Social participation, social capital and socioeconomic differences in health-related behaviours. An epidemiological study

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Social participation, social capital and socioeconomic differences in health-related behaviours

An epidemiological study

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Leg läkare, filosofie magister

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Title and subtitle
SOCIAL PARTICIPATION, SOCIAL CAPITAL AND SOCIOECONOMIC DIFFERENCES IN HEALTH-RELATED BEHAVIOURS - An epidemiological study

Abstract. Cardiovascular mortality and total mortality are higher in lower socioeconomic groups. In the 1980s and the 1990s these socioeconomic differences have been growing. Health-related behaviours (HRB:s) like smoking, leisure-time physical activity and dietary habits have during the same period become increasingly socially patterned. The aims of this thesis have been to study whether socioeconomic differences in HRB:s are present in a middle-aged population in the city of Malmö, and whether psychosocial resources such as social network and social support could explain these differences. The theoretical basis for this hypothesis of a causal link between HRB:s and psychosocial factors is a psychosocial stress theory that focuses on the protective role of the psychosocial resources of the individual in developing benign health-related behaviours. The study population of this thesis is derived from the Malmö Diet and Cancer Study (MDCS), which is a prospective cohort study in Malmö. Recruitment by invitation to the MDCS started in the spring of 1991 and the last participants were examined in the autumn of 1996. The total participation rate in the MDCS was 40.6% (28,098 participated out of 69,129). The study population of this thesis consists of all 11,837 persons (5,380 men and 6,457 women) below the age of 65 who participated in the MDCS during the two year period from the spring of 1992 until the summer of 1994, born between 1926 and 1945. This study sample was selected because the version of the questionnaire used in 1991-1992 did not include the psychosocial variables, and because the dietary data from September 1994 to October 1996 was assessed with a different version of the diet assessment method. Socioeconomic status was defined by occupation title and work tasks. The psychosocial factors tested were social participation, social anchorage, emotional support and instrumental support. No statistically significant socioeconomic differences were observed in the intake of total fat, saturated fat, monounsaturated fat and polyunsaturated fat. Furthermore, no significant socioeconomic differences in fruit consumption and intermittent smoking were observed. However, statistically significant socioeconomic differences were observed in the intake of vegetables and fruit juices, in daily smoking, in smoking cessation and in leisure-time physical activity. In all these cases, the odds ratio of risk behaviour was significantly lower in higher socioeconomic groups. Social participation was the psychosocial variable that most greatly reduced the socioeconomic differences in vegetable consumption, daily smoking, smoking cessation and leisure-time physical activity. Social participation is one important aspect of the concept of social capital as defined by Coleman and Putnam. This literature stresses the importance of inter-personal relations and trust, and social capital is thus partly a contextual trait. A multilevel analysis of the small administrative areas of Malmö revealed that the differing levels of social participation in the areas were partly determined by individual socioeconomic status and education, but an important fraction of the differences in the level of social participation between the areas remained after adjustment for a number of individual determinants. In conclusion, social participation is the psychosocial factor that is related to a number of HRB:s and to socioeconomic differences in these behaviours. The psychosocial stress hypothesis was partly supported, although the other three psychosocial variables were not related to the socioeconomic differences in health-related behaviours. Moreover, it could be demonstrated that social participation (social capital) also is a variable on a contextual level.

Key words: Fat intake, health-related behaviour, intermittent smoking, multilevel analysis, neighbourhood, physical activity, psychosocial, smoking cessation, social capital, social participation, socioeconomic differences, vegetable consumption

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Social participation, social capital and socioeconomic differences in health-related behaviours

An epidemiological study

Martin Lindström

Malmö 2000

Abstract

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The study population of this thesis is derived from the Malmö Diet and Cancer Study (MDCS), which is a prospective cohort study in Malmö. Recruitment by invitation to the MDCS started in the spring of 1991 and the last participants were examined in the autumn of 1996. The total participation rate in the MDCS was 40.6% (28,098 participated out of 69,129). The study population of this thesis consists of all 11,837 persons (5,380 men and 6,457 women) below the age of 65 who participated in the MDCS during the two year period from the spring of 1992 until the summer of 1994, born between 1926 and 1945. This study sample was selected because the version of the questionnaire used in 1991-1992 did not include the psychosocial variables, and because the dietary data from September 1994 to October 1996 was assessed with a different version of the diet assessment method. Socioeconomic status was defined by occupation title and work tasks. The psychosocial factors tested were social participation, social anchorage, emotional support and instrumental support.

No statistically significant socioeconomic differences were observed in the intake of total fat, saturated fat, monounsaturated fat and polyunsaturated fat. Furthermore, no significant socioeconomic differences in fruit consumption and intermittent smoking were observed. However, statistically significant socioeconomic differences were observed in the intake of vegetables and fruit juices, in daily smoking, in smoking cessation and in leisure-time physical activity. In all these cases, the odds ratio of risk behaviour was significantly lower in higher socioeconomic groups. Social participation was the psychosocial variable that most greatly reduced the socioeconomic differences in vegetable consumption, daily smoking, smoking cessation and leisure-time physical activity. Social participation is one important aspect of the concept of social capital as defined by Coleman and Putnam. This literature stresses the importance of inter-personal relations and trust, and social capital is thus partly a contextual trait. A multilevel analysis of the small administrative areas of Malmö revealed that the differing levels of social participation in the areas were partly determined by individual socioeconomic status and education, but an important fraction of the differences in the level of social participation between the areas remained after adjustment for a number of individual determinants. In conclusion, social participation is the psychosocial factor that is related to a number of HRB:s and to socioeconomic differences in these behaviours. The psychosocial stress hypothesis was partly supported, although the other three psychosocial variables were not related to the socioeconomic differences in health-related behaviours. Moreover, it could be demonstrated that social participation (social capital) also is a variable on a contextual level.

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Till min hustru Titti och min dotter Emma

Homines enim ad deos nulla re propius
accedunt quam salutem hominibus dando
Markus Tullius Cicero 106-43 f.Kr.

(Ingenting gör människorna så lika
gudar som inbördes hjälp)

Abbreviations

BMI	Body mass index
BMR	Basal metabolic rate
CI	Confidence interval
HDL	High-density lipoprotein
HRB	Health-related behaviour
LER	Low energy reporting/low energy reporter
LDL	Low-density lipoprotein
MDCS	Malmö Diet and Cancer Study
OR	Odds ratio
RR	Relative risk
SES	Socioeconomic status

List of publications

This thesis is based on the following publications which will be referred to by their Roman numerals:

I. Lindström M, Hanson B S, Brunner E, Wirfält E, Elmståhl S, Mattisson I, Östergren P-O. Socioeconomic differences in fat intake in a middle-aged population: report from the Malmö Diet and Cancer Study. *Int J Epidemiol* 2000; 29: 438-48.

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V. Lindström M, Östergren P-O. Intermittent and daily smokers: two different socioeconomic patterns, and diverging influence of social participation and social capital. Manuscript submitted for publication.

VI. Lindström M, Merlo J, Östergren P-O. Individual and neighbourhood determinants of social participation and social capital in a public health perspective: a multilevel analysis of the city of Malmö, Sweden. Manuscript submitted for publication.

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Introduction

Socioeconomic differences in health and health-related behaviours

In recent decades, all-cause mortality and morbidity as well as cardiovascular mortality and morbidity have consistently been found to be higher in lower socioeconomic groups (Marmot et. al. 1978; Marmot et. al. 1991; Marmot 1999). In Sweden socioeconomic differences in cardiovascular mortality and total mortality have increased in recent decades (National Public Health Report 1997). The Black Report identified four possible explanations for socioeconomic differences in health. These include the social selection explanation, the artefact explanation, materialist or structuralist explanations, and cultural or behavioural explanations. The social selection explanation states that the differences may be due to the mobility between the different SES groups, resulting in a socioeconomically downward mobility of sick people and a correspondingly upward mobility of healthy people. The artefact explanation states that failure to reduce socioeconomic differences in health, or even the increasing socioeconomic differences in health, may be the result of the decreasing proportion of unskilled manual workers and people with low education. The materialist/structuralist explanations emphasise the importance of social and material conditions in society, i.e. "upstream" factors in the causal chains that explain socioeconomic differences in health. The cultural/behavioural explanations represent more "downstream" explanations that concern individual health-related behaviours, e.g. smoking, physical activity and dietary habits. While the social selection and artefact explanations cannot be completely outruled as explanations to the persistent socioeconomic differences in health, the Black Report suggested that most of the differences can be explained by structural/material factors and, to some lesser extent, cultural/behavioural factors. (Townsend et. al. 1982).

Social circumstances affect the health of people. Numerous studies have shown that people with a good social network live longer and healthier lives than isolated people (Berkman et. al. 1979; House et. al. 1988; Kawachi et. al. 1996; Marmot et. al. 1999). Harmful material conditions, e.g. poverty, may also still affect health even in the Western world (Shaw et. al. 1999; Lynch et. al. 2000). The clear distinction between the cultural/behavioural and the materialist/structuralist explanations could, at least partly, be a product of the viewer's perspective, rather than representing mutually exclusive models of the real world. Social structures/material conditions, and individual choice and rationality rather seem to be mutually dependent (Blaxter 1990; Whitehead 1992; Lindbladh et. al. 1996). The

structural/material factors and the cultural/behavioural factors may thus be interrelated in the same chain of causation. Social and material conditions may affect health-related behaviours. This connection between social conditions and health-related behaviours is the focus of this thesis.

The starting point has been the fact that health-related behaviours like dietary habits, smoking and leisure-time physical activity have become increasingly important as explanatory factors for socioeconomic differences in health (Lundberg 1992), e.g. cardiovascular diseases.

Smoking could serve as a good example, since this behaviour has become increasingly associated with low socioeconomic status. In the 1940s and the 1950s, 80% of all men in Great Britain smoked. There were no socioeconomic patterns in smoking, and women smoked to a much lesser extent than men (Jarvis 1994). In the 1980s and the 1990s, the decrease in smoking prevalence in the Western world changed this pattern. Smoking is now strongly linked with low socioeconomic status, and women are smokers to almost the same extent as men (Graham 1996; Wersäll et. al. 1998; Jarvis et. al. 1999).

Furthermore, large-scale surveys have called attention to the fact that a substantial fraction of all smokers are intermittent, non-daily smokers (Hennrikus et. al. 1996; Evans et. al. 1992). The proportion of intermittent smokers may even be rising (Hennrikus et. al. 1996; Husten et. al. 1998). The scientific literature on intermittent smokers is scarce, but the intermittent smokers seem to be younger, and to have a higher educational and occupational status than daily smokers (Hennrikus et. al. 1996; Husten et. al. 1998). In the USA they are also over-represented in some ethnic minority groups (Husten et. al. 1998). These different sociodemographic patterns give reason to believe that there may be different causal mechanisms behind intermittent as opposed to daily smoking, which has to be further explored in order to understand the social patterning of this behaviour.

Other studies have shown differences between socioeconomic groups in the compliance with dietary fat recommendations (Bolton-Smith et. al. 1991; Pryer et. al. 1995), which could be part of the explanation for the socioeconomic differences in cardiovascular disease and mortality. However, such socioeconomic differences could also be due to errors in dietary assessment, such as reporting bias (Prentice et. al. 1986; Livingstone et. al. 1991; Livingstone et. al. 1990; Black et. al. 1991; Scoeller et. al. 1990; Goldberg et. al. 1991). For instance, the Whitehall II Study shows that after excluding low energy reporters (LER:s) the positive socioeconomic gradient in dietary fat intake disappeared because of a significant socioeconomic gradient in low energy reporting. The proportion of LER:s was approximately four times higher in the lowest compared to the highest socioeconomic group (Stallone et. al. 1997).

It has also been shown that people with higher socioeconomic status often report higher consumption of vegetables and fruit than people with lower socioeconomic status (Steele et. al. 1991; Smith et. al. 1992; Shimakawa et. al. 1994; Roos et. al. 1996; National Public Health Report 1997).

Lastly, low leisure-time physical activity has been found to be strongly associated with low income (Johansson et. al. 1988; Steenland 1992), low education (Fletcher et. al. 1996; Yusuf et. al. 1996; Sternfeld et. al. 1999), and low socioeconomic status (Blanksby et. al. 1996; Shinew et. al. 1996; Wister 1996; Mensink et. al. 1997). In Sweden, the prevalence of physical inactivity during leisure time is also higher in lower educational and socioeconomic status groups (National Public Health Report 1997).

Causal biological relationships between health-related behaviours and disease

Since this thesis deals with health-related behaviours that are strong determinants of health, it seems appropriate to briefly summarise the current evidence for these causal biological mechanisms.

Smoking is a major risk factor for diseases of the heart and blood vessels, chronic bronchitis and emphysema, cancers of the lung, larynx, pharynx, oral cavity, esophagus, pancreas, and bladder, and other problems such as respiratory infections and stomach ulcers (Office on Smoking and Health 1989). There are many mechanisms by which smoking increases the risk of cardiovascular disease. Smoking is associated with atheroschlerosis by the increased risk of endothelial damage, the increased risk of blood platelet adherence to arterial endotelium, the reduction of HDL cholesterol and the increased risk of high plasma levels of triglycerides. Furthermore, smoking increases the risk of thrombosis by increased blood platelet aggregation, elevated fibrinogen levels and lower levels of plasminogen. Smoking is also associated with increased risks of acute arterial spasms, a reduction of long-term coronary artery diameter independent of atheroschlerotic plaque, lower threshold for ventricular fibrillation, reduced blood oxygen delivery (caused by carbon monoxide) and peripheral vasoconstrictive effects (US Department of Health and Human Services 1990).

The mechanisms by which a high fat intake may cause cardiovascular diseases, especially ischaemic heart disease, include an increase in the level of plasma cholesterol, a change in the lipoprotein profile (Pekkanen et. al. 1990; Gordon et. al. 1989; Simons 1986; Stone 1990), a direct effect on blood pressure (Smith-Barbaro et. al. 1983; Stein et. al. 1993), and an increase in BMI (Calle et. al. 1999). Higher intake of saturated fat is associated with an increased risk of coronary heart disease, whereas a higher intake of polyunsaturated fats is associated with a decreased risk (Hu et. al. 1997). The new Nordic nutrient recommendations state that total fat intake should not exceed 30% of non-alcohol energy intake. The new recommendations also state that the consumption of saturated fat should not exceed 10% of total non-alcohol energy intake, that the desirable consumption of mono-unsaturated fat should amount to 10-15% and that the desirable intake of poly-

unsaturated fat should amount to 5-10% of total non-alcohol energy intake (Sandström et. al. 1996).

There are indications that dietary antioxidants (Gey 1986; Gey 1995, Price et. al. 1997; Todd et. al. 1999), fibre (Khaw et. al. 1987; Kromhout et. al. 1982) and other components of vegetables and fruit play a role in the prevention of cardiovascular disease and cancer (Gey et. al. 1987; Miller et. al. 1994; Slattery et. al. 1999). The hypothesised mechanism is that antioxidants help prevent atheroschlerosis by blocking the oxidative modification of low-density lipoprotein (LDL), which may be selectively incorporated by monocytes in the arterial wall (Ascherio et. al. 1992; Steinberg et. al. 1990; Diplock 1991). Oxidised LDL may also contribute to atherogenicity by reducing macrophage mortality in the intima (Quinn et. al. 1985), increasing monocyte accumulation (Quinn et. al. 1987), and increasing cytotoxicity (Hessler et. al. 1979).

The biological mechanisms by which physical inactivity causes cardiovascular disease are by lowering effects on blood pressure (MacAuley et. al. 1996; Simonsick et. al. 1993), plasma fibrinogen (MacAuley et. al. 1996; Koenig et. al. 1997; Greendale et. al. 1996), and plasma viscosity (Koenig et. al. 1997). The risk of myocardial infarction among men who are not physically active during their leisure time is about doubled compared to physically active men (Johansson et. al. 1988; Salonen et. al. 1988). The effect of leisure-time physical inactivity on the risk of female myocardial infarction does not seem to be as great as among men (Johansson et. al. 1988; Salonen et. al. 1988). Moreover, obesity and high body weight were strongly related to a lack of physical activity in the adult population in the European Union (Martinez-Gonzales et. al. 1999).

Explanations for socioecioeconomic differences in health and health-related behaviours

It is plausible that material and social conditions affect health-related behaviours in a chain of causal relationships. Material and social conditions represent "upstream" factors that influence the "downstream" health-related behaviours. Even in the case of leisure-time physical activity, that sometimes has been claimed to be an obvious example of a health-related behaviour that is the result of individual choice and "culture" (Whitehead 1992), empirical evidence suggests that there are different kinds of structural barriers to such activities in different socioeconomic status groups. A recent British study has e.g. illustrated that lack of individual material resources, lack of transportation and lack of access to facilities for physical exercice are essential structural barriers to leisure-time physical activity in lower socioeconomic groups, while lack of time and stress at work are essential barriers in higher socioeconomic groups (Chinn et. al. 1999).

Social and psychosocial factors such as social networks have been emphasised as determinants of both health and health-related behaviours. The social capital concept (Coleman 1990; Putnam 1993) has recently been applied to the area of public health. Empirical results suggest that social capital is of importance for e.g. the maintenance of population health (Kawachi et. al. 1997a), and for the prevention of crime (Kawachi et. al. 1999a). Social capital has been defined in several ways, i.e. as the extent to which a nation's citizens participate in civic and social activities, the level of trust between the citizens, the presence of equality before the law and social structures that serve to enhance the cooperation between the citizens (Putnam 1993).

The renewed focus on social relations and psychosocial conditions, especially rephrased as social capital, as predictors of health has also recently been questioned by authors who have maintained the material standpoint that poverty and absolute levels of material resources are crucial for health even in the western world. A link between social capital and equality has also been suggested (Kaplan et. al. 1996; Kawachi et. al. 1997b). Material inequality not only means poorer health produced by the decreased consumption possibilities of one segment of the population, but also generally poorer health as a result of the deterioration of the invisible social fabric and social context of the whole society. According to this view, increasing inequality leads to a decreasing sense of social affiliation that is mediated by frustrated expectations, lack of investment in human capital, and an increase in crime (Wilkinson 1996; Kawachi et. al. 1999a). However, this emphasis on the importance of these psychological reactions to relative inequality has been questioned by others. Lynch et. al. have recently claimed that absolute material deprivation even in the modern western world is still the key determinant of public health, definitely overriding the importance of psychosocial resources and relative inequality. Absolute levels of material resources would e.g. be effective barriers to the consumption of high quality foods (Lynch et. al. 2000).

The mechanism connecting psychosocial factors and HRB:s under exploration in this thesis is the psychosocial stress model, that suggests that psychosocial resources, both psychological and practical social support (emotional and instrumental support), may help the individual in shaping health beneficial behaviours or avoiding behaviours that are unhealthy. The social support resources are dependent on social network resources, i.e. the level of social participation in society and the degree of social anchorage within the closer social network of the individual. Social support and social network resources function as buffers against the effect of demands on the individual such as economic, social or other stressors. Social support and social network thus serve as important sources of successful coping in order to gain control of the life situation of the individual (Syme 1989).

The psychosocial stress theory

The evidence of a causal relationship between social network/social support and health has been increasing for many years. The suggested pathways of such causal relationships are of three principally different kinds (Berkman et. al. 1979).

The first possible pathway is the causally *direct* connection between social network and health mediated by neuroendocrine reactions to stress (Cannon 1935; Cassel 1976). This pathway constitutes the principal model for the psychosocial stress theory. The concept of stress is here defined as to denote a state that can be provoked by a large number of agents, physical as well as psychological (Selye 1946), i.e. stress is not an agent in a strict monocausal sense. The result of such a process is of course modified by constitutional and genetic factors. The social network refers to structural aspects of a person's social relationships. The social network has been defined as "the web of social relationships that surrounds an individual and the characteristics of those linkages" (Berkman 1995). A social network may or may not be supportive for the individual (Hanson et. al. 1995). Social support is a function of the individual's interactions within the social network, and can be defined as "information leading the individual to believe that she is cared for and loved, esteemed, and a member of a network of mutual obligations" (Cobb 1976). Rapid deterioration of social integration has e.g. been shown to increase cardiovascular morbidity and mortality. In the previously Catholic, traditionalist and strongly cohesive American Roseto community, the rapid breakdown of social cohesion was followed by a sharp increase in deaths from coronary heart disease in the 1960s and 1970s. The loss of social cohesion seems to have been the main explanation to this process, since the traditional cardiovascular risk factors (hypertension, high cholesterol levels, and smoking) were unchanged during the period (Bruhn et. al. 1979).

Psychological mechanisms constitute another *direct* causal pathway in the relationship between social network and social support and health. Such a relationship was first described by Emile Durkheim, who reported an increased risk of suicide among socially isolated individuals (Durkheim 1951).

The causal pathway of interest in this thesis is the *indirect* effect hypothesis, which suggests that the effects of social network and social support on health could be mediated indirectly by differing health-related behaviours that constitute e.g. cardiovascular risk factors. Smoking is one example. There is a strong biological mechanism behind nicotine dependence that accounts for the fact that smokers experience stress in connection with acute withdrawal, and the fact that nicotine reinstatement leads to an immediate improvement in the depleted mood state of the smoker (West 1992; Warburton et. al. 1991; Pomerleau et. al. 1991; Warburton 1992). However, no biological model can account for the fact that the socioeconomic differences in smoking among adults are increasing. One reason for the increasing socioeconomic differences may be environmental factors that make it

easier for individuals belonging to higher socioeconomic strata to stop smoking. Psychological factors at the individual level have been shown to predict the inclination to initiate and successfully maintain smoking cessation. Such factors are e.g. self-efficacy (Gulliver et. al. 1995), intention to stop and personal rating of likelihood of cessation (Sanders et. al. 1993). However, these individual characteristics are most likely affected by factors in the social environment of the individual. Being married is e.g. such a well-known factor that predicts successful smoking cessation (Kabat et. al. 1987; Sanders et. al. 1993; Tillgren et. al. 1996). As a way of coping, social network may provide a buffer against stress that leads to health-damaging behaviour by providing good social support, e.g. emotional support and instrumental support (Cohen et. al. 1985; Tsutsumi et. al. 1998). A number of studies have shown that high levels of social network are associated with beneficial health-related behaviours (Waldron et. al. 1989; Broman 1993; Östergren 1991).

Aims

General aim

The general aim of this thesis was to describe socioeconomic differences in health-related behaviours, and to investigate whether socioeconomic differences in psychosocial resources could explain socioeconomic differences in such behaviours.

Specific aims

- To investigate socioeconomic differences in fat intake, both before and after adjustment for low energy reporting (LER). (Paper I)
- To investigate socioeconomic differences in smoking cessation, and whether psychosocial resources could explain these differences. (Paper II)
- To investigate socioeconomic differences in leisure-time physical activity, and whether psychosocial resources could explain these differences. (Paper III)
- To investigate socioeconomic differences in the intake of vegetables, fruit and fruit juices, and whether psychosocial resources could explain these differences. (Paper IV)
- To compare socioeconomic differences among intermittent as opposed to daily smokers, and to investigate the importance of social participation as a determinant of these two smoking patterns. (Paper V)
- To assess both individual and small area determinants of low social participation, the psychosocial variable that in the previous studies was found to be associated with the socioeconomic differences in health-related behaviours. (Paper VI)
- To discuss the causal mechanisms in the relationship between social participation and health-related behaviours using the theory of social capital.

Study population and design

This study is based on the Malmö Diet and Cancer Study (MDCS), which is a prospective cohort study in Malmö, the third largest city of Sweden with approximately 250,000 inhabitants. Recruitment to the MDCS started in the spring of 1991, and the last participants were examined in the autumn of 1996. The population consists of all men and women born between 1926 and 1945 (n=53,491 in 1994). However, in 1995 recruitment was extended to some older and younger age brackets. The total participation rate in the MDCS was 40.6% (28,098 of a total 69,129, after the exclusion of 3,017 individuals who died/moved before first contact, the exclusion of 17 individuals due to technical decline and the exclusion of 1,975 individuals due to language problems).

The present study population consists of all 11,837 persons (5,380 men and 6,457 women) below the age of 65 who participated in the MDCS during the two year period from the spring of 1992 until the summer of 1994 born between 1926 and 1945. The study population consists of approximately a fourth of the population aged 45-64 in Malmö. Persons aged 65 or above (n=2,168), homeworkers (n=340), and students (n=45) that participated during the period 1992-1994 were excluded (except in Paper VI). The study sample was selected, because the version of the questionnaire used in 1991-1992 did not include the psychosocial variables used to test the psychosocial stress hypothesis on the socioeconomic differences in health-related behaviours. Furthermore, dietary data from September 1994 to October 1996 was assessed with a different version of the diet history method. The complete MDCS cohort examined at baseline in 1991-1996 is described in figure 1.

Subjects were recruited by postal invitation at random. Some respondents came to the examination spontaneously (Berglund et. al. 1993). All participants gave informed consent. The baseline demographic health questionnaire, the menu book, and the food questionnaire were completed at home and controlled during the diet history interview by the diet assistants at the second visit to the MDCS project office a few weeks later. The baseline health questionnaire contained items concerning background factors (age, country of origin, marital status, employment status, socioeconomic status, education, sick leave), health-related behaviours (smoking cessation, daily and intermittent smoking, leisure-time physical activity), and psychosocial variables (social participation, social anchorage, emotional support, instrumental support). Height and weight were assessed by trained project staff to the nearest 10 mm and 0.1 kg.

The study population in Papers I, III, IV, and V included all 11,837 participants (men and women) aged 45-64 (described above).

The study population in Paper II included all male and female ever-smokers (the sum of daily smokers, intermittent smokers, and those that had stopped smoking at the time when the questionnaire was answered) aged 45-64 that participated in the baseline examinations of the MDCS in 1992-1994 (n=7,534, 3,842 men and 3,692 women).

The study population in paper VI included all respondents that participated during the period from the spring of 1992 to the summer of 1994 (n=14,390).

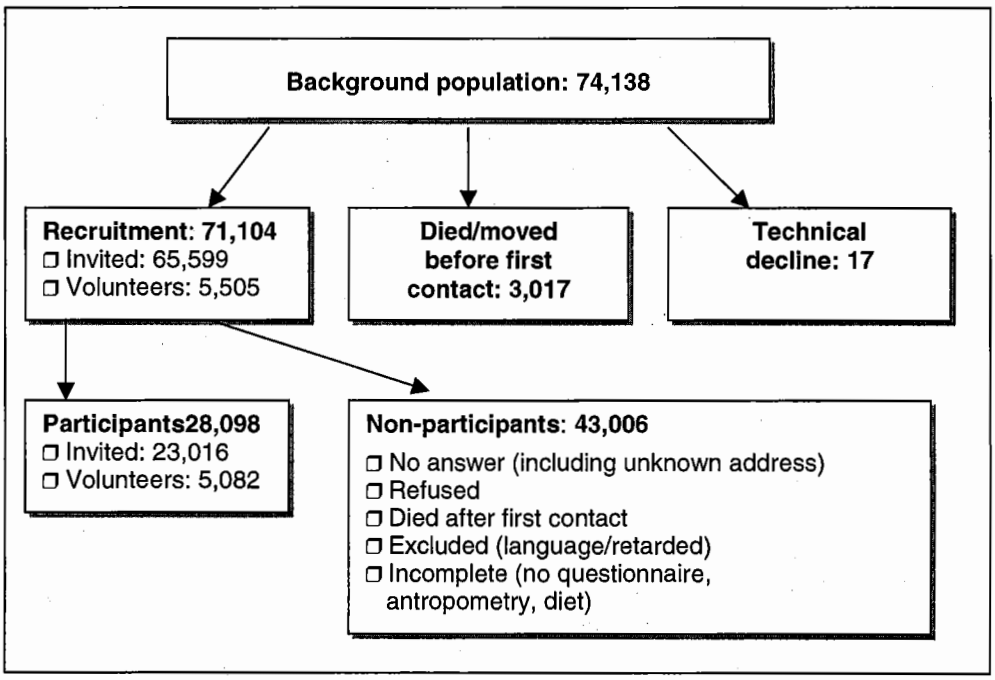

Figure 1. *The Malmö Diet and Cancer Study 1991-1996. (Modified after Manjer et. al., manuscript)*

Measures

Socioeconomic status

Socioeconomic status (SES) was based on data about occupational title and working tasks obtained in the baseline health questionnaire (Statistics Sweden, 1985). The SES groups comprise non-manual employees in leading positions and employees with university degree (I), non-manual employees on a medium (II) and low (III) level, skilled (IV) and unskilled (V) manual workers. The group *self-employed* (VI) persons is very heterogenous, including both academically trained physicians, dentists etc., as well as small shop-keepers, carpenters etc. The *unemployed* (VII) were analysed as a separate category completely outside the active workforce, but still available as a potential part of the workforce. The pensioners below age 65 (VIII) were analysed as a separate category completely outside the workforce. This group consists largely of people that have received disability pensions. Thus, this study analyses eight SES groups.

In Paper I the SES group higher non-manual employees is used as the reference group to which all the other seven SES groups are compared.

In Paper II the SES group unskilled manual workers is used as the reference group to which all the other seven SES groups are compared.

In Papers III, IV and V the SES group composed of higher non-manual employees is used as the reference group to which the other four employee groups are compared. In the next step, the aggregate of the five employee SES groups in the workforce are used as the reference to which the self-employed are compared. In a further step, the aggregate of the five employee SES groups and the self-employed in the workforce are used as the reference to which the unemployed are compared. Finally, the aggregate of the five employee, the self-employed and the unemployed SES groups are used as the reference for comparison with the pensioners below 65 group. The rationale for comparing the three latter SES groups separately with the aggregate of the other SES groups as reference is their relationships to the labour market. SES groups I-V include employed individuals. SES group VI comprises self-employed individuals. This self-employed group includes individuals with highly diverse educational and socioeconomic backgrounds. Different members of this group would have belonged to each of the five first SES groups, if they had not been self-employed. The unemployed (SES VII) belong to the potential workforce, but did not work at the time of the baseline examination. Finally, the pensioner group (SES VIII) does not belong to the potential workforce anymore in any sense (figure 2). The two latter SES groups also have highly different educational and socioeconomic life histories.

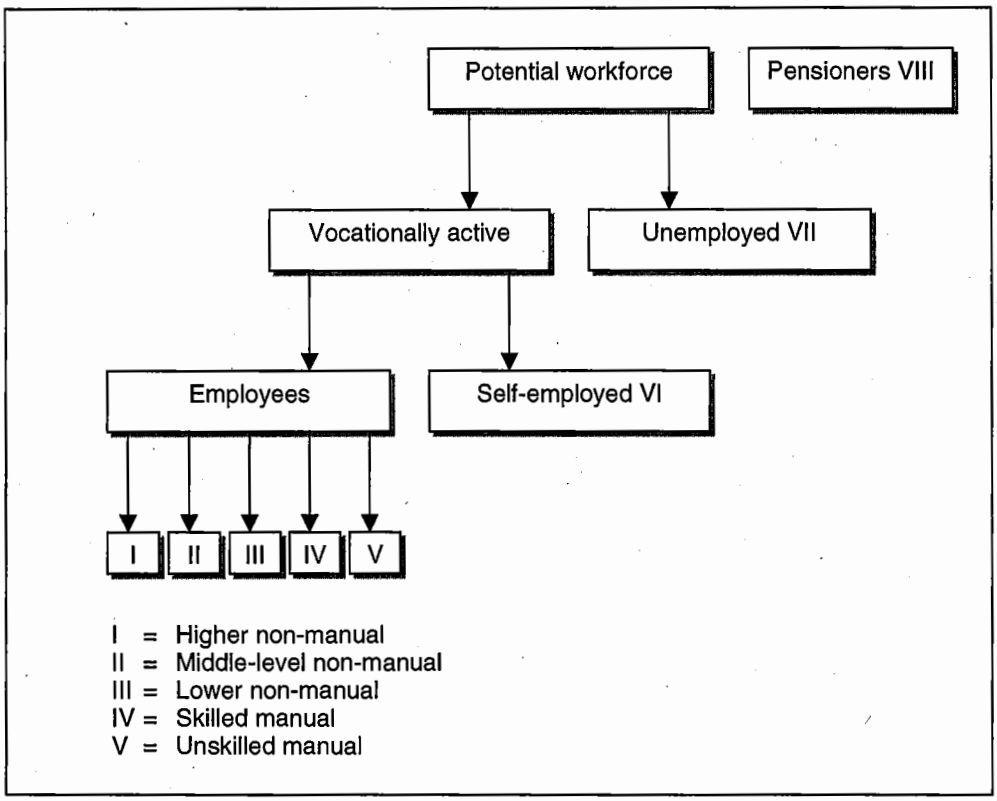

Figure 2. *Socioeconomic status and relation to the labour market.*

Background variables

The background variables were assessed in the questionnaire. *Age* was categorised into four age groups 45-49, 50-54, 55-59, and 60-64 in Papers I-V. In Paper VI the age groups 45-53, 54-60, and 61-68 were used.

In Papers I-VI *country of origin* was categorised into the two categories born in Sweden and born in other countries than Sweden.

In paper I *height* (m) and *weight* (kg) were used to calculate *Body Mass Index (BMI)* and *Basal Metabolic Rate (BMR)*. Height and weight were assessed by trained project staff to the nearest 10 mm and 0.1 kg. Body Mass Index was calculated as height (kg)/ (weight (m))^2. The calculations of the Basal Metabolic Rate depend on age, sex, height and weight. *Low energy reporters (LER:s)* were defined as those individuals reporting a total energy intake of less than 1.2 times their individual basal metabolic rate (WHO, Energy and Protein Requirements 1985). This cut-off point was chosen based on previous estimations of the lowest

possible energy intakes required for weight maintenance in this sedentary population (Goldberg et. al. 1991).

Disease might modify the inclination to stop smoking and the level of physical activity. *Self-reported previous/current diseases* included myocardial infarction, stroke, claudicatio intermittens, diabetes mellitus, cancer and astma/ chronic obstructive lung disease in Papers II and V, but rheumatism/arthritis was also added to this item in Paper III. The list of self-reported diseases also included hypertension, history of goitre, history of peptic ulcer, inflammatory diseases of the gastrointestinal tract and kidney stone. However, the included conditions were regarded as the most relevant factors that could affect the health-related behaviours studied.

Four *marital status* categories were used in Paper II: married/cohabiting, unmarried, divorced, and widow/widower.

Reported intakes of vegetables, fruit, and fruit juices analysed in Paper IV could be influenced by the season during which the individuals completed the baseline examinations. *Seasonal variability* was defined by the month when the individual completed the baseline health questionnaire.

The *total energy intake* variable used in Paper IV was derived from the results of the diet assessment method described below in the fat intake section.

Educational level was categorised by length of education in Paper VI. The respondents were classified into three groups: (a) more than 12 years, (b) 10-12 years, and (c) 9 years of education or less.

The participants in Paper VI were categoried as *living alone* when an affirmative answer to the question "Do you live alone" was reported in the self-administered baseline questionnaire.

Sick leave was defined by an affirmative answer to the question "Are you currently on sick leave" (Paper VI).

All individuals aged less than 65 reporting "retirement" as occupation were considered to have *disability pension* in Paper VI. All individuals aged 65 or less reporting "unemployment" as occupation were considered as *unemployed* in Paper VI.

The *administrative areas* of Malmö used in paper VI were 90 out of a total of 99. The other areas were excluded, because they had less than 20 respondents in the study.

Psychosocial resources

The theoretical framework for the research on the causal pathways between social network, social support and health has its roots in the stress research of the early 20th century. The concept of stress was introduced and defined by Walter B. Cannon in 1935. He described the physiological reaction when confronted with danger, i.e.

the activation of the sympatic part of the nervous system. This fight and flight reaction has obvious benefits for immediate survival, but may under prolonged stress result in imbalance in major physiological functions, disease and death. Cannon defined the factors causing such physiological imbalances "stresses of homeostasis" (Cannon 1935).

In the 1940s and the 1950s Selye developed Cannon's stress model by introducing the concept of the General Adaptation Syndrome. The original model was expanded to comprise the general adaptation of the individual to a continuously changing environment. Stress is a non-specific response of the organism to stressors in the environment, e.g. material, psychological or social, according to Selye. This notion of the lack of specificity in the physiological reactions to stress is supported by the fact that all main regulating processes in the body seem to be affected by stress (Selye 1946).

In 1967, Holmes and Rahe made an early epidemiological attempt to link stressors with health outcomes by introducing the Social Readjustment Rating Scale. This was an index that assessed and comprised several stressful life events in order to obtain a composite measure of the load of stressors on each individual (Holmes et. al. 1967). This association was also verified in several empirical studies (Dohrenwend et. al. 1974).

In 1972, Katherine Nuckolls and coworkers introduced the concept of "psychosocial assets". They demonstrated an association between a heavy load of stressors and complications during pregnancy. Furthermore, they also demonstrated that this association was only statistically significant when the "psychosocial assets" of the individuals were low (Nuckolls et. al. 1972). The social network and social support concepts were incorporated into the framework of the stress theory.

In 1976, Cassel presented his widely quoted paper on the theory of a general susceptibility. Cassel's paper was inspired by Selye's idea of a universal and stereotyped physiological reaction of the organism to a stressor. This implied that most main regulating systems in the body were affected at the same time and by the same causal agent by the stress reaction (Cassel 1976). This could explain why one stressor could be associated with a number of different diseases or different causes of death. Cassel's theory of general susceptibility thus questions one of Hill's criteria concerning causal relationships between a pathological agent and a health outcome, i.e. the specificity of this relationship (Weed 1988).

In 1979 Berkman and Syme presented data from the Alameda County Study, a prospective population study, that showed a significantly higher relative mortality risk among those with a poor social network after adjustment for other possible confounding factors (Berkman et. al. 1979). Syme introduced the concept of "control" in 1989 (Syme 1989). Control was defined as the resulting relationship between the demands of daily life and the resources available to handle these demands. A person's relationship with his or her environment can be viewed as a dynamic process, since environmental changes require continuous adaptation by the individual. The successful adaptation requires both individual resources, e.g.

education and material resources, and social relations, e.g. social support and social network. Social support and social network resources may be sufficient to provide a state of control of the life situation of the individual.

Social support and social network factors may affect the health of a person through at least three different pathways (Berkman et. al. 1979). The first kind of suggested pathway is the causally direct connection between social support and social network and health mediated by psycho-physiological reactions to stress, e.g. neuroendocrine reactions (Cassel 1976). Mechanisms relying on more psychological reactions constitute a second direct pathway between social support/social network and health. Such a relationship was first described by Emile Durkheim, who reported an increased risk of suicide among socially isolated individuals (Durkheim 1951). The third suggested pathway in focus in this paper is the indirect effect of social network and social support on health mediated by life styles, i.e. health-related behaviours. Unhealthy HRB:s could in this context be defined in terms of a destructive coping behaviour to handle the stressful events of life in a situation where alternative coping resources (e.g. social network and social support) are scarce.

Definitions

Social network refers to structural aspects of a person's social relationships. The social network has been defined as "the web of social relationships that surrounds an individual and the characteristics of those linkages" (Berkman 1995). The social network was operationalised in the questionnaire in two dimensions:

Social participation describes how actively the person takes part in the activities of formal and informal groups in society. It was measured as an index consisting of 13 items (study circle/course at place of work, other study circle/course, union meeting, meeting of other organisations, theatre/cinema, arts exhibition, church, sports event, letter to editor of a newspaper/journal, demonstration, night club/entertainment, big gathering of relatives, private party), and dichotomised. If three alternatives or less were indicated, the social participation of that person was considered low. The instrument assessing social participation has previously been used in the Swedish National Survey on Living conditions (The National Central Bureau of Statistics 1980). The social participation variable was used in Papers II, III, IV, V, and VI.

Social anchorage (5 items) describes to what extent a person belongs to and is anchored within formal and informal groups and, in a more qualitative sense, the feeling of membership in these groups (familiarity with neighborhood, sense of belonging to friend, sense of belonging to relatives, membership or position of trust in organisations or clubs, feelings of being important to other people). If three or more of the five items denoted low social anchorage, the whole variable was regarded as low. The social anchorage variable was used in Papers II, III, and IV.

Social support is a function of the individual's interaction within the social network. Social support can be defined as "information leading the individual to believe that she is cared for and loved, esteemed, and a member of a network of mutual obligations" (Cobb 1976), according to the psychosocial stress theory.

Instrumental support (1 item) reflects the individual's access to guidance, advice, information, practical services, and material resources from other persons. This item was measured by a four-alternative question: "Yes, I am absolutely sure to get such support", "Yes, possibly", "Not certain", and " No". The three latter alternatives were classified as low instrumental support. The instrumental support variable was used in the analyses of Papers II, III, and IV.

Emotional support (3 items) reflects the opportunity for care, the encouragement of personal value, and feelings of confidence or trust. Each item has the same four alternatives as instrumental support. If two or three of these items were low, the whole emotional support index variable was considered low. Emotional support was included in the analyses of Papers II, III, and IV.

The reliability and validity of the four psychosocial indices used in this study were assessed in a previous paper that found low correlations between the different indices, and an acceptable validity and reproducibility (test-retest stability) for all the variables (Hanson et. al. 1997).

Health-related behaviours

Fat intake

The diet assessment method is a modified diet history method, specifically designed for the MDCS (Callmer et. al., 1993; Elmståhl et. al., 1996a; Elmståhl et. al., 1996b). The choice of methodology was guided by the need to assess total diet in a middle-aged and elderly urban population. The eating habits of this group were expected to be fairly regular and commonly include cooked sit-down meals. It consisted of two parts: a 7-day menu book for cooked meals, cold beverages (including alcoholic beverages), drugs, natural remedies, and dietary supplements, and a 168-item questionnaire for collecting frequency information on regularly consumed foods, including hot beverages, sandwiches, edible fats, breakfast cereals, yoghurt, milk, fruits, cakes, sweets, and snacks during the past year. The usual portion sizes in the frequency questionnaire were estimated by the participant at home using a booklet with 48 black and white photographs. Portion sizes of dishes in the menu book were estimated during the dietary interview using a separate and more extensive book of photographs.

Energy and nutrient intakes were computed from the reported food intake of the dietary assessment method, and the food and nutrient reference values of the PC Kost2´93 (The National Food and Composition Database of the National Food

Administration 1993). The method measures the entire diet, including cooking methods. It overestimates the absolute value for energy intake by 18% when compared with the reference method, 18 days of weighed food records (Elmståhl et. al. 1996b). The correlations with the reference method are of the order of 0.5 to 0.6 for most of the nutrients. Compared to other commonly used dietary assessment methods this indicates a good concordance between the diet history method and food records. The relative validity thus ranks with the best reported in previous studies (Riboli et. al. 1997; Elmståhl et. al. 1997).

