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Socioeconomic and occupational risk factors for venous thromboembolism in Sweden: A nationwide epidemiological study

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ABSTRACT

Our aims were to investigate possible associations between hospitalisation for venous thromboembolism (VTE) and socioeconomic and occupational factors. A nationwide database was constructed by linking Swedish census data to the Hospital Discharge Register (1990–2007). Hospital diagnoses of VTE were based on the International Classification of Diseases. Standardised incidence ratios were calculated for different socioeconomic and occupational groups. A total of 43063 individuals aged >20 years were hospitalised for VTE. Individuals with >12 years of education were at lower risk for VTE. Blue-collar workers, farmers, and non-employed individuals had higher risks for VTE, and white collar workers and professionals lower risks. In males and/or females, risks for VTE were increased for assistant nurses; farmers; miners and quarry workers; mechanics, iron and metalware workers; wood workers; food manufacture workers; packers; loaders and warehouse workers; public safety and protection workers; cooks and stewards; home helpers; building caretakers; and cleaners. Decreased risks were observed for technical, chemical, physical, and biological workers; physicians; dentists; nurses; other health and medical workers; teachers, religious, juridical, and other social science-related workers; artistic workers; clerical workers; sale agents; and fishermen, whalers and sealers. High educational level and several occupations requiring high levels of education were protective against VTE, while the risks for VTE were increased for farmers, blue-collar workers and non-employed individuals. The mechanisms are unknown but it might involve persistent psychosocial stress related to low socioeconomic and occupational status.

Introduction

Venous thromboembolism (VTE) is a major cause of morbidity and mortality [1–8]. A number of acquired and inherited risk factors for VTE have been identified [1–8]. These include advancing age, surgery, oral contraceptives, hormone replacement therapy, pregnancy, immobilisation, obesity, malignancy, and inherited or acquired thrombophilia [1–8]. Psychosocial factors are important causes of coronary heart disease [9–11], but much less is known about their importance in venous thromboembolism. However, several studies have demonstrated links between psychosocial variables and increased blood clotting and decreased fibrinolysis [12,13], which may be of importance in the pathophysiological process underlying VTE. Low educational level has been associated with increased risk for death by pulmonary embolism (PE) [14]. In a Danish study high income was associated with decreased risk for VTE [15]. In a Swedish study Rosengren et al. found that men with persistent stress had an increased risk for PE but not for deep venous thrombosis (DVT) [16]. They also found that men with intermediate- or high-level white-collar jobs and professionals had a decreased risk for PE, but not DVT. Whether occupation affects the risk for VTE is otherwise largely unknown. In a small case-control study, nurses were reported to be at increased risk for VTE [17]. Another study found no increased risk for VTE among pilots [18]. Socioeconomic factors may increase the risk of disease in many ways. For example, immobilisation, being sedentary, and exposure to harmful agents may be related to occupational, residential and lifestyle factors, which may depend on social class.

Due to the lack of large-scale follow-up studies of the possible associations between venous thromboembolism and socioeconomic status and occupation, we conducted a follow-up study of the entire population of Sweden. The aim of this study was to investigate the associations between socioeconomic status (measured by income, occupational status, and level of education) and different occupations and hospitalisation for VTE in men and women aged >20 years.

Material and methods

This study was approved by the Ethics Committee of Lund University, Sweden. Data used in this study were retrieved from the

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MigMed2 database (an updated version of the original MigMed database), maintained at the Center for Primary Health Care Research, Lund University, Malmö. MigMed2 is a single, comprehensive database that contains individual-level information for all residents of Sweden, including age, sex, occupation, geographic region of residence, hospital diagnoses, dates of hospital admissions, date of emigration and date and cause of death. This unique database was constructed using data from the 1990 census and several national Swedish data registers including, but not limited to, the Total Population Register and the Swedish Hospital Discharge Register [19–22].

Individuals included in the present study were in the 1990 census cohort, based on their occupation at the time of the census. Information retrieved from the various registers in the MigMed2 database was linked at the individual level via the national 10-digit registration number assigned to each person in Sweden for his or her lifetime. Registration numbers were replaced by serial numbers to preserve the anonymity of all individuals. As well as being used to track all records in the database at the individual level, these serial numbers were used to check that individuals with hospital diagnoses of VTE appeared only once in the data set (for their first hospital diagnosis of VTE during the study period).

