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Persistent smoking as a predictor of disability pension due to musculoskeletal diagnoses: A 23 year prospective study of Finnish twins

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ABSTRACT

Objective. To investigate whether stability or changes in smoking predict disability pension (DP) due to low back diagnoses (LBD) and musculoskeletal diagnoses (MSD) after taking familial confounding into account using a co-twin design.

Method. Longitudinal smoking patterns and multiple covariates in a population-based cohort of 17,451 Finnish twins (6959 complete pairs) born before 1958 were surveyed through questionnaires in 1975 and 1981. The outcome data were collected from the national pension registers until the end of 2004. Cox proportional hazards regression models were used for statistical analyses.

Results. Disability pension due to low back diagnoses was granted to 408 individuals and disability pension due to musculoskeletal diagnoses to 1177 individuals during the follow-up of 23 years. Being a persistent smoker (current smoker both 1975 and 1981) predicted a significantly increased risk for disability pension (hazard ratio 1.69, 95% confidence interval 1.46, 1.97) compared to those individuals who had never smoked. The association remained when several confounding factors, including familial factors, were taken into account.

Conclusion. Persistent smoking predicts early disability pension due to musculoskeletal diagnoses and low back diagnoses independently from numerous confounding factors, including familial effects shared by the co-twins.

Introduction

Smoking is a major preventable cause of death (WHO, 2012), and also clearly associated with chronic conditions including musculoskeletal disorders (MSD) (Battie et al., 1991; Brook et al., 2012; Malaise et al., 2012). Smoking can be causally associated with disability pension (DP), for example because of the adverse health effects of smoking related to underlying chronic conditions (MSD) (Karlson and Deane, 2012; Shiri et al., 2010), but the association can be also because of confounding factors, such as low socioeconomic status (Pietikäinen et al., 2011); these different mechanisms can also affect the associations with DP together (Haukenes et al., 2013). Both smoking and MSD incur considerable costs to society, but even more if they lead to an award of a DP. Despite the link between smoking and DP, their relationships, in particular DP due to MSD have been rarely studied. At present, smoking has been mainly studied as a risk factor for DP in general, not accounting for diagnosis group. Furthermore, these studies have had at least one of the following limitations: examined only in men (Neovius et al., 2010) or women (Friis et al., 2008), short follow-up time 10 years or less, or only one occupation or living area (Claessen et al., 2010; Friis et al., 2008; Husemoen et al., 2004).

The previous reports specifically aimed at investigating DP due to MSD have been based on Nordic twin cohorts (Pietikäinen et al., 2011; Ropponen et al., 2011a,b) and have pointed in the direction that smoking might be an early predictor for individuals at risk for DP due to MSD. Some indications also exist that the risk associated with smoking might vary between different diagnosis groups leading to a DP grant. Furthermore, assessment of smoking patterns between two time points located 25 years apart in Swedish twins showed that being a persistent tobacco user predicted both DP in general and DP due to MSD in an 8 year follow-up (Ropponen et al., 2011a).

Smoking is only one aspect of health behavior and different health behaviors are known to be mutually related. For example, smoking cessation may be promoted by a motivation to improve one's fitness level due to increased body weight or conversely smoking may be used to control excess weight gain (Farley et al., 2012; Yong and

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Borland, 2008). Hence, one health behavior (e.g., exercise) may have a confounding effect on the association between a second health behavior (e.g., smoking) and thus granting of DP. According to earlier studies, smoking may play a causal role or may simply be an indicator of numerous other factors increasing morbidity. Since clinical trials using smoking as an exposure would be unethical, more sophisticated techniques are needed to analyze observational data. One such design is to observe the effect of stability or change of smoking on the development of DP. Another issue that has proven to be important in studies of DP is that familial factors (including genetics and shared environment such as social background) may influence the associations. Genetic factors are known to play a role in both DP due to MSD (Harkonmäki et al., 2008; Hartvigsen et al., 2009; Narusyte et al., 2011) and in smoking (Maes et al., 2004; Rose et al., 2009; Schmitt et al., 2005). This suggests that there might be shared genetic influences underlying the association between smoking and DP. Hence, an experimental design which can confound for familial influence (genetics and shared environment) through examining discordant twin pairs where one twin has a DP while the other has not, would be one way to obtain valid information on the association between smoking and DP. If the association found among individuals cannot be replicated within discordant twin pairs, then familial factors are of importance. If discordant twin pairs show similar associations as the individual-based analyses, this is additional evidence that the exposure may actually be a contributing cause of the outcome.

The aim of this study was to investigate whether stability or changes in smoking could predict DP due to low back diagnoses (LBD) and MSD after taking several confounding factors including familial confounding into account.

Methods

The Finnish Twin Cohort includes data from the baseline questionnaire with comprehensive questions on sociodemographic, health, lifestyle and psychosocial factors mailed in 1975 to all same-sex Finnish twin pairs born before 1958 with both co-twins alive (response rate 89%) (Kaprio and Koskenvuo, 2002). The follow-up questionnaire in 1981 was mailed to the same twins irrespective of whether they had responded to the baseline questionnaire (response rate 84%). The present analysis consisted of twin individuals responding to both questionnaires with information on smoking, not retired from work before the date of the 1981 questionnaire, and resident in Finland in 1981. The study sample comprised 17,451 twin individuals (52% women) including 2301 complete monozygotic (MZ) pairs, 4658 complete dizygotic (DZ) pairs, and 3533 twin individuals without a co-twin since the co-twin did not fulfill the selection criteria (Fig. 1).