High fat intake was defined as 35.9% or more for men and 34.8% or more for women of non-alcohol energy intake contributed by total fat (triglyceride fatty acids, glycerol, phospholipids and sterols). The values 35.9% and 34.8% represent the lower limit (25% quartile limit) of the three uppermost quartiles of fat intake, for men and women respectively, in this study. High intakes of saturated, monounsaturated and polyunsaturated fatty acids were also defined as those above the first quartile of total non-alcohol energy intakes (14.1%, 12.6% and 5.3% or more for men, and 14.1%, 12.1% and 5.0% for women. A low P:S ratio was defined as a ratio below 0.30 for men and 0.29 for women, which was the lower quartile limit (a quarter of the individuals below this value) of the polyunsaturated to saturated fatty acids ratio. The corresponding upper quartile limits (75% quartile) of total fat (men 43.9%, women 42.7%), saturated fat (men 19.1%, women 18.9%), monounsaturated fat (men 15.6%, women 14.9%), polyunsaturated fat (men 7.4%, women 7.0%) intake as well as the P:S ratio (men 0.48, women 0.46) were also analysed.

Smoking

The smoking status of the individuals was assessed in the baseline health questionnaire by the question "Do you smoke?", which contained four given alternatives: "Yes, I smoke daily", "Yes, I smoke sometimes" (intermittent, not daily), "No, I have stopped smoking", and "No, I have never smoked".

In Paper II the three categories daily smokers, intermittent smokers, and the group that had previously been smokers but had stopped smoking were defined as *ever-smokers*. The ever-smokers were dichotomised into those who were still smokers (daily and intermittent smokers) and those who had stopped smoking at the point in time when they answered the questionnaire.

In Paper V daily and intermittent smokers were compared regarding socioeconomic differences and the impact of social participation on these socioeconomic differences by using the non-smokers (stopped smoking or never smoked) as the reference group.

The validity of items assessing smoking status has previously been analysed several times, with results consistently showing that self-reported tobacco-smoking is a valid and reliable way to measure smoking habits in a population (Murray et. al.

1993; Tate et. al. 1994; Verkerk et. al. 1994; Steffensen et. al. 1995; US Department of Health and Human Services 1990; Wells et. al. 1998).

Leisure-time physical activity

Leisure-time physical activity was measured by an item in the baseline health questionnaire presenting a variety of possible activities (17 different items and one open alternative), including different sports, gardening, walking etc. The 17 item leisure-time physical activity question in the MDCS baseline health questionnaire is a quantitative history survey according to the classification of physical activity assessment methods by Laporte et. al. (1985), and the validity of this category was regarded as good after comparison with the objective kilocalorie index and treadmill performance (Montoye et. al. 1984). The participants were asked to report how many minutes per week on average, and for each of the four seasons, they spend on a specific activity. These figures were all multiplied by an activity-specific factor representing the assumed energy consumption, which thus became the common denominator allowing the computation of a summary score. The aggregated measure thus takes both duration and intensity of physical activities into account (Taylor et. al. 1978).

Consumption of vegetables, fruit and fruit juices

The diet assessment method for the assessment of the consumption of vegetables, fruit and fruit juices is the same as the one that has already been introduced in the fat intake section (see p.24-25).

Low intake of vegetables and fruit was defined as the lowest quartile of intake measured in grams. The selected cut-off point for fruit juices was whether the respondents had consumed fruit juices at all. The lower quartile limit (25%) of vegetable consumption was 109.67 g/day for men and 121.84 g/day for women. The lower quartile limit of fruit consumption was 65.69 g/day for men, and 97.88 g/day for women. Fruit juices were consumed by 44.7% of the men and 54.7% of the women.

Statistical methods

Paper I

Crude odds ratios (OR) and 95% CI were calculated in order to examine the risk of being a high fat consumer in relation to low energy reporting (LER), age, country of origin, BMI and SES. Multivariate logistic regression analysis was performed to investigate the importance of potential confounders (age, country of origin, LER) of

the socioeconomic differences in fat intake. Socioeconomic gradients were calculated as tests for trend for the five socioeconomic groups that were considered to be ordinally related to each other. Finally, LER was included in the logistic regression analysis to estimate the importance of LER on the socioeconomic patterns of dietary fat intake.

Paper II

Crude OR:s and 95% CI were calculated in order to analyse associations between smoking cessation and different demographic, socioeconomic and psychosocial variables. The multivariate analysis was performed by logistic regression in order to investigate the potential importance of various confounders, and to analyse whether the socioeconomic differences in smoking cessation can be explained by differences in psychosocial factors. Socioeconomic gradients were also calculated as tests for trend for the five SES groups that were considered to be ordinally related to each other.

Paper III

Crude OR:s and 95% CI were calculated in order to analyse associations between different demographic, socioeconomic and psychosocial variables, and low leisure-time physical activity. The multivariate analysis was performed in order to investigate the potential importance of various confounders, and to analyse the importance of the different psychosocial variables on the socioeconomic differences in leisure-time physical activity. SES gradients were also calculated as tests for trend for the five SES groups that were ordinally related to each other. The effects of the covariates were explored by logistic regression analysis concerning the association between psychosocial variables and the odds ratio of low leisure-time physical activity.

Paper IV

Crude OR:s and 95% CI were calculated to examine the risk of being a low consumer of vegetables, fruit and fruit juices in relation to age, country of origin, SES, and social network/social support. Multivariate logistic regression analysis was performed to investigate the importance of potential confounders for socioeconomic differences in vegetable, fruit and fruit juice intakes separately. SES gradients were calculated as tests for trend for the SES groups. The effects of the covariates were explored by logistic regression analysis concerning the association between psychosocial variables and the odds ratio of vegetable, fruit and fruit juice consumption.

Paper V

Crude OR:s and 95% CI were calculated in order to analyse associations between different demographic and socioeconomic variables, social participation, and daily and intermittent smoking. The multivariate analysis was performed in order to investigate the potential importance of various confounders, and to analyse the importance of social participation on the socioeconomic differences in daily and intermittent smoking, respectively. The daily and intermittent smokers were compared to non-smokers in all the multivariate analyses. The effects of the covariates were explored by logistic regression analysis concerning the association between social participation and the odds ratios of daily and intermittent smoking, respectively.

The statistical analyses in Papers I-V were performed using the SPSS software package (Norusis 1993).

Paper VI

Simple variance components multilevel logistic regression models (Goldstein 1995) with individuals (first level) nested within neighbourhoods (second level) were fitted to the data. In the first model, no covariates were entered (i.e., the empty model). In the second model, age and sex, together with one other variable were included. In the final model, all variables were added together. However, since individual socioeconomic status and individual educational level were highly correlated, these variables were studied in two separated final models, one with individual socioeconomic status and the other with individual educational level.

To study whether the neighbourhood environment influence individual associations (i.e., cross-level interaction) random coefficients models were fitted (Goldstein 1995; Rasbash et. al. 1999). The covariance between the slopes of the associations between individual low social participation and the other individual variables in each neighbourhood, and the level of low social participation of the neighbourhoods was analysed. Age and sex were always included in these models. The percentage of the total variance in low social participation that was related to the neighbourhood (i.e., intra-neighbourhood correlation) was used as a measure of the contextual effects. Intra-neighbourhood correlation was calculated as:

Neighbourhood variance/ (neighbourhood variance+$\pi^{2/3}$) (Engström et. al. 2000).

In order to illustrate the neighbourhood differences in low social participation, areas were ranked by log-odds ratios of low social participation in the whole city of Malmö taken as reference (value=0), and uncertainty was estimated by 95% confidence intervals (i.e., level-2 residuals +/- 1.96 standard error). Individual OR:s (95% CI) were obtained from the beta coefficient (standard error) in the fixed part of the model. Parameters were estimated using Iterative Generalized Least Square (IGLS), (Goldstein 1995; Rasbash et. al. 1999). The MlwiN, Version 1.1 software package (Goldstein 1995) was used to perform the analyses.

Results and conclusions

Paper I:

Socioeconomic differences in fat intake in a middle-aged population

Results

Men were self-employed, non-manual employees in higher positions and skilled manual workers to a higher extent than women, while women more often were non-manual employees in lower and middle positions and unskilled manual workers. The proportion of persons of foreign origin was the same for men and women, 13.5% and 12.2%, respectively. Men (21.8%) and women (21.4%) were low energy reporters (LER:s) to the same extent. Men had generally higher BMI:s than women. Patterns of fat intake did not vary significantly by age. The lower quartile limit of total fat intake was 35.9% for men and 34.8% for women. The upper quartile limit of total fat intake was 43.9% for men and 42.7% for women.

The socioeconomic differences in fat intake were small and mostly statistically insignificant. Self-employed men had a significantly higher proportion of persons with high fat intake, OR 1.4 (1.1-1.8), while both male, OR 0.7 (0.6-0.9), and female, OR 0.6 (0.5-0.8), pensioners had lower proportions of persons with high fat intake after adjustment for age. The group born abroad had a significantly lower fat intake both for males, OR 0.5 (0.4-0.6), and females, OR 0.6 (0.5-0.7). The proportion with a high fat intake decreased for women with increasing BMI ($p=0.004$), and this proportion was highest for the group with BMI<20.0. In general the same distributional patterns were obtained when the three subfractions of saturated, monounsaturated and polyunsaturated, and the P:S ratio were examined separately.

A fifth of both men and women were low energy reporters. Both male and female non-LER:s had twice as high an odds ratio of having a high fat intake compared to LER:s. For both sexes, there was a large difference in LER according to BMI with an increasing proportion of LER:s with increasing BMI. However, no differences in LER between SES groups were seen, except for female disability pensioners who had a significantly higher proportion of LER:s compared to the non-manual employees in higher positions reference group, OR 1.7 (1.3-2.3).

Table 1. Odds ratios (OR:s and 95 % CI) and tests for trend of a high fat intake by socioeconomic status. Adjustment also made for age, country of origin and LER.

Lower quartile[1]	Men			Women		
SES	Adjusted * OR, 95%CI	Adjusted** OR, 95%CI	Adjusted*** OR, 95%CI	Adjusted * OR, 95%CI	Adjusted** OR, 95%CI	Adjusted*** OR, 95%CI
I	1,0	1,0	1,0	1,0	1,0	1,0
II	1,0 (0,8-1,3)	1,0 (0,8-1,3)	1,0 (0,8-1,3)	0,9 (0,7-1,2)	0,9 (0,7-1,2)	0,9 (0,7-1,2)
III	1,2 (0,9-1,6)	1,2 (0,9-1,6)	1,2 (0,9-1,6)	1,1 (0,8-1,4)	1,1 (0,8-1,4)	1,1 (0,8-1,4)
IV	0,9 (0,7-1,1)	1,0 (0,7-1,2)	0,9 (0,7-1,2)	0,8 (0,6-1,1)	0,8 (0,6-1,2)	0,8 (0,6-1,2)
V	1,0 (0,7-1,3)	1,1 (0,8-1,4)	1,0 (0,8-1,4)	0,9 (0,7-1,2)	1,0 (0,7-1,3)	1,0 (0,8-1,3)
VI	1,4 (1,1-1,8)	1,5 (1,1-1,9)	1,5 (1,1-1,9)	1,1 (0,7-1,5)	1,1 (0,8-1,5)	1,0 (0,7-1,5)
VII	0,9 (0,7-1,3)	1,1 (0,8-1,5)	1,1 (0,8-1,5)	1,1 (0,8-1,5)	1,1 (0,8-1,6)	1,1 (0,8-1,6)
VIII	0,7 (0,6-0,9)	0,8 (0,6-1,0)	0,8 (0,6-1,1)	0,6 (0,5-0,8)	0,7(0,5-0,9)	0,7 (0,5-0,9)
Test for trend (I,II,III,IV,V)	(p=0,52)	(p=0,80)	(p=0,91)	(p=0,67)	(p=0,96)	(p=0,84)

* Adjusted for age
** Adjusted for age and country of origin.
*** Adjusted for age, country of origin and LER.

[1] The lower quartile (25 %) limit of the distribution of total fat intake as a fraction of total non-alcohol energy intake is 35,9 % for men and 34,8 % for women.

When age, country of origin and LER were included in the final multivariate model, no changes in either the OR:s of high total fat intake, the intake of subgroups of fatty acids or the P:S ratio between the SES groups appeared. Thus, the LER variable did not alter the socioeconomic patterns in fat intake (table 1).

The distribution of total fat intake, subgroups of fatty acids and the P:S ratio did not show any important SES differences at the upper quartile (43.9% of total non-alcohol energy intake for men and 42.7% for women) level.

No significant ($p<0.05$) SES gradients (five SES groups ordinally related to each other) were seen for either men or women in any of the total fat, saturated, mono-unsaturated, polyunsaturated or P:S ratio models.

A multivariate logistic regression model including BMI in the analysis did not alter any of the results already shown.

Conclusions

Almost no socioeconomic differences in fat intake were found in this study. No SES gradients were found for either total fat intake or the fatty acid subgroups and

the P:S ratio in the models. This result does not differ from the results of other studies, e.g. the Whitehall II Study. However, the Whitehall II Study found very strong socioeconomic differences in the distributions of LER:s. In the Whitehall II Study, lower SES groups had a much higher proportion of LER:s than higher. These differences profoundly affected the results concerning the socioeconomic pattern of intake of dietary fat (Stallone et. al. 1997). No such effects were seen in this study.

Paper II:

Socioeconomic differences in smoking cessation: the role of social participation

Results

The proportion of never-smokers was much larger among women (42.8%) than among men (28.6%). On the other hand, the proportion of smokers was about the same for both sexes. The proportion of individuals that had stopped smoking was much larger among men (40.8% compared to 27.1% among women). The odds ratio for having stopped smoking increased with age for both men and women. Married persons had stopped smoking to a higher extent then unmarried, divorced and widows/widowers. Among men, there was a clear socioeconomic gradient in smoking cessation. Men with non-manual employee jobs in higher positions had managed to stop smoking almost twice as often, OR 1.9 (1.4-2.5), as men in the unskilled manual worker reference group. Among women, the socioeconomic differences were similar. For both men and women, those with low social participation had stopped smoking to a lower degree than those with high social participation, OR 0.6 (0.5-0.7). Men with low emotional support had stopped smoking less often than men in the high emotional support category, OR 0.8 (0.7-0.9).

The OR:s of smoking cessation if ever-smoker for males in the different socioeconomic subgroups decreased only marginally after adjustment for potential confounders (age, country of origin, marital status and previous/current diseases), mostly because of the marital status variable. When the social participation variable was included in the multivariate model, the OR:s and the SES differences were reduced. The other three psychosocial variables did not affect the OR:s when included one at a time in the multivariate model. For women, the multivariate analysis showed that the introduction of the confounding variables (age, country of origin, marital status and previous/current diseases) increased the OR:s somewhat. On the other hand, the inclusion of social participation in the model reduced most OR:s and the SES differences. The introduction of the other three psychosocial variables into the model had no effect on the OR:s (table 2).

The SES gradients remained highly significant for both men and women throughout the multivariate analyses despite the risk reduction produced by social participation.

Table 2. Age-adjusted and multivariate odds ratios (OR) and 95% confidence intervals (CI) of smoking cessation in socioeconomic groups. Men and women.

	Men			Women		
	Adjusted * OR, 95% CI	**Adjusted ** OR, 95% CI**	**Adjusted *** OR, 95% CI**	**Adjusted * OR, 95% CI**	**Adjusted ** OR, 95% CI**	**Adjusted *** OR, 95% CI**
V	1.0	1,0	1,0	1.0	1.0	1.0
IV	1.5 (1.1-1.9)	1.4 (1.1-1.8)	1.4 (1.0-1.8)	1.3 (0.9-1.9)	1.4 (1.0-1.9)	1.3 (0.9-1.8)
III	1.7 (1.3-2.3)	1.7 (1.3-2.2)	1.5 (1.2-2.0)	1.6 (1.3-1.9)	1.6 (1.3-1.9)	1.5 (1.2-1.8)
II	2.0 (1.5-2.6)	1.9 (1.5-2.5)	1.7 (1.3-2.1)	1.8 (1.5-2.3)	1.8 (1.4-2.2)	1.6 (1.3-2.0)
I	1.9 (1.4-2.5)	1.8 (1.4-2.4)	1.6 (1.2-2.1)	2.1 (1.5-2.8)	2.1 (1.5-2.9)	1.8 (1.3-2.6)
VI	1.4 (1.1-1.8)	1.3 (1.0-1.7)	1.2 (0.9-1.6)	1.7 (1.2-2.3)	1.6 (1.2-2.2)	1.5 (1.1-2.1)
VII	1.0 (0.8-1.4)	1.0 (0.7-1.3)	1.0 (0.7-1.3)	1.2 (0.9-1.7)	1.3 (0.9-1.8)	1.3 (0.9-1.7)
VIII	1.1 (0.9-1.4)	1.1 (0.8-1.4)	1.1 (0.9-1.4)	1.0 (0.8-1.2)	1.0 (0.8-1.3)	1.1 (0.8-1.3)
P-test for trend (I,II, III, IV,V)	p<0.001	p<0.001	p=0.002	p<0.001	p<0.001	p<0.001

*Adjustment made for age.
**Adjustment made for age, country of origin, marital status and previous/current diseases.
***Adjustment made for age, country of origin, marital status, previous/current diseases and social participation.

Conclusions

A high level of social participation seems to be a predictor of maintenance of smoking cessation. It seems possible to assume that the socioeconomic differences in smoking cessation and its maintenance partly are consequences of differing social network resources between socioeconomic groups.

Paper III:

Socioeconomic differences in leisure-time physical activity: the role of social participation and social capital in shaping health-related behaviours

Results

There were statistically significant socioeconomic differences in the risk of being in the lowest quartile of leisure-time physical activity. Among men, the groups of skilled and unskilled manual workers were more likely to have low leisure-time physical activity, OR 1.5 (1.1-1.9), compared to the high level non-manual employee reference group. Among women, a significantly higher odds ratio of low leisure-time physical activity could only be seen for the unskilled manual worker group, OR 1.6 (1.2-2.1). The male self-employed had an OR 1.4 (1.2-1.7) of having low leisure-time physical activity compared to all employees. The unemployed did not differ significantly from the vocationally active (employees and self-employed). Female pensioners had an OR 1.3 (1.1-1.4) regarding low leisure-time physical activity compared to persons on the labour market (employees, self-employed and unemployed).

Low social participation was associated with an increased risk of low leisure-time physical activity among both men, OR 2.2 (2.0-2.5), and women, OR 2.3 (2.0-2.6). A somewhat weaker positive association between low social anchorage and low leisure-time physical activity was also seen for both sexes. A weaker, but statistically significant association was seen among women between low instrumental support and being in the lower quartile of leisure-time physical activity, OR 1.2 (1.1-1.5).

The patterns of SES differences did not change when age, country of origin and previous/current self-reported dieseases were included in the multivariate logistic regression model, neither for men nor for women. Finally, when social participation was included in the model, the association between SES and low leisure-time physical activity was considerably weakened. It was reduced among men from OR 1.4 (1.1-1.9) to 1.2 (0.9-1.6) for the skilled manual workers, and from OR 1.4 (1.1-1.9) to 1.1 (0.8-1.5) for the unskilled manual worker group. Social participation also reduced the female odds ratios from OR 1.6 (1.2-2.1) to OR 1.2 (0.9-1.6) among unskilled manual workers (table 3). The introduction of the other three psychosocial variables, including social anchorage, into the model had, on the other hand, no effect on the association between SES and low leisure-time physical activity. The SES gradients remained highly significant throughout the multivariate logistic regression analyses for both men and women. The exception was social

participation that reduced the SES gradient for both men (from p< 0.001 to p= 0.02) and women (from p< 0.001 to p= 0.04).

Since social participation was introduced in the final step in the previously mentioned regression analysis, it seemed to be of importance to analyse how much of the association between this variable and low leisure-time physical activity that could be ascribed to the other variables in the model. In this analysis, age, country of origin and previous/current self-reported diseases had almost no effects on the significant relationship between social participation and low leisure-time physical activity.

Table 3. Crude and multivariate odds ratios (OR), 95 % confidence intervals (CI) and p-tests for trend of low leisure-time physical activity in socioeconomic (SES) groups. Men and women. The Malmö Diet and Cancer Study 1992-1994.

	Crude OR, 95% CI	**Adjusted* OR, 95% CI**	**Adjusted** OR, 95% CI**	**Adjusted*** OR, 95% CI**	**Adjusted**** OR, 95% CI**
Men					
High level non-manual	1.0	1.0	1.0	1.0	1.0
Middle level non-manual	0.9 (0.7-1.1)	0.9 (0.7-1.1)	0.9 (0.7-1.1)	0.9 (0.7-1.1)	0.8 (0.6-1.1)
Low level non-manual	1.1 (0.9-1.5)	1.2 (0.9-1.5)	1.1 (0.9-1.5)	1.2 (0.9-1.5)	1.0 (0.8-1.4)
Skilled manual workers	1.5 (1.1-1.9)	1.5 (1.1-1.9)	1.4 (1.1-1.9)	1.4 (1.1-1.9)	1.2 (0.9-1.6)
Unskilled manual workers	1.5 (1.1-1.9)	1.5 (1.1-1.9)	1.4 (1.1-1.9)	1.4 (1.1-1.9)	1.1 (0.8-1.5)
P-test for trend	p<0.001	p<0.001	p<0.001	p<0.001	P=0.019
Women					
High level non-manual	1.0	1.0	1.0	1.0	1.0
Middle level non-manual	0.8 (0.6-1.1)	0.8 (0.6-1.1)	0.8 (0.6-1.1)	0.8 (0.6-1.1)	0.8 (0.6-1.1)
Low level non-manual	1.2 (0.9-1.5)	1.2 (0.9-1.5)	1.2 (0.9-1.5)	1.2 (0.9-1.6)	1.1 (0.8-1.4)
Skilled manual workers	1.2 (0.8-1.7)	1.2 (0.8-1.7)	1.1 (0.8-1.6)	1.1 (0.8-1.6)	1.0 (0.7-1.4)
Unskilled manual workers	1.6 (1.2-2.1)	1.6 (1.2-2.1)	1.5 (1.1-2.0)	1.6 (1.2-2.1)	1.2 (0.9-1.6)
P-test for trend	P<0.001	P<0.001	P<0.001	P<0.001	P=0.037

* Adjustment made for age.
** Adjustment made for age and country of origin.
*** Adjustment made for age, country of origin and previous/current diseases.
**** Adjustment made for age, country of origin, previous/current diseases and social participation.

Conclusions

Social participation is a strong predictor for socioeconomic differences in low leisure-time physical activity. Social participation measures the individual's social activities in e.g political parties and organisations. Our definition of social participation is in good accordance with Putnam's definition of social participation that forms one part of his definition of the overreaching concept of social capital. It therefore seems possible that some of the socioeconomic differences in leisure-time physical activity are due to differing social capital between socioeconomic groups.

Paper IV:

Socioeconomic differences in the consumption of vegetables, fruit and fruit juices: the influence of psychosocial factors

Results

The lower quartile limit (25%) of vegetable consumption was 109.67 g/day for men and 121.8 g/day for women. The lower quartile limit of fruit consumption was 65.7 g/day for men, and 97.9 g/day for women. Fruit juices were consumed by 44.7% of the men and 54.7% of the women.

The group born in other countries than Sweden had a much lower proportion of individuals with low consumption of vegetables and fruit, while the consumption of fruit juices did not differ compared to the group born in Sweden. There were clear socioeconomic differences in vegetable consumption among both men and women. Male unskilled manual workers had an OR 1.5 (1.2-2.0) and female unskilled manual workers an OR 2.2 (1.6-3.1) of low vegetable consumption compared to the higher non-manual reference group. The socioeconomic differences in fruit consumption were much smaller for both sexes, and the SES differences were non-significant among men, while unskilled female manual workers had an OR 1.4 (1.1-1.9) of low fruit consumption compared to the higher non-manual reference group. Socioeconomic differences in the consumption of fruit juices were observed for both sexes. Unskilled manual workers had an OR 2.0 (1.6-2.6) among men and 1.6 (1.2-2.0) among women of low consumption of fruit juices. Social participation was the only psychosocial variable that was strongly associated with consumption of the food items of this study. Men with low social participation had an OR 1.8 (1.5-2.0) and women an OR 2.1 (1.8-2.3) of low vegetable consumption. An OR 1.5 (1.4-1.7) among men and an OR 1.4 (1.3-1.6) among women of no consumtion of fruit juices was observed among individuals with low social participation. The consumption of the self-employed, the unemployed, and the pensioners diverged only slightly from their reference groups.

When age, country of origin, total energy intake, and seasonal variability were included in the multivariate logistic regression model for men and women respectively, the socioeconomic differences were slightly increased in the case of vegetable consumption, mostly due to the introduction of country of origin. The introduction of social participation in the models moderately reduced the SES differences in the OR:s of a low consumption of especially vegetables for both sexes. The OR:s for for men decreased from 1.6 (1.2-2.1) to 1.4 (1.03-1.8) among skilled manual workers, and from 1.8 (1.3-2.4) to 1.5 (1.1-2.0) among unskilled manual workers. The OR:s for women decreased from 1.7 (1.2-2.3) to 1.5 (1.1-2.1)

among lower non-manual employees, from 2.2 (1.5-3.2) to 2.0 (1.3-2.9) among skilled manual workers, and from 2.3 (1.7-3.1) to 1.9 (1.4-2.6) among unskilled manual workers. The changes in the OR:s concerning consumption of fruit and fruit juices were much smaller after the introduction of the social participation variable in the multivariate analysis. The introduction of the other three psychosocial variables into the model had no effect on the OR:s (table 4).

The SES gradient in vegetable consumption remained statistically significant when all covariates had been introduced into the model.

Since social participation was introduced with a decreasing effect on the OR:s of low vegetable consumption in the final step of the multivariate analyses, it seemed important to analyse how much of the association between this variable and low vegetable consumption that could be ascribed to the variables in the model. The result of this analysis was that only country of origin had a significant effect.

Table 4. ORs and 95% CI and p-tests for trend of low vegetable consumption by socioeconomic status in the Malmö Diet and Cancer Study 1992–1994.

	Adjusted OR (95% CI)[a]	Adjusted OR (95% CI)[b]	Adjusted OR (95% CI)[c]	Adjusted OR (95% CI)[d]	Adjusted OR (95% CI)[e]
Men					
Higher non-manual	1.0	1.0	1.0	1.0	1.0
Middle non-manual	1.2 (0.9–1.6)	1.3 (0.95–1.6)	1.3 (0.95–1.7)	1.3 (0.95–1.7)	1.2 (0.9–1.6)
Lower non-manual	1.6 (1.2–2.1)	1.6 (1.2–2.1)	1.6 (1.2–2.1)	1.6 (1.2–2.1)	1.5 (1.1–2.0)
Skilled manual	1.4 (1.01–1.8)	1.5 (1.1–2.0)	1.6 (1.2–2.1)	1.6 (1.2–2.1)	1.4 (1.03–1.8)
Unskilled manual	1.5 (1.2–2.0)	1.7 (1.3–2.2)	1.8 (1.3–2.4)	1.8 (1.3–2.4)	1.5 (1.1–2.0)
Test for trend	*p = 0.003*	*p < 0.001*	*p < 0.001*	*p < 0.001*	*p = 0.014*
Women					
Higher non-manual	1.0	1.0	1.0	1.0	1.0
Middle non-manual	1.1 (0.8–1.6)	1.2 (0.8–1.6)	1.2 (0.8–1.6)	1.2 (0.8–1.6)	1.2 (0.8–1.6)
Lower non-manual	1.7 (1.2–2.3)	1.7 (1.2–2.3)	1.7 (1.2–2.3)	1.7 (1.2–2.3)	1.5 (1.1–2.1)
Skilled manual	2.1 (1.5–3.1)	2.2 (1.5–3.2)	2.2 (1.5–3.2)	2.2 (1.5–3.2)	2.0 (1.3–2.9)
Unskilled manual	2.2 (1.6–3.0)	2.3 (1.7–3.1)	2.3 (1.7–3.1)	2.3 (1.7–3.1)	1.9 (1.4–2.6)
Test for trend	*p < 0.001*	*p < 0.001*	*p < 0.001*	*p < 0.001*	*p < 0.001*

a) Adjusted for age.
b) Adjusted for age and country of origin.
c) Adjusted for age, country of origin and total energy intake.
d) Adjusted for age, country of origin, total energy intake and seasonal variability.
e) Adjusted for age, country of origin, total energy intake, seasonal variability and social participation.

Conclusions

A considerable socioeconomic gradient was found for intake of vegetables and fruit juices, which seemed only moderately dependent on social participation. Social participation was a strong determinant per se of the level of intake. Since the other investigated psychosocial factors were much weaker determinants, the psychosocial stress hypothesis was not convincingly supported regarding these types of dietary habits.

Paper V:

Intermittent and daily smokers: two different socioeconomic patterns, and diverging influence of social participation and social capital

Results

For both sexes, the SES groups skilled and unskilled manual workers showed significantly higher OR:s of daily smoking, compared to the non-manual high level reference group. The unemployed men showed significantly higher OR:s of daily smoking compared to the whole employed reference group, and the male pensioners compared to the whole workforce. On the other hand, no significant socioeconomic differences in intermittent smoking were seen, neither for men nor for women. Men with low social participation had an OR 2.0 (1.8-2.3) of being a daily smoker, while the corresponding OR of being an intermittent smoker was statistically non-significant, the OR being 0.8 (0.6-1.1). Among women, individuals with low social participation had an OR 1.6 (1.4-1.8) of daily smoking. In contrast, females with low social participation only had a non-significant OR 1.1 (0.8-1.4) of intermittent smoking.

The SES patterns in daily and intermittent smoking did not change when age, country of origin, self-reported previous/current diseases, and marital status were included in the multivariate logistic regression models, neither for men nor for women. Finally, when social participation was included in the models, the association between SES and daily smoking was considerably weakened. The OR:s were reduced among men from 2.3 (1.7-3.0) to 1.9 (1.4-2.5) for the unskilled manual workers. Social participation also reduced the female OR:s of daily smoking from 1.9 (1.4-2.5) to 1.6 (1.2-2.2) for the unskilled manual workers. On the other hand, social participation had no effect on the very weak association between SES and intermittent smoking (table 5).

The association between social participation and daily and intermittent smoking, respectively, could theoretically be affected by the other variables in the model. However, age, country of origin, previous/current self-reported diseases and marital status had almost no effect on either the significant relationship between social participation and daily smoking, or the non-significant association between social participation and intermittent smoking.

Conclusions

There were no socioeconomic differences in intermittent smoking, and no association with social participation, a result that sharply contrasts the patterns of daily smoking. These findings may have important implications for the discussion concerning social capital and tobacco preventive measures. The results of this study imply that preventive measures against daily tobacco smoking should be designed to improve at least certain aspects of social capital. Causal pathways between social or psychosocial factors and intermittent smoking remain to be disentangled.

Table 5. Age-adjusted and multivariate odds ratios (OR) and 95% confidence intervals (CI) of regular and intermittent smoking compared to all non-smokers in socioeconomic groups. Men and women. The Malmö Diet and Cancer Study 1992-1994.

	Regular smoking			Intermittent smoking		
	Adjusted * OR, 95% CI	**Adjusted ** OR, 95% CI**	**Adjusted *** OR, 95% CI**	**Adjusted * OR, 95% CI**	**Adjusted ** OR, 95% CI**	**Adjusted *** OR, 95% CI**
Men						
Socioeconomic status (SES)						
High level non-manual	1.0	1.0	1.0	1.0	1.0	1.0
Middle level non-manual	1.0 (0.8-1.3)	1.0 (0.8-1.4)	1.0 (0.8-1.3)	0.7 (0.4-1.1)	0.7 (0.4-1.1)	0.7 (0.4-1.1)
Low level non-manual	1.1 (0.8-1.5)	1.1 (0.9-1.6)	1.1 (0.8-1.4)	1.1 (0.7-1.7)	1.1 (0.7-1.7)	1.1 (0.7-1.8)
Skilled manual	1.5 (1.1-2.0)	1.5 (1.1-2.0)	1.3 (1.00-1.8)	0.9 (0.5-1.4)	0.8 (0.5-1.3)	0.8 (0.5-1.4)
Unskilled manual	2.3 (1.7-3.0)	2.3 (1.7-3.0)	1.9 (1.4-2.5)	0.7 (0.4-1.2)	0.7 (0.4-1.2)	0.7 (0.4-1.2)
Women						
Socioeconomic status (SES)						
High level non-manual	1.0	1.0	1.0	1.0	1.0	1.0
Middle level non-manual	1.1 (0.8-1.5)	1.2 (0.9-1.6)	1.1 (0.8-1.6)	1.3 (0.7-2.3)	1.3 (0.7-2.4)	1.3 (0.7-2.4)
Low level non-manual	1.3 (1.01-1.8)	1.4 (1.01-1.8)	1.3 (0.96-1.7)	1.1 (0.6-2.0)	1.1 (0.6-2.0)	1.1 (0.6-2.0)
Skilled manual	1.5 (1.02-2.1)	1.5 (1.02-2.1)	1.4 (0.9-2.0)	0.7 (0.3-1.6)	0.7 (0.3-1.6)	0.7 (0.3-1.6)
Unskilled manual	1.8 (1.4-2.4)	1.9 (1.4-2.5)	1.6 (1.2-2.2)	1.3 (0.7-2.3)	1.3 (0.7-2.4)	1.3 (0.7-2.4)

*Adjustment for age.
**Adjustment made for age, ethnicity, self-reported diseases and marital status.
***Adjustment made for age, ethnicity, self-reported disease, marital status and social participation.

Paper VI:

Individual and neighbourhood determinants of social participation and social capital: a multilevel analysis of the city of Malmö, Sweden

Results

The neighbourhood (n=90) median proportion of inhabitants with low social participation was 31.0%, the lower quartile proportion was 23.0% and the upper quartile proportion 39.7%. The proportion with low social participation among individuals in the study was 29.8%. The neighbourhood medians regarding age, sex, country of origin, living alone, socioeconomic status, sick leave, disability pension and unemployment were approximately the same as the individual proportions, while the neighbourhood median for the high educational level variable was 17.5% compared to the individual proportion 20.9%.

The individual odds ratios of having low social participation increased with age, OR 2.28 (2.06-2.51, 95% CI) in the age interval 61-68 years compared to the 45-53 years group. The odds ratio of having low social participation was 1.69 (1.50-1.89) among individuals born in other countries than Sweden. The odds ratio of low social participation was 4.39 (3.86-5.00, 95% CI) in the group with the lowest level of education compared to the highest educational level reference group, and 6.54 (5.30-8.07) in the lowest unskilled manual worker socioeconomic status group compared to the high level non-manual employee reference group.

The crude second level (neighbourhood) variance was 0.221 (0.040). In the second age- and sex-adjusted step the individual education variable strongly reduced the second level (neighbourhood) variance in social participation to 0.109 (0.032). The age- and sex-adjusted individual country of origin variable also somewhat reduced the second level (neighbourhood) variance in social participation to 0.193 (0.036), and the socioeconomic status variable reduced the second level variance to 0.089 (0.026). The other individual variables introduced one at a time only marginally affected the second level variance. The percentage of the total variance in social participation that was explained by the area of residence (i.e., intra-neighbourhood level correlation) was 6.3% in the empty model. When all the individual variables were introduced simultaneously in the model, the second level (neighbourhood) effect on social participation was reduced to 0.057 (0.015) (table 6). The percentage of the total variance in low social participation that was explained by the area of residence (i.e. intra-neighbourhood level correction) was finally reduced by 73% (6.3-1.7)/6.3, when all the individual variables were entered into the model.

The neighbourhood (second level) variance in social participation was reduced but not fully erased when all the individual variables were entered into the model (figures 3 and 4).

There was also a significant covariance between the slopes of the associations between individual low social participation and each of the three individual variables living alone, sick leave and unemployment, and the level of low social participation of the neighbourhoods. There was evidence of a clear cross-level synergistic effect between low neighbourhood social participation and the mentioned individual factors regarding individual social participation. In other words, the lower the level of social participation in a neighbourhood, the weaker the association between living alone, sick leave, unemployment, respectively, and low individual social participation.

Table 6. Individual level odds ratios (OR) and 95% confidence interval (95% CI) of low social participation, and neighbourhood effect on individual low social participation in 13.335 individuals from 90 neighbourhoods of the city of Malmö, in function of different individual characteristics.

		Neighbourhood effect	
	OR (95%CI)	Neighbourhood level variance (standard error)	Intra-neighbourhood correlation
All variables in the model			
Age			
46 – 53	Reference		
54 – 60	1.25 (1.13 – 1.39)		
61 - 68	2.27 (2.05 – 2.51)		
Sex	1.15 (1.06 – 1.26)		
Born outside Sweden (yes vs. no)	1.42 (1.26 – 1.60)		
Education level*			
High	Reference		
Medium	1.92 (1.68 – 2.20)		
Low	4.56 (4.01 – 5.19)		
Living alone (yes vs. no)	1.19 (1.08 – 1.30)	0.0.57 (0.015)	1.7%
Socioeconomic status*			
High-level non-manual employees	Reference		
Self-employed persons	2.74 (2.19 – 3.44)		
Medium-level non-manual			
Employees	1.62 (1.30 – 2.03)		
Low-level non-manual employees	2.80 (2.26 – 3.46)		
Skilled manual workers	4.23 (3.39 – 5.29)		
Unskilled manual workers	6.05 (4.90 – 7.47)		
Disability pension	2.31 (1.96 – 2.73)		
Sick leave	1.32 (1.12 – 1.55)		
Unemployment	1.30 (1.10 – 1.54)		

Individual educational level and socioeconomic status were not included in the same model as they are highly correlated. The effect estimations in the two models were very similar and therefore only the estimations of the model including individual socioeconomic status are presented.

Conclusions

Small area variations in social participation remain after adjustment for individual factors. These results seem to confirm Putnam's notion that social capital is a property of social life that is partly independent of individual factors, i.e. a characteristic which is partly contextual in nature. The study also showed evidence of a cross-level synergistic effect between low neighbourhood social participation and individual living alone, sick leave and unemployment factors regarding individual social participation. The higher the level of social participation in a neighbourhood, the stronger the association between living alone, sick leave and unemployment, respectively, and low individual social participation.

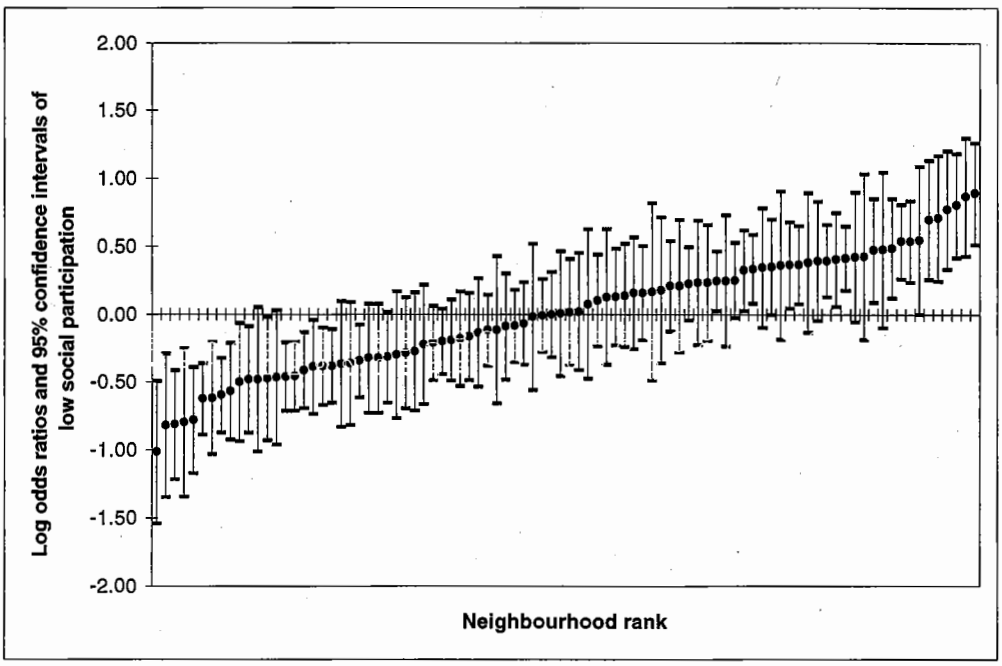

Figure 3. *Crude log-odds ratios of low social participation of the 90 neighbourhoods having the whole city of Malmö as reference (value=0) according to the empty model. The intra-neighbourhood correlation (i.e., the percentage of the social participation variance that is related to the area) is 6.3%.*

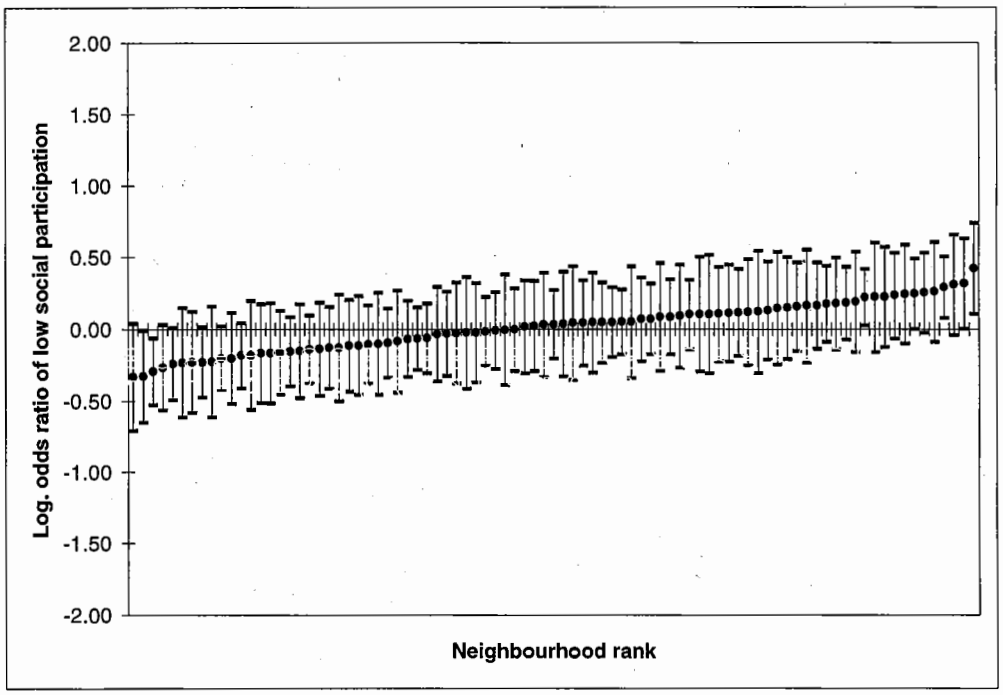

Figure 4. *Adjusted log-odds ratios of low social participation of the 90 neighbourhoods having the whole city of Malmö as reference (value=0) according the final model (i.e., all studied variables included). The intra-neighbourhood correlation (i.e., the percentage of the social participation variance that is related to the area) is 1.3%.*

General discussion

The hypothesis of this thesis has been that psychosocial factors could be a link in a causal chain between socioeconomic status and health-related behaviours. Social network and social support factors may affect the health of a person by at least three different pathways (Berkman et.al. 1979). The third and indirect pathway by which psychosocial factors affect health by the influence on health-related behaviours is the one that has been investigated in this thesis. No statistically significant socioeconomic differences in the total fat intake and the intake of subgroups of fat were observed. Furthermore, no significant socioeconomic differences in fruit consumption and intermittent smoking were observed. However, statistically significant socioeconomic differences were observed in the intake of vegetables and fruit juices, in smoking cessation, in daily smoking and in leisure-time physical activity. In all these cases, the OR:s of risk (unhealthy) behaviour were significantly higher in lower socioeconomic groups. Social participation was the one of the four psychosocial variables that significantly reduced the socioeconomic differences in vegetable consumption, smoking cessation, daily smoking and leisure-time physical activity. In contrast, the other social network variable, i.e. social anchorage, did not affect the socioeconomic differences in health-related behaviours. The two social support variables, i.e. emotional support and instrumental support, had no significant impact on the socioeconomic differences in any of the health-related behaviours. Social participation is one aspect of the concept of social capital as defined by Coleman and Putnam. The social capital literature stresses the importance of inter-personal relations and trust, and social capital is thus partly a contextual trait. A multilevel analysis of the small administrative areas of Malmö revealed that the differing levels of social participation in the areas were partly determined by individual socioeconomic status and education, but a significant fraction of the differences in the level of social participation between the areas remained after adjustment for a number of individual determinants.