Data for first hospitalisations for VTE during the study period were retrieved from the Hospital Discharge Register (1990–2007). This register does not include data for hospital outpatients or patients treated at primary health care centres. Diagnoses of VTE (deep and superficial venous thrombosis of the lower extremities and pulmonary embolism) were based on the International Classification of Diseases (ICD). The 9th version of the ICD was used between 1990 and 1996 (451 and 415B) and the 10th version between 1997 and 2007 (I80 and I26). Comorbidity was defined as the first diagnosis at follow up from 1980–2008 (ten years earlier than the study period): 1) Chronic obstructive pulmonary disease (COPD); ICD-8 490–493, ICD-9 490–496, and ICD-10 J40-J49, 2) Obesity; ICD-8 277.99, ICD-9 278A, and ICD-10 E65-E68, 3) Alcoholism and alcohol related liver disease; ICD-8 291,303,571, ICD-9 291, 303, and ICD-10 F10 and K70, 4) coronary heart disease (CHD); 410–410 (ICD-8); 410–414 (ICD-9); and I20-I25 (ICD-10), and 5) stroke; ICD-8,9: 431,432,433,434,435, 437.0, 437.1; ICD-10: I61,I62, I63, I65, I66, I67.2, I67.8.

Individual variables

Sex was classified as male or female.

Age at diagnosis was categorised into 5-year groups. We only included individuals aged >20 years because many people do not have a stable occupation at younger ages.

Individuals were assigned to different occupation groups according to their occupation, as recorded in the Swedish censuses in 1990.

Occupation was coded according to a national adaptation of the Nordic Occupational Classification (NYK). The NYK is a Nordic adaptation of the International Standard Classification of Occupations (1958). Three-digit occupation codes were grouped into 53 NYK occupational groups based on their similarities [23]. Economically inactive individuals belong to the non-employed group. We were unable to separate for instance homemakers from unemployed in this group.

Immigrant status was classified as born in Sweden or born outside Sweden.

Three different measures of socioeconomic status were used: level of education, socioeconomic occupational status, and income.

Level of education was categorised into three groups: completion of compulsory schooling or less (≤9 years), practical high school education or some theoretical high school education (10–12 years), and theoretical high school and/or university studies (>12 years). Level of education could be regarded as a stable measure of socioeconomic status.

Socioeconomic occupational status was categorised, according to the Swedish socio-economic classification by Statistics Sweden [24], into six groups: (1) farmer, (2) blue-collar worker, (3) white-collar worker, (4) professional, (5) and self-employed, and (6) non-employed group (economically inactive individuals like unemployed and homemakers). **Income** (1990) was categorised into four groups: low (<64200 Swedish Kronor), middle-low (64300–81700 Swedish Kronor), middle-high (81800–102500 Swedish Kronor), and high >102500 Swedish Kronor).

Geographic region of residence was categorised as (1) large city (city with a population of >200000, i.e. Stockholm, Gothenburg or Malmö), (2) Southern Sweden, and (3) Northern Sweden. Large cities were grouped into a separate category because it is likely that individuals living in large cities have better access to health care. In addition, they are exposed to air pollution. Sweden is divided into 25 counties. The Dalälven River traditionally marks the border between Northern and Southern Sweden and was here used to define the geographic boundaries between Southern and Northern Sweden. Geographic region was included as an individual-level variable to adjust for possible differences between geographic regions in Sweden regarding hospital admissions for VTE.

Statistical analysis

Person-years (i.e. the number of persons at risk multiplied by the time at risk) were calculated from the start of follow-up on 1 January 1990 until hospitalisation for VT or PE, death, emigration, or the end of the study period on 31 December 2007. The follow-up was started at immigration or on January 1 following the included census, i.e. 1990. Age-specific incidence rates were calculated for the whole follow-up period, divided into five 5-year periods. Standardised incidence ratios (SIRs) were calculated for different socioeconomic and occupational groups as the ratio of the observed and expected number of cases [25]. The expected number of cases was based on the actual number of cases in the corresponding cohort of individuals aged >20 years and was calculated for age (5-year groups), sex, time period, geographic region of residence, immigrant status, comorbidities, and for different socioeconomic status and occupations. All SIRs in Tables 1–3 were adjusted for age (5-year groups), time period, and geographic region of residence, except those for different geographic regions of residence, which were adjusted for age (5-year groups) and time period.

The SIR was calculated as the ratio of observed (O) to expected number of VTE cases using the indirect standardization method, as specified:

$$SIR = \frac{\sum_{j=1}^{J} o_j}{\sum_{j=1}^{J} n_j \lambda_j^*} = \frac{O}{E^*},$$

where $O = \sum o_j$ denotes the total observed number of cases in the study group ; E^* is calculated by applying stratum-specific standard incidence rates (λ_j^*) obtained from the reference group to the stratum-specific person-year (n_j) experience of the study group. o_j represents the observed cases that the cohort subjects contribute to the jth stratum and J represents the strata defined by the cross-classification of various adjustment variables [25]. Ninety-five percent and 99% confidence intervals were calculated assuming a Poisson distribution [25]. All analyses were performed using the SAS version 9.1 (SAS Institute, Cary, NC, USA).

Results

A total of 23464 males and 19599 females were hospitalised for VTE during the study period (Table 1). Table 1 shows the SIRs for hospitalisation for VTE by socioeconomic status (level of education,