both cohorts, covariates were measured at the baseline and included sex and age, which were retrieved from employers' registers. In the FPS, other somatic disease included asthma, rheumatoid arthritis, cancer, and diabetes; information on which was derived from electronic medical records (cancer from the Finnish Cancer Registry, and the rest of the diseases from the Special Refund Entitlement Register of the Social Insurance Institute). The HHS included the same somatic diseases, but these were based on a check-list of self-reported doctor-diagnosed diseases. In both cohorts, common mental disorder was measured by a psychological distress scale, the 12-item General Health Questionnaire (GHQ-12) [21,22]. In the GHQ-12, respondents rate the extent to which they are affected by each of the 12 symptoms (1 = not at all, 2 = as much as usual, 3 = slightly more than usual, 4 = much more than usual). Participants with a rating of 3 or 4 in at least four items of the total measure were coded as cases of common mental disorder [23]. In both cohorts, obesity (body mass index ≥30 kg/m^2) and smoking (yes/no) were based on survey responses.

2.6. Statistical analyses

We used ANOVA and χ^2 tests to assess differences between the baseline characteristics of participants with and without CVD, in both cohorts. We used Cox proportional hazard regression analysis to estimate hazard ratios (HR) and the 95% CI for disability pension. Predictor variables were CVD, occupational class, and their combinations. Follow-up started at the beginning of the year following the survey year for both cohorts, and lasted a maximum of seven years, or until the awarding of work disability or old-age pension, or death, whichever occurred first. The status of CVD and occupational class were based on baseline information although there might have been some changes in these exposures during follow-up. Men and women were analysed together due to a relatively small number of men in both cohorts. The first model was adjusted for age and sex, and the second model for age, sex, other somatic disease, common mental disorder, obesity, and smoking. We calculated the Synergy Index (S) to examine whether the joint association of low occupational class and CVD deviated from their additive effect. This was done using the previously reported algorithm [16] in which S = [HR (low occupational class and having CVD) − 1] / [(HR (high occupational class and CVD) − 1) + (HR(low occupational class and no CVD) − 1)]. We used an Excel sheet provided by Andersson et al. [16] to calculate S and its 95% confidence intervals (available at www.epinet.se). A Synergy Index of 1.0 implies perfect additivity and >1.0 indicates that the joint effects of low occupational class and CVD on subsequent disability retirement are more than additive, i.e., more than one would assume by summing the two effects. To obtain a summary estimate across the two studies, the study-specific estimates were pooled using fixed-effect meta-analysis. We conducted I^2 statistics to assess the heterogeneity between the FPS and HHS estimates, which describes the percentage of variability in point estimates that is due to heterogeneity rather than sampling error [24]. All study-specific analyses were performed using SAS 9.4 statistical software, and meta-analyses were performed using Stata version 13.

3. Results

The mean age of the participants was 45.5 (SD = 9.6) in the FPS and 49.2 (SD = 6.5) in the HHS, and the proportion of women was 80.1% and 78.5%, respectively. Prevalent CVD was ascertained in 878 (2.0%) FPS participants and 391 (6.2%) HHS participants (Table 1). Of the 878 FPS participants with CVD, 818 (93.2%) had ischemic heart disease (IHD) only, 55 (6.3%) had stroke only, and 5 (0.6%) had both. Of the 391 HHS participants with CVD, 378 (96.7%) had IHD only and 13 (3.3%) had stroke only. Participants with prevalent CVD were older, more often men (in FPS), of lower occupational class, had more comorbid diseases and common mental disorders, and were more often obese than those free from CVD in both cohorts. No difference between the CVD cases' and non-cases' smoking was found in either cohort.

The associations between CVD and the incidence of work disability pension, and between occupational class and the incidence of work disability pension are shown in Online Online Supplemental Table 1, both for each cohort separately, and for the cohorts in combination. In the age- and sex-adjusted model, CVD was associated with an HR of 2.95 (95% CI 2.55–3.41) for disability retirement in the FPS, and an HR of 2.28 (95% CI 1.77–2.94) in the HHS. Adjustment for covariates attenuated this estimate to some extent (HRs 2.33 and 1.65). The pooled estimate for CVD associated with work disability pension was HR = 2.14 (95% CI 1.88–2.43) in the multivariable adjusted model, although the association was stronger in the FPS cohort than in the HHS cohort (I^2 = 80.6%, $p = 0.023$). Low occupational class was associated with disability retirement in both cohorts (multivariable adjusted HR = 2.16, 95% CI 2.00–2.34 in FPS; HR = 1.92, 95% CI 1.58–2.33 in HHS). The pooled

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