The causal mechanism by which a high level of social participation may be a resource that supports and enhances healthy behaviours could plausibly be found within the framework of the psychosocial stress theory. Health-related behaviours are a result of the interaction between a person and her environment. A person's relation to her environment can be viewed as a dynamic process, since environmental changes require continuous adaptation by the individual. The successful adaptation to changes in the environment requires both individual resources, e.g. education and material resources, and social support and social network. Social network (social participation and social anchorage) was first used in anthropology and sociology to describe and analyse social relationships (Barnes 1954; Hanson 1988). According to the public health literature on social network, the health promoting and health protective effects of the social network (i.e. social

participation and social anchorage) are due to its ability to provide various resources for the individual, e.g. social support (Berkman 1984; Hanson 1988; Östergren 1991).

The results may thus be understood in terms of a causal chain by which social participation relays some of the socioeconomic differences in health-related behaviours (figure 5). However, the results could also theoretically be the product of effect modification at the individual level, by which different proportions of individuals with high levels of social participation in different socioeconomic groups modifies the OR:s of damaging health-related behaviours (figure 6). The effect modification could also occur at the contextual, i.e. neighbourhood level (figure 7). The next section will deal with this problem.

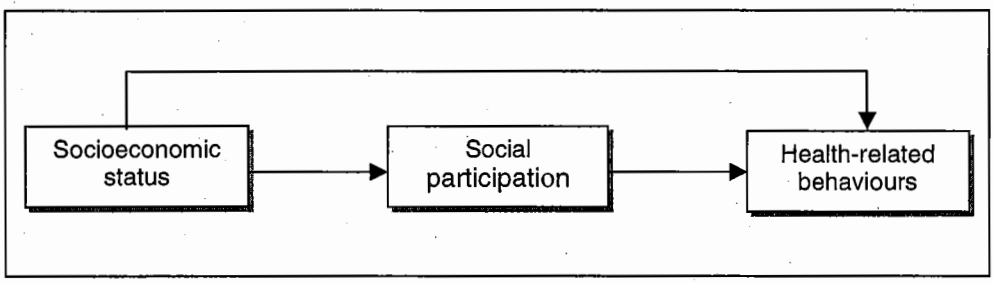

Figure 5. *Chain of causal relatonships between socioeconomic status, social participation and health-related behaviours.*

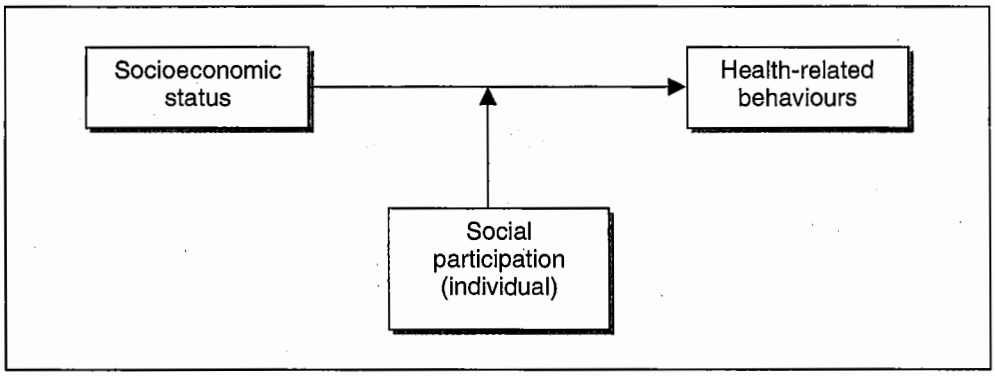

Figure 6. *Effect modification by social participation (individual).*

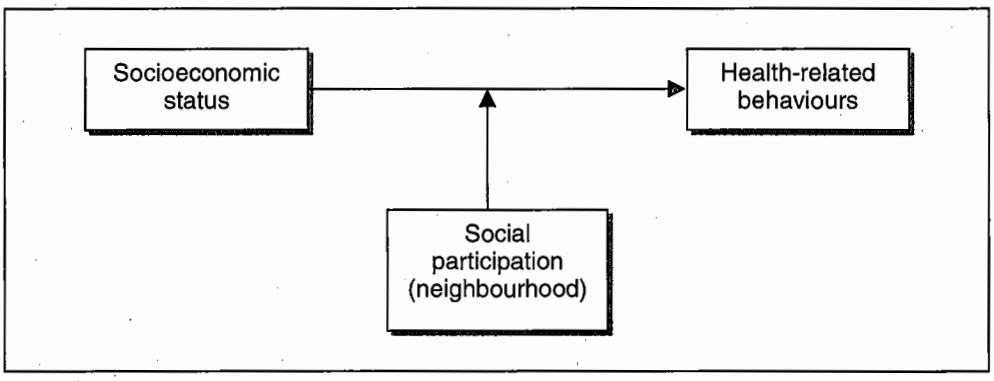

Figure 7. *Effect modification by social participation (neighbourhood).*

Causal chains and effect modification

Table 7 shows that the odds ratio of having low social participation greatly increases with lower socioeconomic position. Unskilled manual workers have an OR 5.7 (4.1-7.9) for men, and 8.0 (5.2-12.1) for women of low social participation compared to non-manual employees in higher positions (OR by definition 1.0). The corresponding OR:s for male and female pensioners are 6.9 (5.0-9.5) and 10.7 (7.0-16.5), respectively (table 7). The adjustments for age, country of origin, and self-reported previous/current diseases only slightly reduces these OR:s. This socioeconomic pattern of social participation could support the notion that the results in Papers II-V are due to effect modification instead of a causal effect of social participation on health-related behaviours.

Table 7. Odds ratios (OR:s) and 95 % confidence intervals (CI) of having low social participation in the SES groups. Adjusted for age, country of origin and previous/current diseases. Logistic regression analysis. N= 11,837. The Malmö Diet and Cancer Study 1992-1994.

	Men	**Women**
Higher non-manual employees	1.00	1.00
Middle non-manual employees	1.55 (1.10-2.20)	1.44 (0.91-2.28)
Low non-manual employees	2.49 (1.76-3.52)	3.32 (2.17-5.08)
Skilled manual employees	4.06 (2.91-5.67)	4.07 (2.51-6.60)
Unskilled manual employees	5.70 (4.09-7.94)	7.95 (5.21-12.13)
Self-employed	2.23 (1.60-3.13)	3.23 (1.99-5.25)
Unemployed	5.13 (3.61-7.29)	5.50 (3.46-8.73)
Pensioners	6.90 (5.00-9.53)	10.7 (7.00-16.47)

However, the stratified analysis (stratification by socioeconomic status) in table 8 shows that the statistical effects of social participation on the health-related behaviours daily smoking, low leisure-time physical activity, and low vegetable consumption are similar within each of all the eight socioeconomic groups of this study. A low individual level of social participation is associated with more unhealthy behaviours within each of the eight socioeconomic groups with one single exception. These associations between social participation and daily smoking, low leisure-time physical activity, and low vegetable consumption are further strengthened by adjustment for age, country of origin, and self-reported previous/current diseases. No such significant associations were observed for either social anchorage, emotional support, or instrumental support when similar stratified analyses were conducted to analyse the association within each socioeconomic group and the health-related behaviours for these three psychosocial variables. The results of the stratified analyses by socioeconomic status of the effect of social participation on health-related behaviours support the idea that social participation may be involved as a link in the causal chain linking socioeconomic status to health-related behaviours. Effect modification at the individual level thus seems to be of less importance.

The results in Paper VI support Putnam's notion that social capital is an aspect that is at least partly contextual in its nature. Effect modification by contextual level social participation may therefore have an impact on the relationships between socioeconomic status and health-related behaviours (figure 7). However, this possibility has not been tested in this thesis. It remains to be disentangled.

Common cause and common effect scales

The social participation variable is an index variable that consists of 13 different items. The items may reflect the same kind of participation. The social participation index variable would in that case be a common cause scale, which means that the different items of the social participation index variable would just measure the same causal chain between social participation and health-related behaviours. However, both theory (Putnam 1993) and empirical evidence (Baum et. al. 2000) suggest that the items of the social participation variable reflect different aspects of both civic and social participation in society. In this second case there would be several or many different causal chains between each of the different items of the social participation variable and health-related behaviour. This lack of a relationship between an item and other items (divergent validity) (Campbell et. al. 1959) can be empirically tested by calculating the bivariate correlations between the items.

Table 8. Odds ratios (OR:s) and 95 % confidence intervals (CI) of daily smoking, low leisure-time physical activity and low vegetable consumption within each SES group when social social participation is low. Adjusted for age, country of origin and previous/current diseases. Logistic regression analysis. N= 11,837. The Malmö Diet and Cancer Study 1992-1994.

		Daily smoking	Leisure-time physical activity	Vegetable consumption
Women				
I	-high	1.00	1.00	1.00
	-low	0.74 (0.25-2.25)	1.51 (0.60-3.80)	2.26 0.90-5.71)
II	-high	1.00	1.00	1.00
	-low	1.37 (0.83-2.26)	1.78 (1.08-2.95)	2.43 (1.50-3.93)
III	-high	1.00	1.00	1.00
	-low	1.79 (1.36-2.35)	2.00 (1.53-2.61)	2.24 (1.72-2.91)
IV	-high	1.00	1.00	1.00
	-low	1.34 (0.74-2.44)	2.48 (1.39-4.45)	1.52 (0.87-2.65)
V	-high	1.00	1.00	1.00
	-low	1.37 (1.07-1.77)	2.46 (1.91-3.16)	1.89 (1.47-2.43)
VI	-high	1.00	1.00	1.00
	-low	1.95 (1.06-3.58)	4.51 (2.57-7.92)	2.11 (1.19-3.74)
VII	-high	1.00	1.00	1.00
	-low	1.64 (1.01-2.66)	3.17 (1.85-5.43)	1.81 (1.12-2.92)
VIII	-high	1.00	1.00	1.00
	-low	1.57 (1.21-2.03)	1.62 (1.25-2.08)	1.69 (1.32-2.16)
Men				
I	-high	1.00	1.00	1.00
	-low	2.47 (1.31-4.67)	1.58 (0.83-3.00)	1.95 (1.02-3.73)
II	-high	1.00	1.00	1.00
	-low	2.12 (1.36-3.30)	1.98 (1.27-3.06)	1.14 (0.72-1.79)
III	-high	1.00	1.00	1.00
	-low	2.14 (1.36-3.37)	2.26 (1.48-3.45)	2.00 (1.31-3.04)
IV	-high	1.00	1.00	1.00
	-low	1.97 (1.35-2.88)	2.64 (1.83-3.80)	2.04 (1.39-3.00)
V	-high	1.00	1.00	1.00
	-low	1.74 (1.23-2.46)	2.32 (1.62-3.33)	2.34 (1.61-3.40)
VI	-high	1.00	1.00	1.00
	-low	1.69 (1.14-2.50)	2.88 (2.00-4.15)	1.43 (0.97-2.10)
VII	-high	1.00	1.00	1.00
	-low	1.70 (1.11-2.61)	2.97 (1.84-4.79)	1.79 (1.14-2.80)
VIII	-high	1.00	1.00	1.00
	-low	1.74 (1.31-2.31)	2.23 (1.62-3.07)	1.82 (1.36-2.43)

I= non-manual employees in higher positions.
II= non-manual employees in middle positions
III= non-manual employees in lower positions
IV= skilled manual workers
V= unskilled manual workers
VI= self-employed
VII= unemployed
VIII= pensioners

Table 9 shows that the highest bivariate correlations (Pearson, two-tailed) between the 13 items of the social participation variable could be observed between arts exhibition and cinema/ theatre (r=0.39), union meeting and study circle at the place of work (r=0.25), private party and theatre/cinema (r=0.25), big gathering of relatives and going to church (r=0.20), going to church and theatre/cinema (r=0.20), and demonstration and union meeting (r=0.20). All the other correlations are even weaker. This fact indicates that the different items included in the social participation index variable represent different kinds of civic and social participation. The social participation measure thus seems to be a common effect scale (divergent validity) rather than a common cause scale (convergent validity). This diverse pattern of participation is supported in the literature (Baum et. al. 2000).

Table 9. Correlations between the 13 items of the social participation index variable. N= 11,837. The Malmö Diet and Cancer Study 1992-1994.

	A	B	C	D	E	F	G	H	I	J	K	L	M
A	1.00												
B	0.11[1]	1.00											
C	0.25[1]	0.07[1]	1.00										
D	0.10[1]	0.14[1]	0.11[1]	1.00									
E	0.17[1]	0.15[1]	0.08[1]	0.11[1]	1.00								
F	0.14[1]	0.17[1]	0.05[1]	0.14[1]	0.39[1]	1.00							
G	0.09[1]	0.10[1]	0.04[1]	0.14[1]	0.20[1]	0.19[1]	1.00						
H	0.08[1]	0.01[6]	0.06[1]	0.16[1]	0.12[1]	0.06[1]	0.07[1]	1.00					
I	0.06[1]	0.09[1]	0.04[1]	0.13[1]	0.07[1]	0.09[1]	0.05[1]	0.05[1]	1.00				
J	0.06[1]	0.10[1]	0.20[1]	0.13[1]	0.02[3]	0.04[1]	0.03[1]	0.03[2]	0.12[1]	1.00			
K	0.12[1]	0.06[1]	0.08[1]	0.10[1]	0.18[1]	0.07[1]	0.07[1]	0.19[1]	0.03[1]	0.03[2]	1.00		
L	0.10[1]	0.07[1]	0.05[1]	0.06[1]	0.14[1]	0.12[1]	0.20[1]	0.06[1]	0.02[4]	0.02[4]	0.11[1]	1.00	
M	0.08[1]	0.07[1]	0.05[1]	0.10[1]	0.25[1]	0.17[1]	0.14[1]	0.11[1]	0.03[2]	0.02[5]	0.17[1]	0.19[1]	1.00

A = Study circle at workplace.
B = Study circle/other.
C = Union meeting.
D = Other organisation meeting.
E = Theatre/cinema.
F = Arts exhibition.
G = Church.
H = Sports event.
I = Letter to the editor of a newspaper/journal.
J = Demonstration.
K = Night club/entertainment.
L = Gathering of relatives.
M = Private party.

[1] p<0.001
[2] p=0.002
[3] p=0.005
[4] p=0.01
[5] p=0.06
[6] p=0.20

Causal mechanisms

The results of Papers II-VI support the notion that structural/material and cultural/behavioural determinants of health are inter-related, and that the causal pathway linking socioeconomic status to health-related behaviours is partially mediated by social participation (figure 8).

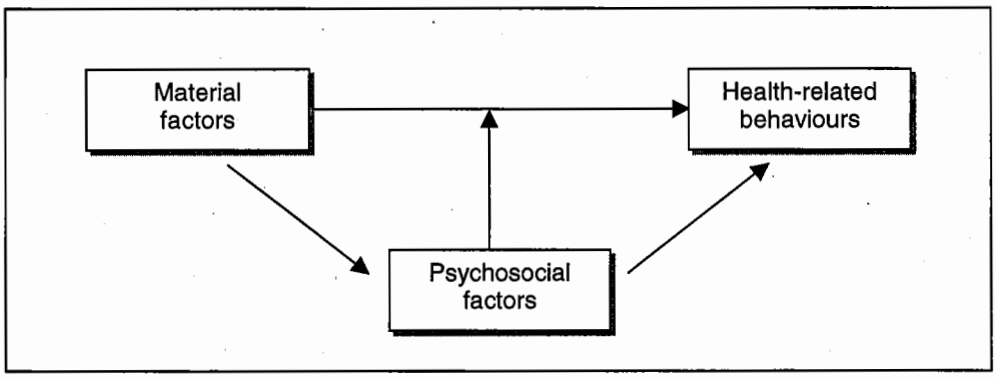

Figure 8. *Causal relationships between material factors, psychosocial factors and health-related behaviours.*

The results (Papers II-V) and the complementary analysis above thus partly support the psychosocial stress hypothesis. A high level of social participation seems to promote beneficial and health-protective behaviours, while the other psychosocial factors largely do not seem to play this role. The causal mechanisms behind this beneficial effect of social participation may also differ between different behaviours. The process of giving up smoking and remaining smoke-free is complex, and involves social, psychological and physiological factors (Ockene et. al. 1981; Haire-Joshu et. al. 1991). Important psychological factors are e.g. self-efficacy (Gulliver et. al. 1995), intention to stop, and personal rating of likelihood of cessation (Sanders et. al. 1993). Smoking could thus be regarded as a maladaptive behaviour of the individual to be able to cope with a stressful life situation (Dejin-Karlsson 1999), i.e. a life situation characterised by low social participation.

On the other hand, the unsatisfactory effects of low social participation on other health-related behaviours, e.g. leisure-time physical activity and vegetable consumption, could partly be more directly related to the impact on the individual of phenomena inherent in the social structure itself. High leisure-time physical activity may be mediated by a higher extent of encouragement/peer pressure to participate in physical activities experienced by persons with a high social participation. In the case of physical activity, the improvements of such structural

factors as the physical environment (Sallis et. al. 1997), physical exercise in groups instead of individually (Clark 1996), as well as community and workplace policies (Eyler et. al. 1997) have been shown to promote physical activity in a population. The social structure also seems to be of importance for the explanation of the beneficial effect of social participation on the socioeconomic differences in vegetable consumption. Social norms and eating habits at home may e.g. contribute to the individual's consumption patterns (Yetley et. al. 1980). Worksite interventions with the aim of increasing vegetable and fruit consumption that also include family educational components have also been more successful compared to isolated worksite interventions (Sorensen et. al. 1999). Influence of both family and structural conditions have also been demonstrated to be important predictors of food consumption (Roos et. al. 1998; Arber 1997).

According to the specified psychosocial stress hypothesis, the level of social participation experienced by the individual ought to result in corresponding levels of social support (emotional and/or instrumental support). No correspondance of this kind was observed in the analyses. The empirical literature concerning at least leisure-time physical activity and vegetable consumption cited above indicates that social structures and social norms, rather than psychosocial and psychological coping mechanisms derived from the psychosocial stress theory, protect the individual from these unhealthy behaviours.

Social participation seems to be a factor that determines the health-related behaviours of individuals independently of their social support characteristics. The literature on social capital (Coleman 1990; Putnam 1993) seems to provide a framework, since a society characterised by high levels of social capital has been defined by one of the leading social capital theorists Robert D. Putnam as a society characterised by (1) engaged citizens (high level of civic engagement/social participation), (2) political equality, (3) solidarity, trust and tolerance, and (4) social structures that serve to enhance cooperation between citizens (Putnam 1993).

The nature and characteristics of social capital will be discussed more thoroughly below (pp. 58ff.).

The assessment of psychosocial resources

The psychosocial resources analysed in this thesis were derived and developed from the psychosocial stress theory, and the concept of psychosocial resources (Syme 1989; Hanson 1988; Cassel 1976). The original method to assess the psychosocial resources was developed for the investigation "Men born in 1914" (Hanson et. al. 1987).

The reliability and validity of the four items analysed in this work have been assessed in several earlier studies (Hanson et. al. 1987; Östergren et. al. 1995; Hanson et. al. 1997). The different items showed a good or acceptable validity and

reliability. The test-retest stability was high, and showed good reliability in both the "Men born in Malmö 1914" population and the "Malmö Shoulder and Neck Study" population (Hanson et. al. 1987; Hanson et. al. 1997). The kappa coefficents for the two social network items social participation and social anchorage were 0.70 and 0.66, respectively. The kappa coefficients for the social support variables were 0.57 for emotional support and 0.47 for instrumental support. Some gender and age differences were noted. Males showed higher reliability than females, and so did older age groups (55-64 years) in comparison with the younger. The construct validity analysed by Cronbach's alpha was highest for emotional support (0.63) and social participation (0.61), while social anchorage scored the lowest (0.40). The analysis of construct validity indicated that the different indices measure different aspects of the psychosocial environment (Hanson et. al. 1997).

The MDCS study does not seem to suffer from serious selection bias concerning the psychosocial items used in this work. The MDCS population used in this work (n=11,837, aged 45-64 years) was compared to the same age brackets of the Public Health Survey in Malmö 1994 that had a participation rate of 71%, and even 74% in the age brackets 45-64 years (n=1,001 in these age brackets). This comparison revealed that the MDCS population was exposed to low social participation (28.4% compared to 24.7%) and low instrumental support (31.1% compared to 34.3%) to almost the same extent as the Health Survey in Malmö 1994 population (Lindström et. al. 2000a).

The assessment of socioeconomic status and background factors

Classification of socioeconomic status (SES) was based on data about job title, and work tasks, obtained from the baseline questionnaire. The classification procedure was identical to the one used in the Swedish population census (Statistics Sweden), with two manual groups and three non-manual groups, and, finally, one self-employed group.

One pensioner and one unemployment category were also assessed. Both these categories are very heterogeneous when it comes to previous position on the labour market. The categories comprise both former non-manual employees in higher positions and former unskilled manual workers. This heterogeneity can also be observed among the self-employed when it comes to their prior position as employees or their job titles. The self-employed group was therefore compared with the whole employee group (all five categories), the unemployed with all on the labour market (six categories including the self-employed), and the pensioners with all others (seven categories including the unemployed) in Papers III-V.

The risk of selection bias concerning socioeconomic status seems small. All eight socioeconomic categories were very similar in their distributions compared to

the Public Health Survey in Malmö 1994. Only country of origin differed from this pattern, mostly due to the fact that almost 2,000 individuals of foreign origin were excluded from the MDCS study due to language problems (Lindström 2000a).

The problem of confounding has been dealt with by including age, country of origin, self-reported previous/current diseases, and marital status in the multivariate analyses. The population has also been stratified by sex in Papers I-V.

There is always a risk of residual confounding due to the omission of one or several important factors relevant to the research problem. However, the set of variables used in this work seems reasonably to cover this research subject according to existing empirical evidence in the scientific literature.

The assessment of health-related behaviours

The risk of misclassification of fat intake is related to the concern that self-reported energy intakes are often too low for the habitual energy consumption. A difference in the measurement of fat intake between the SES groups may produce a differential misclassification that would not be compensated for by increasing the sample size. Differences in literacy skills, the ability to estimate portion sizes and frequencies, dietary memories, social desirability expectations etc. between the SES or educational groups might contribute to this source of misclassification. The finding that the LER:s are evenly distributed in all SES groups seems to make this possibility less plausible. Non-differential misclassification is a problem of principal interest in nutrition epidemiology, since it always tends to attenuate differences. This problem nay have been present concerning the assessment of fat intake, because the main results were negative. However, the risk of misclassification is affected by the reproducibility and validity of the dietary assessment method used. The diet history method used has been among the best obtained (Callmer et. al. 1993; Elmståhl et. al. 1996a; Elmståhl et. al. 1996b).

The results of the study on vegetable, fruit, and fruit juice consumption show important socioeconomic differences in the consumption of vegetables and fruit juices. This is important, since non-differential misclassification tends to attenuate the relations observed. The risk of misclassification was also taken into consideration by examining the effect of the adjustment for total energy intake. This had no impact on the socioeconomic differences in the consumption of vegetables, fruit and fruit juices.

The validity of items on smoking cessation has previously been analysed, with results consistently showing that self-reported tobacco smoking is a valid and reliable way to measure smoking habits in a population (Murray et. al. 1993; Tate et. al. 1994; Verkerk et. al. 1994; Steffensen et. al. 1995; US Department of Health and Human Services 1990). There seems to be no reason to believe that the validity of the smoking variable should be any different in the MDCS.

More than 30 various methods are available for the assessment of physical activity, with many different variations in the techniques. The validation criterion depends on the specific operational definition of physical activity used. For example, surveys that derive kilocalorie scores may wish to use double-labelled water, surveys concerned with intense aerobic activity might employ maximum oxygen uptake measures, motion sensors might use behavioural observation, and walking surveys might employ a pedometer (Montoye et. al. 1984; Sequeira et. al. 1995). These methods have the advantage of avoiding the bias and/or precision problem of physical activity questionnaires connected with self-reporting. However, the 17-item leisure-time physical activity question in the MDCS questionnaire is a quantitative history survey according to the classification of methods by Laporte et. al. (Laporte et. al. 1985), and the validity of these types of surveys were regarded as good after comparison with the objective summary kilocalorie index and treadmill performance (Montoye et. al. 1984; Taylor et. al. 1978). Furthermore, respondents with extreme recorded values were interviewed by telephone with a high reproducibility to assure that the question had been correctly understood. The results of this interview did not support the notion that there might be a risk of precision differences in self-reported leisure-time physical activity between the SES groups, which could bias the findings.

Civic culture, individualism and social capital

Social capital has become a popular concept in the civic/political culture debate. This literature traces its origins back to the original version of the book "The Civic Culture: Poltical Attitudes and Democracy in Five Nations" by Almond and Verba (1963). The extensive literature in the field of political culture has often emphasized the individual autonomy and the independence of modern man. In the ideal society, the social structures that the individual becomes part of are considered as consequences of a free choice guided by the individual's effort to realize his/her own personal aims (Milner 1990). However, this liberal and individualistic emphasis has in recent decades been questioned by a "republican" school within the civic culture literature. A renewed interest in the virtues of modern community and citizenship has manifested itself (Herzog 1986). Michael Walzer (1980) also stresses the interest in public issues and the devotion to public issues as the key signs of civic virtue. The liberal authors do not seem to have been able to contradict the following:

"As the proportion of nonvirtuous citizens increases significantly, the ability of liberal societies to function successfully will progressively diminish" (Galston 1988).

In the liberal perspective, the individual's rights come prior to any social concerns. Consequently, the liberal concept of citizenship a priori requires no common social environment or shared values (Miller 1995). The discussion concerning liberal individualism versus republicanism is also very close to the liberal versus communitarian discussion, also within the civic/political culture theoretical tradition. The participants of this discussion have ranged from very clearly anti-liberal communitarians to very consistent liberals (Lindström 2000b). For some communitarians, e.g. Alisdair MacIntyre, the communitarian standpoint is part of a broad attack on liberal society. According to MacIntyre, modern man

"...is a citizen of nowhere, an internal exile where he lives... Modern liberal political society can appear only as a collection of citizens of nowhere who have banded together for their common protection" (MacIntyre 1981).

The social capital concept (Coleman 1990; Putnam 1993) has partly evolved in a broad variety of scientific subjects in the 1990s, e.g. political science, sociology, economy and in recent years public health, as a response to the previously pronounced individualism and liberalism of the civic culture tradition.

Social capital and its components

Robert D. Putnam's book "Making Democracy Work" (1993), adresses typical empirical research problems in the tradition of the civic culture literature. Italian society in the period 1970-1990 is analysed in the setting of a reform that implemented regional governments and a high extent of regional administrative independence in the twenty regions of Italy in the beginning of the 1970s. Italy had formerly been a highly centralistic state. The study of the reform and its effects highlighted inherited differences between the north and the south of Italy. While the regional governments of the north worked in a highly developed and well-functioning social and political environment, the regional governments of the south had to try to implement their policies in a social and economic environment that was much less developed. Consequently, the same regional reform led to very different results in terms of policy outcome and citizen participation in different parts of the country. Putnam concludes that the south is caught in a civic and political culture that hampers the process of reforms. The reason for this, according to Putnam, seems to be that the political, economic and social system of the south is characterised by vertical (hierarchical) power relations, which result in a state of dependence and passivity for ordinary citizens. In contrast, the system of the north is characterised by interpersonal trust, generalised reciprocity, a rich variety of networks of social participation, and equality of power and influence between citizens, i.e. horizontal (non-hierarchical) power relations. These characteristics of the north represent different aspects of social capital, according to Putnam.

Social capital is created when the relations among persons change in ways that facilitate social interaction, social participation and cooperation:

"Physical capital is wholly tangible, being embodied in observable material form; human capital is less tangible, being embodied in the skills and knowledge aquired by an individual; social capital is even less tangible, for it is embodied in the relations among persons" (Coleman 1990).

But why are not all societies characterised by mutual understanding and cooperation? Failure to cooperate for mutual benefit does not necessarily imply ignorance or irrationality. Putnam discusses how several games of the Public Choice Theory end up with solutions that are rational for each of the individuals, but suboptimal for the individuals as a collective or as a society. In all these games (the tragedy of the commons, the dismal logic of collective action, the prisoner's dilemma), everyone loses by acting only as egoistic individuals. However, the game theory also suggests that cooperation would be enhanced if players were engaged in many repeated games, since this would make possible the use of experience and consequently the punishment of defectors (Putnam 1993; see also McLean 1987) According to Putnam, a high degree of social capital and social participation is needed in society to be able to achieve such repeated situations that would identify defectors and punish them.

The definition of social capital implies that this concept covers a much wider set of laws, rules and values that restrain individual human action more than just written laws sanctioned by the official political and juridical system. Social capital is thus a public good, embedded in all activities of society.

Trust is an essential component of social capital. Trust enhances cooperation, and increased cooperation enhances trust in a process of mutual dependence. This process of mutual enhancing results in an accumulation of social capital, according to Putnam. Social trust between people in a complex society can arise from two sources, according to Putnam: norms of reciprocity and networks of civic engagement.

Norms of reciprocity capture a wide range of "externalities", i.e. consequences of actions that have positive or negative effects on others. Such norms of reciprocity are sustained by modelling and socialisation. In the ideal society, these norms of reciprocity involve all citizens.

Networks of civic engagement and social participation, e.g. neighbourhood associations, cooperatives, sports clubs, political parties, represent intense horisontal networks. They constitute an essential form of social capital, because they increase the potential costs to a defector in any individual transaction, they foster robust norms of reciprocity, they facilitate communication and improve the flow of information about the trustwordiness of individuals, and because they embody past success at collaboration, which can serve as a culturally-defined template for future collaboration (Putnam 1993).

This discussion suggests that the concept of social capital concerns inter-personal characteristics to a higher extent than individual characteristics. Social capital is thus a contextual characteristic of society rather than an individual characteristic. Paper VI in this thesis shows that a significant small area level variance remains even after adjustment, and possibly over-adjustment, for demographic, educational, and socioeconomic characteristics of the individuals living in the 90 administrative areas of the city of Malmö.

Social capital and public health

The association between social conditions and health is well known. Numerous epidemiological studies have shown that integrated people live longer and healthier lives than socially isolated individuals (Berkman et. al. 1979; House et. al. 1988; Kawachi et. al. 1996). The group dynamics and the social character of a community affect the well-being of its citizens. This was illustrated in the prospective study of the highly coherent and traditional Roseto community between 1955 and 1965, where a strikingly low mortality rate from myocardial infarction was found compared to other nearby communities (Stout et. al 1964; Bruhn et. al. 1979). The conventional cardiovascular risk factors were at least as prevalent as in the control communities (Bruhn et. al. 1966; Lynn et. al. 1967). However, as traditional social cohesion was eroded over time, the cardiovascular mortality levels rose and converged with those of the surrounding communities (Egolf et. al. 1992).

In recent years there has been a renewed interest in the social determinants of health. The social capital concept (Coleman 1990; Putnam 1993) has been applied to the area of public health. Study results suggest that social capital is of importance for the prevention of crime (Kawachi 1999a), and for the maintenance of population health (Kawachi et. al. 1997a).

Social capital thus seems to be associated with health. According to the results of this thesis, one of the pathways by which social capital (defined as social participation) promotes health may be by its beneficial effect on some health-related behaviours.

Social participation, social capital and health-related behaviours

The investigation of patterns of social participation seems to represent one important step to increase the understanding of social capital and its effects on public health and health-related behaviours.

Often the patterns of social participation may differ between different age, socioeconomic or educational groups. Older people are e.g. more likely to visit their neighbours, since they spend more time at home after retirement. People in higher socioeconomic status positions are likely to participate in activities that require more material resources. Similarly, people with higher levels of education are more likely to be well-informed, and thus able to participate in a wider variaty of social activities and social settings (Baum et. al. 2000). People with higher levels of education also more often have higher socioeconomic status, which means that the highly educated with high socioeconomic status are both more well-informed, have a wider range of possibilities to participate in social activities, and have access to more material resources. In the MDCS, this strong association between educational level and socioeconomic status can be observed as a highly significant statistical correlation between the education and socioeconomic (occupational) status variables (Spearman's $r=0.65$, $p<0.001$), which is one reason why only occupational status has been used to measure socioeconomic stratification in this thesis.

A high social participation means that the norms of generalised reciprocity as well as other values and norms of society are more likely to affect the thinking and the attitudes of the individual. The almost continuously decreasing prevalence of tobacco smoking during the past three decades has for example resulted in a situation, where non-smoking is the norm, and to some extent even the norm of generalised reciprocity, rather than tobacco smoking. Low levels of social participation have also in other sudies been shown to be associated with smoking (Tillgren et. al. 1996). Leisure-time physical activity and vegetable consumption are also associated with social participation, which illustrates the importance of norms and values (see the beginning of the general discussion).

A high level of social participation may also reinforce the "empowerment" of both individals and social settings. "Empowerment" refers to the ability of people to gain understanding and control over personal, social, economic and political forces in order to improve their life situations (Israel et. al. 1994; Baum et. al. 2000). This constitutes a second, somewhat different pathway by which individuals may experience an increased significance of their own actions, resulting in smoking cessation, increased leisure-time physical activity, and improved vegetable consumption.

The multilevel analysis (Paper VI) has also shown that high levels of social participation within neighbourhoods may be a contextual trait that is partly independent of compositional (individual) factors such as age, sex, country of origin, educational level, socioeconomic status, unemployment etc.

It is important to emphasise that not all forms of social participation or social capital are beneficial for society or for public health. Membership of criminal organisations, and some religious sects may for instance have a detrimental effect on both individuals, society and public health (Kawachi et. al. 1999a). However, these exceptions most likely have no effects on the associations between social

participation, socioeconomic differences, and health-related behaviours studied in this thesis.

Implications for future research and prevention

Social participation has a priori been used as a measure of one aspect of psychosocial social network resources in this work. The results partly support a psychosocial stress hypothesis. In the discussion, social participation has previously been treated as an aspect of social capital. Our social participation item has been tested regarding validity and reproducibility, but contains both civic participation (union meeting, membership in organisations, letter to editor of journal or newspaper, participation in demonstration), religious participation (visiting church), cultural participation (study circle, theatre/cinema, arts exhibition), social participation in sports events, and more private social participation items (night-club, big gathering of relatives, private party) items. A recent study has suggested that these different aspects of social participation respresent different aspects of social participation, with different demographic distributions. Baum et. al. (2000) have investigated six different aspects of social participation: informal social participation, social participation in public places, participation in social group hobby/support or sport activity, individual civic participation, collective civic participation, and participation in other community groups. It is not unreasonable that the present social participation item in future research could be split up into several different civic/social participation items. Another option would be to construct completely new and separate civic/social participation items for use in the assessment of future databases.

Paper VI has statistically supported Putnam's notion that social capital and social participation is a contextual trait of society. Social participation was partly independent of compositional (individual) socioeconomic characteristics. This means that contextual aspects of the associations between social participation/ social capital, socioeconomic status, and health-related behaviours ought to be included by the use of statistical multilevel techniques. Multilevel methods have already been applied in the area of social capital and public health (Kawachi et. al. 1999b; Malmström et. al. 1999). However, these techniques would also be possible to apply concerning the association between social capital/social participation and health-related behaviours.

The results also imply that preventive measures directed at least at some health-related behaviours should be designed to improve aspects of social participation or social capital instead of individual behaviour directly (Lomas 1998). As already mentioned, improvements in structural factors such as the physical environment (Sallis et. al 1997), physical exercise in groups instead of individually (Clark 1996) and community and workplace policies (Eyler et. al. 1997) are measures that are

liable to improve the level of physical exercise in a population. Similarly, vegetable and fruit consumption could most likely be increased by the combination of workplace and family educational interventions (Sorensen et. al. 1999). Thus, there must be a shift in the focus of public health policy strategies from individual to social/structural preventive programs.

Conclusions

- No socioeconomic differences or gradients in total fat intake or the intake of subgroups of fat were observed. Similarly, no socioeconomic differences or gradients in intermittent smoking were observed.
- Significant socioeconomic differences and gradients in smoking cessation, leisure-time physical activity, vegetable consumption, fruit juice consumption and daily smoking were observed.
- Social participation was the psychosocial variable that most markedly affected the significant socioeconomic differences and gradients in smoking cessation, leisure-time physical activity, vegetable consumption and daily smoking. Adjusting for social participation decreased the differences. The other three psychosocial variables: social anchorage, emotional support and instrumental support affected the estimates very marginally.
- Low social participation was independently and positively associated with smoking, low leisure-time physical activity and low vegetable consumption to a similar degree within each of the socioeconomic groups. Social participation thus seems to be an intermediate part of a causal chain between socioeconomic status and health-related behaviours. The support for effect modification between socioeconomic status and social participation was weak.
- A multilevel analysis of the small administrative areas of Malmö revealed that the differing levels of social participation in the areas were partly determined by individual socioeconomic status and education, but an important fraction of the differences in the level of social participation remained after adjustment for a number of individual determinants.
- The independent effect of low social participation on health-related behaviours partially support the psychosocial stress hypothesis, although the other three psychosocial variables were not related to the socioeconomic differences in health-related behaviours. Social participation can be discussed within the framework of the concept of social capital as defined by Coleman and Putnam. This literature stresses the importance of inter-personal relations and trust, and social capital is thus partly a contextual trait.

Populärvetenskaplig sammanfattning

Syftet med avhandlingen är att undersöka vilken roll psykosociala faktorer spelar vid uppkomsten av skillnader mellan olika socioekonomiska grupper i levnadsvanor av betydelse för hälsan.

De sociala skillnaderna i hälsa, sjuklighet och dödlighet förefaller ha ökat under senare decennier i Sverige. Ökande skillnader i sjuklighet och dödlighet i hjärt-kärlsjukdomar är en viktig orsak till detta. En viktig förklaring till denna utveckling är att insjuknande och förekomst av hjärt-kärlsjukdomar har minskat mycket snabbare i välsituerade än i lägre socioekonomiska grupper under senare decennier. Detta hänger i sin tur samman med ökande sociala skillnader i sådana levnadsvanor som är relaterade till hälsa, till exempel rökning, låg fysisk aktivitet, hög andel fett i kosten och låg konsumtion av frukt och grönsaker. Rökning och låg konsumtion av frukt och grönsaker är dessutom välkända riskfaktorer för en lång rad cancersjukdomar.

Kunskapen om psykosociala faktorers betydelse för människors hälsa har ökat snabbt under senare decennier. Forskningen inom detta fält visar att det finns faktorer i den psykosociala miljön som påverkar människans generella sårbarhet för olika sjukdomsframkallande faktorer. Psykosociala faktorer anses ha en direkt påverkan på hälsan via psykofysiologiska stressreaktioner och mer renodlade psykologiska mekanismer. Psykosociala faktorer har emellertid också en indirekt påverkan på hälsan genom en inverkan på olika levnadsvanor som i sin tur har betydelse för hälsan.

Människans relation till sin omgivning kan ses som en dynamisk process av ständig förändring, vilket kräver en ständig anpassning av individen. Individen behöver därför resurser för att möta de krav som förändringar i omgivningen innebär. Sådana resurser kan vara individuella som god ekonomi, utbildning, vissa personlighetsdrag etc., men resurserna kan också utgöras av det sociala nätverk och det sociala stöd som individen får från sin omgivning. Det sociala nätverket utgörs av individens relationer till den sociala omgivningen, till exempel familj, bostadsområde, föreningsliv och kulturliv. Socialt deltagande i samhällets formella och informella nätverk är en viktig del av dessa relationer, liksom känslan av social förankring i bostadsområdet, familjen, arbetslivet och vänkretsen. Det sociala stödet uppstår i individens samspel med det sociala nätverket. Det hjälper individen att hantera stressfyllda situationer i livet. Det sociala stödet kan vara praktiskt/materiellt eller emotionellt. Fyra psykosociala variabler ingick i avhandlingens analyser: socialt deltagande, social förankring, emotionellt socialt stöd och instrumentellt socialt stöd.

Brist på resurser i form av ett svagt socialt nätverk eller lågt socialt stöd kan till exempel påverka benägenheten att sluta röka. I en stressfylld miljö med

otillräckliga resurser för att kunna hantera stressen blir till exempel förutsättningarna för att ta sig ur nikotinberoende och annat hälsodestruktivt beteende mindre.

Undersökningsgruppen i denna avhandling utgörs av individer som ingår i Malmö Kost och Cancer-undersökningen, som i första hand syftar till att undersöka sambandet mellan kost och cancer. Sammanlagt 28 098 individer undersöktes under åren 1991-1996 avseende såväl kostvanor som olika bakgrundsfaktorer (till exempel längd, vikt, yrkestillhörighet, levnadsvanor och psykosociala faktorer). I denna avhandling ingår 11 837 individer som genomgick denna första undersökning under något av åren 1992-1994 och som var 45-64 år gamla. Avgränsningen beror på att de psykosociala frågorna inte ingick i frågeformuläret 1991-1992, och på att kostmetoden ändrades från och med september 1994.

I det första delarbetet (Paper I) undersöktes om det fanns socioekonomiska skillnader i fettintag. Några sådana skillnader kunde inte upptäckas. När hänsyn togs till underrapportering av energiintag förblev resultaten oförändrade.

Det andra delarbetet (Paper II) undersökte benägenheten att sluta röka bland alla som någonsin rökt i de olika socialgrupperna. Resultaten visade stora skillnader i detta avseende. Personer i högre socialgrupper hade slutat röka i mycket större omfattning än personer i lägre. Individer med högt socialt deltagande hade slutat röka i större utsträckning än individer med lågt socialt deltagande. Socialt deltagande förklarade delar av de sociala skillnaderna i att ha slutat röka.