Information on DP was obtained from the official Finnish pension registers (Harkonmäki et al., 2008). A medically confirmed illness, disease, or injury which essentially restricts or prevents working is required for the granting of disease-based early retirement pension (DP or individual early retirement pension for employees 58–64 years old) in the Finnish pension system. In addition, functional capacity, occupational skills, education, work tasks, and work history are always assessed as a part of the evaluation of work capacity. The final decision of a person's work disability is made by physicians working in the insurance institutions. The International Classification of Diseases (ICD) ICD-10 codes M00-M99 for DP due to MSD, and M45–M54 for DP due to LBD and the corresponding codes in ICD-8 and ICD-9 are used for encoding by the Finnish insurance institutions. Censoring was assessed through the information on mortality and migration derived from the Population Register Centre of Finland. The record linkages were done using the personal identification code, which is unique for each resident of Finland and included in virtually all medical and social registers. The follow-up time was from the date of the 1981 questionnaire to the date when DP was awarded, or until the person began to receive an old age pension, or to the date of death/emigration, or to December 31st 2004, which ever occurred first.

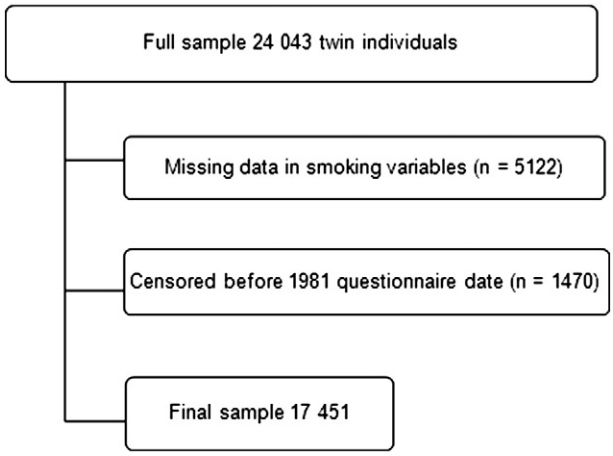

Fig. 1. Flowchart for the sample definition based on The Finnish Twin Cohort.

Cigarette smoking was queried in detail with a series of questions and categorized into four classes from both the 1975 baseline and the 1981 follow-up questionnaires (Hukkinen et al., 2009). First the never smokers were identified through answering "no" to the first question "Have you ever smoked more than 5–10 packs of cigarettes in your lifetime". Those answering "yes" to this question, but "no" to the question "Do you smoke or have you smoked cigarettes regularly, say daily, or almost daily during your lifetime?" were classified as occasional smokers. Those answering "yes" to this latter question, were further asked "Do you still smoke regularly?". Those answering "no" were regarded as former smokers, and those saying "yes" were classified as a current daily smokers. For the analyses, the categorization was based on the consistency/change of smoking status and amount smoked between 1975 and 1981 as follows: constant never smokers (in 1975 and 1981); constant occasional/non-daily smokers (in 1975 and 1981); constant former smokers (in 1975 and 1981), initiators of daily smoking (never smokers in 1975, daily smokers in 1981); quitters (current smokers in 1975, former smokers in 1981); recurrent smokers (former smokers in 1975, current smokers in 1981); persistent smokers (current smokers in 1975 and 1981); and others (including pipe and cigar smokers, irregular smoking, confusing self-reports of smoking status, and misclassifications) (Hukkinen et al., 2009, 2011; Korhonen et al., 2007). The last category including "other smokers" was included in the analysis to avoid losing that information. However since they represent very heterogeneous smoking behavior patterns, the results were not used to make any interpretations. In addition, for those who reported being persistent smokers, we separately identified those who smoked heavily and persistently (both in 1975 and 1981) more than 15 cigarettes per day (CPD).

The covariates from the 1981 questionnaire included in this study were: age, sex, education (nine categories by years of education, converted into years of education), and marital status dichotomized to those living with someone vs. single. Body mass index (BMI, self-reported kg/m^2, the validity of self-reported BMI values in known to be high (Korkeila et al., 1998)), leisure-time physical activity measured by monthly frequency, mean duration and mean intensity and computed to metabolic equivalent (MET) values (Kujala et al., 1998), and alcohol consumption (based on self-reported average quantities of beer, wine, and spirits consumed (Romanov et al., 1987)) grouped into four categories of abstainers, light, moderate, and heavy users according to the sex-specific criteria of the National Institute on Alcohol Abuse and Alcoholism (Järvenpää et al., 2005). Furthermore, musculoskeletal pain assessed with the question of having pain in low back, neck or shoulder area that had affected work capacity in the recent years (yes vs. no) was included. The responses to these three items were used to calculate a summary pain score (0–3 locations). Life satisfaction was measured with a four item scale on levels of interest, happiness, easiness and loneliness of life (Allardt, 1973) and analyzed as a continuous sum score ranging from 4 to 20 (Cronbach's alpha 0.74) (Koivumaa-Honkanen et al., 2000). The life satisfaction scale has been shown to carry a strong association (correlation > 0.6) with depressive symptoms (Koivumaa-Honkanen et al., 2004). The use of hypnotics and/or tranquilizers was classified as: no use of hypnotics or tranquilizers, infrequent use (1–59 days per year of either medication), and frequent use (60 or more days per year of either medication) (Hublin et al., 2007); those with missing data were coded as a missing category to be included in the analyses.

Statistical analysis

Descriptive statistics were used for reporting background factors, and all the analyses were performed using the Stata statistical software, version 12.1.