Socioeconomic inequalities in coronary heart disease in Italy: A multilevel population-based study

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Abstract

This longitudinal study evaluates the role of individual and contextual socioeconomic determinants in the socioeconomic inequalities in incidence and mortality for coronary events in Turin, Italy, using hierarchical models. All residents aged 35–74 at the start of 1997 were included in the study population. We considered as outcomes all incident cases and deaths that occurred in the study population in the period 1997–2002. The socioeconomic indicators were educational level, job status and median income per census tract. A neighbourhood deprivation index was also used, which combines, in an aggregated measure, a series of poor individual socioeconomic conditions. The analyses were performed using hierarchical Poisson models, with individuals ($n = 523,755$) considered as level I units and neighbourhoods ($n = 23$) as level II units. Among men, we observed an inverse gradient in incidence by educational level and an excess risk for persons who were not actively employed. More marked excesses were found for mortality (RR: 1.63; 95% CI: 1.05–2.55, for unemployed persons compared to employed persons). Among women, greater socioeconomic differences were observed for both incidence and mortality; all of the individual indicators contributed to these differences. The differentials in mortality were particularly great for the retired and for housewives (RR: 1.98; 95% CI: 1.40–2.81). Slight excesses in incidence were observed among men for the most deprived areas. The results of this study reveal that job status is the most important individual factor explaining socioeconomic inequalities for coronary events, whereas context seems to play a marginal role.
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Introduction

Socioeconomic inequalities in the occurrence of, and mortality for, cardiovascular disease have been well documented in nearly all Western countries (Mackenbach, Cavelaars, Kunst, & Groenhof, 2000). More marked inequalities have been ob-

served in the United States, whereas in Europe there exists a north–south gradient in inequalities (Kunst, Groenhof, Mackenbach & Health, 1998; Leclerc, Lert & Fabien, 1990; Morrison, Woodward, Leslie & Tunstall-Pedoe, 1997), with less accentuated differences in Latin countries (Mackenbach et al., 2000).

An inverse relationship has been observed between mortality for cardiovascular disease and the three main indicators of socioeconomic status (i.e., educational level, occupation, and income)

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(Hallqvist, Lundberg, Diderichsen, & Ahlbom, 1998; Peltonen, Rosen, Lundberg, & Asplund, 2000; Pocock, Shaper, Cook, Phillips, & Walker, 1987), even after having controlled for biological, behavioural, and psychological risk factors (Lynch, Kaplan, Cohen, Tuomilehto, & Salonen, 1996). Of these indicators, educational level has been shown to have the greatest inverse correlation with cardiovascular risk factors (i.e., smoking, systolic blood pressure, and cholesterol level) (Winkleby, Jatulis, Frank, & Fortmann, 1992). There is also growing evidence of the role played by psychosocial determinants (Marmot & Wilkinson, 2001): in particular, social support and work conditions have been shown to affect the pathogenesis of coronary disease; these factors can condition lifestyles and result in stress (Ruberman, Weinblatt, Goldberg, & Chaudhary, 1984), depression, and anxiety, and they can directly cause neuroendocrine changes, increasing the susceptibility to cardiovascular diseases (Brunner, 1997; Hemingway & Marmot, 1999; Kaplan & Keil, 1993).

According to Lynch, an indirect effect of income on health can also be hypothesised, with income compensating for the influence of social and environmental stressors (Lynch & Kaplan, 2000). Studies conducted to date in northern Europe and the United States have reported that there exist effects that are contextual (Macintyre et al., 2001) and thus associated with the socio-economic deprivation of residential area and that the effects of contextual variables on incidence (Diez Roux et al., 2001; Kolegard Stjarne, Diderichsen, Reuterwall, & Hallqvist, 2002; Sundquist, Winkleby, Ahlen, & Johansson, 2004) and mortality (Smith, Hart, Watt, Hole, & Hawthorne, 1998) are independent of individual factors. The effect of socioeconomic context has also been shown to be more evident for coronary mortality compared to general mortality (Pickett & Pearl, 2001). Area deprivation can act through diverse mechanisms, such as the relationship between life conditions (influenced by area of residence) and at-risk behaviours (Diez Roux, Merkin, Hannan, Jacobs, & Kiefe, 2003; Diez Roux et al., 1997; Sundquist, Malmstrom, & Johansson, 1999). Moreover, the importance of hierarchical models in accurately estimating the uncertainty of information correlated on a geographic basis has been well established (Diez Roux, 2001; O'Campo, 2003).

In Italy, both the incidence of, and mortality for, coronary events have decreased since 1993 (Ferrario et al., 2003), yet no studies have evaluated the role of area deprivation and individual socioeconomic level in the variability observed for coronary events. To this end, we conducted a longitudinal study among the population of the city of Turin, using hierarchical models.

Materials and methods

Databases

The study was conducted as part of the Turin Longitudinal Study (TLS), which was begun in 1971 to monitor social inequalities in health and which constitutes a dynamic population-based data base (Office of National Statistics, 2001). The fulcrum of the TLS is represented by the Turin Population Register (TPR), which can be linked to demographic information and health systems in order to longitudinally assess the relationship between socioeconomic covariates and health outcomes. Turin, located in northwest Italy, has a population of approximately 900,000 inhabitants. All the residents in Turin, aged 35–74 at the beginning of 1997, were included in the study population ($n = 529,284$). Coronary events were extracted from the Turin Coronary Event Database (TCED), that records all coronary events among residents of Turin from 1996 to 2002. The data base was obtained selecting cases from: (1) the regional data base of hospital discharges, considering those discharges referring to persons resident in Turin with a main discharge diagnosis identified with the ICD-9 codes 410–414. Information on death, if it occurred during hospital admission, was also taken from the data base; (2) the Mortality Registry of Turin, extracting those records referring to persons who died of a coronary event before reaching the hospital (main cause of death identified with ICD-9 codes 410–414 and 798–799). For repeated events, in accordance with the MONICA Project (Mahonen, Salomaa, Keskimaki, & Moltchanov, 2000; Tunstall Pedoe et al., 1994), we adopted the following criteria: if two events (i.e., either two consecutive hospitalisations or a hospitalisation followed by death) occurred within less than 28 days of each other, only the first event was considered, as the second is treated as part of the same coronary event. The outcomes of the study were incident cases and deaths occurring between 1 January 1997 and 31 December 2002. Cases were defined as "incident" when they were not preceded by an event in the previous year. An