Det tredje delarbetet (Paper III) visade statistiskt signifikanta socioekonomiska skillnader i fysisk aktivitet på fritiden. Individer i högre socialgrupper uppvisade mera fysisk aktivitet på fritiden. Detta samband förklaras nästan helt av skillnader i socialt deltagande i de olika socioekonomiska grupperna. Socialt deltagande hade således ett mycket starkt samband med fysisk aktivitet på fritiden. Individer med högt socialt deltagande var också mer benägna till en hög fysisk aktivitet.

Det fjärde arbetet (Paper IV) visade stora socioekonomiska skillnader i konsumtionen av grönsaker och fruktjuicer, men endast obetydliga skillnader i konsumtion av frukt. De stora socioekonomiska skillnaderna i grönsakskonsumtion hade också ett starkt samband med socialt deltagande.

Intermittenta rökare är sådana rökare som inte röker varje dag. Det femte arbetet (Paper V) visade stora socioekonomiska skillnader i dagligrökning (högre andel dagligrökare i lägre socialgrupper), medan andelen intermittenta rökare var jämnt fördelad socialt. Lågt socialt deltagande uppvisade ett starkt statistiskt samband med en högre benägenhet till att röka dagligen, men inget samband alls med intermittent rökning.

Ett högt socialt deltagande är en del av definitionen av socialt kapital. Ett samhälle med ett gott socialt kapital kännetecknas förutom av högt socialt deltagande också av en hög grad av förtroende mellan människor och inbördes hjälp. Socialt kapital och socialt deltagande är därför s.k. kontextuella faktorer som karakteriserar ett större socialt sammanhang än individen själv. Det sjätte arbetet (Paper VI) syftade därför till att med en statistisk flernivåanalys utröna om graden

av socialt deltagande i 90 bostadsområden i Malmö delvis är områdesberoende och inte endast knutet till individernas egenskaper i de olika områdena. Flernivåanalysen visade en sådan självständig områdeseffekt på det sociala deltagandet.

Slutsatsen av avhandlingen är att insatser för att förbättra levnadsvanorna i en befolkning inte endast bör vara individinriktade. Sådana insatser bör också vara inriktade på att stärka det social deltagandet. Detta kan åstadkommas genom en ökad betoning av gruppinriktade insatser i till exempel arbetsliv och föreningsliv.

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Appendix

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Socioeconomic differences in fat intake in a middle-aged population: report from the Malmö Diet and Cancer Study

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Background	The objective was to investigate whether socioeconomic differences in fat intake may explain socioeconomic differences in cardiovascular diseases.
Methods	The Malmö Diet and Cancer Study is a prospective cohort study. The baseline examinations used in the present cross-sectional study were undertaken in 1992–1994. Dietary habits were assessed using a modified diet history method consisting of a 7-day menu book and a 168-item questionnaire. A subpopulation of 11 837 individuals born 1926–1945 was investigated. This study examined high fat intake, defined as >35.9% among men and >34.8% among women (25% quartile limit) of the proportion of the non-alcohol energy intake contributed by fat. The subfractions saturated, mono-unsaturated and poly-unsaturated fatty acids and the P:S ratio (polyunsaturated/saturated fatty acids) were analysed in the same way. The uppermost quartile (75%) of total and subgroup fat intake was also studied. Socioeconomic differences before and after adjustment for low energy reporting (LER), defined as energy intake below 1.2 × Basal Metabolic Rate, were examined.
Results	No socioeconomic differences in fat intake were seen between the SES groups, except for self-employed men, and male and female pensioners. Approximately 20% in most SES groups were LER. The LER and body mass index were strongly related. The SES pattern of fat intake remained unchanged after adjustment for age, country of origin and LER in a logistic regression model. The results for the subfractions of fat and the P:S ratio did not principally differ from the total fat results.
Conclusions	This study provides no evidence that fat intake contributes to the inverse socioeconomic differences in cardiovascular diseases.
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Cardiovascular mortality has been found to be higher in lower social classes,[1–9] and in Sweden the socioeconomic differences in cardiovascular mortality have increased in the late 1980s and the 1990s.[1]

The Black Report proposed several possible explanations for socioeconomic differences in health, including theories of social selection, materialist or structuralist explanations, and cultural or behavioural explanations.[10] Behaviours like smoking, leisure-time physical activity and dietary habits have become increasingly socially patterned.[11] The mechanisms by which a high fat intake may cause cardiovascular diseases, especially ischaemic heart disease, include an increase in the level of plasma cholesterol, change in the lipoprotein profile,[12–15] a direct effect on blood pressure[16,17] and an increase in (body mass index) BMI.[18] Higher intake of saturated fat is associated with an increased risk of coronary heart disease, whereas a higher intake of polyunsaturated fats is associated with a decreased risk.[19] In Sweden, the National Board of Health and Welfare previously recommended a reduction in total dietary intake of fat to below 30% of total energy intake including all energy-yielding nutrients.[20] However, the new Nordic nutrient recommendations state that total fat intake should not exceed 30% of

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non-alcohol energy intake. The new recommendations also state that the consumption of saturated fat should not exceed 10% of total non-alcohol energy intake, that the desirable consumption of monounsaturated fat should amount to 10–15% and the desirable intake of polyunsaturated fat to 5–10% of total non-alcohol energy intake.[21] Studies have shown differences between socioeconomic groups in the compliance with dietary fat recommendations,[22,23] which could be one explanation for the socioeconomic differences in cardiovascular disease and mortality. However, such socioeconomic differences could also be due to errors in dietary assessment, such as reporting bias.[24–29] For instance, the Whitehall II study shows that after excluding low energy reporters the positive socioeconomic gradient in dietary fat intake disappeared, because of a significant socioeconomic gradient in low energy reporting. The proportion of low energy reporters was approximately four times higher in the lowest compared to the highest socioeconomic group.[30]

The aim of this paper is to investigate whether there are socioeconomic differences in total, saturated, monounsaturated and polyunsaturated fat intake in a Swedish population, and if low energy reporting might affect such a socioeconomic pattern as it did in the Whitehall II study.

Material and Methods

Study population

The Malmö Diet and Cancer Study (MDCS) is a prospective cohort study in Malmö, the third largest city of Sweden with approximately 250 000 inhabitants. Recruitment to the MDCS started in the spring of 1991 and the last participants were examined in the autumn of 1996. The MDCS source population consists of all men and women living in Malmö born between 1926 and 1945 (n = 53 491 in 1994). However, in 1995 recruitment was extended to some older and younger age brackets. The total participation rate in the MDCS was 41.8% (30 146/72 163). Of all participants, 28 098 individuals have complete data covering both the baseline questionnaire, the complete diet assessment and the anthropometric measurement, while the other 2048 individuals only participated to some extent. Only individuals with complete data are included in this study.

The present study population consists of all 11 837 people aged <65 years who participated in the MDCS during the 2-year period from the spring of 1992 until the summer of 1994 born between 1926 and 1945. The study sample consists of approximately one-quarter of the whole population aged 45–64 in Malmö. People aged ≥65 (n = 2168), homeworkers (mostly women) (n = 340) and students (n = 45) were excluded. This study sample was selected because the first version of the questionnaire used in 1991–1992 did not include the psychosocial variables used to investigate socioeconomic differences in other analysis projects by the same research group. Also, dietary data was from September 1994 to October 1996 assessed with a second version of the diet history method.

Subjects were recruited by postal invitation at random. Some respondents (25.2%) came to the examination spontaneously.[31]

All participants gave informed consent. Height and weight were assessed by trained project staff to the nearest 10 mm and 0.1 kg. The baseline demographic health questionnaire, the menu book and the food questionnaire were completed at home and controlled during the diet history interview by the diet assistants at the second visit to the MDCS project office a few weeks later.

Diet assessment

We used a modified diet history method, specifically designed for the MDCS.[32–34] The choice of methodology was guided by the need to assess total diet in a middle-aged and elderly urban population. The eating habits of this group were expected to be fairly regular and commonly include cooked sit-down meals. It consisted of two parts: a 7-day menu book for cooked meals, cold beverages (including alcoholic beverages), drugs, natural remedies and dietary supplements, and a 168-item questionnaire for collecting frequency information on regularly consumed foods, including hot beverages, sandwiches, edible fats, breakfast cereals, yoghurt, milk, fruits, cakes, candies and snacks during the past year. The usual portion sizes in the frequency questionnaire were estimated by the participant at home using a booklet with 48 black and white photographs. Portion sizes of dishes in the menu book were estimated during the dietary interview using a separate and more extensive book of photographs.

Energy and nutrient intakes were computed from the reported food intake of the dietary assessment method, and the food and nutrient reference values of the PC Kost2 '93.[35] The method measures the entire diet, including cooking methods. It overestimates the absolute value for energy intake by 18% when compared with the reference method, 18 days of weighed food records.[34] The correlations with the reference method are of the order of 0.5 to 0.6 for most of the nutrients. Compared to other 'usual diet' methods this indicates a good concordance between the diet history method and food records. The relative validity thus ranks with the best reported in previous studies.[36,37]

Definitions

High fat intake was defined as ≥35.9% for men and ≥34.8% for women of non-alcohol energy intake contributed by total fat (triglyceride fatty acids, glycerol, phospholipids and sterols). The values 35.9% and 34.8% represent the lower limit (25% quartile limit) of the three uppermost quartiles of fat intake, for men and women respectively, in this study. High intakes of saturated, monounsaturated and polyunsaturated fatty acids were also defined as those above the first quartile of total non-alcohol energy intakes (14.1%, 12.6% and ≥5.3% for men and 14.1%, 12.1% and 5.0% for women). A low P:S (polyunsaturated/saturated fatty acids) ratio was defined as a ratio <0.30 for men and <0.29 for women, which was the lower quartile limit (a quarter of the individuals below this value) of the P:S ratio. The corresponding upper quartile limits (75% quartile) of total fat (men 43.9%, women 42.7%), saturated fat (19.1%, women 18.9%), monounsaturated fat (men 15.6%, women 14.9%), polyunsaturated fat (men 7.4%, women 7.0%) intake as well as the P:S ratio (men 0.48, women 0.46) were also analysed.

Low energy reporters (LER) were defined as those individuals reporting a total energy of <1.2 times their individual basal metabolic rate (BMR).[38] This cutoff was chosen based on previous estimations of the lowest physically possible energy intakes required for weight maintenance in this sedentary population,[39] and to make comparisons with other studies[30] possible.

Country of origin—all those born in other countries than Sweden were merged into a single category.

Classification of socioeconomic status (SES) was based on data concerning job title, tasks and position at work, obtained in the questionnaire. The procedure was identical to the one used in the Swedish population census.[40] The SES groups IV and V include qualified and unqualified manual workers, respectively, the SES groups II and III non-manual employees on a medium and low level, respectively, and the SES I group comprises non-manual employees in leading positions and employees with university degree. The five socioeconomic groups already defined (I, II,III, IV and V) are considered to be ordinally related to each other, which makes it possible to estimate not only socioeconomic differences but also a socioeconomic gradient for these five groups. The group self-employed people and business owners (group VI) is very heterogenous, including academically trained physicians, dentists, big company employers and also small shopkeepers, self-employed carpenters etc. Pensioners below age 65 (VII) and the unemployed (VIII) were included as two separate categories outside the active work force, thus making a total of eight socioeconomic categories. The category pensioners below age 65 partly consists of people that receive disability pensions.

Statistical methods

The prevalences of the country of origin and the SES variables were compared to the prevalences in the same age brackets in another investigation with a higher participation rate (χ^2-tests). Crude odds ratios (OR) and 95% CI were calculated in order to examine the risk of being a high fat consumer in relation to underreporting of energy (LER), age, country of origin, BMI and SES. Multivariate logistic regression analysis was performed to investigate the importance of potential confounders (age, country of origin, LER) of the socioeconomic differences in fat intake. Socioeconomic gradients were calculated as tests for trend for the five socioeconomic groups that were ordinally related to each other (I, II, III, IV and V). Finally, LER status was included in the logistic regression analysis to estimate the importance of LER on the socioeconomic patterns of dietary fat intake. The SPSS computer package was used in all the statistical analyses.[41]

Results

When comparing sociodemographic data from a questionnaire-based investigation in 1994 of the population in Malmö (n = 1005 in the corresponding age brackets) with a higher participation rate (70%) regarding the complete age cohort (unpublished data), we could observe that those born abroad (12.8% compared to 24.1%) ($P < 0.001$) are underrepresented in the MDCS, while men and people of lower socioeconomic status are only somewhat underepresented (of all participants the unemployed constitute 6.8% compared to 9.0%, pensioners 18.8% compared to 23.0%, manual workers 23.9% compared to 24.7%, non-manual employees in higher positions and employers 17.2% compared to 13.1% (in all cases $P < 0.001$).

Table 1 shows that men were self-employed, non-manual employees in higher positions and qualified manual workers to a higher extent than women, while women more often than men were non-manual employees in lower and middle positions and unqualified manual workers. The proportion of people of foreign origin was the same for men and women, 13.5% and 12.2%, respectively. Men (21.8%) and women (21.4%) were LER to the same extent. Men had generally higher BMI than women.

Patterns of fat intake by socioeconomic position did not vary significantly by age, therefore OR and 95% CI in Tables 2–6 are adjusted to a mean age of 55.6 years for men and 55.7 years for women.

Table 2 shows that socioeconomic differences in fat intake were small. Only the male self-employed (group VI) had a significantly higher proportion of people with high fat intake (OR = 1.4, 95% CI : 1.1–1.8); while both male (OR = 0.7, 95% CI : 0.6–0.9), and female (OR = 0.6, 95% CI : 0.5–0.8), disability pensioners had a lower proportion of people with high fat intake. The group born abroad had a significantly lower fat intake both for males (OR = 0.5, 95% CI : 0.4–0.6) and females (OR = 0.6, 95% CI : 0.5–0.7). The proportion with a high fat intake decreased for women with increasing BMI ($P = 0.004$), and the proportion with a high fat intake was highest for the group with BMI <20.0 even for men. Principally the same distributional patterns were obtained when the three subfractions of saturated, monounsaturated and polyunsaturated fatty acids and the P:S ratio were examined separately.

Table 3 shows that a fifth of both men and women were LER. Low energy reporting was more common in older age groups. People born abroad had a higher OR of being LER than people born in Sweden. Both male and female non-LER had twice as high an OR of having a high fat intake compared to LER. For both males and females, there was a large difference in low energy reporting according to BMI. Above BMI 30.0 an OR 10.7 (95% CI : 4.9–23.4) was obtained for men; an OR of 6.1 (95% CI : 4.3–8.9) for women. However, no differences in LER between SES groups were seen, except for female disability pensioners who had a significantly higher proportion of LER compared to the SES group I (OR = 1.7, 95% CI : 1.3–2.3).

When country of origin and LER were included in the final multivariate model (together with age and country of origin), no change in the OR appeared. Thus, the LER variable did not alter the socioeconomic patterns in fat intake already apparent. The same patterns were observed for the upper quartile (75%) limit for total non-alcohol fat intake for both men and women (Table 4).

When the lower quartile limits (25%) of the three subfractions of fat were analysed separately in the multivariate model, an OR of 1.4 (95% CI : 1.1–1.8) in the intake of saturated fat and an OR 1.3 (95% CI : 1.0–1.7) in the intake of monounsaturated fat were seen for the self-employed (SES group VI) among men. Both male (OR = 0.6, 95% CI : 0.5–0.8) and female (OR = 0.6, 95% CI : 0.5–0.7), disability pensioners had a lower proportion of people with high intake of saturated fat. Male disability pensioners (OR = 0.6, 95% CI : 0.5–0.8), and the male unemployed (OR = 0.7, 95% CI : 0.5–0.9) had a lower intake of polyunsaturated fat. When age, country of origin and LER were included in the multivariate logistic regression model for men and women respectively, the SES pattern did not change. Finally, when the OR of having a low P:S ratio was analysed in the model, an OR of 1.5 (95% CI : 1.2–2.0) for male self-employed and business owners (SES group IV) and an OR of 1.9 (95% CI : 1.4–2.5) for unemployed men was seen. No SES differences were seen for women. When age, country of origin and LER were included in the multivariate logistic regression model for men and women respectively, the SES pattern did not change (Table 5).

Table 1 Distribution (number and per cent) of fat intake, demographic, body mass index (BMI), low energy reporting (LER) and socioeconomic variables. The Malmö Diet and Cancer Study

	Men		Women		Total	
	Sample N	%	Sample N	%	Sample N	%
Total	5380	6457	11 837			
Socioeconomic status						
I	528	9.8	358	5.6	886	7.5
II	833	15.5	932	14.5	1765	14.9
III	598	11.1	1587	24.6	2185	18.5
IV	646	12.0	312	4.8	958	8.1
V	604	11.2	1258	19.5	1862	15.8
VI	794	14.8	349	5.4	1143	9.7
VII	953	17.7	1269	19.7	2222	18.8
VIII	418	7.8	383	5.9	801	6.8
(Missing)	(6)		(9)		(15)	
Age (years)						
45–49	808	15.0	976	15.1	1784	15.1
50–54	1574	29.3	1928	29.9	3502	29.6
55–59	1468	27.3	1699	26.3	3167	26.8
60–64	1530	28.4	1854	28.7	3384	28.6
(Missing)	(0)		(0)		(0)	
Country of origin						
Born in Sweden	4653	86.5	5667	87.8	10 320	87.2
Born abroad	725	13.5	787	12.2	1512	12.8
(Missing)	(2)		(3)		(5)	
Body mass index						
–19.9	124	2.3	347	5.4	471	4.0
20.0–24.9	1921	35.8	3056	47.4	4977	42.1
25.0–29.9	2648	49.3	2183	33.9	4831	40.9
30.0–	674	12.6	860	13.3	1534	13.0
(Missing)	(13)		(11)		(24)	
Low energy reporting						
LER	1169	21.8	1379	21.4	2548	21.6
Non-LER	4199	78.2	5064	78.6	9263	78.4
(Missing)	(12)		(14)		(26)	
Fat intake[a]						
Low fat intake	1343	25.0	1612	25.0	2955	25.0
High fat intake	4036	75.0	4842	75.0	8878	75.0
(Missing)	(1)		(3)		(4)	

[a] High fat intake is defined as fat intake of >35.9% for men and >34.8% for women (the three upper quartiles of the study population) of the non-alcohol energy intake contributed by fat.

The distribution of total fat intake, subgroups of fatty acids and the P:S ratio did not show any important SES differences at the upper quartile (43.9% of total energy intake for men and 42.7% for women) level. The results of the multivariate analyses for the upper (75%) quartile limits for saturated, monounsaturated, polyunsaturated fatty acids and the P:S ratio did not differ from the results at the lower quartile levels (Table 6).

No significant ($P < 0.05$) SES gradients (analysis including SES groups I, II, III, IV and V) were seen for either men or women in any of the total fat, saturated, monounsaturated, polyunsaturated or P:S ratio models.

The multivariate models (Tables 4, 5 and 6) were also calculated with the exclusion of the spontaneously appearing participants. These analyses yielded the same results as the results already illustrated in Tables 4, 5 and 6.

Body Mass Index (BMI) was not included in the multivariate analyses. A multivariate logistic regression model including BMI in the analysis did not change any of the results already shown.

When the mean fat intake proportions were calculated for each of the SES groups using multivariate ANOVA analysis, the same SES patterns as those illustrated in this study were observed.

Discussion

This investigation shows that there were almost no socioeconomic differences between SES groups in relative dietary fat intake, either before or after adjustment for LER. There were no striking differences between the socioeconomic groups in the proportion of LER. Exceptions were the male self-employed and

Table 2 Distribution (number and per cent) odds ratios (OR) and 95% CI of high fat intake[1] by age, country of origin, body mass index (BMI), low energy reporting (LER) and socioeconomic status. Age-adjusted OR with 95% CI and tests for trend. The Malmö Diet and Cancer Study

	Men			Women		
	N	%	OR (95% CI)	N	%	OR (95% CI)
Total	5380			6457		
Socioeconomic status (SES)						
I	528	75.6	1.0	358	77.1	1.0
II	833	75.0	1.0 (0.8–1.3)	931	75.3	0.9 (0.7–1.2)
III	598	78.6	1.2 (0.9–1.6)	1586	78.2	1.1 (0.8–1.4)
IV	646	72.9	0.9 (0.7–1.1)	312	73.1	0.8 (0.6–1.1)
V	604	74.8	1.0 (0.7–1.3)	1258	76.1	0.9 (0.7–1.2)
VI	794	81.2	1.4 (1.1–1.8)	349	77.9	1.1 (0.7–1.5)
VII	952	69.0	0.7 (0.6–0.9)	1268	67.8	0.6 (0.5–0.8)
VIII	418	74.4	0.9 (0.7–1.3)	383	78.3	1.1 (0.8–1.5)
(Missing)	(7)			(12)		
Test for trend (I.II.III.IV.V)			$P = 0.52$			$P = 0.67$
Country of origin						
Born in Sweden	4653	77.1	1.0	5666	76.3	1.0
Born abroad	724	61.6	0.5 (0.4–0.6)	785	66.1	0.6 (0.5–0.7)
(Missing)	(3)			(6)		
Test for trend			$P < 0.001$			$P < 0.001$
BMI						
–19.9	124	81.5	1.0	347	79.5	1.0
20.0–24.9	1921	75.4	0.7 (0.4–1.1)	3054	74.0	0.8 (0.6–1.1)
25.0–29.9	2647	74.5	0.7 (0.4–1.1)	2183	76.3	0.7 (0.5–0.9)
30.0–	674	74.6	0.7 (0.4–1.1)	859	73.2	0.7 (0.5–1.0)
(Missing)	(14)			(14)		
Test for trend			$P = 0.27$			$P = 0.004$
Low energy reporting (LER)						
LER	1169	64.8	1.0	1379	62.5	1.0
Non-LER	4199	77.9	1.9 (1.7–2.2)	5064	78.5	2.2 (1.9–2.5)
(Missing)	(12)			(14)		
Test for trend			$P < 0.001$			$P < 0.001$

[a] High fat intake is defined as fat intake of >35.9% for men and >34.8% for women (the three upper quartiles of the study population) of non-alcohol energy intake contributed by fat.

business owners, who had a significantly higher proportion of people with a high fat intake, and male and female disability pensioners, who had a significantly lower proportion of people with high fat intake. The group born abroad seems to be underrepresented mostly due to the fact that approximately 2000 individuals of foreign origin were excluded from the whole study population (everyone interviewed 1991–1996) due to problems with the language. Our analysis excluding the volunteers showed that this group was similar to the invited participants in dietary habits.

The risk of misclassification of fat intake is related to the concern that self-reported energy intakes often are too low for the habitual energy consumption. A difference in the measurement of fat intake between the SES groups might produce a differential misclassification that would not be compensated for by increasing the sample size. Differences in literacy skills, the ability to estimate portion sizes and frequencies, dietary memories, social desirability expectations etc. between the SES or educational groups might contribute to this source of misclassification. The finding that the LER are evenly distributed in all SES groups seems to make this possibility less plausible. Non-differential misclassification is a problem of principal interest in nutrition epidemiology, since it always works in the direction towards the null. This problem may have been present in this study, because the main results were negative. However, the risk of misclassification is affected by the reproducibility and validity of the dietary assessment method used. The diet history method used in this study has been among the best obtained.[32–35]

Objections can also be raised to the definition of LER as subjects with a total energy intake/BMR of <1.2. This cutoff only identifies underreporters by comparison with a sedentary physical activity level. Studies have shown that there is underreporting at all levels of energy expenditure and that a cutoff around 1.2 identifies only about 50% of them.[42] The situation would be improved if a more appropriate higher mean physical activity level was used in groups that are more active, or if each individual was evaluated against a physical activity level appropriate to him/herself.[43] This problem has been the basis for the recommendation that all dietary studies should incorporate assessments of physical activity.[44] However, such an inclusion of physical activity level has not been performed in this study since one of our main objectives was a comparison with the

Table 3 Distribution (number and per cent) and odds ratios (OR and 95% CI) of low energy reporting (LER) by age, country of origin, body mass index (BMI) and socioeconomic status. Age-adjusted OR with 95% CI and tests for trend. The Malmö Diet and Cancer Study

	Men			Women		
	Sample N	%	OR (95% CI)	Sample N	%	OR (95% CI)
Total	5380			6457		
Socioeconomic status						
I	528	22.2	1.0	358	18.4	1.0
II	833	19.7	0.9 (0.7–1.1)	931	17.7	1.0 (0.7–1.3)
III	597	22.1	1.0 (0.8–1.3)	1584	18.8	1.0 (0.8–1.4)
IV	644	18.8	0.8 (0.6–1.1)	312	21.5	1.2 (0.8–1.8)
V	603	19.2	0.8 (0.6–1.1)	1257	21.8	1.2 (0.9–1.7)
VI	794	20.5	0.9 (0.7–1.2)	349	15.2	0.8 (0.5–1.2)
VII	945	26.8	1.1 (0.9–1.4)	1260	29.4	1.7 (1.3–2.3)
VIII	418	23.9	1.1 (0.8–1.5)	383	20.9	1.1 (0.8–1.6)
(Missing)	(18)			(23)		
Test for trend (I.II.III.IV.V)			$P = 0.22$			$P < 0.001$
Country of origin						
Born in Sweden	4642	21.2	1.0	5656	20.6	1.0
Born abroad	724	25.7	1.3 (1.1–1.6)	784	27.4	1.5 (1.2–1.7)
(Missing)	(14)			(17)		
Test for trend			$P = 0.002$			$P < 0.001$
BMI						
–19.9	124	5.6	1.0	347	10.7	1.0
20.0–24.9	1921	12.2	2.3 (1.1–5.1)	3054	13.3	1.3 (0.9–1.8)
25.0–29.9	2647	25.0	5.5 (2.6–11.9)	2183	25.9	2.9 (2.0–4.1)
30.0–	674	39.3	10.7 (4.9–23.4)	859	43.0	6.1 (4.3–8.9)
(Missing)	(14)			(14)		
Test for trend			$P < 0.001$			$P < 0.001$

British studies cited above, where such an adjustment for physical activity level had not been performed.

In Sweden, the National board of Health and Welfare previously recommended a reduction of fat to below 30 % of total energy intake.[20] Similar recommendations have been made by governments in other Western countries.[45] The new recommendations state that fat intake should not exceed 30% of non-alcohol energy intake.[21] However, the main results—no SES differences in fat intake—remained the same even when the old recommendation (30% of total energy including alcohol) was used in the model.

The reason for using the lower (25%) and higher (75%) quartile cutoff limits instead of the 30% limit was that the 30% limit resulted in a 94.3 % and 92.9 % risk population among men and women respectively.

The new recommendations from the Swedish National board on Health and Welfare also state that the intake of saturated fat should not exceed 10% of total non-alcohol energy, that the intake of monounsaturated fat should be within the limits 10–15% of total non-alcohol energy intake and that the intake of polyunsaturated fat should range within the limits 5–10%.[21] In this study, the lower quartile cutoff limit 14.1% for both sexes for saturated fat is way above the recommended upper limit. The lower quartile cutoff, 12.6% for men and 12.1% for women for monounsaturated fat is in the middle of the recommended 10–15% range, while the upper (75%) quartile value indicates that a quarter of the population has an intake above the recommendations.

Overreporting has been defined as a total energy intake above 2.82 × BMR.[42,43] This appears to be a negligible problem in our study, since only 0.4 % of the participants were overreporters according to this definition.

Studies of the relation between dietary fat and chronic disease commonly use different forms of energy adjustment to isolate the effect of high fat intake from that of dietary energy.[46–49] In this study only one kind of energy adjustment was performed by defining fat intake as a proportion of non-alcohol energy intake.

Only a few socioeconomic differences in dietary fat intake were found in this study. No SES gradients were found for either total fat intake or the fatty acid subgroups and the P:S ratio in the models. This result does not differ from the results of the Whitehall II study. However, the Whitehall II study found very strong differences in the distributions of LER. Lower SES groups had a much higher proportion of LER than higher groups. These socioeconomic differences profoundly affected the results concerning the intake of dietary fat.[30] No such effects were seen in this study. Consequently, our study provides stronger evidence than the Whitehall II study for the notion that there are no socioeconomic differences in fat intake. Furthermore, the MDCS cohort represents the whole range of SES groups in Swedish society, from the white collar workers in higher positions to the unskilled blue collar workers and the unemployed, while the Whitehall II study comprises only civil servants working in offices.

The very strong relationship between BMI and low energy reporting is consistent with the findings of Stallone *et al.* This

Table 4 Odds ratios (OR and 95% CI) and tests for trend of a high fat intake (Lower quartile: >35.9% among men and >34.8% among women. Higher quartile: >43.9% among men and >42.7% among women) by socioeconomic status. Adjustment also made for age, country of origin and low energy reporting (LER)

	Men			Women		
Lower quartile[a]	Adjusted[b] OR, 95% CI	Adjusted[c] OR, 95% CI	Adjusted[d] OR, 95% CI	Adjusted[a] OR, 95% CI	Adjusted[b] OR, 95% CI	Adjusted[c] OR, 95% CI
Socioeconomic status						
I	1.0	1.0	1.0	1.0	1.0	1.0
II	1.0 (0.8–1.3)	1.0 (0.8–1.3)	1.0 (0.8–1.3)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)
III	1.2 (0.9–1.6)	1.2 (0.9–1.6)	1.2 (0.9–1.6)	1.1 (0.8–1.4)	1.1 (0.8–1.4)	1.1 (0.8–1.4)
IV	0.9 (0.7–1.1)	1.0 (0.7–1.2)	0.9 (0.7–1.2)	0.8 (0.6–1.1)	0.8 (0.6–1.2)	0.8 (0.6–1.2)
V	1.0 (0.7–1.3)	1.1 (0.8–1.4)	1.0 (0.8–1.4)	0.9 (0.7–1.2)	1.0 (0.7–1.3)	1.0 (0.8–1.3)
VI	1.4 (1.1–1.8)	1.5 (1.1–1.9)	1.5 (1.1–1.9)	1.1 (0.7–1.5)	1.1 (0.8–1.5)	1.0 (0.7–1.5)
VII	0.7 (0.6–0.9)	0.8 (0.6–1.0)	0.8 (0.6–1.1)	0.6 (0.5–0.8)	0.7(0.5–0.9)	0.7 (0.5–0.9)
VIII	0.9 (0.7–1.3)	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.1 (0.8–1.6)	1.1 (0.8–1.6)
Test for trend (I.II.III.IV.V)	(P = 0.52)	(P = 0.80)	(P = 0.91)	(P = 0.67)	(P = 0.96)	(P = 0.84)
	Men			**Women**		
Upper quartile[a]	Adjusted[b] OR, 95% CI	Adjusted[c] OR, 95% CI	Adjusted[d] OR, 95% CI	Adjusted[a] OR, 95% CI	Adjusted[b] OR, 95% CI	Adjusted[c] OR, 95% CI
Socioeconomic status						
I	1.0	1.0	1.0	1.0	1.0	1.0
II	0.9 (0.7–1.2)	1.0 (0.7–1.2)	0.9 (0.7–1.2)	1.0 (0.7–1.3)	1.0 (0.7–1.3)	1.0 (0.7–1.3)
III	1.1 (0.8–1.4)	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.1 (0.8–1.4)	1.1 (0.8–1.4)	1.1 (0.8–1.4)
IV	1.0 (0.7–1.3)	1.0 (0.8–1.3)	1.0 (0.8–1.3)	0.9 (0.6–1.3)	0.9 (0.6–1.3)	0.9 (0.7–1.3)
V	1.0 (0.8–1.3)	1.1 (0.8–1.4)	1.1 (0.8–1.4)	1.0 (0.8–1.4)	1.1 (0.8–1.4)	1.1 (0.8–1.4)
VI	1.4 (1.1–1.8)	1.4 (1.1–1.8)	1.4 (1.1–1.8)	1.4 (1.0–1.9)	1.4 (1.0–1.9)	1.3 (1.0–1.9)
VII	1.0 (0.8–1.3)	1.1 (0.8–1.4)	1.1 (0.8–1.4)	0.8 (0.6–1.1)	0.9 (0.7–1.2)	0.9 (0.7–1.2)
VIII	1.0 (0.8–1.4)	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.0 (0.7–1.4)	1.0 (0.7–1.5)	1.1 (0.8–1.5)
Test for trend (I.II.III.IV.V)	(P = 0.79)	(P = 0.46)	(P = 0.55)	(P = 0.81)	(P = 0.64)	(P = 0.46)

[a] The lower quartile (25%) limit of the distribution of total fat intake as a fraction of total non-alcohol energy intake is 35.9% for men and 34.8% for women. The upper quartile (75%) limit of the distribution of total fat intake as a fraction of total non-alcohol energy intake is 43.9% for men and 42.7% for women.

[b] Adjusted for age.

[c] Adjusted for age and country of origin.

[d] Adjusted for age, country of origin and LER.

Table 5 Odds ratios (OR and 95% CI) and tests for trend of a high intake of saturated, monounsaturated and polyunsaturated fatty acids, and of a low P:S ratio by socioeconomic status. Adjustment also made for age, country of origin and low energy reporting (LER). Lower quartile. The Malmö Diet and Cancer Study

	Men			Women		
Lower quartile[a]	Adjusted[b] OR, 95% CI	Adjusted[c] OR, 95% CI	Adjusted[d] OR, 95% CI	Adjusted[a] OR, 95% CI	Adjusted[b] OR, 95% CI	Adjusted[c] OR, 95% CI
Socioeconomic status						
Saturated fatty acids						
I	1.0	1.0	1.0	1.0	1.0	1.0
II	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.3)	1.0 (0.7–1.3)	1.0 (0.7–1.3)
III	1.0 (0.8–1.4)	1.1 (0.8–1.4)	1.0 (0.8–1.4)	1.0 (0.8–1.3)	1.0 (0.7–1.3)	1.0 (0.8–1.3)
IV	0.8 (0.6–1.0)	0.8 (0.6–1.1)	0.8 (0.6–1.0)	0.9 (0.6–1.3)	0.9 (0.6–1.3)	0.9 (0.7–1.4)
V	0.9 (0.6–1.1)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.1)	0.9 (0.7–1.2)	0.9 (0.7–1.2)
VI	1.4 (1.1–1.8)	1.4 (1.1–1.9)	1.4 (1.1–1.9)	1.0 (0.7–1.4)	1.0 (0.7–1.4)	0.9 (0.7–1.4)
VII	0.6 (0.5–0.8)	0.7 (0.5–0.9)	0.7 (0.5–0.9)	0.6 (0.4–0.7)	0.6 (0.5–0.8)	0.7 (0.5–0.9)
VIII	0.8 (0.6–1.1)	0.9 (0.7–1.3)	0.9 (0.7–1.3)	1.0 (0.7–1.5)	1.1 (0.8–1.5)	1.1 (0.8–1.6)
Test for trend (I.II.III.IV.V)	(P = 0.10)	(P = 0.29)	(P = 0.22)	(P = 0.19)	(P = 0.31)	(P = 0.49)
Monounsaturated fatty acids						
I	1.0	1.0	1.0	1.0	1.0	1.0
II	0.9 (0.7–1.2)	1.0 (0.8–1.2)	1.0 (0.7–1.2)	1.0 (0.8–1.3)	1.0 (0.8–1.3)	1.0 (0.8–1.3)
III	1.2 (0.9–1.5)	1.2 (0.9–1.6)	1.2 (0.9–1.6)	1.3 (1.0–1.6)	1.3 (1.0–1.6)	1.3 (1.0–1.7)
IV	1.0 (0.8–1.4)	1.1 (0.9–1.5)	1.1 (0.9–1.5)	0.9 (0.7–1.3)	1.0 (0.7–1.3)	1.0 (0.7–1.4)
V	0.9 (0.7–1.2)	1.0 (0.8–1.4)	1.0 (0.8–1.3)	1.3 (1.0–1.7)	1.3 (1.0–1.7)	1.3 (1.0–1.8)
VI	1.3 (1.0–1.7)	1.3 (1.0–1.8)	1.3 (1.0–1.7)	1.1 (0.8–1.6)	1.2 (0.8–1.6)	1.1 (0.8–1.6)
VII	0.8 (0.6–1.0)	0.9 (0.7–1.1)	0.9 (0.7–1.1)	0.8 (0.6–1.1)	0.9 (0.7–1.2)	1.0 (0.7–1.3)
VIII	0.9 (0.7–1.2)	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.1 (0.8–1.6)	1.2 (0.9–1.7)	1.2 (0.9–1.7)
Test for trend (I.II.III.IV.V)	(P = 0.98)	(P = 0.35)	(P = 0.40)	(P = 0.05)	(P = 0.02)	(P = 0.01)
Polyunsaturated fatty acids						
I	1.0	1.0	1.0	1.0	1.0	1.0
III	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	1.1 (0.8–1.4)	1.0 (0.8–1.5)	1.1 (0.8–1.4)
IV	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	1.3 (1.0–1.6)	1.3 (1.0–1.6)	1.3 (1.0–1.6)
V	0.9 (0.7–1.2)	1.0 (0.7–1.3)	1.0 (0.7–1.3)	0.9 (0.7–1.3)	0.9 (0.7–1.3)	0.9 (0.7–1.3)
VI	0.8 (0.6–1.1)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	1.3 (1.0–1.7)	1.3 (1.0–1.7)	1.3 (1.0–1.7)
II	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	1.3 (1.0–1.9)	1.4 (1.0–1.9)	1.4 (1.0–1.9)
VII	0.6 (0.5–0.8)	0.7 (0.5–0.9)	0.7 (0.5–0.9)	1.2 (0.9–1.6)	1.3 (1.0–1.7)	1.3 (1.0–1.7)
VIII	0.7 (0.5–0.9)	0.7 (0.5–0.9)	0.7 (0.5–1.0)	1.0 (0.7–1.3)	1.0 (0.7–1.4)	1.0 (0.7–1.4)
Test for trend (I.II.III.IV.V)	(P = 0.32)	(P = 0.63)	(P = 0.62)	(P = 0.12)	(P = 0.06)	(P = 0.05)
P:S ratio						
I	1.0	1.0	1.0	1.0	1.0	1.0
II	1.1 (0.8–1.4)	1.1 (0.8–1.4)	1.1 (0.8–1.4)	1.0 (0.7–1.3)	1.0 (0.7–1.3)	1.0 (0.7–1.3)
III	1.3 (1.0–1.7)	1.3 (1.0–1.7)	1.3 (1.0–1.7)	0.9 (0.7–1.1)	0.9 (0.7–1.1)	0.9 (0.7–1.1)
IV	1.1 (0.8–1.4)	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.0 (0.7–1.5)	1.0 (0.7–1.5)	1.0 (0.7–1.5)
V	1.3 (1.0–1.8)	1.4 (1.0–1.8)	1.3 (1.0–1.8)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)
VI	1.5 (1.2–2.0)	1.5 (1.2–2.0)	1.5 (1.2–2.0)	1.0 (0.7–1.4)	1.0 (0.7–1.4)	1.0 (0.7–1.4)
VII	1.4 (1.1–1.8)	1.4 (1.1–1.9)	1.4 (1.1–1.9)	0.8 (0.6–1.0)	0.8 (0.6–1.0)	0.8 (0.6–1.1)
VIII	1.9 (1.4–2.5)	1.9 (1.4–2.6)	2.0 (1.5–2.6)	1.0 (0.7–1.3)	1.0 (0.7–1.3)	1.0 (0.7–1.3)
Test for trend (I.II.III.IV.V)	(P = 0.07)	(P = 0.05)	(P = 0.06)	(P = 0.75)	(P = 0.68)	(P = 0.82)

[a] High intakes of saturated, monounsaturated and polyunsaturated fatty acids are defined as those above the first quartile of total non-alcohol energy intakes (14.1%, 12.6% and 5.3% or more for men, and 14.1%, 12.1% and 5.0% for women. The P:S ratio is 0.30 for men and 0.29 for women.

[b] Adjusted for age. [c] Adjusted for age and country of origin. [d] Adjusted for age, country of origin and LER.

Table 6 Odds ratios (OR and 95% CI) and tests for trend of a high intake of saturated, monounsaturated and polyunsaturated fatty acids, and of a low P:S ratio by socioeconomic status. Adjustment also made for age, country of origin and low energy reportintg (LER). Upper quartile. The Malmö Diet and Cancer Study

	Men			Women		
Upper quartile[a]	Adjusted[b] OR, 95% CI	Adjusted[c] OR, 95% CI	Adjusted[d] OR, 95% CI	Adjusted[a] OR, 95% CI	Adjusted[b] OR, 95% CI	Adjusted[c] OR, 95% CI
Socioeconomic status						
Saturated fatty acids						
I	1.0	1.0	1.0	1.0	1.0	1.0
II	0.9 (0.7–1.2)	1.0 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)
III	1.1 (0.8–1.4)	1.1 (0.8–1.4)	1.1 (0.8–1.4)	1.0 (0.7–1.2)	1.0 (0.7–1.3)	1.0 (0.7–1.3)
IV	1.0 (0.8–1.3)	1.1 (0.8–1.4)	1.1 (0.8–1.4)	0.9 (0.6–1.3)	0.9 (0.6–1.3)	0.9 (0.7–1.3)
V	1.0 (0.8–1.4)	1.1 (0.8–1.5)	1.1 (0.8–1.4)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)
VI	1.4 (1.1–1.8)	1.4 (1.1–1.9)	1.4 (1.1–1.8)	1.0 (0.7–1.4)	1.0 (0.7–1.4)	1.0 (0.7–1.4)
VII	1.1 (0.8–1.4)	1.1 (0.9–1.5)	1.1 (0.9–1.5)	0.8 (0.6–1.0)	0.8 (0.6–1.1)	0.9 (0.7–1.1)
VIII	1.2 (0.9–1.6)	1.3 (1.0–1.8)	1.3 (1.0–1.8)	1.0 (0.8–1.4)	1.0 (0.8–1.5)	1.1 (0.8–1.5)
Test for trend (I.II.III.IV.V)	(P = 0.49)	(P = 0.27)	(P = 0.32)	(P = 0.35)	(P = 0.44)	(P = 0.61)
Monounsaturated fatty acids						
I	1.0	1.0	1.0	1.0	1.0	1.0
II	0.8 (0.7–1.1)	0.9 (0.7–1.1)	0.9 (0.7–1.1)	1.0 (0.7–1.3)	1.0 (0.8–1.3)	1.0 (0.7–1.3)
III	1.1 (0.9–1.5)	1.1 (0.9–1.5)	1.1 (0.9–1.5)	1.2 (0.9–1.5)	1.2 (0.9–1.5)	1.2 (0.9–1.5)
IV	0.9 (0.7–1.2)	1.0 (0.8–1.3)	1.0 (0.8–1.3)	0.9 (0.6–1.2)	0.9 (0.6–1.3)	0.9 (0.6–1.3)
V	1.1 (0.8–1.4)	1.1 (0.9–1.5)	1.1 (0.9–1.5)	1.2 (0.9–1.5)	1.2 (0.9–1.6)	1.2 (0.9 –1.6)
VI	1.2 (1.0–1.6)	1.3 (1.0–1.6)	1.3 (1.0–1.6)	1.4 (1.0–2.0)	1.4 (1.0–2.0)	1.4 (1.0–2.0)
VII	0.9 (0.7–1.2)	1.0 (0.8–1.3)	1.0 (0.8–1.3)	0.9 (0.7–1.3)	1.0 (0.8–1.4)	1.1 (0.8–1.4)
VIII	0.9 (0.7–1.2)	1.0 (0.7–1.4)	1.0 (0.7–1.4)	1.2 (0.8–1.6)	1.2 (0.9–1.7)	1.2 (0.9–1.7)
Test for trend (I.II.III.IV.V)	(P = 0.36)	(P = 0.13)	(P = 0.14)	(P = 0.22)	(P = 0.12)	(P = 0.08)
Polyunsaturated fatty acids						
I	1.0	1.0	1.0	1.0	1.0	1.0
II	1.1 (0.9–1.4)	1.1 (0.9–1.4)	1.1 (0.9–1.4)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)
III	1.1 (0.9–1.5)	1.1 (0.9–1.5)	1.1 (0.9–1.5)	1.1 (0.9–1.5)	1.1 (0.9–1.5)	1.1 (0.9–1.5)
IV	1.1 (0.8–1.4)	1.1 (0.8–1.4)	1.1 (0.8–1.4)	0.8 (0.6–1.2)	0.8 (0.6–1.2)	0.8 (0.6–1.2)
V	1.1 (0.9–1.5)	1.1 (0.9–1.5)	1.1 (0.9–1.5)	0.9 (0.7–1.1)	0.9 (0.7–1.1)	0.9 (0.7–1.1)
VI	1.0 (0.8–1.3)	1.0 (0.8–1.3)	1.0 (0.8–1.3)	0.9 (0.7–1.3)	0.9 (0.7–1.3)	0.9 (0.7–1.3)
VII	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.6–1.1)	0.8 (0.6–1.1)	0.8 (0.6–1.1)
VIII	0.9 (0.7–1.3)	0.9 (0.7–1.3)	0.9 (0.7–1.3)	1.0 (0.7–1.4)	1.0 (0.7–1.4)	1.0 (0.7–1.4)
Test for trend (I.II.III.IV.V)	(P = 0.61)	(P = 0.61)	(P = 0.64)	(P = 0.16)	(P = 0.16)	(P = 0.18)
P:S ratio						
I	1.0	1.0	1.0	1.0	1.0	1.0
II	0.9 (0.7–1.1)	0.9 (0.7–1.1)	0.9 (0.7–1.1)	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.1 (0.8–1.5)
III	0.9 (0.7–1.2)	0.9 (0.7–1.2)	1.0 (0.7–1.3)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)
IV	0.9 (0.7–1.1)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	1.0 (0.7–1.4)	1.0 (0.7–1.4)	1.0 (0.7–1.4)
V	0.8 (0.6–1.1)	0.8 (0.6–1.1)	0.8 (0.6–1.1)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)
VI	1.2 (0.9–1.5)	1.2 (0.9–1.5)	1.2 (0.9–1.5)	0.9 (0.7–1.3)	0.9 (0.7–1.3)	0.9 (0.7–1.3)
VII	0.9 (0.7–1.2)	1.0 (0.7–1.2)	1.0 (0.7–1.2)	0.8 (0.6–1.0)	0.8 (0.6–1.1)	0.9 (0.6–1.1)
VIII	0.9 (0.7–1.2)	0.9 (0.7–1.3)	0.9 (0.7–1.3)	0.9 (0.6–1.2)	0.9 (0.7–1.3)	0.9 (0.7–1.3)
Test for trend (I.II.III.IV.V)	(P = 0.22)	(P = 0.36)	(P = 0.33)	(P = 0.09)	(P = 0.11)	(P = 0.14)

[a] High intakes of saturated, monounsaturated and polyunsaturated fatty acids are defined as those above the third quartile of total non-alcohol energy intakes (19.1%, 15.6% and 7.4% or more for men and 18.9%, 14.9% and 7.0% for women. The P:S ration is 0.48 for men and 0.46 for women.

[b] Adjusted for age. [c] Adjusted for age and country of origin. [d] Adjusted for age, country of origin and LER.

finding also supports their conclusion that the higher proportion of low energy reporters among lower socioeconomic groups and among persons with higher BMI are two independent phenomena.[30]

The almost complete absence of socioeconomic differences between the eight socioeconomic groups examined in this study seems to make differences in dietary fat intake a less plausible explanation to the socioeconomic inequalities in cardiovascular morbidity and mortality among individuals 45–64 years of age living in the city of Malmö and other similar urban populations.

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II

Socioeconomic differences in smoking cessation: The role of social participation

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Abstract

Background: The aim of this study was to investigate if psychosocial resources explain socioeconomic differences in smoking cessation and its maintenance.

Method: A subpopulation of 11,837 individuals from the Malmö Diet and Cancer Study interviewed 1992-1994, aged 45-64 years was investigated in this cross-sectional study. A multivariate logistic regression model was used to assess relative risks of having stopped smoking, adjusting for age, country of origin, previous/current diseases and marital status.

Results: An odds ratio of 1.9 (1.4-2.5;95% CI) for men and 2.0 (1.4-2.7;95% CI) for women of having stopped smoking was found for higher non-manual employees when compared to unskilled manual workers. A decrease in these odds ratios was found when social participation was introduced in the model. The other three social network and social support variables were non-significant.

Conclusions: High social participation is a predictor of maintenance of smoking cessation. It seems possible to interpret parts of the socioeconomic differences in smoking cessation and its maintenance as a consequence of differing social network resources and social capital between socioeconomic groups.

Key words: Smoking cessation, socioeconomic status, social participation, social capital

Introduction

Smoking has become a marker of low socioeconomic status and even deprivation. In the late 1940s and the 1950s, 80 per cent of all men in Great Britain smoked. There were no socioeconomic patterns in smoking, and women smoked to a much lesser extent than men (1). In the 1980s and 1990s, the decrease in smoking prevalence has changed the pattern in most Western countries. Smoking is now strongly associated with low socioeconomic status, and women are smokers to almost the same extent as men (2,3,4,5,6).

It is likely that smoking will continue to decline (7), plausibly creating even more pronounced socioeconomic differences in smoking prevalence. It is therefore important to study possible mechanisms behind this process of widening socioeconomic differences in smoking. The socioeconomic differences can depend on both differences in the recruitment of new smokers as well as on differences in smoking cessation. This study focus on socioeconomic differences in smoking cessation and the maintenance of a smoke free behaviour.

There is a strong biological mechanism behind nicotine dependency that can account for the fact that smokers experience stress in connection with acute nicotine withdrawal, and the fact that nicotine reinstatement leads to an immediate improvement in the depleted mood state of the smoker (8,9,10,11,12,13). However, no biological model can account for the fact that the socioeconomic differences in smoking among adults are increasing. One reason for the increasing socioeconomic differences might be environmental factors that make it easier for individuals belonging to higher socioeconomic strata to stop smoking. Psychological factors at the individual level have been shown to predict the inclination to initiate and successfully maintain smoking cessation. Such factors are e.g. self-efficacy (14), intention to stop and personal rating of likelihood of cessation (15). However, these individual characteristics are most likely affected by factors in the social environment of the individual. Being married and having a good emotional support are such well-known positive psychosocial factors that predict successful smoking cessation (15,16,17,18,19,20,21).

The aim of this paper is to test a psycho-social stress theory on the likelihood of smoking cessation and the maintenance of a smoke free behaviour in different socioeconomic groups (22,23,24,25). According to the part of the psychosocial stress theory tested in this study, resources are individual ones, but also resources that the individual has access to through his social network. Our hypothesis is that psychosocial resources such as aspects of social network and social support at least partly can explain the socioeconomic differences in smoking cessation rate.

Material and methods

Study population

The Malmö Diet and Cancer Study (MDCS) is a prospective cohort study in Malmö, the third largest city of Sweden with approximately 250,000 inhabitants. Recruitment to the MDCS started in the spring of 1991 and the last participants were examined in the autumn of 1996. The MDCS source population consists of all men and women living in Malmö born between 1926 and 1945 (n=53,491 in 1994), and was in 1995-1996 extended to some older and younger age brackets. The total participation rate in the MDCS was 38.9% (28,098 of a total 72,163). The 28,098 individuals have complete data concerning both baseline questionnaire, complete diet assessment and anthropometric measurement, while another 2,048 individuals only participated to some extent.

The present study population consists of most persons who participated in the MDCS during the two year period from the spring of 1992 until the summer of 1994 that were aged below 65 (n=11,837). The study population represents approximately a fourth of the whole population aged 45-64 in Malmö. Persons aged 65 or above (n=2,168) were excluded in this study. Homeworkers (n=340) and students (n=45) were also excluded. The psychosocial variables were not included in the first version of the questionnaire used 1991-1992, and data from 1994-1996 have not been accessible.

Subjects were recruited by postal invitation at random. Some respondents (25.2%) came to the examination spontaneously (26).

Definitions

There were four answers possible to the question "Do you smoke?"; "Yes, I smoke regularly", "Yes, I smoke sometimes", "No, I have stopped smoking" and "No, I have never smoked". Having *stopped smoking* is defined as the proportion of respondents having stopped smoking among all ever-smokers (= regular and occasional smokers and those who had stopped smoking).

Country of origin. All persons born in other countries than Sweden were merged into a single category. Thus, the two categories used in the analysis are either "born in Sweden" or "born abroad".

Previous/ current diseases. Disease might modify the inclination to stop smoking. Self-reported previous or current diseases included myocardial infarction, stroke, claudicatio intermittens, diabetes mellitus or astma/ chronic obstructive lung disease as alternatives in one of the questions in the questionnaire.

Marital status. Four categories were used: married, unmarried, divorced and widow/ widower.

Socioeconomic status (SES). Classification of socioeconomic status (SES) was based on data about job title, working tasks and position, obtained in the questionnaire. The procedure was identical to the one used in the Swedish population census (27). The SES groups IV and V include skilled and unskilled manual workers, respectively, the SES groups II and III non-manual employees on a medium and low level, respectively, and the SES I group comprises non-manual employees in leading positions and employees with university degree. The five socioeconomic groups already defined (I, II, III, IV and V) are considered to be ordinally related to each other, which makes it possible to estimate not only socioeconomic differences but also a socioeconomic gradient for these five groups. The group self-employed persons (group VI) is very heterogenous, including both academically trained physicians, dentists, big company employers and, on the other hand, small shop-keepers, self-employed carpenters etc. The pensioners below age 65 (mostly disability pensioners) (VII) and the unemployed (VIII) were included as two separate categories outside the active work force, thus making a total of 8 socioeconomic categories.

Psychosocial factors: The psychosocial variables were dichotomised. The following psychosocial factors were used in this study (24,28):

Social network refers to structural aspects of a person´s network of social relationships. The social network was operationalised in the questionnaire in two dimensions:

Social anchorage (5 items) describes to what extent the person belongs to and is anchored within formal and informal groups and, in a more qualitative sense, the feeling of a membership in these groups (familiarity with neighborhood, belonging to friends and relatives, membership or position of trust in organisations or clubs, feelings of importance to other people). If three or more of the five items denoted low social anchorage, the whole index variable was regarded as low.

Social participation (13 items) describes how actively the person takes part in the activities of formal and informal groups in society (study circle/course at place of work, other study circle/course, union meeting, meeting of other organisations, theatre/cinema, arts exhibition, church, sports event, letters to the editor of a newspaper/journal, demonstration, night club/entertainment, big gathering of relatives, private party). If three alternatives or less were indicated, the social participation of that person was classified as low.

A social network may or may not be supportive of the individual. The beneficial effects of a personal social network depend upon its ability to supply various resources to the individual, i.e. social support. Two dimensions of social support were measured:

Instrumental support (1 item) reflects the individual´s access to guidance, advice, information, practical services and material resources from the other persons. This item was measured by a four alternative question: "Yes, I am

absolutely sure to get such support", "Yes, possibly", "Not certain" and "No". The three latter alternatives were classified as low instrumental support.

Emotional support (3 items) reflects the opportunity for care, the encouragement of personal value and feelings of confidence and trust. Each item has the same four alternatives as instrumental support. If two or three items were low, the index variable was considered low.

The reliability and validity of the four psychosocial index variables used in this paper was assessed in a previous paper that found low correlations between the different indices and an acceptable validity and reproducibility for all the variables (28).

Statistical methods

The prevalences of some of the variables were compared to the prevalences in the same age brackets in another investigation with a higher participation rate. The mode of smoking (cigarette, pipe, cigar), the number of cigarettes smoked, as well as the year of smoking cessation for the quitters was assessed for men and women in the MDCS. Crude odds ratios (OR) and 95 % confidence intervals (95% CI) were calculated in order to analyse associations between smoking cessation and different demographic, socioeconomic and psychosocial variables. The multivariate analysis was performed by logistic regression in order to investigate the potential importance of various confounders and to analyse whether the socioeconomic differences in smoking cessation can be explained by differences in psychosocial factors. Socioeconomic gradients were also calculated as tests for trend for the five SES groups (I, II, III, IV and V) that were ordinally related to each other. The statistical analysis was performed using the SPSS programme (29).

Results

When comparing sociodemographic data from a contemporaneous questionnaire-based investigation of the population in Malmö (N=3,861 for all age brackets, N=1,001 for comparable age brackets used here) (30), with a higher participation rate (71%), we could observe that the MDCS study population is reasonably representative of the population in Malmö regarding regular smoking (25.3% in MDCS compared to 27.6%), occasional smoking (5.0% compared to 3.9%), stopped smoking (33.3% compared to 30.9%), low social participation (28.4% compared to 24.7%), low instrumental support (31.1% compared to 34.3%), higher non-manual employees and employers (17.2% compared to 13.1%), non-manual employees in middle and lower positions (33.4% compared to 30.2%), manual workers (23.9% compared to 24.7%), pensioners (18.8% compared to 23.0%) and the unemployed (6.8% compared to 9.0%) (in all cases $p<0.001$). On the other

hand, the proportion of persons born abroad was only 12.8% in the MDCS compared to 25.8% in the HL-94 ($p<0.001$).

The male smokers were mostly cigarette smokers (81%), but to some extent cigar smokers (7%) and pipe smokers (12%). Female smokers were almost exclusively cigarette smokers (97%). Only very few were cigar smokers (2%) or pipe smokers (1%). Among men, 32.9% of the cigarette smokers smoked as an average 0-10 cigarettes/day, 50.5% smoked 11-20/day, 15.6% smoked 21-40/day and 1.0% more than 40/day. Among women, 43.5% smoked 0-10 cigarettes/day, 50.3% smoked 11-20/day, 5.9% smoked 21-40/day and 0.2% more than 40/day. The quitters had stopped smoking to almost the same extent before (men 56.1% and women 53.7%) as after (men 43.9% and women 46.3%) 1980.

The proportion of never-smokers was much larger among women (42.8%) than among men (28.6%). On the other hand, the proportion of smokers was about the same for both sexes. The proportion of individuals having stopped smoking was much larger among men (40.8% compared to 27.1% among women). The relative risk of having stopped smoking increased with age for both men and women. (Table 1) However, a higher proportion of men than women in all age groups had stopped smoking. Married persons had stopped smoking to a higher degree than the unmarried, divorced and the widows/ widowers. Among men, there was a clear socioeconomic gradient in smoking cessation. Men with non-manual employee jobs in higher positions (SES I) had managed to stop smoking almost twice as often, OR= 1.9 (1.4-2.5), as men in the SES V group. Among women, the socioeconomic differences were similar. The disability pensioners (SES VII) and the unemployed (SES VIII) did not differ significantly from the reference group except for males with pension (OR 1.4, 1.1-1.8). For men, those with low social participation had stopped smoking to a lower degree than those with high social participation, OR= 0.6 (0.5-0.7). Among women, this relation was of the same magnitude, OR= 0.6 (0.5-0.7). Men with low emotional support had stopped smoking less often than men in the high category, OR= 0.8 (0.7-0.9). (Table 2)

The first step in the multivariate analysis was to adjust for potential confounders (age, country of origin, marital status and previous/current diseases). The OR:s of smoking cessation for males in the different socioeconomic groups decreased only somewhat, mostly because of the marital status variable. (Table 3) In the next step social participation was introduced in the regression model in order to assess the importance of this psychosocial variable for the socioeconomic gradients. (Table 3) When the social participation variable was included in the model (together with age, country of origin, marital status and previous/current diseases), the OR:s and the differences were further reduced. (Table 3) The other three psychosocial variables, even emotional support, did not affect the OR:s when included one at a time in the model.

For women, the multivariate analysis showed that the introduction of the confounding variables (age, country of origin, marital status and previous/current diseases) increased the OR:s and the socioeconomic differences somewhat. (Table

4) On the other hand, the inclusion of social participation in the model reduced most OR:s and the socioeconomic differences. The introduction of the other three psychosocial variables, even emotional support, into the model had no effect on the OR:s.

The SES gradients remained highly significant for both men and women throughout the multivariate analyses despite the risk reduction produced by social participation.

Discussion

We found clear socioeconomic differences in smoking cessation, which is a well known phenomenon for both males and females. After adjustment for potential confounders the inclusion of social participation in the multivariate analysis had a moderately decreasing effect on the OR:s and the socioeconomic differences in smoking cessation. These results could support the idea that lower psychosocial resources in lower SES groups could be a part of the causal mechanism behind the socioeconomic differences in smoking cessation.

The present results could be biased by selection bias, misclassification and confounding.

The study population of this paper is representative of the population in the city of Malmö. Men, people with lower socioeconomic status and the unemployed are only slightly underrepresented in the MDCS population. A comparison with another investigation with a higher participation rate has also shown a good correspondence concerning social participation and instrumental support between the two investigations. The group born abroad is underepresented due to the fact that 1,975 individuals of foreign origin were excluded from the total MDCS study population due to problems with the language. Some studies have shown that non-participants differ from study participants in terms of smoking habits (31,32). The smoking prevalence in these studies has been shown to be somewhat higher among non-participants. The selection bias due to non-participation is just as likely to have underestimated as to have overestimated the true differences in this study with a low participation rate. People with a positive attitude to health aspects such as smoking cessation may be considerably overrepresented among participants. This group may be considerably overepresented among people with high socioeconomic status, resulting in an overestimation of the SES differences in smoking cessation. On the other hand, the SES differences in smoking cessation may be underestimated due to the probably higher non-participation of the smokers of lower SES groups. The smoking prevalence and the prevalence of quitters for both sexes in this study are almost exactly the same as in the population with a higher participation rate in the Malmö population. The prevalence of ex-smoking (quitters) among men in this study is also exactly the same as in another study of similar age brackets in the city of Gothenburg in Sweden (5). This is a prevalence study and differential survival

may have distorted the results. However, this effect would most probably lead to an underestimation of current SES differences in smoking cessation, since mortality due to smoking would be higher in lower SES groups that have a lower proportion of ex-smokers and a higher proportion of smokers.

The validity of items on smoking has previously been analysed several times, with results consistently showing that self-reported tobacco-smoking is a valid and reliable way to measure smoking habits in a population (33,34,35,36,37,38). There is no reason to believe that the validity of the smoking variable should be any different in our study. However, the validity between the SES groups may vary, since the validity can be expected to be higher in the higher SES groups than in the lower SES groups. This fact could result in an underestimation of the true differences in smoking cessation due to differential misclassification. Non-differential misclassification is a problem of less importance in this study, since non-differential misclassification always work in the direction towards the null, and the main results of this study show clear socioeconomic differences. The reliability and validity of the five psychosocial indeces used in this paper has been assessed in a previous paper. The different indices showed a good or acceptable validity and reliability with no differences between the various SES groups (28).

Age, sex, country of origin, previous/current diseases and marital status could be confounders of the associations between the psychosocial variables and smoking cessation. Adjusting for these confounders, however, only marginally affected the estimates.

It could be considered a problem, that the social network and social support factors were assessed in 1992-1994, while the majority of the study participants did quit smoking during a 30 year period prior to the examination. The aim of this study, however, was not principally to study smoking cessation, but also maintenance of smoking cessation and that is a process over many years. The number of individuals in the social network also remains relatively stable throughout the adult life. The turnover of individuals in the social network occurs more often in early adult life than in late life, and those who are valued most are retained (20,39).

The risk reduction produced by the inclusion of social participation in the multivariate analysis may seem moderate or even small. However, there are plausibly several causal factors (multicausality) behind the socioeconomic differences in smoking cessation. Taking this into consideration, a risk reduction of 10-30 per cent units seems important.

The effect of social participation to decrease the odds ratios of smoking cessation of the SES groups might be suspected to be just an effect of multicolinearity between the SES and the social participation variables. However, there was a consistent difference in the fraction of all ever-smokers within each SES group that had stopped smoking depending on whether the individuals were unexposed or exposed to low social participation. The differences within each SES group was of the size ten absolute per cent units or somewhat more.

Social participation has in other studies been shown to be associated with smoking (20,40). In this study, social participation was associated with smoking cessation and maintenance of smoking cessation. Exposure to low social participation partly explained the socioeconomic gradient in smoking cessation. Social participation measures the individual´s participation in several social activities within the life of modern society. The process of giving up smoking and remaining smoke free is complex, and involves social, psychological and physiological factors (41,42). Health related behaviours like smoking are a result of the interaction between a person and her environment. A person´s relation to her environment can be viewed as a dynamic process, since environmental changes require continuous adaptation by the individual. The successful adaptation to changes in the environment requires both individual resources, e.g. education and material resources, and social relations, e.g. social support and social network. The process of smoking cessation and its maintenance, being difficult in itself, becomes even more difficult when the individual has low psychosocial resources, i.e. an inadequate social participation.

The definition of social participation in this study is in accordance with Robert D Putnam´s definition of social participation, which forms a part of the definition of social capital (43,44,45). The findings of this study consequently suggest an importance of social capital in the link between socioeconomic status and smoking cessation as a health-related behaviour. The amount and quality of the social capital in a society is partly historically inherited and partly aquired through recent social and economic change of society (43). This perspective makes the fact that the psychosocial variables were assessed in 1992-1994 while smoking cessation had occurred previously for many years even less critical. An important task is to increase the understanding of which aspects of social capital that promotes smoking cessation, e.g. those generated by family and kinship compared with those from associational life or from the links that connect different groups within society (46). The results of this study suggest that the latter, i.e. social participation and not social anchorage, is the important aspect of social capital in this context. Furthermore, the results also imply that preventive measures against tobacco smoking should be designed to improve at least certain aspects of social capital and social cohesion (47).

The findings of this paper provide further and more specific support for the notion that the psychosocial stress theory might contribute to the understanding of socioeconomic differences in smoking cessation. Social participation is the structural social network factor that reflects the social contact surfaces of modern society, and its influence on the socioeconomic differences in smoking cessation could reflect the marginalisation of lower socioeconomic groups.

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Table 1. Distribution (number and %) of the smoking, demographic, socioeconomic and psychosocial variables

	Men		Women		Total	
	N	%	N	%	N	%
"Do you smoke"						
Regular/daily smoker	1346	25.0	1647	25.5	2993	25.3
Occasional smoker	299	5.6	296	4.6	595	5.0
Stopped smoking	2197	40.8	1746	27.1	3943	33.3
Never smoked	1538	28.6	2765	42.8	4303	36.4
(Missing)	(0)		(3)		(3)	
Age						
45-49 years	808	15.0	976	15.1	1784	15.1
50-54 years	1574	29.3	1928	29.9	3502	29.6
55-59 years	1468	27.3	1699	26.3	3167	26.8
60-64 years	1530	28.4	1854	28.7	3384	28.6
(Missing)	(0)		(0)		(0)	
Country of origin						
Sweden	4653	86.5	5667	87.8	10320	87.2
Other country	725	13.5	787	12.2	1512	12.8
(Missing)	(2)		(3)		(5)	
Previous/current diseases						
No	4466	83.2	5311	82.6	9777	82.9
Yes	901	16.8	1118	17.4	2019	17.1
(Missing)	(13)		(28)		(41)	
Marital status						
Married	3860	71.8	4039	62.6	7899	66.8
Unmarried	603	11.2	569	8.8	1172	9.9
Divorced	803	14.9	1354	21.0	2157	18.2
Widow/widower	112	2.1	491	7.6	603	5.1
(Missing)	(2)		(4)		(6)	
Socioeconomic status (SES)						
V	604	11.2	1258	19.5	1862	15.8
IV	646	12.0	312	4.8	958	8.1
III	598	11.1	1587	24.6	2185	18.5
II	833	15.5	932	14.5	1765	14.9
I	528	9.8	358	5.6	886	7.5
VI	794	14.8	349	5.4	1143	9.7
VII	953	17.7	1269	19.7	2222	18.8
VIII	418	7.8	383	5.9	801	6.8
(Missing)	(6)		(9)		(15)	
Social part. High	3851	71.6	4635	71.8	8486	71.7
Low	1529	28.4	1822	28.2	3351	28.3
(Missing)	(0)		(0)		(0)	
Social anch. High	3888	73.1	4792	75.6	8680	74.5
Low	1428	26.9	1549	24.4	2977	25.5
(Missing)	(64)		(116)		(180)	
Instrumental s. High	3454	64.3	4688	72.9	8142	68.9
Low	1918	35.7	1755	27.1	3673	31.1
(Missing)	(8)		(14)		(22)	
Emotional s. High	3517	65.7	4638	72.1	8155	69.2
Low	1839	34.3	1792	27.9	3631	30.8
(Missing)	(24)		(27)		(51)	
Total	**5380**		**6457**		**11837**	

Table 2. Crude odds ratios (OR) and 95% confidence intervals (CI) of smoking cessation in relation to demographic, socioeconomic and psychosocial variables

	Men			Women		
	N	%	Crude OR, 95% CI	N	%	Crude OR, 95% CI
Age						
45-49 years	589	53.0	1.0	632	41.6	1.0
50-54 years	1113	54.7	1.1 (0.9-1.3)	1202	43.5	1.1 (0.9-1.3)
55-59 years	1027	55.4	1.1 (0.9-1.4)	937	51.2	1.5 (1.2-1.8)
60-64 years	1027	63.5	1.6 (1.3-1.9)	918	52.2	1.5 (1.2-1.8)
(Missing)	(0)			(3)		
Country of origin						
Sweden	3301	57.7	1.0	3261	47.7	1.0
Other country	539	54.2	0.9 (0.7-1.0)	426	43.9	0.8 (0.7-1.0)
(Missing)	(2)			(5)		
Diseases						
No	3152	56.2	1.0	2999	47.6	1.0
Yes	678	61.8	1.0 (0.9-1.2)	671	46.8	1.3 (1.1-1.5)
(Missing)	(12)			(22)		
Marital status						
Married	2733	61.3	1.0	2146	53.6	1.0
Unmarried	415	45.5	0.5 (0.4-0.7)	331	43.5	0.7 (0.5-0.8)
Divorced	621	47.3	0.6 (0.5-0.7)	918	36.8	0.5 (0.4-0.6)
Widow/ widower	72	52.8	0.7 (0.4-1.1)	290	39.3	0.6 (0.4-0.7)
(Missing)	(1)			(7)		
SES						
V	446	47.8	1.0	736	39.9	1.0
IV	464	57.5	1.5 (1.1-1.9)	167	45.5	1.3 (0.9-1.8)
III	426	62.2	1.8 (1.4-2.4)	916	50.0	1.5 (1.2-1.8)
II	544	64.3	2.0 (1.5-2.5)	542	53.5	1.7 (1.4-2.2)
I	355	63.1	1.9 (1.4-2.5)	200	56.5	2.0 (1.4-2.7)
VI	542	56.3	1.4 (1.1-1.8)	199	50.3	1.5 (1.1-2.1)
VII	738	56.0	1.4 (1.1-1.8)	703	44.7	1.2 (1.0-1.5)
VIII	322	48.8	1.0 (0.8-1.4)	219	45.2	1.2 (0.9-1.7)
(Missing)	(5)			(10)		
Social part.						
High	2661	61.1	1.0	2610	51.0	1.0
Low	1181	48.4	0.6 (0.5-0.7)	1079	38.5	0.6 (0.5-0.7)
(Missing)	(0)			(3)		
Social anch.						
High	2752	57.8	1.0	2690	48.2	1.0
Low	1049	55.7	0.9 (0.8-1.1)	937	45.1	0.9 (0.8-1.03)
(Missing)	(41)			(65)		
Instrument. s.						
High	2477	58.1	1.0	2674	47.6	1.0
Low	1362	55.5	0.9 (0.8-1.03)	1009	46.8	1.0 (0.9-1.2)
(Missing)	(3)			(9)		
Emotional s.						
High	2516	59.1	1.0	2603	48.7	1.0
Low	1313	53.8	0.8 (0.7-0.9)	1072	44.4	0.8 (0.7-1.0)
(Missing)	(13)			(17)		
Total	3842			3692		

Table 3. Age-adjusted and multivariate odds ratios (OR) and 95% confidence intervals (CI) of smoking cessation in socioeconomic groups. Men.

	Adjusted * OR, 95% CI	**Adjusted ** OR, 95% CI**	**Adjusted *** OR, 95% CI**	**Adjusted **** OR, 95% CI**	**Adjusted ***** OR, 95% CI**	**Adjusted ****** OR, 95% CI**
V	1.0	1,0	1,0	1.0	1.0	1.0
IV	1.5 (1.1-1.9)	1.4 (1.1-1.8)	1.4 (1.0-1.8)	1.4 (1.1-1.8)	1.4 (1.1-1.8)	1.4 (1.1-1.9)
III	1.7 (1.3-2.3)	1.7 (1.3-2.2)	1.5 (1.2-2.0)	1.6 (1.2-2.1)	1.7 (1.3-2.2)	1.7 (1.3-2.2)
II	2.0 (1.5-2.6)	1.9 (1.5-2.5)	1.7 (1.3-2.1)	1.9 (1.4-2.4)	1.9 (1.5-2.5)	1.9 (1.5-2.5)
I	1.9 (1.4-2.5)	1.8 (1.4-2.4)	1.6 (1.2-2.1)	1.8 (1.3-2.4)	1.8 (1.4-2.4)	1.8 (1.4-2.4)
VI	1.4 (1.1-1.8)	1.3 (1.0-1.7)	1.2 (0.9-1.6)	1.3 (1.0-1.7)	1.3 (1.0-1.7)	1.3 (1.0-1.7)
VII	1.1 (0.9-1.4)	1.1 (0.8-1.4)	1.1 (0.9-1.4)	1.1 (0.8-1.4)	1.1 (0.8-1.4)	1.1 (0.9-1.4)
VIII	1.0 (0.8-1.4)	1.0 (0.7-1.3)	1.0 (0.7-1.3)	1.0 (0.7-1.3)	1.0 (0.7-1.3)	1.0 (0.7-1.3)
P-test for trend (I,II,III,IV, V)	p<0.001	p<0.001	p=0.002	p<0.001	p<0.001	p<0.001

*Adjustment made for age.
**Adjustment made for age, country of origin, marital status and previous/current diseases.
***Adjustment made for age, country of origin, marital status, previous/current diseases and social participation.
****Adjustment made for age, country of origin, marital status, previous/current diseases and emotional support.
*****Adjustment made for age, country of origin, marital status, previous/current diseases and instrumental support.
******Adjustment made for age, country of origin, marital status, previous/current diseases and social anchorage.

Table 4. Age-adjusted and multivariate odds ratios (OR) and 95 % confidence intervals (CI) of smoking cessation in socioeconomic groups. Women.

	Adjusted * OR, 95% CI	**Adjusted ** OR, 95% CI**	**Adjusted *** OR, 95% CI**	**Adjusted**** OR, 95% CI**	**Adjusted ***** OR, 95% CI**	**Adjusted ****** OR, 95% CI**
V	1.0	1.0	1.0	1.0	1.0	1.0
IV	1.3 (0.9-1.9)	1.4 (1.0-1.9)	1.3 (0.9-1.8)	1.4 (1.0-1.9)	1.4 (1.0-1.9)	1.4 (1.0-2.0)
III	1.6 (1.3-1.9)	1.6 (1.3-1.9)	1.5 (1.2-1.8)	1.6 (1.3-1.9)	1.6 (1.3-1.9)	1.6 (1.3-1.9)
II	1.8 (1.5-2.3)	1.8 (1.4-2.2)	1.6 (1.3-2.0)	1.8 (1.4-2.2)	1.8 (1.4-2.2)	1.8 (1.4-2.2)
I	2.1 (1.5-2.8)	2.1 (1.5-2.9)	1.8 (1.3-2.6)	2.1 (1.5-2.9)	2.1 (1.5-2.9)	2.1 (1.5-3.0)
VI	1.7 (1.2-2.3)	1.6 (1.2-2.2)	1.5 (1.1-2.1)	1.6 (1.2-2.2)	1.6 (1.2-2.2)	1.6 (1,1-2.2)
VII	1.0 (0.8-1.2)	1.0 (0.8-1.3)	1.1 (0.8-1.3)	1.0 (0.8-1.3)	1.0 (0.8-1.3)	1.0 (0.8-1.3)
VIII	1.2 (0.9-1.7)	1.3 (0.9-1.8)	1.3 (0.9-1.7)	1.3 (0.9-1.7)	1.3 (0.9-1.8)	1.3 (0.9-1.8)
P-test for trend (I,II,III.IV, V)	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001

*Adjustment made for age.
**Adjustment made for age, country of origin, marital status and previous/current diseases.
***Adjustment made for age, country of origin, marital status, previous/current diseases and social participation.
****Adjustment made for age, country of origin, marital status, previous/current diseases and emotional support.
*****Adjustment made for age, country of origin, marital status, previous/current diseases and instrumental support.
******Adjustment made for age, country of origin, marital status, previous/current diseases and social anchorage.

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III

Socioeconomic differences in leisure-time physical activity: The role of social participation and social capital in shaping health related behaviour

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Abstract

Several studies have shown socioeconomic differences in leisure-time physical activity. One explanation may be socioeconomic differences in relevant psychosocial conditions. The Malmö Diet and Cancer Study is a prospective cohort study including inhabitants in Malmö, Sweden. The baseline questionnaire used in this cross-sectional study was completed by the 11,837 participants born 1926-1945 in 1992-1994. Leisure-time physical activity was measured by an item presenting a variety of activities. These activities were aggregated into a summary measure of leisure-time physical activity that takes both the intensity and duration of each specific activity into consideration. The effects of the psychosocial variables on the socioeconomic differences in leisure-time physical activity were calculated in a multivariate logistic regression analysis. The quartile with the lowest degree of leisure-time physical activity was not evenly distributed between the socioeconomic groups. Socioeconomic differences were seen as odds ratios 1.5 (1.1-1.9) for skilled and 1.5 (1.1-1.9) for unskilled male manual workers, compared to the high level non-manual employees. An OR 1.6 (1.2-2.1) was observed for female unskilled manual workers. Self-employed men and female pensioners also had a significantly increased risk of low leisure-time physical activity. Adjustment for age, country of origin and previous/ current diseases had no effect on these SES differences. Finally, adjusting for social participation almost completely erased the SES differences. Among the psychosocial variables, social participation was the strongest predictor of low physical activity. Social participation is a strong predictor for socioeconomic differences in low leisure-time physical activity. Social participation measures the individual´s social activities in e.g. political parties and organisations. It therefore seems possible that some of the socioeconomic differences in leisure-time physical activity are due to differing social capital between socioeconomic groups.

Key words: Socioeconomic status, leisure-time physical activity, psychosocial, social participation, social capital

Introduction

Behaviours like smoking, physical leisure-time activity and dietary habits have become increasingly important as explanatory factors for socioeconomic differences in health (Lundberg, 1992), e.g. cardiovascular diseases. In recent decades, all-cause as well as cardiovascular mortality and morbidity have consistently been found to be higher in lower socioeconomic groups (Marmot et. al., 1978; Marmot et. al., 1991). In Sweden socioeconomic differences in cardiovascular mortality have increased (National Public Health Report, 1997). Low leisure-time physical activity has been found to be strongly associated with low income (Johansson et. al., 1988; Steenland, 1992), low education (Fletcher et. al., 1996; Yusuf et. al., 1996; Sternfeld et. al., 1999), and low socioeconomic status (Blanksby et. al., 1996; Shinew et. al., 1996; Wister, 1996; Mensink et. al., 1997). There are several explanations for socioeconomic differences in health-related behaviours (Townsend et. al., 1982).

The suggested biological mechanisms by which lack of physical activity causes cardiovascular disease are by a lowering effect on blood pressure (MacAuley et. al., 1996; Simonsick et. al., 1993), on plasma fibrinogen (MacAuley et. al., 1996; Koenig et. al., 1997; Greendale et. al., 1996), and on plasma viscosity (Koenig et. al., 1997). Improvements in glucose metabolism and blood lipid levels (Simonsick et. al., 1993; Donahue et. al., 1988) have also been proposed as causally important. Studies have shown that the risk of myocardial infarction among men that are not physically active during leisure-time is about doubled compared to the risk of physically active men. The effect of leisure-time physical activity on female myocardial infarction mortality does not seem to be as great as among men (e.g. Johansson et. al., 1988; Salonen et. al., 1988). Some studies have also shown that low levels of physical activity are associated with an increased risk of stroke (Sacco et. al., 1998) and peripheral artery disease (Housley et. al., 1993). Moradi et. al. have also presented some support for the hypothesis that occupational physical activity reduces a woman´s risk of breast cancer (1999).

The aim of this paper is to investigate whether there are socioeconomic differences in leisure-time physical activity in a Swedish population, to investigate whether psychosocial resources (Hanson et. al., 1987; Syme, 1989) are associated with the level of leisure-time physical activity, and to investigate whether socioeconomic differences in psychosocial resources could explain the socioeconomic differences in leisure-time physical activity.

Material and method

Study population

The Malmö Diet and Cancer Study (MDCS) is a prospective cohort study in Malmö, the third largest city of Sweden with approximately 250,000 inhabitants. Recruitment to the MDCS started in the spring of 1991 and the last participants were examined in the autumn of 1996. The population consists of all men and women living in Malmö born between 1926 and 1945 (n=53,000). However, in 1995 recruitment was extended to some older and younger age brackets. The total participation rate in the MDCS was 38,9% (28,098 of a total 72,163).

The psychosocial variables were not included in the first version of the questionnaire used in 1991-1992, and thus the present study population consists of every person who participated in the MDCS during the two year period from March 1992 to August 1994, and were aged below 65 (n=11,837). This represents a quarter of the whole population aged 45-64 in Malmö. Homeworkers (mostly women) (n=340) and students (n=45) were excluded from the analysis in this study. Since individuals of the full MDCS were included continuously during the period 1991-1996, it has not been possible to estimate the exact participation rate in the part of the cohort analysed in this study. It was estimated to be slightly higher than the participation rate of the whole MDCS study.

The predominant method of recruiting participants in the MDCS were letters of invitation to individuals chosen at random from the cohort. However, some of the respondents came to the examination spontaneously after a recruitment campaign in the mass media. In this study, this latter group represents 25.2 % of the population (Berglund et. al., 1993).

All participants were informed about the aims of the MDCS project on their first visit to the project site, and the baseline questionnaire and the diet assessment method were introduced and explained. The baseline questionnaire was completed at home and checked for missing answers by the diet assistants at the second visit to the MDCS project office a few weeks later.

Definitions

Outcome variable

Leisure-time physical activity was measured by an item in the questionnaire presenting a variety of possible activities (17 different items and one open alternative), including different sports, gardening, walking. The 17-item leisure-time physical activity question in the MDCS questionnaire is a quantitative history survey according to the classification of methods by Laporte et. al., and the validity

of this category was regarded as good after comparison with the objective kilocalorie index and treadmill performance (Laporte et. al., 1985; Montoye et. al., 1984). The participants were asked to report how many minutes per week on average, and for each of the four seasons, they spend on a specific activity. These figures were all multiplied by an activity-specific factor representing assumed energy consumption, which thus became the common denominator allowing the computation of a summary score. The aggregated measure thus takes both duration and intensity of physical activities into account (Taylor et. al., 1978).

In 1994, 447 persons in the sample with what was believed to be extremely high recorded values regarding leisure-time physical activity were interviewed by telephone. The reproducibility was found to be very high (93%). The aggregated leisure-time physical activity variable is continuous. Low leisure-time physical activity was in this study defined as the quartile of the population with the lowest level of leisure-time physical activity.

Exposure variables

Classification of *socioeconomic status* (SES) was based on data about job title, tasks and position at work, obtained from the questionnaire. The classification procedure was identical to the one used in the Swedish population census (Statistics Sweden, 1985), with two manual groups and three non-manual groups.

The group of *self-employed* persons is very heterogenous, including both academically trained physicians, dentists, big company employers and, on the other hand, small shop-keepers, self-employed carpenters etc. The *unemployed* include those outside the active workforce, but still available for work. The *pensioners* were analysed as a separate category, who are completely outside the work force. Pensioners below age 65 consist largely of people in receipt of disability pensions.

Country of origin. All persons born in other countries than Sweden were merged into a single category. Thus, the two categories used in the analysis are "Sweden" or "other".

Previous/ current self-reported diseases might influence the level of leisure-time physical activity. Self-reported previous or current diseases included myocardial infarction, stroke, claudicatio intermittens, diabetes mellitus, cancer, astma/ chronic obstructive lung disease or rheumatism/arthritis. The list of self-reported diseases also included hypertension, history of goitre, history of peptic ulcer, inflammatory diseases of the gastrointestinal tract and kidney stone. However, the former conditions were regarded as the most relevant determinants of the leisure-time physical activity level.

Psychosocial factors:. The four psychosocial variables used in the study represented two categories of social network (social anchorage and social participation) and two factors assessing social support (emotional support and instrumental support):

Social network refers to structural aspects of a person´s network of social relationships.

Social participation describes how actively the person takes part in the activities of formal and informal groups in society (study circle/course at place of work, other study circle/course, union meeting, meeting of other organisations, theatre/cinema, arts exhibition, church, sports event, letter to editor of a newspaper/journal, demonstration, night club/entertainment, big gathering of relatives, private party). It was measured as an index consisting of 13 items and dichotomised. If three alternatives or less were indicated, the social participation of that person was classified as low.

Social anchorage (5 items) describes to what extent the person belongs to and is anchored within formal and informal groups and, in a more qualitative sense, the feeling of a membership in these groups (familiarity with neighborhood, belonging to friends and relatives, membership or position of trust in organisations or clubs, feelings of importance to other people). If three or more of the five items denoted low social anchorage, the whole index variable was regarded as low.

A social network may or may not be supportive of the individual. The beneficial effects of a personal social network depend upon its ability to supply various resources to the individual, i.e. social support.

Instrumental support (1 item) reflects the individual´s access to guidance, advice, information, practical services and material resources from the other persons. This item was measured by a four alternative question: "Yes, I am absolutely sure to get such support", "Yes, possibly", "Not certain" and "No". The three latter alternatives were classified as low instrumental support.

Emotional support (3 items) reflects the opportunity for care, the encouragement of personal value and feelings of confidence or trust. Each item has the same four alternatives as instrumental support. If two or three items were low, the index variable was considered low.

The reliability and validity of the four psychosocial indices used in this paper was assessed in a previous paper that found low correlations between the different indices and an acceptable validity and reproducibility (test-retest stability) for all the variables (Hanson et. al., 1997).

Statistics

Crude odds ratios (OR) and 95 % confidence intervals were calculated in order to analyse associations between different demographic, socioeconomic and psychosocial variables, and low leisure-time physical activity. The multivariate analysis was performed in order to investigate the potential importance of various confounders and to analyse the importance of the different psychosocial variables on the socioeconomic differences in leisure-time physical activity. SES gradients were also calculated as tests for trend for the five SES groups that were ordinally

related to each other. The effects of the covariates were explored by logistic regression analysis concerning the association between psychosocial variables and the odds ratio of low leisure-time physical activity.

Results

Table 1 shows that men in our study were more likely to be self-employed, non-manual employees in higher positions and skilled manual workers compared to women, while women more often than men were non-manual employees in lower and middle positions and unskilled manual workers. These differences further support our belief that men and women should be analysed separately. The proportion of persons born in other countries than Sweden were almost the same for men and women, 13.5 and 12.2 %, respectively.

Table 2 shows that there were statistically significant socioeconomic differences in the risk of being in the lowest quartile of leisure-time physical activity. Among men, the groups of skilled manual workers, and unskilled manual workers were more likely to have low leisure-time physical activity, OR=1.5, compared to the high level non-manual employee reference group. Among women, a significantly higher odds ratio could only be seen for the unskilled manual worker group, OR=1.6. The male self-employed had an OR=1.4 of having low leisure-time physical activity compared to employees. The unemployed did not differ significantly from the vocationally active (employees and self-employed). Female pensioners had an OR=1.3 regarding low leisure-time physical activity compared to persons on the labour market (employees, self-employed and unemployed).

The proportion of individuals with a low level of leisure-time physical activity (lowest quartile) did not vary greatly by age or previous/ current self-reported diseases, although among men the age group 60-64 years was less likely to have low leisure-time physical activity, OR=0.6, and among women the group with previous/ current self-reported diseases had a somewhat higher odds ratio, OR=1.2. The group born in countries other than Sweden had a significanly higher odds ratio of a low level of leisure-time physical activity both for males, OR=1.3, and females, OR=1.4. Low social participation was associated with an increased risk of low leisure-time physical activity among both men, OR=2.2 and women, OR=2.3. A somewhat weaker association between low social anchorage and low leisure-time physical activity was also seen for both sexes. A weaker, but statistically significant association was seen among women between low instrumental support and being in the lower quartile of leisure-time physical activity, OR=1.2.

Table 3 illustrates that the SES pattern did not change when age, country of origin and previous/ current diseases were included in the multivariate logistic regression model neither for men nor for women. Finally, when social participation was included in the model, the association between SES and low leisure-time

physical activity was considerably weakened. It was reduced among men from from OR 1.4 to OR 1.2 for the skilled manual workers and from OR 1.4 to OR 1.1 for the unskilled manual worker group. Social participation also reduced the female odds ratios from OR 1.6 to 1.2 among unskilled manual workers. The introduction of the other four psychosocial variables, including social anchorage, into the model had, on the other hand, no effect on the association between SES and of low leisure-time physical activity (not shown in the table). The SES gradients remained highly significant throughout the multivariate logistic regression analyses for both men and women. The exception was social participation that reduced the SES gradient for both men (from $p<0.001$ to $p=0.02$) and women (from $p<0.001$ to $p=0.04$).

Since social participation was introduced in the final step in the mentioned regression analyses, it seemed to be of importance to analyse how much of the association between this variable and low leisure-time physical activity that could be ascribed to the other variables in the model.

Table 4 shows the results of this analysis, namely that age, country of origin and previous/ current self-reported diseases had almost no effects on the significant relationship between social participation and low leisure-time physical activity.

Discussion

We found statistically significant socioeconomic differences and socioeconomic gradients in the extent of leisure-time physical activity. Lower socioeconomic groups had a higher risk of being in the lower quartile of leisure-time physical activity. The inclusion of social participation in the multivariate logistic regression model had a decreasing effect on the socioeconomic differences and gradients in low leisure-time physical activity. These results support the idea that insufficient psychosocial resources in some socioeconomic groups are a part of the important link behind the socioeconomic differences in leisure-time physical activity and, ultimately, cardiovascular diseases.

Non-participation is not likely to have produced serious selection bias in this study. A comparison with another investigation made in the city of Malmö during the same time period with a higher participation rate showed a good correspondance concerning SES, smoking, social participation and instrumental support between the two investigations. On the other hand, people born abroad are underrepresented in the MDCS population (Lindström et. al.). However, this is due to the fact that approximately 2,000 individuals of foreign origin were excluded from the whole study population because of problems with the Swedish language (all interviewed 1991-1996). The selection bias due to non-participation is just as likely to have underestimated as to have overestimated the true differences in leisure-time physical activity in this with a low participation rate. People with a positive attitude to health aspects such as physical activity may be considerably overrepresented among participants. This group may be considerably overrepresented among people

with high socioeconomic status, resulting in an overestimation of the SES differences in leisure-time physical activity. On the other hand, the SES differences in physical activity may be underestimated due to the probably higher non-participation among people with low levels of leisure-time physical activity of lower SES groups. Finally, the physical activity assessment method used is not known to produce any selection bias in itself (Sequeira et. al., 1995).

More than 30 various methods are available for assessing physical activity, with many different variations in the techniques. The validation criterion depends on the specific operational definition of physical activity used. E.g., surveys that derive kilocalorie scores may wish to use doubly labeled water, surveys concerned with intense aerobic activity might employ maximum oxygen uptake measures, motion sensors might use behavioural observation, and walking surveys might employ a pedometer (Montoye et. al., 1984; Sequeira et. al., 1995). These methods have the advantage of avoiding the specific bias and/or precision problem of physical activity questionnaires connected with self-reporting.

However, the 17-item leisure-time physical activity question in the MDCS questionnaire is a quantitative history survey according to the classification of methods by Laporte et. al. (Laporte et. al., 1985), and the validity of this type of surveys were regarded as good after comparison with the objective summary kilocalorie index and treadmill work performance (Montoye et. al., 1984; Taylor et. al., 1978). Furthermore, respondents with extreme recorded values were interviewed by telephone with a high reproducibility to assure that the question had been rightly understood. The results of this interview did not support the notion that there might be a risk of precision differences in self-reported leisure-time physical activity between the SES groups, which would otherwise have resulted in the dominance of the results of those SES groups with physical activity results measured with a higher precision over the results of the SES groups with a lower precision.

The lowest quartile cut-off limit of the leisure-time physical activity variable corresponds to 34.4 minutes of walking daily. This is approximately the lowest amount of physical exercise recommended by the Year 2000 National Health Objectives (30 minutes) (US Department of Health and Human Services, 1990). Other studies support this notion that the majority of health benefits occur when sedentary adults become moderately active (Haapanen et. al., 1996).

Age, sex, country of origin and previous/ current diseases might be confounders of the associations between the psychosocial variables and leisure-time physical activity. Adjusting for these confounders, however, only marginally affected the estimates.

The self-employed, the unemployed and the pensioners were not compared with the higher level non-manual employee reference group. The reason is that these three groups are composed of people from different socioeconomic strata, e.g. a self-employed person could either be a carpenter or an academically trained dentist. The self-employed were instead compared with all employee groups (aggregated),

the unemployed with all employee groups and the self-employed (aggregated), and the pensioners with all employee groups, self-employed and the unemployed (aggregated).

Leisure-time physical activity is only one aspect of physical activity. However, it seems obvious that the relative importance of leisure-time physical activity has become greater over time (Aarnio et. al., 1997; Simoes et. al., 1995). Furthermore, data concerning physical activity at work are less convincing when it comes to the risk relationship with myocardial infarction (Salonen et. al., 1988), and such cardiovascular risk factors as plasma viscosity (Koenig et. al., 1997) and fibrinogen profiles (Greendale et. al., 1996).

The results of this study confirm the findings of investigations in other countries that have found lower levels of leisure-time physical activity in lower educational groups (Droomers et. al., 1998; Iribarren et. al., 1997), income level groups (Iribarren et. al., 1997), and socioeconomic status groups (Wister 1996; Shinew et. al., 1996; Mensink et. al., 1997). In this study, exposure to low social participation partially explained the socioeconomic differences in the level of leisure-time physical activity.

Other explanations than differences in social participation could also affect the extent of socioeconomic differences in leisure-time physical activity. Barriers to physical activity could be either "internal" or "external". "Internal" barriers such as lack of motivation or lack of leisure time are more common in higher socioeconomic groups, while "external" barriers such as lack of money, lack of transport or illness/disability are more common in lower socioeconomic groups (Chinn et. al. 1999). Zuzanek et. al. have also shown that stress and time pressure is more common in groups with high education and high income (1998). As mentioned in the introduction, the causal relationship between SES and physical activity may go in both directions. Poor social conditions could contribute to low levels of physical activity. There may also be a social drift of physically inactive into lower socioeconomic groups (social selection), although the social selection alternative is probably of less importance in the age groups 45-64 years analysed in the present study.

Social participation measures the individual´s participation in several social activities within the life of modern society. The effects of social participation on the extent of leisure-time physical activity may be mediated by a higher extent of encouragement/peer pressure to participate in physical activities experienced by persons with a high social participation. Interestingly, the definition of social participation in this study is in accordance with Robert D Putnam´s definition of civic engagement/social participation, which forms one part of his definition of social capital (Putnam, 1993). Kawachi et. al. have e.g. used the per capita number of groups and associations to which residents in a state belonged as a measure of civic engagement (Kawachi et. al., 1997), but our social participation variable also measures the extent to which citizens involve themselves in their communities.

The findings of this study accordingly suggest an influence of social capital in the link between socioeconomic status and this health behaviour. High levels of social capital might thus enhance the individual´s ability to influence determinants relevant for future health. It is plausible that access to a high level of social capital, which implies a strong sense of being able to influence one´s own health, thus increases the extent of leisure-time physical activity. Yang et. al. have also shown that the variable "attention paid to health" was the best predictor of physical activity (1999). Studies in political sciences concerning sports and physical activity also support such an interpretation (Allison, 1995).

This suggests that measures to improve social capital in society might be important in lowering the prevalence of health-related risk behaviours such as low leisure-time physical activity, and also in countering socioeconomic differences in such behaviours. The traditional focus of prevention has been on health-related behaviours as an individual quality. The preventive measures recommended according to the individual model are e.g. information and mass media campaigns. A second area of interest has been on material and economic deprivation. However, as shown by Marmot (Marmot et. al., 1991), the five SES groups of relatively well-off and not materially deprived civil servants in the Whitehall study showed large differences in health, which suggests that material deprivation is not sufficient to account for the differences in health throughout the whole spectrum of SES groups. Lomas has suggested that measures to improve social capital and social cohesion are important in public health. Our results suggest a similar way to reduce risk factors in health-related behaviours in a population. This means that epidemiologists and public health practitioners must focus much more on evaluating and modifying the impact of disintegrating social structures on health, and promote community integrity, social cohesion and collective reallocation of fiscal and social resources (Lomas, 1998). The focus must shift from individual risk behaviour to patterns of civic and social engagement associated with these risks. In the case of physical activity, the improvements of the physical environment (Sallis et. al., 1997), physical exercise in groups instead of individually (Clark, 1996), as well as community and workplace policies (Eyler et. al., 1997) may promote increased physical activity in a population. Other studies have shown that adult physical activity was significantly predicted not only by e.g. employment status and education, but also by physical activity in early life (Yang et. al., 1999). Government support of youth sports organisations is thus another example of public health policies to promote social capital and physical activity not only among youths and adolescents, but also among adults later in life.

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Table 1. Prevalence (%) of demographic, socioeconomic, psychosocial and low leisure-time physical activity variables. The Malmö Diet and Cancer Study 1992-1994.

	Men		Women		Total	
	N (total)	%	N (total)	%	N (total)	%
Total	5380		6457		11837	
Socioeconomic status						
High level non-manual	528	9.8	358	5.6	886	7.5
Middle level non-manual	833	15.5	932	14.4	1765	14.9
Low level non-manual	598	11.1	1587	24.6	2185	18.5
Skilled manual worker	646	12.0	312	4.8	958	8.1
Unskilled manual worker	604	11.2	1258	19.5	1862	15.8
Self-employed	794	14.8	349	5.4	1143	9.7
Unemployed	418	7.8	383	5.9	801	6.8
Pensioners	953	17.7	1269	19.7	2222	18.8
(Missing)	(6)		(9)		(15)	
Age						
45-49 years	808	15.0	976	15.1	1784	15.1
50-54 years	1574	29.3	1928	29.9	3502	29.6
55-59 years	1468	27.3	1699	26.3	3167	26.8
60-64 years	1530	28.4	1854	28.7	3384	28.6
(Missing)	(0)		(0)		(0)	
Country of origin						
Sweden	4653	86.5	5667	87.8	10320	87.2
Other country	725	13.5	787	12.2	1512	12.8
(Missing)	(2)		(3)		(5)	
Self-reported diseases [1]						
No	4377	81.7	5146	80.2	9523	80.9
Yes	983	18.3	1268	19.8	2251	19.1
(Missing)	(20)		(43)		(63)	
Social participation						
High	3851	71.6	4635	71.8	8486	71.7
Low	1529	28.4	1822	28.2	3351	28.3
(Missing)	(0)		(0)		(0)	
Social anchorage						
High	3888	73.1	4792	75.6	8680	74.5
Low	1428	26.9	1549	24.4	2977	25.5
(Missing)	(64)		(116)		(180)	
Instrumental support						
High	3454	64.3	4688	72.8	8142	68.9
Low	1918	35.7	1755	27.2	3673	31.1
(Missing)	(8)		(14)		(22)	
Emotional support						
High	3517	65.7	4638	72.1	8155	69.2
Low	1839	34.3	1792	27.9	3631	30.8
(Missing)	(24)		(27)		(51)	
Leisure-time physical activity						
High	3973	74.3	4847	75.6	8820	75.0
Low	1372	25.7	1567	24.4	2939	25.0
(Missing)	(35)		(43)		(78)	

[1)] Self-reported previous or current diseases included myocardial infarction, stroke, claudicatio intermittens, diabetes mellitus, cancer, astma/ chronic obstructive lung disease or rheumatism.

Table 2. Crude odds ratios (OR) and 95 % confidence intervals (CI) of low leisure-time physical activity in relation to demographic, socioeconomic and psychosocial variables. The Malmö Diet and Cancer Study 1992-1994.

	Men			Women		
	N (total)	%	Crude OR, 95% CI	N (total)	%	Crude OR, 95% CI
Total	5380			6457		
SES						
High level non-manual	527	22.4	1.0	355	21.1	1.0
Middle level non.-manual	830	20.2	0.9 (0.7-1.1)	928	17.6	0.8 (0.6-1.1)
Low level non-manual	596	24.7	1.1 (0.9-1.5)	1583	23.8	1.2 (0.9-1.5)
Skilled manual	639	29.6	1.5 (1.1-1.9)	309	23.7	1.2 (0.8-1.7)
Unskilled manual	599	29.9	1.5 (1.1-1.9)	1248	29.4	1.6 (1.2-2.1)
(Missing)	(2189)			(2034)		
Vocationally active[1]						
Employees	3191	25.1	1.0	4423	23.8	1.0
Self-employed	791	32.0	1.4 (1.2-1.7)	346	25.7	1.1 (0.9-1.4)
(Missing)	(1398)			(1688)		
Vocationally active and unemployed[2]						
All employed	3982	26.5	1.0	4769	24.0	1.0
Unemployed	416	23.8	0.9 (0.7-1.1)	377	19.1	0.7 (0.6-1.0)
(Missing)	(982)			(1311)		
Workforce vs pensioners[3]						
Workforce	4398	26.2	1.0	5146	23.6	1.0
Pensioners	941	23.2	0.8 (0.7-1.0)	1259	27.9	1.3 (1.1-1.4)
(Missing)	(41)			(52)		
Age						
45-49 years	805	29.9	1.0	965	22.7	1.0
50-54 years	1560	28.2	0.9 (0.8-1.1)	1921	24.0	1.1(0.9-1.3)
55-59 years	1461	25.9	0.8 (0.7-1.0)	1686	25.2	1.1 (1.0-1.4)
60-64 years	1519	20.5	0.6 (0.5-0.7)	1842	25.0	1.1 (0.9-1.4)
(Missing)	(35)			(43)		
Country of origin						
Sweden	4626	24.9	1.0	5635	23.7	1.0
Other	717	30.4	1.3 (1.1-1.6)	776	30.2	1.4 (1.2-1.6)
(Missing)	(37)			(46)		
Self-reported diseases [4)]						
No	4353	25.6	1.0	5112	23.4	1.0
Yes	971	26.0	1.0 (0.8-1.2)	1257	28.3	1.2 (1.1-1.4)
(Missing)	(56)			(88)		

Table 2 (continued)

	Men			Women		
	N (total)	%	Crude OR, 95% CI	N (total)	%	Crude OR, 95% CI
Social participation						
High	3838	21.1	1.0	4614	19.9	1.0
Low	1507	37.3	2.2 (2.0-2.5)	1800	36.2	2.3 (2.0-2.6)
(Missing)	(35)			(43)		
Social anchorage						
High	3867	23.3	1.0	4771	22.8	1.0
Low	1416	31.4	1.5 (1.3-1.7)	1536	28.3	1.3 (1.2-1.5)
(Missing)	(97)			(150)		
Instrumental support						
High	3435	24.8	1.0	4662	23.4	1.0
Low	1903	27.2	1.1 (1.0-1.3)	1743	27.2	1.2 (1.1-1.4)
(Missing)	(42)			(52)		
Emotional support						
High	3496	24.7	1.0	4616	23.3	1.0
Low	1828	27.2	1.1 (1.0-1.3)	1776	27.3	1.2 (1.0-1.4)
(Missing)	(56)			(65)		

[1] Employees (five groups) versus self-employed.
[2] All employed (six groups including self-employed) versus unemployed.
[3] Workforce (five emploee groups, self-employed and unemployed) versus pensioners.
[4] Self-reported previous or current diseases included myocardial infarction, stroke, claudicatio intermittens, diabetes mellitus, cancer, astma/ chronic obstructive lung disease or rheumatism.

Table 3. Crude and multivariate odds ratios (OR), 95 % confidence intervals (CI) and p-tests for trend of low leisure-time physical activity in socioeconomic (SES) groups. Men and women. The Malmö Diet and Cancer Study 1992-1994.

	Crude OR, 95% CI	**Adjusted* OR, 95% CI**	**Adjusted** OR, 95% CI**	**Adjusted*** OR, 95% CI**	**Adjusted*** * OR, 95% CI**
Men					
High level non-manual	1.0	1.0	1.0	1.0	1.0
Middle level non-manual	0.9 (0.7-1.1)	0.9 (0.7-1.1)	0.9 (0.7-1.1)	0.9 (0.7-1.1)	0.8 (0.6-1.1)
Low level non-manual	1.1 (0.9-1.5)	1.2 (0.9-1.5)	1.1 (0.9-1.5)	1.2 (0.9-1.5)	1.0 (0.8-1.4)
Skilled manual workers	1.5 (1.1-1.9)	1.5 (1.1-1.9)	1.4 (1.1-1.9)	1.4 (1.1-1.9)	1.2 (0.9-1.6)
Unskilled manual workers	1.5 (1.1-1.9)	1.5 (1.1-1.9)	1.4 (1.1-1.9)	1.4 (1.1-1.9)	1.1 (0.8-1.5)
P-test for trend	p<0.001	p<0.001	p<0.001	p<0.001	P=0.019
Women					
High level non-manual	1.0	1.0	1.0	1.0	1.0
Middle level non-manual	0.8 (0.6-1.1)	0.8 (0.6-1.1)	0.8 (0.6-1.1)	0.8 (0.6-1.1)	0.8 (0.6-1.1)
Low level non-manual	1.2 (0.9-1.5)	1.2 (0.9-1.5)	1.2 (0.9-1.5)	1.2 (0.9-1.6)	1.1 (0.8-1.4)
Skilled manual workers	1.2 (0.8-1.7)	1.2 (0.8-1.7)	1.1 (0.8-1.6)	1.1 (0.8-1.6)	1.0 (0.7-1.4)
Unskilled manual workers	1.6 (1.2-2.1)	1.6 (1.2-2.1)	1.5 (1.1-2.0)	1.6 (1.2-2.1)	1.2 (0.9-1.6)
P-test for trend	P<0.001	P<0.001	P<0.001	P<0.001	P=0.037

* Adjustment made for age.
** Adjustment made for age and country of origin.
*** Adjustment made for age, country of origin and previous/ current diseases.
**** Adjustment made for age, country of origin, previous/ current diseases and social participation.

Table 4. Logistic regression analysis of association between social participation and the odds ratio of low leisure-time physical activity presented as crude odds ratio (OR), adjusted OR and confidence intervals (95 % CI). The Malmö Diet and Cancer Study 1992-1994.

	Crude OR	Model I	Model II	Model III	Model IV
Men					
Social participation[1]	2.2 (2.0-2.5)	2.4 (2.1-2.7)	2.3 (2.0-2.7)	2.3 (2.1-2.7)	2.2 (1.9-2.7)
Age[2]		0.8 (0.8-0.9)	0.8 (0.8-0.9)	0.8 (0.8-0.9)	0.9 (0.8-1.0)
Country of origin[3]			1.1 (0.9-1.3)	1.1 (0.9-1.3)	1.0 (0.8-1.3)
Self-reported diseases[4]				1.0 (0.8-1.2)	1.0 (0.8-1.2)
Socioeconomic status[5]					1.1 (1.0-1.1)
Women					
Social participation[1]	2.3 (2.0-2.6)	2.3 (2.0-2.6)	2.3 (2.0-2.5)	2.2 (2.0-2.5)	2.2 (1.8-2.5)
Age[2]		1.0 (0.9-1.0)	1.0 (0.9-1.0)	1.0 (0.9-1.0)	1.1 (1.0-1.1)
Country of origin[3]			1.2 (1.0-1.5)	1.2 (1.0-1.4)	1.1 (0.9-1.4)
Self-reported diseases[4]				1.1 (1.0-1.3)	1.1 (0.9-1.4)
Socioeconomic status[5]					1.1 (1.0-1.2)

1) Low vs high
2) Per 5-year interval
3) Born in other country than sweden vs Born in Sweden
4) Disease vs No disease
5) Five socioeconomic employee groups

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Socioeconomic differences in the consumption of vegetables, fruit and fruit juices: The influence of psychosocial factors

IV

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Abstract

Background: The aim was to investigate whether social network and social support factors can explain socioeconomic differences in the risk of consuming low amounts of vegetables, fruit and fruit juices.

Methods: The Malmö Diet and Cancer Study is a prospective cohort study. The present cross-sectional study examined data from a subpopulation of 11,837 individuals that completed baseline examinations in 1992–1994. Dietary habits were assessed using a modified diet history method, and socioeconomic and social network factors were measured with a structured questionnaire. Low consumption was defined as the lowest consumption quartile for vegetables and fruit, while fruit juice consumption was dichotomised to separate users from non-users.

Results: Socioeconomic differences were most pronounced regarding the consumption of vegetables and fruit juices. For both sexes, unskilled manual workers had a twice as high risk of low vegetable and fruit juice consumption as higher non-manual employees. No socioeconomic differences in fruit consumption were observed for men, and only moderate differences for women with a higher consumption in higher socioeconomic groups. When the psychosocial variables were introduced in the multivariate model, social participation moderately reduced the socioeconomic differences in vegetable consumption, and the female socioeconomic differences in fruit consumption, but had no effect on the socioeconomic differences in fruit juice consumption. The other psychosocial variables had no effect on the socioeconomic differences.

Conclusion: Considerable socioeconomic differences in vegetable, fruit and fruit juice consumption were observed. Social participation seemed to be a strong determinant for these food choices. However, this effect was largely independent of the socioeconomic differences.

Key words: Vegetables, fruit, fruit juices, socioeconomic differences, social network, social support, social participation, social capital

Introduction

People with higher socioeconomic status often report higher consumption of vegetables and fruit than people with lower socioeconomic status.[1-5]

There are indications that dietary antioxidants,[6-9] fibre[10,11] and other components of vegetables and fruit play a role in the prevention of cardiovascular diseases and cancer.[12-14] Socioeconomic differences in the dietary intake of antioxidants such as vitamin C and ß-carotene have been partly proposed to explain socioeconomic differences in cardiovascular diseases.[15]

A large proportion of both Americans and Swedes fall short of the recommended intake of vegetables and fruit.[16,17] Thus, there seems to be a need for identifying barriers to vegetable and fruit consumption and for developing strategies for overcoming those barriers.[16] Social norms and eating habits at home may, for example, contribute to an individual's consumption pattern.[18] Work site interventions with the aim of increasing vegetable and fruit consumption that also include family educational components have been more successful compared to isolated work site interventions.[19] The influence of both family and structural conditions on food consumption has also been demonstrated to be an important predictor of food consumption.[20,21] It thus seems plausible that psychosocial factors may be of importance in the consumption of vegetables and fruit.

The aim of this paper was to investigate whether socioeconomic differences in the consumption of vegetables, fruit and fruit juices can be explained by psychosocial factors derived from a psychosocial stress theory.[22,23] The basis of this theory is the relationship between the demands of daily life and the disposable resources of the individual for handling these demands. Demands represent all types of phenomena that can be potential stressors. Psychosocial resources are those of the individual and their social network.[24] Our hypothesis is that psychosocial resources at least partly explain the socioeconomic differences in the consumption of vegetables, fruit and fruit juices.

Material and methods

Study population

The Malmö Diet and Cancer Study (MDCS) was a prospective cohort study in Malmö (250,000 inhabitants), Sweden. Recruitment to the MDCS started in 1991 and the last participants were examined in 1996. The total participation rate in the MDCS was 38.9%.

The present study consisted of persons born in 1926–1945 who joined the MDCS during the 2 year period from the spring of 1992 until the summer of 1994.

The study sample (n = 11,837) represented one quarter of the whole population aged 45–64 years in Malmö. Persons aged 65+ (n = 2168) were excluded. The recruitment period of the selected subsample was determined by the fact that the psychosocial variables were not included in the first version of the questionnaire used in 1991–1992 and diet habits were assessed with a different version of the diet history method from September 1994.

The dominant recruitment method was letters of invitation to individuals chosen at random from the source population. However, a fraction of the respondents joined the study spontaneously due to recruitment campaigns through the media. In this study, this group represented 25.2% of the population.[25]

The baseline health questionnaire, menu book and food questionnaire were completed at home and controlled during the diet history interview by the diet assistants at the second visit to the MDCS project office a few weeks later.

Diet assessment

Food habits were assessed through a modified diet history method which was specifically designed for the MDCS.[26-28] It consisted of two parts: a 7 day menu book for lunch and dinner meals, cold beverages (including alcoholic beverages), drugs, natural remedies and dietary supplements and a 168 item questionnaire for frequency information on regularly consumed foods including hot beverages, cakes, sandwiches, edible fats, breakfast cereals, yoghurt, milk, fruits, candies and snacks during the previous year. The usual portion sizes in the questionnaire were estimated at home by the participant using a booklet with 48 black and white photographs. Portion sizes of dishes in the menu book were estimated during the dietary interview from a more extensive book of photographs.

The choice of methodology was guided by the need for assessing the total diet in a middle-aged and elderly urban population. The eating habits of this group were expected to be fairly regular and commonly included cooked sit-down meals. The menu book (and the book of photographs) was chosen to facilitate the assessment of frequency and portion sizes from cooked mixed dishes. The questionnaire (i.e. including some open-ended questions and portion sizes estimated with a booklet of photos) was also considered more suitable for middle-aged and elderly study subjects.

Energy and nutrient intake values were derived and computed from the food intake statements of the dietary assessment method and the food and nutrient reference values of the PC Kost2 `93 of the Swedish National Food Administration.[29] The method measures the entire diet, including cooking methods. It overestimates the absolute value for energy intake by 18% when compared with the reference method, i.e. 18 days of weighed food records.[28] The correlations with the reference method were of the order of 0.5–0.6 for most of the nutrients. Compared to other usual diet methods this indicates good concordance between the

diet history method and food records. The relative validity thus ranks with the best obtained in previous studies.[30,31]

Definitions

A low intake of vegetables and fruit was defined as being below the lowest quartile of intake measured in grams. The selected cut-off for fruit juices was whether the respondents had consumed fruit juices at all.

For *country of origin*, all persons born in countries other than Sweden were merged into a single category.

Reported intakes could be influenced by the season the individuals completed the baseline examinations. *Seasonal variability* was defined by the month when the individual completed the questionnaire.

Socioeconomic status was based on data about profession, working tasks and position, obtained in the questionnaire.[32] The socioeconomic status groups comprised non-manual employees in leading positions and employees with university degrees, non-manual employees on medium and low levels, skilled manual workers and unskilled manual workers.

The *self-employed* persons group was very heterogenous, including both academically trained physicians, etc. and, on the other hand, small shop keepers, etc.

The *unemployed* were analysed as a separate group composed of persons outside the active workforce, but still available as a potential part of the workforce.

The *pensioners* below age 65 years were analysed as a separate category completely outside the workforce. This group consisted largely of people that had received disability pensions.

The social network was operationalised in two dimensions.

(i) *Social participation* (13 items) described participation in the activities of formal and informal groups in society (study circle/course at work-place, other study circle/course, union meeting, meeting of other organisations, theatre/cinema, arts exhibition, church, sports event, letter to editor of a newspaper/journal, demonstration, night club/entertainment, big gathering of relatives and private party). If three alternatives or less were indicated, social participation was classified as low.

(ii) *Social anchorage* (five items) descibed belonging to formal and informal groups and the feeling of membership in these groups (familiarity with neighbourhood, sense of belonging to friends and relatives, membership in organisations or clubs and feelings of importance to other people). If three or more items denoted low social anchorage, the whole index variable was regarded as low.

Two dimensions of social support were measured.

(i) *Instrumental support* (one item) reflected the individual´s access to advice, information, practical sevices and material resources from other persons. This item

was measured by a four-alternative question: ´Yes, I am absolutely sure to get such support`, ´Yes, possibly`, ´Not certain` and ´No`. The three latter alternatives were classified as low instrumental support.

(ii) *Emotional support* (three items) reflected the opportunity for care, encouragement of personal value and feelings of confidence and trust. Each item had the same four alternatives as instrumental support. If two or three items were low, emotional support was considered low.

The reliability and validity of the psychosocial index variables was assessed in a previous paper that found good or acceptable reproducibility for all the variables.[33]

Statistical methods

Crude odds ratios (ORs) and 95% confidence intervals (CIs) were calculated in order to examine the risk of being a low consumer of vegetables, fruit and fruit juices in relation to age, country of origin, socioeconomic status and social network/social support. Multivariate logistic regression analysis was performed in order to investigate the importance of potential confounders for socioeconomic differences in vegetable, fruit and fruit juices intakes separately. Socioeconomic status gradients were calculated as tests for trends for the socioeconomic groups. The effects of the covariates were explored by logistic regression analysis concerning the association between psychosocial variables and the OR of low vegetable, fruit and fruit juice consumption. The SPSS computer package was used in the statistical analyses.[34]

Results

The lower quartile limit (25%) of vegetable consumption was 109.67 g/day for men and 121.84 g/ day for women. The lower quartile limit of fruit consumption was 65.69 g/ day for men, and 97.88 g/ day for women. Fruit juices were consumed by 44.7% of the men and 54.7% of the women.

Table 1 shows that the proportion born in countries other than Sweden was 13.5% among men and 12.2% among women. More men were higher non-manual employees, skilled manual workers and self-employed.

Table 2 shows that the proportion with a low consumption of vegetables and no consumption of fruit juices increased with age, while the proportion with a low consumption of fruit decreased with increasing age. The group born in countries other than Sweden had a much lower proportion of individuals with a low consumption of vegetables and fruit, while the consumption of fruit juices did not differ compared to the group born in Sweden. There were clear socioeconomic differences in vegetable consumption among both men and women. Male unskilled manual workers had an OR of 1.5 and female unskilled manual workers an OR of

2.2 for low vegetable consumption compared to the higher non-manual employee reference group. The socioeconomic differences in fruit consumption were much smaller for both sexes, and the socioeconomic status differences were non-significant among men, while unskilled female manual workers had an OR of 1.4 for low fruit consumption compared to the higher non-manual employee reference group. Socioeconomic differences in the consumption of fruit juices were observed for both sexes. Unskilled manual workers had an OR of 2.0 among men and 1.6 among women for low consumption of fruit juices. Social participation was the only psychosocial variable that was strongly associated with consumption of the food items in this study. Men with low social participation had an OR of 1.8 and women an OR of 2.1 for low vegetable consumption. Individuals with low social participation had an OR of 1.3 among men and 1.7 among women of low fruit consumption. An OR of 1.5 among men and an OR 1.4 for no consumption of fruit juices was observed among individuals with low social participation. The consumption of the self-employed, unemployed and pensioners only slightly diverged from their reference groups.

Table 3 shows that, when age, country of origin, total energy intake and seasonal variability were included in the multivariate logistic regression model for men and women respectively, the socioeconomic differences were slightly increased in the case of vegetable consumption, mostly due to the introduction of country of origin. The introduction of social participation in the models moderately reduced the socioeconomic differences in the ORs for a low consumption of, in particular, vegetables for both sexes. The ORs for men decreased from 1.6 to 1.4 among skilled manual workers and from 1.8 to 1.5 among unskilled manual workers. The ORs for women decreased from 1.7 to 1.5 among lower non-manual employees, from 2.2 to 2.0 among skilled manual workers and from 2.3 to 1.9 among unskilled manual workers. The changes in the ORs concerning fruit consumption and consumption of fruit juices after the introduction of social participation in the multivariate model were much smaller. The introduction of the other three psychosocial variables into the model had no effect on the ORs.

The socioeconomic status gradients in vegetable consumption remained significant for both sexes throughout the multivariate analyses. The socioeconomic status gradient in fruit intake remained non-significant for men, but changed for women from $p < 0.001$ to $p = 0.17$. The socioeconomic status gradient in the consumption of fruit juices remained significant.

Since social participation was introduced with a decreasing effect on the ORs for low vegetable consumption in the final step in the multivariate analyses, it seemed important to analyse how much of the association between this variable and low vegetable consumption could be ascribed to the other variables in the model. Table 4 shows that only country of origin had a significant effect.

Discussion

Socioeconomic differences were most pronounced regarding the consumption of vegetables and fruit juices. For both sexes, unskilled manual workers had twice as high a risk of low vegetable and fruit juice consumption as higher non-manual employees. No socioeconomic differences in fruit consumption were observed for men, and only moderate differences for women with a higher consumption in higher socioeconomic groups. When the psychosocial variables were introduced into the multivariate model, social participation moderately reduced the socioeconomic differences in vegetable consumption and the female socioeconomic differences in fruit consumption, but had no effect on the socioeconomic differences in fruit juice consumption. The other psychosocial variables had no effect on the socioeconomic differences. The effect of social participation on vegetable consumption seemed to be partly independent of socioeconomic status.

The group born abroad seemed to be under-represented, mostly due to the fact that approximately 2,000 individuals of foreign origin were excluded from the whole study population (inteviewed 1991–1996) due to limited Swedish language skills. There was also a non-significant under-representation of individuals in the low socioeconomic status groups among participants.[35] If individuals with low social participation also have a tendency for non-participation, this could lead to a situation where individuals with low consumption of vegetables and low social participation (i.e. ´exposed cases`) are over-represented among non-participants. However, this would lead to an underestimation of the true association between low vegetable consumption and social participation. The associations demonstrated were consequently probably smaller than the true associations.

A separate analysis excluding the participants without invitation showed that this group was similar to the invited participants in their consumption of the foods investigated.

The risk of misclassification of vegetable, fruit and fruit juice consumption is related to the concern that self-reported energy intakes are often too low for habitual energy requirements. A difference in the measurement of dietary intakes between the socioeconomic groups might produce a differential misclassification that would not be compensated for by increasing the sample size. Differences in literacy skills, the ability to estimate portion sizes and frequencies and social desirability expectations between the socioeconomic groups might contribute to this source of misclassification. However, another study on fat intake concluded that there were no socioeconomic differences in low energy reporting in this population.[36] Non-differential misclassification is a problem of principal interest in nutrition epidemiology, mainly because it causes attenuated relations. The results of this study showed important socioeconomic differences in the consumption of vegetables and fruit juices. The risk of misclassification was also been taken into consideration by examining the effect of adjustment for total energy intake. This

had no impact on the socioeconomic differences in the consumption of vegetables, fruit and fruit juices. The reproducibility and validity of the method used in this study was among the best obtained.[30,31]

Confounding due to age, country of origin, total energy intake and seasonal variability was adjusted for by including these variables in the multivariate analyses.

The international recommendations concerning the consumption of vegetables, fruit and fruit juices state that the sum of vegetable, fruit and fruit juice intakes should amount to 400–800 g/ day.[37] In this study, vegetables, fruit and fruit juices were analysed separately. The rationale for this separation is that the choice of the three food groups may be influenced by separate and specific psychosocial factors. The aggregated consumptions were 226.3 g/ day for men and 281.8 g/ day for women at the lowest quartile limit, 333.6 g/ day for men and 389.1 g/ day for women at the median limit and 469.0 g/ day for men and 523.0 g/ day for women at the highest quartile limit, which were close to the results of other Swedish studies.[17]

This study confirmed the findings of other investigations which have shown lower intakes of vegetables and fruit in lower socioeconomic groups.[1-4] In this study, low social participation explained some of the socioeconomic differences in the consumption of vegetables. The effects of socioeconomic status and social participation were largely independent of each other. The socioeconomic differences in fruit consumption were smaller and the influence of social participation on the socioeconomic differences weaker. Social participation measure the individual´s participation in several social activities in society. Health-related behaviours are a result of the interaction between a person and their environment. Environmental changes require both individual resources and social relations. A high level of social participation seems to constitute a resource that makes it easier to choose a healthy lifestyle. The effect of social participation on patterns of food consumption may be mediated by social norms provided by the social network. The process of learning about dietary recommendations and adapting to them becomes more difficult when the individual has low social participation.

The definition of social participation in this study is in accordance with Putnam´s definition of social participation which forms a part of the definition of social capital.[38] The findings consequently suggest the importance of this aspect of social capital in the link between socioeconomic status and dietary intake of vegetables and, to some extent, fruit. This could support the suggestion that measures to improve social capital are important in public health.[39] Intervention studies concerning wor ksite intervention.[19] and combined work site-family interventions[40] have suggested possible pathways for influencing dietary behaviour. The positive results of these contextual/structural interventions may either be mediated by improved access to vegetables, fruit and fruit juices in public dining rooms, by access to norms concerning food consumption or by access to better psychosocial resources.

A considerable socioeconomic gradient was found for intake of vegetables and fruit juices, which seemed only moderately dependent on social participation. Social participation was a strong determinant per se of the level of intake. Since the other psychosocial factors investigated were much weaker determinants, the stress-coping hypothesis was not convincingly supported.

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Table 1 Distribution (number and percentage) of the demographic, socioeconomic and social network/social support variables in the Malmö Diet and Cancer Study 1992–1994

	Men		Women		Total	
	N	%	N	%	N	%
Age						
45–49 years	808	15.0	976	15.1	1,784	15.1
50–54 years	1,574	29.3	1,928	29.6	3,502	29.6
55–59 years	1,468	27.3	1,699	26.8	3,167	26.8
60–64 years	1,530	28.4	1,854	28.6	3,384	28.6
Missing	0		0		0	
Country of origin						
Born in Sweden	4,653	86.5	5,667	87.8	10,320	87.2
Born abroad	725	13.5	787	12.2	1,512	12.8
Missing	2		3		5	
Socioeconomic status						
Higher non-manual	528	9.8	358	5.6	886	7.5
Middle non-manual	833	15.5	932	14.5	1,765	14.9
Lower non-manual	598	11.1	1,587	24.6	2,185	18.5
Skilled manual	646	12.0	312	4.8	958	8.1
Unskilled manual	604	11.2	1,258	19.5	1,862	15.8
Self-employed	794	14.8	349	5.4	1,143	9.7
Unemployed	418	7.8	383	5.9	801	6.8
Pensioners	953	17.7	1,269	19.7	2,222	18.8
Missing	6		9		15	
Social participation						
High	3,851	71.6	4,635	71.8	8,486	71.7
Low	1,529	28.4	1,822	28.2	3,351	28.3
Missing	0		0		0	
Social anchorage						
High	3,888	73.1	4,792	75.6	8,680	74.5
Low	1,428	26.9	1,549	24.4	2,977	25.5
Missing	64		116		180	
Instrumental support						
High	3,454	64.3	4,688	72.9	8,142	68.9
Low	1,918	35.7	1,755	27.1	3,673	31.1
Missing	8		14		22	
Emotional support						
High	3,517	65.7	4,638	72.1	8,155	69.2
Low	1,839	34.3	1,792	27.9	3,631	30.8
Missing	24		27		51	
Total	5,380		6,457		11,837	

Table 2 Distribution (number and %), odds ratios (OR) and 95% confidence intervals of low consumption of vegetables, fruit and fruit juices by age, country of origin, socioeconomic status and social network/social support in the Malmö Diet and Cancer Study 1992–1994

	Men						
		Vegetables		Fruit		Fruit juices	
	N	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)
Age							
45–49 years	808	23.0	1.0	28.8	1.0	51.0	1.0
50–54 years	1,573	23.2	1.0 (0.8–1.2)	26.6	0.9 (0.7–1.1)	52.8	1.1 (0.9–1.3)
55–59 years	1,468	26.6	1.2 (1.0–1.5)	24.9	0.8 (0.7–1.0)	56.1	1.2 (1.0–1.5)
60–64 years	1,530	26.3	1.2 (1.0–1.5)	21.3	0.7 (0.5–0.8)	59.5	1.4 (1.2–1.7)
Missing	1						
Country of origin							
Born in Sweden	4,653	26.7	1.0	26.1	1.0	55.3	1.0
Born abroad	724	13.7	0.4 (0.3-0.5)	17.5	0.6 (0.5-0.7)	55.7	1.0 (0.9-1.2)
Missing	3						
Socioeconomic status							
Higher non-manual	528	18.8	1.0	24.2	1.0	45.8	1.0
Middle non-manual	833	21.7	1.2 (0.9–1.6)	21.4	0.9 (0.7–1.1)	50.7	1.2 (1.0–1.5)
Lower non-manual	598	26.8	1.6 (1.2–2.1)	25.9	1.1 (0.8–1.4)	54.8	1.4 (1.1–1.8)
Skilled manual	646	23.8	1.4 (1.0–1.8)	21.7	0.9 (0.7–1.1)	57.7	1.6 (1.3–2.0)
Unskilled manual	604	26.2	1.5 (1.2–2.0)	25.7	1.1 (0.8–1.4)	63.4	2.0 (1.6–2.6)
Missing	2,171						
Vocationally active[a]							
Employees	3,209	23.4	1.0	23.6	1.0	54.5	1.0
Self-employed	794	25.2	1.1 (0.9–1.3)	29.8	1.4 (1.2–1.6)	50.1	0.8 (0.7–1.0)
Missing	1,377						
Vocationally active and unemployed[b]							
All employed	4,003	23.8	1.0	24.8	1.0	53.6	1.0
Unemployed	418	28.9	1.3 (1.0–1.6)	30.4	1.3 (1.1–1.6)	60.0	1.3 (1.1–1.6)
Missing	959						
Workforce versus pensioners[c]							
Workforce	4,421	24.3	1.0	25.3	1.0	54.2	1.0
Pensioners	952	28.3	1.2 (1.1–1.4)	23.3	0.9 (0.8–1.1)	60.6	1.3 (1.1–1.5)
Missing	7						
Social participation							
High	3,851	21.8	1.0	23.4	1.0	52.3	1.0
Low	1,528	33.0	1.8 (1.5–2.0)	29.0	1.3 (1.2–1.5)	62.9	1.5 (1.4–1.7)
Missing	1						
Social anchorage							
High	3,888	24.0	1.0	24.2	1.0	54.4	1.0
Low	1,427	27.3	1.2 (1.0–1.4)	26.9	1.1 (1.0–1.3)	57.4	1.1 (1.0–1.3)
Missing	65						
Instrumental support							
High	3,453	23.6	1.0	24.5	1.0	55.3	1.0
Low	1,918	27.8	1.2 (1.1–1.4)	26.0	1.1 (1.0–1.2)	55.4	1.0 (0.9–1.1)
Missing	9						
Emotional support							
High	3,516	23.6	1.0	24.4	1.0	55.1	1.0
Low	1,839	27.7	1.2 (1.1–1.4)	26.2	1.1 (1.0–1.3)	55.8	1.0 (0.9–1.2)
Missing	45						
Total	5,380						

a) Employees (five groups) versus self-employed.
b) All employed (six groups) including self-employed.
c) Workforce (five employee groups, self-employed and unemployed) versus pensioners.

Table 2 (continued)

	Women						
		Vegetables		Fruit		Fruit juices	
	N	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)
Age							
45–49 years	975	21.9	1.0	29.7	1.0	42.3	1.0
50–54 years	1,927	23.8	1.1 (0.9–1.3)	26.9	0.9 (0.7–1.0)	42.4	1.0 (0.9–1.2)
55–59 years	1,698	25.1	1.2 (1.0–1.4)	24.4	0.8 (0.6–0.9)	46.9	1.2 (1.0–1.4)
60–64 years	1,854	27.7	1.4 (1.1–1.6)	21.1	0.6 (0.5–0.8)	48.5	1.3 (1.1–1.5)
Missing	3						
Country of origin							
Born in Sweden	5,666	25.5	1.0	25.5	1.0	45.1	1.0
Born abroad	785	21.3	0.8 (0.7–0.9)	21.1	0.8 (0.7–0.9)	47.1	1.1 (0.9–1.3)
Missing	6						
Socioeconomic status							
Higher non-manual	358	15.6	1.0	20.7	1.0	38.8	1.0
Middle non-manual	931	17.6	1.2 (0.8–1.6)	22.0	1.1 (0.8–1.5)	37.1	0.9 (0.7–1.2)
Lower non-manual	1,586	24.0	1.7 (1.3–2.3)	25.3	1.3 (1.0–1.7)	42.4	1.2 (0.9–1.5)
Skilled manual	312	28.5	2.2 (1.5–3.3)	21.5	1.0 (0.7–1.5)	41.7	1.1 (0.8–1.5)
Unskilled manual	1,258	29.3	2.2 (1.6–3.1)	27.1	1.4 (1.1–1.9)	49.7	1.6 (1.2–2.0)
Vocationally active[a]							
Employees	4,445	23.8	1.0	24.5	1.0	43.0	1.0
Self-employed	349	24.6	1.0 (0.8–1.4)	30.7	1.4 (1.1–1.7)	44.7	1.1 (0.9–1.3)
Missing	1,663						
Vocationally active and unemployed[b]							
All employed	4,794	23.9	1.0	24.9	1.0	43.1	1.0
Unemployed	383	26.1	1.1 (0.9–1.4)	24.5	1.0 (0.8–1.2)	51.7	1.4 (1.1–1.7)
Missing	1,280						
Workforce versus pensioners[c]							
Workforce	5,177	24.0	1.0	24.9	1.0	43.8	1.0
Pensioners	1,268	28.9	1.3 (1.1–1.5)	25.4	1.0 (0.9–1.2)	51.7	1.4 (1.2–1.6)
Missing	12						
Social participation							
High	4,633	20.9	1.0	22.0	1.0	42.8	1.0
Low	1,821	35.3	2.1 (1.8–2.3)	32.6	1.7 (1.5–1.9)	51.8	1.4 (1.3–1.6)
Missing	3						
Social anchorage							
High	4,790	23.6	1.0	23.6	1.0	44.4	1.0
Low	1,548	28.6	1.3 (1.1–1.5)	28.6	1.3 (1.1–1.5)	48.1	1.2 (1.0–1.3)
Missing	119						
Instrumental support							
High	4,686	23.3	1.0	24.2	1.0	44.6	1.0
Low	1,754	29.6	1.4 (1.2–1.6)	27.1	1.2 (1.0–1.3)	47.3	1.1 (1.0–1.2)
Missing	17						
Emotional support							
High	4,635	23.6	1.0	24.2	1.0	44.9	1.0
Low	1,792	28.5	1.3 (1.1–1.5)	27.3	1.2 (1.0–1.3)	46.7	1.1 (1.0–1.2)
Missing	30						
Total	6,457						

a) Employees (five groups) versus self-employed.
b) All employed (six groups) including self-employed.
c) Workforce (five employee groups, self-employed and unemployed) versus pensioners.

Table 3. ORs and 95% CI and p-tests for trend of low vegetable, fruit and fruit juices consumption by socioeconomic status in the Malmö Diet and Cancer Study 1992–1994

	Men				
	Adjusted OR (95% CI)[a]	Adjusted OR (95% CI)[b]	Adjusted OR (95% CI)[c]	Adjusted OR (95% CI)[d]	Adjusted OR (95% CI)[e]
Vegetables					
Higher non-manual	1.0	1.0	1.0	1.0	1.0
Middle non-manual	1.2 (0.9–1.6)	1.3 (0.95–1.6)	1.3 (0.95–1.7)	1.3 (0.95–1.7)	1.2 (0.9–1.6)
Lower non-manual	1.6 (1.2–2.1)	1.6 (1.2–2.1)	1.6 (1.2–2.1)	1.6 (1.2–2.1)	1.5 (1.1–2.0)
Skilled manual	1.4 (1.01–1.8)	1.5 (1.1–2.0)	1.6 (1.2–2.1)	1.6 (1.2–2.1)	1.4 (1.03–1.8)
Unskilled manual	1.5 (1.2–2.0)	1.7 (1.3–2.2)	1.8 (1.3–2.4)	1.8 (1.3–2.4)	1.5 (1.1–2.0)
Test for trend	*p = 0.003*	*p < 0.001*	*p < 0.001*	*p < 0.001*	*p = 0.014*
Fruit					
Higher non-manual	1.0	1.0	1.0	1.0	1.0
Middle non-manual	0.8 (0.6–1.1)	0.9 (0.7–1.1)	0.9 (0.7–1.1)	0.9 (0.7–1.1)	0.8 (0.6–1.1)
Lower non-manual	1.1 (0.8–1.5)	1.1 (0.9–1.5)	1.1 (0.9–1.5)	1.1 (0.9–1.5)	1.1 (0.8–1.4)
Skilled manual	0.9 (0.7–1.1)	0.9 (0.7–1.2)	1.0 (0.7–1.3)	1.0 (0.7–1.3)	0.9 (0.7–1.2)
Unskilled manual	1.1 (0.8–1.4)	1.1 (0.9–1.5)	1.2 (0.9–1.5)	1.2 (0.9–1.5)	1.0 (0.8–1.4)
Test for trend	*p = 0.44*	*p = 0.26*	*p = 0.15*	*p = 0.15*	*p = 0.48*
Fruit juices					
Higher non-manual	1.0	1.0	1.0	1.0	1.0
Middle non-manual	1.2 (0.99–1.5)	1.2 (0.99–1.5)	1.2 (0.99–1.5)	1.2 (0.99–1.5)	1.2 (0.98–1.5)
Lower non-manual	1.4 (1.1–1.8)	1.4 (1.1–1.8)	1.4 (1.1–1.8)	1.4 (1.1–1.8)	1.4 (1.1–1.7)
Skilled manual	1.6 (1.3–2.0)	1.6 (1.3–2.0)	1.7 (1.3–2.1)	1.7 (1.3–2.1)	1.6 (1.2–2.0)
Unskilled manual	2.1 (1.6–2.6)	2.1 (1.6–2.6)	2.1 (1.7–2.7)	2.1 (1.7–2.7)	2.0 (1.5–2.5)
Test for trend	*p < 0.001*	*p < 0.001*	*p < 0.001*	*p < 0.001*	*p < 0.001*

a) Adjusted for age.
b) Adjusted for age and country of origin.
c) Adjusted for age, country of origin and total energy intake.
d) Adjusted for age, country of origin, total energy intake and seasonal variability.
e) Adjusted for age, country of origin, total energy intake, seasonal variability and social participation.

Table 3 (continued)

	Women				
	Adjusted OR (95% CI)[a]	Adjusted OR (95% CI)[b]	Adjusted OR (95% CI)[c]	Adjusted OR (95% CI)[d]	Adjusted OR (95% CI)[e]
Vegetables					
Higher non-manual	1.0	1.0	1.0	1.0	1.0
Middle non-manual	1.1 (0.8–1.6)	1.2 (0.8–1.6)	1.2 (0.8–1.6)	1.2 (0.8–1.6)	1.2 (0.8–1.6)
Lower non-manual	1.7 (1.2–2.3)	1.7 (1.2–2.3)	1.7 (1.2–2.3)	1.7 (1.2–2.3)	1.5 (1.1–2.1)
Skilled manual	2.1 (1.5–3.1)	2.2 (1.5–3.2)	2.2 (1.5–3.2)	2.2 (1.5–3.2)	2.0 (1.3–2.9)
Unskilled manual	2.2 (1.6–3.0)	2.3 (1.7–3.1)	2.3 (1.7–3.1)	2.3 (1.7–3.1)	1.9 (1.4–2.6)
Test for trend	*p < 0.001*	*p < 0.001*	*p < 0.001*	*p < 0.001*	*p < 0.001*
Fruit					
Higher non-manual	1.0	1.0	1.0	1.0	1.0
Middle non-manual	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.1 (0.8–1.5)
Lower non-manual	1.3 (1.01–1.8)	1.3 (1.01–1.8)	1.3 (1.01–1.8)	1.3 (1.01–1.8)	1.2 (0.9–1.7)
Skilled manual	1.1 (0.7–1.6)	1.1 (0.8–1.6)	1.1 (0.7–1.6)	1.1 (0.7–1.6)	1.0 (0.7–1.4)
Unskilled manual	1.5 (1.1–2.0)	1.5 (1.2–2.0)	1.5 (1.2–2.1)	1.5 (1.2–2.1)	1.3 (0.97–1.7)
Test for trend	*p = 0.001*	*p < 0.001*	*p < 0.001*	*p < 0.001*	*p = 0.17*
Fruit juices					
Higher non-manual	1.0	1.0	1.0	1.0	1.0
Middle non-manual	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)	0.9 (0.7–1.2)
Lower non-manual	1.1 (0.9–1.5)	1.1 (0.9–1.5)	1.1 (0.9–1.5)	1.1 (0.9–1.5)	1.1 (0.9–1.4)
Skilled manual	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.1 (0.8–1.5)	1.1 (0.8–1.5)
Unskilled manual	1.5 (1.2–2.0)	1.5 (1.2–2.0)	1.5 (1.2–2.0)	1.5 (1.2–2.0)	1.5 (1.1–1.9)
Test for trend	*p < 0.001*	*p < 0.001*	*p < 0.001*	*p < 0.001*	*p < 0.001*

a) Adjusted for age.
b) Adjusted for age and country of origin.
c) Adjusted for age, country of origin and total energy intake.
d) Adjusted for age, country of origin, total energy intake and seasonal variability.
e) Adjusted for age, country of origin, total energy intake, seasonal variability and social participation.

Table 4 Logistic regression analysis of association between social participation and the OR of low vegetable consumption presented as crude OR adjusted ORs and 95 % CI in the Malmö Diet and Cancer Study 1992-1994

	Crude OR	Model I	Model II	Model III	Model IV	Model V
Men						
Social participation[a]	1.8 (1.5–2.0)	1.7 (1.5–2.0)	1.9 (1.7–2.2)	1.9 (1.6–2.2)	1.9 (1.5–2.2)	1.8 (1.5–2.2)
Age[b]	–	1.0 (1.0–1.1)	1.0 (1.0–1.1)	1.0 (0.9–1.1)	1.0 (0.9–1.1)	1.0 (0.9–1.1)
Country of origin[c]	–	–	0.4 (0.3–0.5)	0.4 (0.3–0.5)	0.4 (0.3–0.5)	0.4 (0.3–0.5)
Total energy intake[d]	–	–	–	1.0 (1.0–1.0)	1.0 (1.0–1.0)	1.0 (1.0–1.0)
Seasonal variability[e]	–	–	–	–	1.0 81.0–1.0)	1.0 (1.0–1.0)
Socioeconomic status[f]	–	–	–	–	–	1.1 (1.0–1.2)
Women						
Social participation[a]	2.1 (1.8–2.3)	2.1 (1.9–2.4)	2.1 (1.8–2.4)	2.0 (1.8–2.3)	2.0 (1.8–2.3)	1.9 (1.6–2.3)
Age[b]	–	1.1 (1.0–1.1)	1.1 (1.0–1.1)	1.0 (1.0–1.1)	1.0 (1.0–1.1)	1.0 (1.0–1.1)
Country of origin[c]	–	–	0.7 (0.6–0.8)	0.7 (0.6–0.8)	0.7 (0.6–0.8)	0.7 (0.5–0.9)
Total energy intake[d]	–	–	–	1.0 (1.0–1.0)	1.0 (1.0–1.0)	1.0 (1.0–1.0)
Seasonal variability[e]	–	–	–	–	1.0 (1.0–1.0)	1.0 (1.0–1.0)
Socioeconomic status[f]	–	–	–	–	–	1.2 (1.1–1.2)

a) Low versus high.
b) Per 5 year interval.
c) Born in country other than Sweden versus born in Sweden.
d) Continuous.
e) The 12 months of the year.
f) Five socioeconomic employee groups.

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Intermittent and daily smokers: Two different socioeconomic patterns, and diverging influence of social participation

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Abstract

Objective: To investigate socioeconomic differences in intermittent and daily smoking, and to assess the association between social participation and these two smoking behaviours.

Design/Setting/Participants/Measurements: A population of 11,837 individuals interviewed in 1992-1994, aged 45-64 years was investigated in this cross-sectional study. A multivariate logistic regression model was used to assess socioeconomic differences in daily and intermittent smoking, adjusting for age, country of origin, previous/current diseases and marital status. Finally, social participation as a measure of social capital was introduced in the multivariate model.

Findings: When unskilled manual workers were compared to high level non-manual employees, an odds ratio of 2.3 (1.7-3.0; 95% CI) was found for men and 1.9 (1.4-2.5; 95% CI) for women regarding daily smoking, but only 0.7 (0.4-1.2; 95%CI) for men and 1.3 (0.7-2.4; 95%CI) for women regarding intermittent smoking. A decrease in the daily smoking odds ratios was found when social participation was introduced in the model, while the odds ratios regarding intermittent smoking were unaffected.

Conclusions: There were no socioeconomic differences in intermittent smoking and no association with social participation, a result that sharply contrasts the patterns of daily smoking. These findings have important implications for the discussion concerning social capital and preventive measures.

Key words: Intermittent smoking, daily smoking, socioeconomic status, social participation, social capital.

Introduction

Recent large-scale surveys have called attention to the fact that a substantial fraction of all smokers nowadays are intermittent, non-daily smokers (1,2,3). The proportion of intermittent smokers may even be rising (1,4). The scientific literature on intermittent smokers is scarce, but the intermittent smokers seem to be younger, and to have a higher educational and occupational status than daily smokers (1,4). These sociodemographic differences between intermittent and daily smokers give reason to believe that there may be different causal mechanisms behind these two phenomena. The sociodemographic pattern for intermittent smokers thus sharply contrasts the general sociodemographic smoking pattern in Europe and the USA. In the 1950s there were no socioeconomic differences in smoking, and women smoked to a much lesser extent than men (5). In the 1980s and 1990s, the decrease in smoking prevalence has also involved a change in this pattern in most Western countries. Smoking is now associated with low socioeconomic status, and women are in many countries smokers to the same extent as men (6,7,8,9).

There is a strong biological mechanism that explains nicotine dependence (10,11,12,13). However, no biological model can account for the presence of socioeconomic differences in smoking. Psychological factors at the individual level have been shown to predict the inclination to initiate smoking cessation (14,15). These individual characteristics are most likely affected by factors in the psychosocial environment. One study has suggested that psychosocial factors may protect very light smokers against nicotine dependence and higher tobacco consumption (16). Participation in social and civic life is a central factor to the understanding of empowerment. Israel et. al. have defined empowerment, in its most general sense, as the ability of people to gain understanding and control over personal, social, economic and political forces in order to take action to improve their own life situations. In contrast to reactive approaches that derive from a treatment or illness mode, the concept of empowerment is positive and proactive (17). Civic and social participation enable individuals and groups of individuals to assume responsibility and control concerning their own lifes (18). Social participation has in several studies been shown to be associated with smoking (19,20). Social participation is one aspect of Robert D Putnam´s social capital concept. Social capital concerns both the real and perceived possibilities for the citizens to participate, feel trust, have equal opportunities and cooperate in society (21,22,23). Low levels of social capital indicate low perceived and real possibilities to influence one´s own life situation, e.g. the smoking status and the general health status of the individual. Social capital has in the literature been defined and operationalised as social participation and social trust (24). The aspect of social capital investigated in this study is social participation. However, no investigation on social participation or social capital including intermittent smoking or the

differentiation of social determinants between daily and intermittent smoking has previously been conducted to our knowledge.

The aim of this paper is to characterise and compare daily and intermittent (non-daily) smokers to non-smokers according to sociodemographic characteristics. The aim is also to investigate whether socioeconomic differences in smoking can be observed for both regular and intermittent smokers, and whether the socioeconomic patterns observed for daily and intermittent smokers are associated with social participation as a measure of social capital.

Material and methods

Study population

The Malmö Diet and Cancer Study (MDCS) is a prospective cohort study in Malmö, the third largest city of Sweden with approximately 250,000 inhabitants. Recruitment to the MDCS started in the spring of 1991 and the last participants were examined in the autumn of 1996. The MDCS source population consists of all men and women living in Malmö born between 1926 and 1945 (n=53,000), and was in 1995-1996 extended to some older and younger age brackets. The total participation rate in the MDCS was 38.9%.

The social participation variable was not included in the first version of the questionnaire used in 1991-1992, and a third version of the questionnaire was used in 1994-1996. The present study population consists of every person who participated in the MDCS during the two year period from March 1992 until August 1994, and were aged below 65 (N= 11,837). This represents a fourth of the whole population aged 45-64 in Malmö.

Subjects were recruited by postal invitation at random. Some respondents (25.2%) came to the examination spontaneously (25). The baseline questionnaire was completed at home and checked for missing answers by the diet assistants at the second visit to the MDCS project office a few weeks later.

Definitions

There were four alternative answers possible to the question "Do you smoke?": "Yes, I smoke daily" (*daily smoker*), "Yes, I smoke sometimes (not daily)" (*intermittent smoker*), "No, I have stopped smoking" and "No, I have never smoked". *Non-smoker* status was defined as having stopped smoking or having never smoked (alternatives 3 and 4).

Classification of *socioeconomic status* (SES) was based on data about job title, working tasks and position obtained in the questionnaire. The procedure was identical to the one used in the Swedish population census (26). The employee groups include skilled and unskilled manual workers, non-manual employees in low

and medium position, and high level non-manual employees in leading positions or with university degree.

The group *self-employed* persons is very heterogenous, including both academically trained physicians, dentists, big company employers and, on the other hand, small shop-keepers, self-employed carpenters etc.

The *unemployed* were analysed as a separate group of individuals, composed of persons who are outside the active workforce but still available as a potential part of the workforce, thus excluding self-retired individuals.

The *pensioners* were analysed as a separate category that is completely outside the workforce. The group pensioners below age 65 consists largely of people that have received disability pensions.

Country of origin. All persons born in other countries than Sweden were merged into a single category. Thus, the two categories used in the analysis are "Sweden" or "other".

Self-reported diseases might modify the inclination to stop smoking. Self-reported previous or current diseases included myocardial infarction, stroke, claudicatio intermittens, diabetes mellitus, cancer or astma/ chronic obstructive lung disease.

Marital status included four categories: married, unmarried, divorced and widow/ widower.

Social participation (during the past year) describes how actively the person takes part in the activities of formal and informal groups in society (study circle/course at workplace, other study circle/course, union meeting, meeting of other organisations, theatre/cinema, arts exhibition, church, sports event, letter to editor of a newspaper/journal, demonstration, night club/entertainment, big gathering of relatives, private party). It was measured as an index consisting of 13 items and dichotomised. If three alternatives or less were indicated, the social participation of that individual was classified as low.

The reliability and validity of the social participation variable used in this paper was assessed in a previous paper that found an acceptable validity and reproducibility (27).

Statistics

Crude odds ratios (OR) and 95% confidence intervals (95% CI) were calculated in order to analyse associations between different demographic and socioeconomic variables, social participation, and regular and intermittent smoking. The multivariate analysis was performed in order to investigate the potential importance of various confounders and to analyse the importance of social participation on the socioeconomic differences in regular and intermittent smoking, respectively. The regular and intermittent smokers were compared to non-smokers in all the multivariate analyses. The effects of the covariates were explored by logistic

regression analysis concerning the association between social participation and the odds ratio of regular and intermittent smoking, respectively. The statistical analysis was performed using the SPSS software package (28).

Results

Table 1 shows that men in our study were self-employed, non-manual employees in higher positions and skilled manual workers to a higher extent than women. Women were more often non-manual employees in lower and middle positions and unskilled manual workers. These differences further support our notion that men and women should be analysed separately. The proportion of persons born in other countries than Sweden were almost the same for men and women, 13.5% and 12.2% respectively.

The proportion of both daily and intermittent smokers was the same for both sexes. The proportion of persons who had never smoked was much larger among women (42.8%) than among men (28.6%) ($p<0.001$, t-test). On the other hand, the proportion of individuals that had stopped smoking was much larger among men (40.8%) compared to women (27.1%) ($p<0.001$, t-test). The sum proportion of non-smokers (according to our definition above) is thus approximately the same for men and women.

Tables 2a and 2b illustrate that there were statistically significant socioeconomic differences in daily smoking among both men and women. For both sexes, the SES groups skilled and unskilled manual workers showed significantly higher odds ratios of daily smoking, compared to the non-manual high level reference group. The unemployed men showed significantly higher odds ratios of daily smoking compared to the whole employed group. The male pensioners also had higher odds ratios of daily smoking compared to the whole workforce. On the other hand, no significant socioeconomic differences in intermittent smoking were seen, neither for men nor for women. Unmarried and divorced men had significantly higher odds ratios of daily smoking than married men. The same patterns of higher odds ratios of daily smoking were seen for both female unmarried, divorced and widows. In contrast, the odds ratio of being an intermittent smoker was only significantly higher among females who were divorced. Males with low social participation had an OR 2.0 (1.8-2.3) of being a daily smoker, while the corresponding odds ratio of being intermittent smoker was statistically non-significant 0.8 (0.6-1.1). Among women, individuals with low social participation had an OR 1.6 (1.4-1.8) of daily smoking. In contrast, females with low social participation only had a non-significant OR 1.1 (0.8-1.4) of intermittent smoking.

Tables 3a and 3b illustrate that the SES patterns among daily and intermittent smokers compared to non-smokers did not change when age, country of origin, self-reported diseases and marital status were included in the multivariate logistic

regression models, neither for men nor for women. Finally, when social participation was included in the models, the association between SES and daily smoking was considerably weakened because one third of the excess risk disappeared among the unskilled manual workers for both sexes. The odds ratios were reduced among men from 2.3 (1.7-3.0) to 1.9 (1.4-2.5) for the unskilled manual workers. Social participation also reduced the female odds ratios from 1.9 (1.4-2.5) to 1.6 (1.2-2.2) for the unskilled manual workers. On the other hand, social participation had no association with intermittent smoking.

Since social participation was introduced in the final step in the regression analyses, it seemed to be of importance to analyse how much of the association between this variable and regular and intermittent smoking, respectively, that could be ascribed to the other variables in the model. Tables 4a and 4b show that age, country of origin and self-reported diseases had almost no effects on either the significant relationship between social participation and daily smoking. Marital status had some effect on the relationship between social participation and daily smoking among both men and women.

Nicotine consumption in the form of *oral snuff* is a common habit in Sweden (29). The prevalence of snuff intake (yes/no) in the population of this study was 7.9% among men and 0.5% among women. When snuff consumption was included in the multivariate analysis (not shown in tables), it had no effect on the odds ratios obtained.

When the respondents that came to the MDCS spontaneously were analysed separately, all the statistical patterns reported above remained unchanged (not shown in tables).

Discussion

We found clear socioeconomic differences in daily smoking among both males and females. However, no significant socioeconomic differences in intermittent smoking were observed. After adjustment for potential confounders the inclusion of social participation in the final model of the multivariate analysis had a decreasing effect on the OR:s and the socioeconomic differences in daily smoking. In contrast, social participation showed no association with intermittent smoking.

The present results could be biased by selection bias, misclassification and confounding.

A comparison with another investigation conducted in the city of Malmö during the same time period with a higher participation rate (71%) showed a good correspondance in the same age groups concerning SES, smoking and social participation. On the other hand, people born abroad are underepresented in the MDCS population (20). However, this is due to the fact that approximately 2,000 individuals of foreign origin were excluded from the whole study due to insufficient language skills (all interviewed 1991-1996). Some studies have shown that non-

participants differ from study participants in terms of smoking habits (30,31). The smoking prevalence in these studies have been shown to be somewhat higher among non-participants. If individuals with low social participation also have a tendency of non-participation, this could lead to a situation where smokers with low social participation (i.e. "exposed" cases) are overrepresented among non-participants. However, this would lead to an underestimation of the true association between smoking and social participation. Moreover, we do not find any plausible reason for assuming that the tendency of non-participation would be lower for intermittent smokers compared with daily smokers. Accordingly, the difference between these two groups in our study are probably not biased to any important extent by selection.

The validity of items assessing smoking has previously been analysed several times. The results have consistently shown that self-reported tobacco-smoking is a valid and reliable way to measure smoking habits in a population (32,33,34,35,36,37). Differential misclassification is not likely to have been present. Non-differential misclassification seems to be a problem of less importance in this study, since non-differential misclassification tends to attenuate true differences, and the main results of this study show clear socioeconomic differences. The reliability and validity of the social participation variable showed a good or acceptable validity and reliability with no differences between the various SES groups in a previous paper (26). The validity and reliability of the social participation variable was assessed using the 3-item cut-off to distinguish between low and high social participation, which is the reason why this cut-off also has been used in this paper.

Age, sex, country of origin, self-reported diseases and marital status could be confounders of the associations between the psychosocial variables and smoking cessation. Adjusting for these variables, however, only marginally affected the estimates.

The 8% prevalence of snuff using among men may be regarded as low compared to the prevalence sometimes reported for Sweden. However, other unpublished data from Scania in southern Sweden reveal the same prevalence of snuff use in this part of Sweden.

The analysis of the age interval 45-64 years may be regarded as a strength in this study, since only few individuals start smoking after adolescense (38). The cross-sectional study design may on the other hand be considered a weakness, because this design makes it impossible to follow the smoking history of the individuals. Some intermittent smokers may in fact be former daily smokers on their way to smoking cessation. However, this possibility does not contradict the main conclusions of this study. An objection against the aggregation of former and never smokers may also be raised. However, many former smokers stopped smoking many years ago, and the prevalence of low social participation was the same in these two groups.

Social participation has in other studies been shown to be associated with smoking and smoking cessation (19,20). In this study, social participation was associated with daily smoking. Exposure to low social participation partly explained a part of the socioeconomic gradient in daily smoking. Social participation measures the individual´s participation in several social activities within the life of modern society. Health related behaviours like smoking are a result of the interaction between a person and her environment. A person´s relation to her environment can be viewed as a dynamic process, since environmental changes require continuous adaptation by the individual. The successful adaptation to changes in the environment requires both individual resources, e.g. education and material resources, and social relations, e.g. social support and social network. Daily smoking and its maintenance might function as a coping mechanism when the individual has low social participation. In contrast, intermittent smoking appears to be a different health behaviour phenomenon. Intermittent smoking was not associated with low socioeconomic status or low social participation. The absence of socioeconomic differences in intermittent smoking is in accordance with previous finding that intermittent smokers have higher educational and occupational status than regular smokers (1,4). Previous studies have also reported that intermittent smokers often are free of nicotine dependence (39,40). This study has also shown their particular smoking behaviour to be unrelated to social participation.

There are two plausible explanations to the differences between intermittent and regular smokers in socioeconomic patterns and influence of social participation observed in this study. First, as already mentioned, some smokers are biologically nicotine dependent and others are not. Nicotine dependence is a biological and not a socioeconomic or psychosocial characteristic. The nicotine dependent smokers are mostly daily smokers. To be able to stop smoking, they would have to quit completely. The process of smoking cessation and its maintenance may be more difficult for nicotine dependent smokers in a less supportive environment, i.e. an environment with a low level of social participation and social capital.

The second plausible explanation concerns the initiation of the smoking behaviour. Many smokers start their career as intermittent smokers during adolescense (41). A supportive environment with a high level of social participation prevents the progress from the state of intermittent smoking to the state of daily smoking. This notion is supported by the fact that the fraction of intermittent smokers of all smokers is higher in higher social classes than in the lower classes in our study. The nicotine dependence could thus be an effect of the smoking habits that are determined by socioeconomic and psychosocial factors closely related to social participation and social capital.

These two tentative explanations are not mutually contradictory, but represent two possible hypotheses.

The definition of social participation in this study is in accordance with Robert D Putnam´s definition of social participation, which forms a part of his definition of

social capital (21,22,23). The findings of this study thus suggest an influence of social capital in the link between socioeconomic status and daily smoking, but not intermittent smoking. An important task is therefore to increase the understanding of which aspects of social capital that are protective against daily smoking, e.g. those generated by family and kinship compared with those from associational life or from the links that connect different groups within society (42). Measures to improve social capital have been suggested as a mean to improve health-related behaviours that are not sufficiently influenced by individually-targeted health promotion measures (43). The results of this study imply that preventive measures against daily tobacco smoking should be designed to improve at least certain aspects of social participation. A campaign, supported by the health services, to increase involvement (empowerment) in social and civic activities could have health promoting effects (18). Causal pathways between social or psychosocial factors and intermittent smoking remain to be disentangled.

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Table 1. Prevalence (%) of smoking, socioeconomic, demographic, and social participation variables. The Malmö Diet and Cancer Study 1992-1994

	Men		Women		Total	
	N	%	N	%	N	%
Smoking status						
Regular/daily smoker	1346	25.0	1647	25.5	2993	25.3
Intermittent smoker	299	5.6	296	4.6	595	5.0
Stopped smoking	2197	40.8	1746	27.1	3943	33.3
Never smoked	1538	28.6	2765	42.8	4303	36.4
(Missing)	(0)		(3)		(3)	
Socioeconomic status (SES)						
High level non-manual	528	9.8	358	5.6	886	7.5
Middle level non-manual	833	15.5	932	14.5	1765	14.9
Low level non-manual	598	11.1	1587	24.6	2185	18.5
Skilled manual	646	12.0	312	4.8	958	8.1
Unskilled manual	604	11.2	1258	19.5	1862	15.8
Self-employed	794	14.8	349	5.4	1143	9.7
Pensioners	953	17.7	1269	19.7	2222	18.8
Unemployed	418	7.8	383	5.9	801	6.8
(Missing)	(6)		(9)		(15)	
Age						
45-49 years	808	15.0	976	15.1	1784	15.1
50-54 years	1574	29.3	1928	29.9	3502	29.6
55-59 years	1468	27.3	1699	26.3	3167	26.8
60-64 years	1530	28.4	1854	28.7	3384	28.6
(Missing)	(0)		(0)		(0)	
Country of origin						
Sweden	4653	86.5	5667	87.8	10320	87.2
Other country	725	13.5	787	12.2	1512	12.8
(Missing)	(2)		(3)		(5)	
Self-reported diseases[1]						
No	4466	83.2	5311	82.6	9777	82.9
Yes	901	16.8	1118	17.4	2019	17.1
(Missing)	(13)		(28)		(41)	
Marital status						
Married	3860	71.8	4039	62.6	7899	66.8
Unmarried	603	11.2	569	8.8	1172	9.9
Divorced	803	14.9	1354	21.0	2157	18.2
Widow/widower	112	2.1	491	7.6	603	5.1
(Missing)	(2)		(4)		(6)	
Social participation						
High	3851	71.6	4635	71.8	8486	71.7
Low	1529	28.4	1822	28.2	3351	28.3
(Missing)	(0)		(0)		(0)	
Total	**5380**		**6457**		**11,837**	

1 Self-reported previous or current diseases included myocradial infarction, stroke, claudicatio intermittens, diabetes mellitus, cancer and astma/ chronic obstructive lung disease.

Table 2a. Crude odds ratios (OR) and 95% confidence intervals (CI) of regular and intermittent smoking in relation to demographic, socioeconomic and psychosocial variables. Men. Malmö Diet and Cancer Study 1992-1994

	N	Regular smokers		Intermittent smokers	
		%	Crude OR, 95% CI	%	Crude OR, 95% CI
SES					
High level non-manual	528	18.4	1.0	6.4	1.0
Middle level non-manual	833	18.8	1.0 (0.8-1.4)	4.4	0.7 (0.4-1.1)
Low level non-manual	598	20.1	1.1 (0.8-1.5)	6.9	1.1 (0.7-1.7)
Skilled manual	646	24.9	1.5 (1.1-2.0)	5.6	0.9 (0.5-1.4)
Unskilled manual	604	33.8	2.3 (1.7-3.0)	4.8	0.7 (0.4-1.2)
(Missing)	(2171)				
Vocationally active[1]					
Employees	3209	23.0	1.0	5.5	1.0
Self-employed	794	22.8	1.0 (0.8-1.2)	7.1	1.3 (0.95-1.8)
(Missing)	(1377)				
Vocationally active and unemployed[2]					
All employed	4003	23.0	1.0	5.8	1.0
Unemployed	418	34.4	1.8 (1.4-2.2)	5.0	0.9 (0.5-1.4)
(Missing)	(959)				
Workforce vs pensioners[3]					
Workforce	4421	24.1	1.0	5.7	1,0
Pensioners	953	29.4	1.3 (1.1-1.5)	4.7	0,8 (0,6-1,1)
(Missing)	(6)				
Age					
45-49 years	808	27.5	1.0	6.8	1.0
50-54 years	1574	25.9	0.9 (0.8-1.1)	6.2	0.9 (0.6-1.3)
55-59 years	1468	26.1	0.9 (0.8-1.1)	5.1	0.7 (0.5-1.1)
60-64 years	1530	21.8	0.7 (0.6-0.9)	4.7	0.7 (0.5-0.97)
(Missing)	(0)				
Country of origin					
Sweden	4653	24.7	1.0	5.3	1.0
Other country	725	27.0	1.1 (0.9-1.3)	7.0	1.3 (0.98-1.8)
(Missing)	(2)				
Self-reported diseases[4]					
No	4466	25.5	1.0	5.5	1.0
Yes	901	22.8	0.9 (0.7-1.02)	6.0	1.1 (0.8-1.4)
(Missing)	(13)				
Marital status					
Married	3860	21,9	1.0	5.5	1.0
Unmarried	603	31,3	1.6 (1.3-2.0)	6.1	1.1 (0.8-1.6)
Divorced	803	34,9	1.9 (1.6-2.2)	5.9	1.1 (0.8-1.5)
Widow/ widower	112	26,8	1.3 (0.9-2.0)	3.6	0.6 (0.2-1.8)
(Missing)	(2)				

Table 2a. (continued)

	N	Regular smokers		Intermittent smokers	
		%	Crude OR, 95% CI	%	Crude OR, 95% CI
Social participation					
High	3851	21.1	1.0	5.8	1.0
Low	1529	34.9	2.0 (1.8-2.3)	4.9	0.8 (0.6-1.1)
(Missing)	(6)				
Total	5380				

1 Employees (five groups) versus self-employed.
2 All employed (six groups including self-employed) versus unemployed.
3 Workforce (five employee groups, self-employed and unemployed) versus pensioners.
4 Self-reported previous or current diseases included myocradial infarction, stroke, claudicatio intermittens, diabetes mellitus, cancer and astma/ chronic obstructive lung disease.

Table 2b. Crude odds ratios (OR) and 95% confidence intervals (CI) of regular and intermittent smoking in relation to demographic, socioeconomic and psychosocial variables. Women. Malmö Diet and Cancer Study 1992-1994

	N	Regular smokers		Intermittent smokers	
		%	Crude OR, 95% CI	%	Crude OR, 95% CI
SES					
High level non-manual	358	20.1	1.0	4.2	1.0
Middle level non-manual	932	21.8	1.1 (0.8-1.5)	5.3	1.3 (0.7-2.3)
Low level non-manual	1587	24.3	1.3 (0.9-1.7)	4.6	1.1 (0.6-1.9)
Skilled manual	312	26.3	1.4 (0.99-2.0)	2.9	0.7 (0.3-1.6)
Unskilled manual	1257	30.0	1.7 (1.3-2.3)	5.2	1.2 (0.7-2.2)
(Missing)	(2011)				
Vocationally active[1]					
Employees	4446	25.3	1.0	4.7	1.0
Self-employed	349	22.1	0.8 (0.6-1.1)	6.3	1.4 (0.9-2.1)
(Missing)	(1662)				
Vocationally active and unemployed[2]					
All employed	4795	25.1	1.0	4.9	1.0
Unemployed	383	27.7	1.2 (0.9-1.5)	3.7	0.7 (0.4-1.3)
(Missing)	(1279)				
Workforce vs pensioners[3]					
Workforce	5178	25.3	1.0	4.8	1.0
Pensioners	1267	26.9	1.1 (0.95-1.3)	3.8	0.8 (0.6-1.1)
(Missing)	(12)				
Age					
45-49 years	976	31.9	1.0	5.9	1.0
50-54 years	1928	29.5	0.9 (0.8-1.1)	5.7	0.9 (0.7-1.3)
55-59 years	1699	23.1	0.6 (0.5-0.8)	3.8	0.6 (0.4-0.9)
60-64 years	1851	20.3	0.5 (0.46-0.7)	3.5	0.6 (0.4-0.8)
(Missing)	(3)				
Country of origin					
Sweden	5666	25.4	1.0	4.7	1.0
Other country	785	26.5	1.1 (0.9-1.3)	3.9	0.8 (0.6-1.2)
(Missing)	(6)				
Self-reported diseases[4]					
No	5311	25.0	1.0	4.6	1.0
Yes	1116	27.5	1.1 (0.98-1.3)	4.5	0.97 (0.7-1.3)
(Missing)	(30)				
Marital status					
Married	4038	20.6	1.0	4.0	1.0
Unmarried	569	28.6	1.5 (1.3-1.9)	4.2	1.0 (0.7-1.6)
Divorced	490	36.7	2.2 (1.9-2.5)	6.2	1.6 (1.2-2.1)
Widow/ widower	6450	31.4	1.8 (1.4-2.2)	4.5	1.1 (0.7-1.8)
(Missing)	(7)				

Table 2b (continued)

	N	Regular smokers		Intermittent smokers	
		%	Crude OR, 95% CI	%	Crude OR, 95% CI
Social participation					
High	4635	22.9	1.0	4.7	1.0
Low	1819	32.1	1.6 (1.4-1.8)	4.4	1.1 (0.8-1.4)
(Missing)	(3)				
Total	6457				

1 Employees (five groups) versus self-employed.
2 All employed (six groups including self-employed) versus unemployed.
3 Workforce (five employee groups, self-employed and unemployed) versus pensioners.
4 Self-reported previous or current diseases included myocradial infarction, stroke, claudicatio intermittens, diabetes mellitus, cancer and astma/ chronic obstructive lung disease.

Table 3a. Age-adjusted and multivariate odds ratios (OR) and 95% confidence intervals (CI) of regular and intermittent smoking compared to all non-smokers in socioeconomic groups. Men. Malmö Diet and Cancer Study 1992-1994

	Regular smoking			Intermittent smoking		
	Adjusted * OR, 95% CI	**Adjusted ** OR, 95% CI**	**Adjusted *** OR, 95% CI**	**Adjusted * OR, 95% CI**	**Adjusted ** OR, 95% CI**	**Adjusted *** OR, 95% CI**
Socioeconomic status (SES)						
High level non-manual	1.0	1.0	1.0	1.0	1.0	1.0
Middle level non-manual	1.0 (0.8-1.3)	1.0 (0.8-1.4)	1.0 (0.8-1.3)	0.7 (0.4-1.1)	0.7 (0.4-1.1)	0.7 (0.4-1.1)
Low level non-manual	1.1 (0.8-1.5)	1.1 (0.9-1.6)	1.1 (0.8-1.4)	1.1 (0.7-1.7)	1.1 (0.7-1.7)	1.1 (0.7-1.8)
Skilled manual	1.5 (1.1-2.0)	1.5 (1.1-2.0)	1.3 (1.00-1.8)	0.9 (0.5-1.4)	0.8 (0.5-1.3)	0.8 (0.5-1.4)
Unskilled manual	2.3 (1.7-3.0)	2.3 (1.7-3.0)	1.9 (1.4-2.5)	0.7 (0.4-1.2)	0.7 (0.4-1.2)	0.7 (0.4-1.2)
Vocationally active[1]						
Employees	1.0	1.0	1.0	1,0	1.0	1.0
Self-employed	1.0 (0.8-1.2)	1.0 (0.8-1.2)	1.0 (0.8-1.2)	1,3 (0,95-1,8)	1.3 (0.96-1.8)	1.3 (0.95-1.8)
Vocationally active and unemployed[2]						
All employed	1,0	1.0	1.0	1,0	1,0	1.0
Unemployed	1,8 (1,4-2,2)	1.8 (1.4-2.2)	1.6 (1.3-2.0)	0,9 (0,5-1,4)	0,8 (0,5-1,3)	0.8 (0.5-1.4)
Workforce vs pensioners[3]						
Workforce	1,0	1.0	1.0	1,0	1,0	1.0
Pensioners	1,6 (1,3-1,8)	1.6 (1.3-1.8)	1.3 (1.1-1.6)	0,9 (0,7-1,3)	0,9 (0,6-1,3)	0.9 (0.6-1.3)

*Adjustment for age.
**Adjustment made for age, ethnicity, self-reported diseases and marital status.
***Adjustment made for age, ethnicity, self-reported disease, marital status and social participation.

1 Employees (five groups) versus self-employed.
2 All employed (six groups including self-employed) versus unemployed.
3 Workforce (five employee groups, self-employed and unemployed) versus pensioners.

Table 3b. Age-adjusted and multivariate odds ratios (OR) and 95 % confidence intervals (CI) of regular and intermittent smoking compared to all non-smokers in socioeconomic groups. Women. Malmö Diet and Cancer Study 1992-1994

	Regular smoking			Intermittent smoking		
	Adjusted * OR, 95% CI	**Adjusted ** OR, 95% CI**	**Adjusted *** OR, 95% CI**	**Adjusted* OR, 95% CI**	**Adjusted ** OR, 95% CI**	**Adjusted *** OR, 95% CI**
Socioeconomic status (SES)						
High level non-manual	1.0	1.0	1.0	1.0	1.0	1.0
Middle level non-manual	1.1 (0.8-1.5)	1.2 (0.9-1.6)	1.1 (0.8-1.6)	1.3 (0.7-2.3)	1.3 (0.7-2.4)	1.3 (0.7-2.4)
Low level non-manual	1.3 (1.01-1.8)	1.4 (1.01-1.8)	1.3 (0.96-1.7)	1.1 (0.6-2.0)	1.1 (0.6-2.0)	1.1 (0.6-2.0)
Skilled manual	1.5 (1.02-2.1)	1.5 (1.02-2.1)	1.4 (0.9-2.0)	0.7 (0.3-1.6)	0.7 (0.3-1.6)	0.7 (0.3-1.6)
Unskilled manual	1.8 (1.4-2.4)	1.9 (1.4-2.5)	1.6 (1.2-2.2)	1.3 (0.7-2.3)	1.3 (0.7-2.4)	1.3 (0.7-2.4)
Vocationally active[1]						
Employees	1.0	1.0	1.0	1.0	1.0	1.0
Self-employed	0.8 (0.6-1.1)	0.8 (0.6-1.1)	0.8 (0.6-1.1)	1.3 (0.8-2.1)	1.3 (0.9-2.1)	1.3 (0.9-2.1)
Vocationally active and unemployed[2]						
All employed	1.0	1.0	1.0	1.0	1.0	1.0
Unemployed	1.2 (0.98-1.6)	1.2 (0.95-1.5)	1.2 (0.9-1.5)	0.8 (0.5-1.4)	0.8 (0.5-1.4)	0.8 (0.5-1.4)
Workforce vs pensioners[3]						
Workforce	1.0	1.0	1.0	1.0	1.0	1.0
Pensioners	1.5 (1.3-1.7)	1.4 (1.2-1.7)	1.3 (1.1-1.5)	1.0 (0.7-1.4)	1.0 (0.7-1.4)	1.0 (0.7-1.4)

*Adjustment for age.
**Adjustment made for age, ethnicity, self-reported diseases and marital status.
***Adjustment made for age, ethnicity, self-reported disease, marital status and social participation.

1 Employees (five groups) versus self-employed.
2 All employed (six groups including self-employed) versus unemployed.
3 Workforce (five employee groups, self-employed and unemployed) versus pensioners.

Table 4a. Logistic regression analysis of association between social participation and the odds ratio of regular and intermittent smoking, respectively, compared to all non-smokers and presented as crude odds ratio (OR), adjusted OR and confidence intervals (95 % CI). Men. The Malmö Diet and Cancer Study 1992-1994

Regular smokers	Crude OR	Model I	Model II	Model III	Model IV	Model V
Social participation[1]	2.0 (1.8-2.3)	2.1 (1.8-2.4)	2.1 (1.8-2.4)	2.1 (1.8-2.4)	2.1 (1.8-2.4)	1.9 (1.6-2.2)
Age[2]		0.9 (0.8-0.9)	0.9 (0.8-0.9)	0.9 (0.8-0.9)	0.9 (0.8-1.0)	0.9 (0.8-0.9)
Country of origin[3]			1.0 (0.8-1.2)	1.0 (0.8-1.2)	1.0 (0.8-1.2)	0.9 (0.8-1.1)
Self-reported diseases[4]				0.8 (0.7-1.0)	0.8 (0.7-1.0)	0.8 (0.7-0.9)
Marital status[5]					1.3 (1.2-1.4)	1.3 (1.2-1.4)
Socioeconomic status[6]						1.1 (1.1-1.1)
Intermittent smokers	Crude OR	Model I	Model II	Model III	Model IV	Model V
Social participation[1]	0.8 (0.6-1.1)	0.9 (0.7-1.1)	0.8 (0.6-1.1)	0.8 (0.6-1.1)	0.8 (0.6-1.1)	0.8 (0.6-1.1)
Age[2]		0.9 (0.8-1.0)	0.9 (0.8-1.0)	0.9 (0.8-1.0)	0.9 (0.8-1.0)	0.9 (0.8-1.0)
Country of origin[3]			1.4 (1.0-1.9)	1.4 (1.0-1.9)	1.4 (1.0-1.9)	1.4 (1.0-1.9)
Self-reported diseases[4]				1.2 (0.9-1.6)	1.2 (0.9-1.6)	1.2 (0.9-1.6)
Marital status[5]					1.0 (0.9-1.2)	1.0 (0.9-1.1)
Socioeconomic status[6]						1.0 (0.9-1.1)

1) Low vs high
2) Per 5-year interval
3) Born in other country than sweden vs Born in Sweden
4) Disease vs No disease
5) Four marital status groups
6) Eight socioeconomic groups

Table 4b. Logistic regression analysis of association between social participation and the odds ratio of regular and intermittent smoking, respectively, compared to all non-smokers and presented as crude odds ratio (OR), adjusted OR and confidence intervals (95 % CI). Women. The Malmö Diet and Cancer Study 1992-1994

Regular smokers	Crude OR	Model I	Model II	Model III	Model IV	Model V
Social participation[1]	1.6 (1.4-1.8)	1.7 (1.5-2.0)	1.7 (1.5-2.0)	1.7 (1.5-1.9)	1.7 (1.5-1.9)	1.5 (1.3-1.8)
Age[2]		0.8 (0.7-0.8)	0.8 (0.7-0.8)	0.8 (0.7-0.8)	0.8 (0.7-0.8)	0.7 (0.7-0.8)
Country of origin[3]			1.0 (0.8-1.1)	1.0 (0.8-1.1)	0.9 (0.8-1.1)	0.9 (0.7-1.0)
Self-reported diseases[4]				1.2 (1.0-1.4)	1.1 (1.0-1.3)	1.1 (1.0-1.3)
Marital status[5]					1.4 (1.3-1.4)	1.4 (1.3-1.4)
Socioeconomic status[6]						1.1 (1.0-1.1)
Intermittent smokers	Crude OR	Model I	Model II	Model III	Model IV	Model V
Social participation[1]	0.9 (0.7-1.2)	1.0 (0.8-1.3)	1.0 (0.8-1.3)	1.0 (0.8-1.3)	1.0 (0.8-1.3)	1.0 (0.8-1.3)
Age[2]		0.8 (0.7-0.9)	0.8 (0.7-0.9)	0.8 (0.7-0.9)	0.8 (0.7-0.9)	0.8 (0.7-0.9)
Country of origin[3]			0.8 (0.6-1.2)	0.8 (0.6-1.2)	0.8 (0.6-1.2)	0.8 (0.6-1.2)
Self-reported diseases[4]				1.0 (0.8-1.4)	1.0 (0.8-1.4)	1.0 (0.8-1.4)
Marital status[5]					1.2 (1.0-1.3)	1.2 (1.0-1.3)
Socioeconomic status[6]						1.0 (0.9-1.1)

1) Low vs high
2) Per 5-year interval
3) Born in other country than sweden vs Born in Sweden
4) Disease vs No disease
5) Four marital status groups
6) Eight socioeconomic groups

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Individual and neighbourhood determinants of social participation and social capital in a public health perspective: A multilevel analysis of the city of Malmö, Sweden

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Abstract

The aim of this study was to analyse the impact of the neighbourhood on individual social capital (measured as social participation) in a public health perspective. The study population consisted of 13,335 individuals aged 45 to 73 that participated in the Malmö Diet and Cancer Study in 1992-1994, and resided in 90 neighbourhoods of Malmö, Sweden (population 250,000). A multilevel logistic regression model, with individuals at the first level and neighbourhoods at the second level, was performed. The study analysed the effect (intra-area correlation and cross-level modification) of the neighbourhood on individual social capital after adjustment for compositional factors (e.g., age, sex, educational level, socioeconomic status, disability pension, living alone, sick leave, unemployment). The prevalence of social participation varied from 23.0% to 39.7% in the first and third neighborhood quartiles respectively. Neighbourhood factors accounted for 6.3% of the total variance in social participation, and this effect was reduced but not eliminated when adjusting for all studied variables (-73%), especially the socioeconomic composition of the neighbourhoods (-58%). Our study supports Putnam´s notion that social capital, which is suggested to be an important factor for population health and possibly for health equity, is an aspect that is partly contextual in its nature.

Key Words: Social participation, social capital, individual factors, neighbourhood, contextual effect, multilevel analysis

Introduction

The association between social environment and health is well known. Numerous epidemiological studies have shown that socially integrated people live healthier lives than socially isolated persons (1,2,3). The variables used to operationalise the degree of social integration have in recent years often been defined from the social capital concept introduced by Coleman and Putnam (4,5). Study results indicate that social capital is of importance for the prevention of crime (6,7) and for the maintenance of population health (8).

The group dynamics and the social character of a community affect the well-being of its citizens. This was e.g. illustrated in the prospective study of the highly socially coherent Roseto community between 1955 and 1965, where a strikingly low mortality rate from myocardial infarction was found compared to other nearby communities (9,10). The conventional risk factors were at least as prevalent as in the control communities (11,12). However, as traditional social cohesion was eroded over time, the cardiovascular mortality levels rose and converged to those of the surrounding communities (13). The complex social and institutional changes of modern society should thus be taken into consideration when discussing the impact of social conditions on health (14).

The social capital concept (4,5,15,16) has introduced a new way of understanding the complex social characteristics of modern society and their effects on health. Social capital has, in good accordance with Putnam, been defined and operationalised in the public health literature as social participation (the number of the groups and associations to which citizens belong) and social trust (8). Social participation in community matters has been reported to be a powerful predictor of cardiovascular and total mortality (17,18). A possible causal pathway is the association between the degree of social participation and health-related behaviours (19,20,21). According to Putnam´s own conclusions in "Making democracy Work" (5), the extent and quality of social participation and social trust varied over the regions of Italy in the 1970s and the 1980s as historically inherited cultural characteristics that were independent of individual characteristics, e.g. socioeconomic characteristics, in the populations of the different regions. Social capital might thus be regarded as a trait of a geographic area, that is contextual in its nature.

A recent Australian study has shown that social participation, and even different components of social participation, is associated with sex, age, education, household income, health status, and social isolation. Participation in ethnic clubs was in this study considered as a component of social participation in itself (22). All these sociodemographic individual factors thus seems to be important determinants of social participation.

The aspect of social capital investigated in this study is social participation. The aim of the study is to investigate the effect of the area of one´s residence (i.e.

neighbourhood) on individual social participation, and also to analyse individual determinants of social participation in a middle-aged population.

Material and methods

Study population

The Malmö Diet and Cancer Study (MDCS) is a prospective cohort study in Malmö, the third largest city of Sweden with approximately 250,000 inhabitants. A more detailed description of the MDCS study is given elsewhere (23).

Subjects were recruited by postal invitation at random. Some respondents (25.2%) came to the examination spontaneously (24). All participants gave informed consent. The baseline health questionnaire was completed at home.

The social participation item used in this study was not included in the first version of the questionnaire used in 1991-1992, and some of the assessed items were altered in the period 1994-1996, and thus the present study population consists of every person who participated in the MDCS during the two year period from March 1992 until August 1994 (N=14,390). A total of 13,335 of these respondents had complete data on all the studied variables. This represents a fourth of the whole population aged 45-68 in Malmö.

Operational definitions

Outcome variable

Social participation describes how actively the person takes part in the activities of formal and informal groups in society. It was measured as an index consisting of 13 items (study circle/course at place of work, other study circle/course, union meeting, meeting of other organisations, theatre/cinema, arts exhibition, church, sports event, letter to editor of a newspaper/journal, demonstration, night club/entertainment, big gathering of relatives, private party) and dichotomised. If three alternatives or less were indicated, the social participation of that individual was classified as low. The social participation variable is used as a measure of social capital in this study. The social participation variable has been used in Sweden since the 1970s (25).

Individual exposure variables

The *age* of the participants was computed from birth to the first visit to the Malmö Diet and Cancer Study Center and categorised in four groups by quartiles.

Country of origin. All participants born in other countries than Sweden were merged into a single category.

Education was categorised by length of education. The respondents were classified into three groups: a) more than 12 years or university studies, b) 10-12 years, and c) 9 years of education or less.

The participants were categorised as *living alone* when an affirmative answer to the question "Do you live alone" was reported in the self-administered questionnaire.

Classification of *socioeconomic status* (SES) was based on data about job title, tasks, and position at work, obtained from the questionnaire. The classification procedure was identical to the one used in the Swedish population census (26), with two manual (skilled and unskilled) and three non-manual (high, middle, low positions) employee groups. The group of self-employed persons is very heterogenous, including both academically trained physicians, big company employers, and, on the other hand, small shopkeepers etc.

Sickness absense was defined by an affirmative answer to the question "Are You currently on sick leave?".

All individuals aged less than 65 reporting in the questionnaire that they were retired were considered to have *disability pension.*

All individuals aged less than 65 reporting in the questionnaire that they were unemployed were considered as *unemployed.*

Neighbourhoods

The city of Malmö is administratively divided into 99 neighbourhoods. In this study all 90 neighbourhoods with more than 20 respondents in the MDCS were included.

Statistics and epidemiological methods

Simple variance components multilevel logistic regression models (27) with individuals (first level) nested within neighbourhoods (second level) were fitted to the data. In the first model, no variables were entered (i.e., the empty model). In the second model, age and sex, together with one other variable were included. In the final model, all variables were added together. However, since individual socioeconomic status and individual educational level were highly correlated, these variables were studied in two separate final models one with individual socioeconomic status, another with individual educational level.

To study the influence of the neighbourhood on individual associations (i.e., cross-level effect modification) random coefficients models were fitted (27,28). In these models we analysed the covariance between the slopes of the associations between individual low social participation and the other individual variables in

each neighbourhood, and the level of low social participation of the neighbourhoods. In these models age and sex were always included.

The percentage of the total variance in low social participation that was related to the neighbourhood (i.e., intra-neighbourhood correlation) was also used as a measure of the contextual effects. Intra-neighbourhood correlation was calculated as:

Neighbourhood variance/(neighbourhood variance+$\pi^{2/3}$) (29).

In order to illustrate the neighbourhood differences in low social participation, areas were ranked by the log-odds ratios of low social participation with the whole city of Malmö as reference (value=0), and uncertainty was estimated by 95% confidence intervals (i.e., level 2 residuals +/- 1.96 standard error). Individual odds ratios (95% confidence interval) were obtained from the beta coefficient (standard error) in the fixed part of the model. Parameters were estimated using the Iterative Generalized Least Square (IGLS) method, (27,28). The MlwiN, version 1.1 software package (28) was used to perform the analyses.

Results

Characteristics of the population

Table 1 shows the properties of the neighbourhoods included in the analysis (n= 90). The neighbourhood median proportion of inhabitants with low social participation was 31.0%, the lower quartile proportion was 23.0% and the upper quartile proportion 39.7%. The proportion with low social participation among individuals in the study was 29.8%. The neighbourhood medians regarding age, sex, country of origin, living alone, socioeconomic status, sick leave, disability pension and unemployment were approximately the same as the indivual proportions, while the small city area median for the high educational level variable was 17.5% compared to the indivual proportion 20.9%.

Individual determinants of social participation

The individual odds ratios of having low social participation increased with age, OR 2.28 (2.06-2.51 95% CI) in the age interval 61-68 years compared to the 46-53 years group. On the other hand, the odds ratio of low individual social participation did not vary by sex. The odds ratio of having low social participation was 1.69 (1.50-1.89) among individuals born in other countries than Sweden. The odds ratio of low social participation was 4.39 (3.86-5.00 95% CI) in the group with the lowest level of education compared to the highest educational level reference group, and 6.54 (5.30-8.07) in the lowest unskilled manual worker socioeconomic status

group compared to the high-level non-manual employee reference group. The odds ratios of having low social participation were significantly higher for those who live alone compared to those who do not live alone, and analogously the odds ratios were higher for those on sick leave, for those with disability pension, and for the unemployed (table 2).

Neighbourhood determinants of social participation

Direct cross-level effect

Table 2 illustrates that the crude second level (small city area) variance was 0.221 (0.040). In the second age and sex adjusted step the individual education variable strongly reduced the second level (neighbourhood) variance in social participation to 0.109 (0.032). The age and sex adjusted individual country of origin variable also somewhat reduced the second level (neighbourhood) variance in social participation 0.193 (0.036). The age and sex adjusted socioeconomic status variable reduced the second level variance to 0.089 (0.026). The living alone, sick leave, disability pension and unemployment individual variables only marginally affected the second level (neighbourhood) variance when they were introduced one at a time only, adjusting for age and sex.

The percentage of the total variance in social participation that was explained by the area of one´s residence (i.e., intra-neighbourhood level correlation) was 6.3% in the empty model. This neighbourhood effect did not change when the age and sex components were taken into account. Adjustment for socioeconomic status reduced the effect by 58%, i.e. (6.3-3.2)/6.3. Adjustment for educational level reduced the effect by 49%, i.e. (6.3-2.6)/6.3. Country of origin also reduced the effect by 13%, while disability pension reduced the effect by 11%. The other individual (compositional) variables had no reducing effect on the neighbourhood effect.

Table 3 shows that when all the individual variables were introduced simultaneously in the model, the second level (neighbourhood) effect on social participation was reduced to 0.057 (0.015). The percentage of the total variance in low social participation that was explained by the area of one´s residence (i.e. intra-neighbourhood level correction) was finally reduced by 73%, i.e. (6.3-1.7)/6.3, when all the individual variables were entered into the model. Individual educational level and socioeconomic status were not included in the same model as they were highly correlated. The effect estimations in the two models were highly similar, and therefore only the estimates of the model including individual socioeconomic status are presented.

The neighbourhood (second level) variance in social participation was reduced but not fully erased when all the individual variables were entered into the model (figures 1-2).

Cross-level effect modification

Figures 3-5 illustrate that there was a significant covariance between the slopes of the associations between individual low social participation and each of the three individual variables living alone, sick leave and unemployment, and the level of low social participation of the neighbourhoods. I.e. there was evidence of a clear cross-level synergistic effect between low social participation and the mentioned individual factors regarding individual social participation. In other words, the higher the level of low social participation in a neighbourhood, the weaker the association between living alone and low individual social participation. Also, a higher level of low social participation in a neighbourhood is associated with a weaker association between sick leave and low individual social participation. Finally, the higher the level of low social participation in a neighbourhood, the weaker the association between unemployment and low individual social participation.

Discussion

This study suggests that social participation is a contextual charcteristic as well as a characteristic of individuals, which supports the notion that it is part of the social capital construct, as suggested by Putnam. After adjustment for a wide variety of individual factors such as age, sex, country of origin, living alone, educational level, socioeconomic status, sick leave, disability pension and unemployment variables significant differences in social capital between the neighbourhoods remained, although reduced compared to the initial empty model. Since social capital has been discussed in relation to health inequity, it is noteworthy that educational level and socioeconomic status were the individual variables that most strongly reduced the variance in social capital between the small areas.

Non-participation is not likely to have produced serious selection bias in this study. A comparison with another investigation made in the city of Malmö during the same period using a similar questionnaire with a higher participation rate (ca 75%) showed good correspondance concerning socioeconomic status, disability pension, unemployement and social participation between the two investigations (30). On the other hand, people born abroad are under-represented in the MDCS population (30). The selection of ecological units ought not to be a source of selection bias, since 90 of the 99 administrative geographic areas were included, leaving out only the least populated areas.

The reliability and validity of the social participation variable used in this study was assessed in a previous paper that found low correlations between this and other psychosocial indices, and an acceptable validity and reproducibility (test-retest stability) for all the components (31).

The remaining area effects on variance in social participation may be associated with either compositional/individual or contextual factors (32). Age and sex may be compositional confounders of the association between the compositional determinants and social participation. However, adjusting for these "natural" compositional confounders only marginally affected the estimates. The remaining variance between neighbourhoods could be due to contextual properties of the neighbourhoods, or to individual variables which were not included in the analysis. Since the major demographic and socioeconomic variables (socioeconomic status, educational level, country of origin, employment status) as well as two health-related variables which could affect individual social functioning (sickness absence and disability pension) were included in the analysis, we find it plausible that most of the individual confounding has been accounted for. This would support the notion of social participation as a variable partially dependent on factors linked to the area level. On the other hand, there is also a risk of over-adjusting for inter-level confounding, in that some or even many of the mentioned individual variables could in fact be determined by the area level social capital, and they could therefore be on the pathway between area social capital and individual individual social network.

Conventional methods of analysis are inadequate as means to distinguish between how much of the differences between geographical areas that depend on variations in individual characteristics as opposed to contextual characteristics related to these areas (33,34,35,36,37,38). Individual and ecological methods dealing with only one level of analysis do not account for the fact that the individuals appear in clusters, i.e. that the individuals of a particular geographic area have a number of factors in common that may be of importance in the analysis. This fact leads to different problems of interpretation of the results of the analyses. The interpretation of the results of conventional individual level studies is often that they correctly reflect individual causal connections, without accounting for the possibility that the discovered connections could be due to area effects (e.g. the effects of variations in social capital between different geographic areas). This possible misinterpretation has been named "the atomistic fallacy" (39). On the other hand, the results of conventional ecologic analyses are often interpreted as being related to area characteristics, without any discussion concerning the possibility that the "ecological" results only reflect individual level associations. This kind of fallacy has been named "the sociologist fallacy" (39). The "sociologist fallacy" obviously differs from the well-known "ecological fallacy", where an observed association at the area level of analysis is interpreted as being the result of the same association at the individual (compositional) level (40).

Theoretically, social capital is primarily a contextual concept (4,5). The social relationships and the level of trust among the citizens of a society constitute the social fabric of society. The extent to which an individual participates in the organisational and other social activities of society is thus partly determined by the contextual characteristics of society, i.e. the presence or absence of organisations,

informal social networks and mutual trust. However, the extent of social relationships and the feeling of trust are also compositional individual characteristics that might be determined by such individual traits as country of origin, education, living alone, socioeconomic status, sick leave, disability pension and unemployment characteristics that all might hamper or, alternatively, facilitate social participation. Other Swedish studies have shown that minority status appears to be an independent burden, resulting in social and cultural marginalisation in Swedish society (41,42). The contribution of the highly correlated individual/compositional educational level and socioeconomic status variables to the decrease in small area variance in social participation is more complicated to interpret. According to the first interpretation, material aspects of social and economic conditions may be of importance in determining the extent to which individuals participate in different social activities. It has e.g. been shown that lack of material resources such as money and means of communication act as barriers to participation in sports and other physical activities, and sports organisations (43). Second, on the other hand, educational level may be seen as a source of knowledge and information. The theory of diffusions of innovations suggests that some segments of the population adapt to changes in society earlier than others (44). One non-material resource that could explain earlier adaptation to changing forms of social relationships and changing social networks may be educational level.

The results of the analyses of cross-level effect modification illustrate that low area (contextual) levels of social participation seems to decrease the negative effects of living alone, sick leave and unemployment on individual (compositional) level social participation, i.e. the the effects of living alone, being on sick level or being unemployed on the individual´s level of social participation are less important when the individual lives in an area characterised by low social capital in the form of low social participation.

Conclusion; small area variations in social participation remain after adjustment for individual factors. This seems to confirm Putnam´s notion that social capital is a trait partly independent of individual factors, a characteristic that is partly contextual in its nature.

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Table 1. Characteristics of the population according to aggregated data (i.e., neighbourhood) and according to individual data.

	Small city areas			Individuals
	Median	1st quartile	3rd quartile	Proportion
Low social participation	31.0%	23.0%	39.7%	29.8%
Number of individuals	110	69	203	13,335
Age (mean)	57.2	56.0	57.8	57.1
Sex	45.5%	41.8%	50.0%	45.1%
Born outside Sweden	11.0%	7.2%	16.4%	12.0%
Education level				
High	17.5%	11.6%	27.7%	20.9%
Medium	34.5%	28.7%	38.4%	35.5%
Low	46.2%	35.2%	56.9%	43.6%
Living alone	23.9%	11.6%	36.4%	23.2%
Socioeconomic status				
Unskilled manual workers	25.8%	17.4%	38.2%	25.6%
Skilled manual workers	11.7%	6.7%	17.4%	11.9%
Low-level non-manual employees	23.5%	17.8%	27.1%	24.5%
Medium-level non-manual Employees	17.8%	12.5%	21.2%	17.7%
High-level non-manual employees	7.3%	3.8%	11.3%	8.5%
Self-employed persons	11.3%	7.9%	15.5%	11.8%
Sick leave	5.9%	4.3%	7.4%	5.9%
Disability pension	5.2%	3.3%	7.8%	5.6%
Unemployment	5.3%	3.3%	7.3%	5.6%

Table 2. Individual level odds ratios (OR) and 95% confidence interval (95% CI) of low social participation, and neighbourhood effect on individual low social participation in 13.335 individuals from 90 neighbourhoods of the city of Malmö , in function of different individual characteristics.

		Neighbourhood effect	
		Neighbourhood level variance (standard error)	Intra-neighbourhood correlation
Empty model		0.221 (0.040)	6.3%
	OR (95%CI)		
Age and sex adjusted models			
Age			
46 – 53	Reference		
54 – 60	1.42 (1.28 – 1.57)	0.223 (0.040)	6.3%
61 - 68	2.28 (2.06 – 2.51)		
Sex	0.98 (0.91 – 1.06)		
Born outside Sweden (yes vs. no)	1.69 (1.50 – 1.89)	0.193 (0.036)	5.5%
Education level			
High	Reference		
Medium	1.90 (1.66 – 2.17)	0.109 (0.023)	3.2%
Low	4.39 (3.86 – 5.00)		
Living alone (yes vs. no)	1.17 (1.07 – 1.29)	0.212 (0.039)	6.1%
Socioeconomic status			
High-level non-manual employees	Reference		
Self-employed persons	2.88 (2.30 – 3.61)		
Medium-level non-manual Employees	1.66 (1.33 – 2.08)	0.089 (0.020)	2.6%
Low-level non-manual employees	2.89 (2.34 – 3.57)		
Skilled manual workers	4.63 (3.71 – 5.78)		
Unskilled manual workers	6.54 (5.30 – 8.07)		
Sick leave (yes vs. no)	1.66 (1.37 – 2.02)	0.214 (0.039)	6.1%
Disability pension (yes vs. no)	2.91 (2.48 – 3.41)	0.196 (0.036)	5.6%
Unemployment	1.30 (1.11 – 1.54)	0.220 (0.040)	6.3%

Table 3. Individual level odds ratios (OR) and 95% confidence interval (95% CI) of low social participation, and neighbourhood effect on individual low social participation in 13.335 individuals from 90 neighbourhoods of the city of Malmö, in function of different individual characteristics.

		Neighbourhood effect	
	OR (95%CI)	Neighbourhood level variance (standard error)	Intra-neighbourhood correlation
All variables in the model			
Age			
46 – 53	Reference		
54 – 60	1.25 (1.13 – 1.39)		
61 - 68	2.27 (2.05 – 2.51)		
Sex	1.15 (1.06 – 1.26)		
Born outside Sweden (yes vs. no)	1.42 (1.26 – 1.60)		
Education level*			
High	Reference		
Medium	1.92 (1.68 – 2.20)		
Low	4.56 (4.01 – 5.19)		
Living alone (yes vs. no)	1.19 (1.08 – 1.30)	0.0.57 (0.015)	1.7%
Socioeconomic status*			
High-level non-manual employees	Reference		
Self-employed persons	2.74 (2.19 – 3.44)		
Medium-level non-manual Employees	1.62 (1.30 – 2.03)		
Low-level non-manual employees	2.80 (2.26 – 3.46)		
Skilled manual workers	4.23 (3.39 – 5.29)		
Unskilled manual workers	6.05 (4.90 – 7.47)		
Disability pension	2.31 (1.96 – 2.73)		
Sick leave	1.32 (1.12 – 1.55)		
Unemployment	1.30 (1.10 – 1.54)		

Individual educational level and socioeconomic status were not included in the same model as they are highly correlated. The effect estimations in the two models were very similar and therefore only the estimations of the model including individual socioeconomic status are presented.

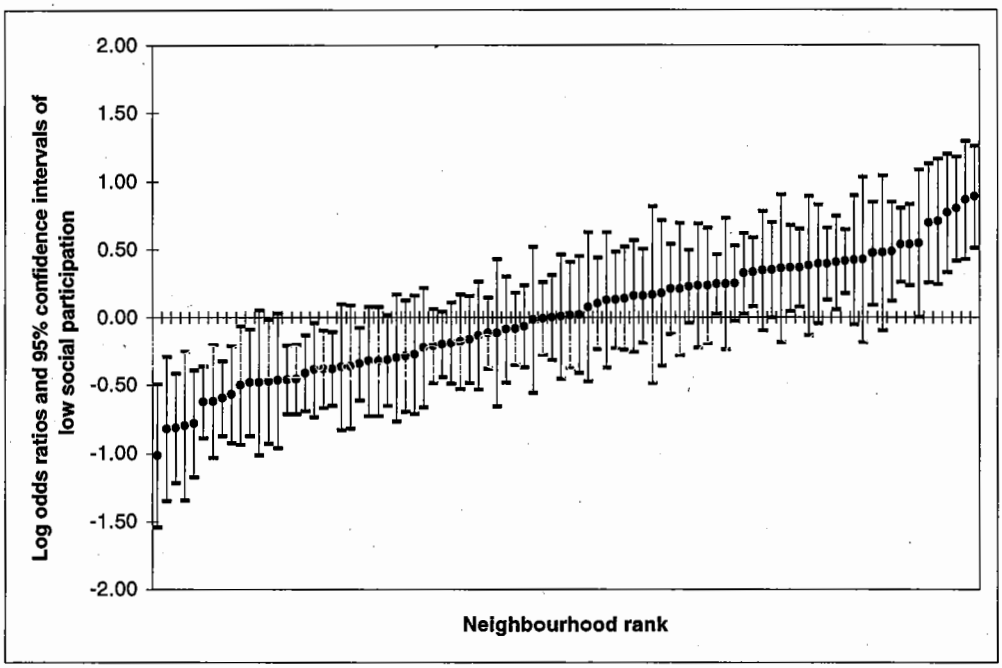


Figure 1. *Crude log-odds ratios of low social participation of the 90 neighbourhoods having the whole city of Malmö as reference (value=0) according to the empty model. The intra-neighbourhood correlation (i.e., the percentage of the variance in social participation that is related to the area) is 6.3%.*

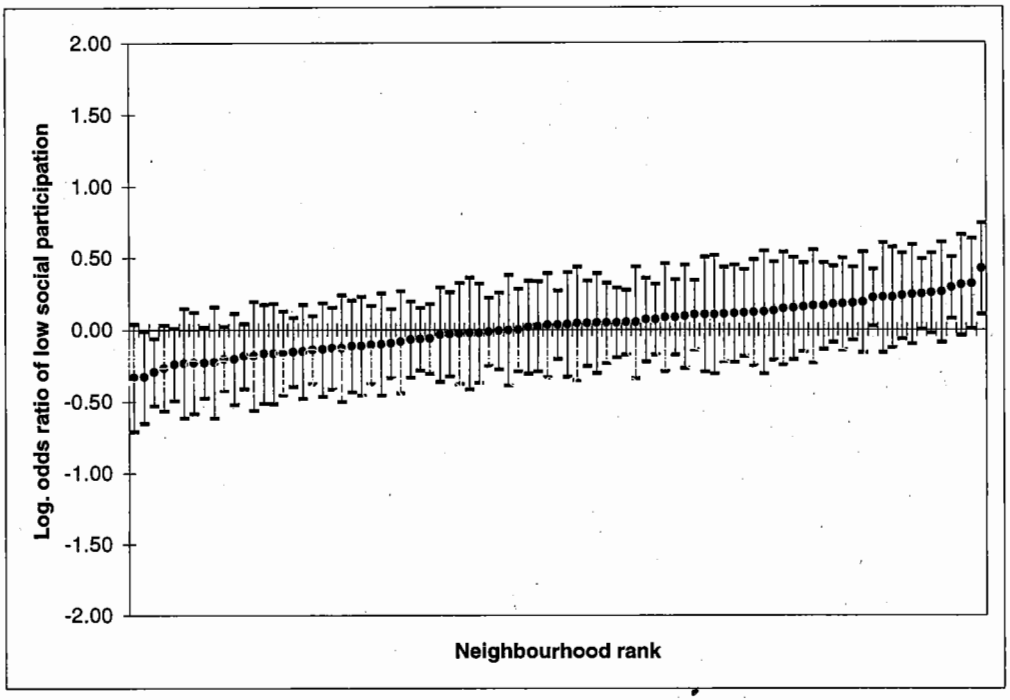


Figure 2. *Adjusted log-odds ratios of low social participation of the 90 neighbourhoods having the whole city of Malmö as reference (value=0) according the final model (i.e., all studied variables included). The intra-neighbourhood correlation (i.e., the percentage of the variance in social participation that is related to the area) is 1.3%.*

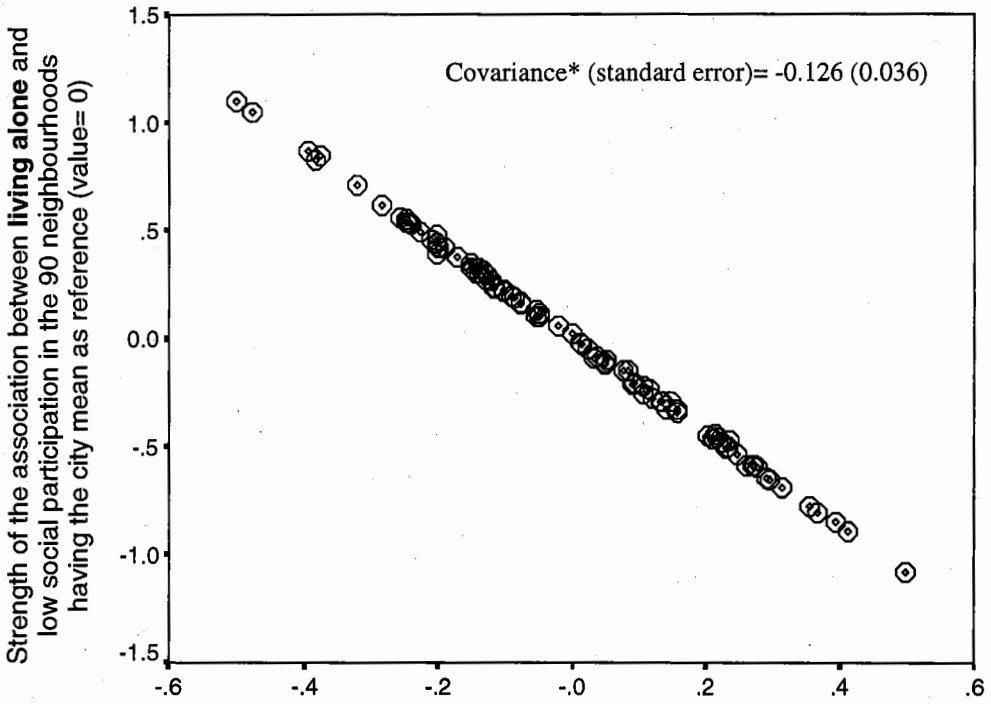


Figure 3. *Influence of the neighbourhood environment on the individual association between living alone and low social participation (i.e., cross-level interaction). Covariance between the slopes of the association between individual low social participation and living alone in each neighbourhood, and the level of low social participation of the neighbourhoods (i.e., intercepts). In this model age and sex were included.*

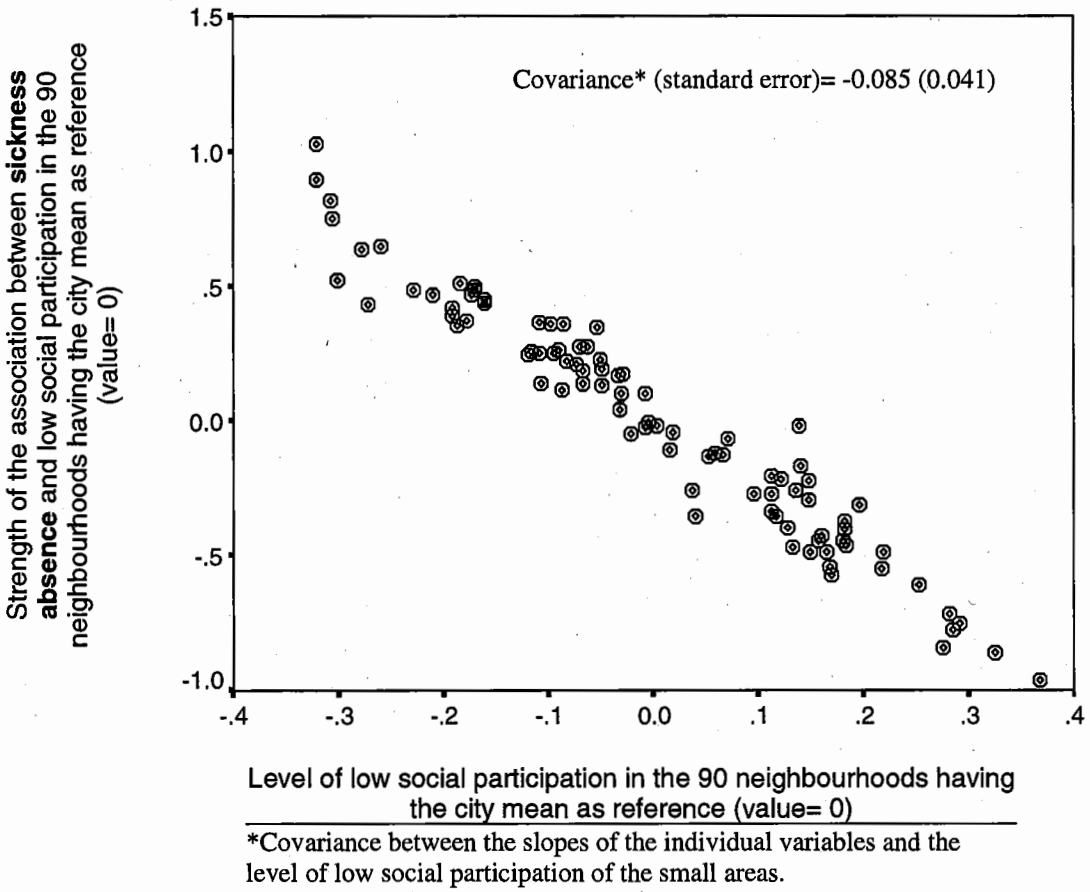
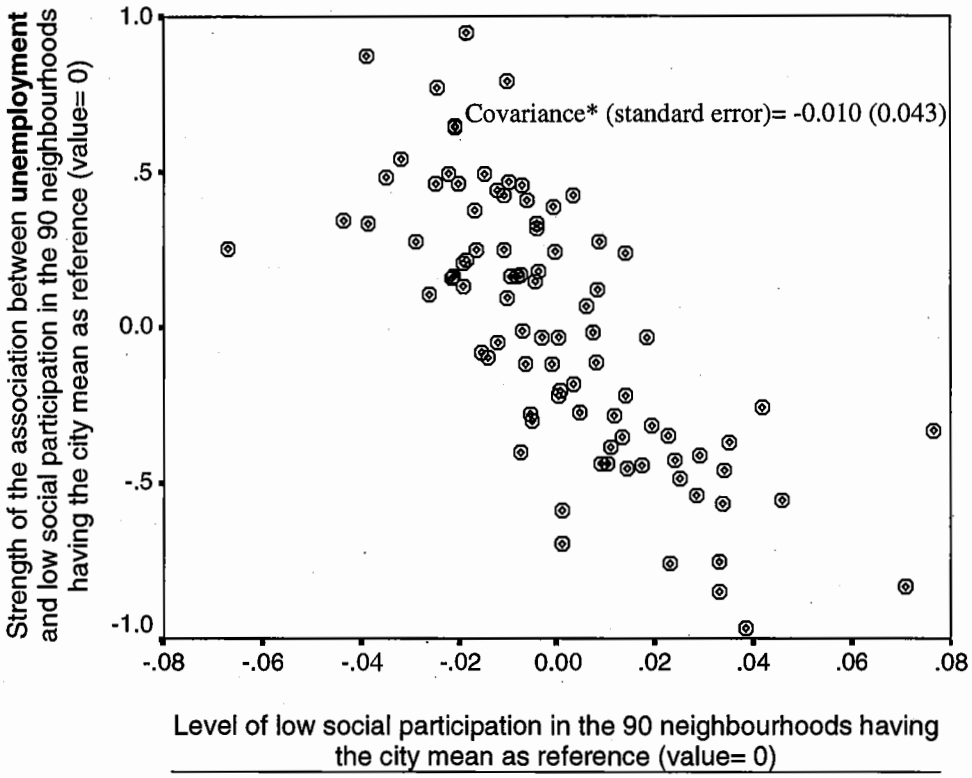


Figure 4. *Influence of the neighbourhood environment on the individual association between sick leave and low social participation (i.e., cross-level interaction). Covariance between the slopes of the association between individual low social participation and sick leave in each neighbourhood, and the level of low social participation of the neighbourhoods (i.e., intercepts). In this model age and sex were included.*



*Covariance between the slopes of the individual variables and the level of low social participation of the small areas.

Figure 5. *Influence of the neighbourhood environment on the individual association between unemployment and low social participation (i.e., cross-level interaction). Covariance between the slopes of the association between individual low social participation and unemployment in each neighbourhood, and the level of low social participation of the neighbourhoods (i.e., intercepts). In this model age and sex were included.*