

Social inequity in health

Explanation from a life course and gender perspective

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*To Ma & Baba (my parents), &
Daniel, Liam, Isabelle.*

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ABSTRACT

Background: A boy child born in a Gothenburg suburb has a life expectancy that is nine years shorter than that of another child just 23 km away, and among girls the difference is five years. There is no necessary biological reason to this observed difference. In fact, like life length, most diseases follow a social gradient, even in a country like Sweden where many believe there is no class inequity. This social inequity in health tells us that some of us are not achieving our potential in health or in life length compared to our more fortunate fellow citizens.

Aim: This thesis attempts to explore the patterns of health inequities and the pathways by which health inequities develop from a life course and gender perspective. In particular focuses on the importance of material, behavioural, health related and psychosocial circumstances from adolescence to adulthood in explaining social inequity in musculoskeletal disorders (MSDs), obesity, smoking, and social mobility.

Method: All four papers of this thesis were based on quantitative analyses of data from a 14-year follow-up study. The baseline survey was conducted in 1981 in Luleå, Sweden. The survey included all 16-year-old pupils born in 1965. A total of 1081 pupils (575 boys and 506 girls) were surveyed. They were followed up at ages 18, 21 and 30 years with comprehensive self-administered questionnaires. The response rate was 96.5% throughout the 14-year follow-up. In addition to the questionnaires data, school records, and interviews with nurse and teachers' were used.

Results: There were no class or gender differences in MSDs and in obesity during adolescence, but significantly more girls than boys were smokers. Class and gender differences had emerged when they reached adulthood with more women reporting to have MSDs but more men being overweight and obese. Women continued to be smokers at a higher rate than men through to adulthood. When an intersection between class and gender was considered, a more complex picture emerged. For example, not all women had higher prevalence of MSDs or smoked more than men, rather men with high socioeconomic position (SEP) had lower prevalences of MSDs and smoking than women with high SEP; and these high SEP women had lower prevalences than men with low SEP. The worst-off group was women with low SEP. The obesity pattern was quite the contrary, where women with high SEP had a lower prevalence of obesity than women with low SEP; and these low SEP women had a lower prevalence than men with high SEP. The worst-off group was men with low SEP. Regarding social mobility, health status (other than height in women) and ethnic background were not associated with mobility either for men or women.

The results indicated that unequal distribution of material, psychosocial, health and health related behavioural factors during adolescence, young adulthood and adulthood accounted for the observed social gradients and social mobility. However, several factors from adolescence appeared to be more important for women while recent factors were more important for

men. Important adolescent factors for social inequity and downward mobility were: unfavourable *material circumstances* defined as low SEP of parent, unemployed family member, and had no own room during upbringing; unfavourable *psychosocial circumstances* defined as parental divorce, poor contact with parents, being less liked in school, and low school control; and poor *health related behaviour* defined as smoking and physical inactivity. Among these factors, being less liked in school showed consistent association with all outcome measures of this thesis. Being less liked by the teachers and students was found to be more common among adolescents whose parents had low SEP. Men and women who were less liked in school during their adolescence were more likely as adults to be smokers, obese (only women), and downwardly mobile. The dominant adult life factor that contributed to class inequity in MSDs for men and women was physical heavy working conditions, which attributed to an estimated 46.9% (women) and 49.5% (men) of the increased risk in MSDs of the lower SEP group. High alcohol consumption among men with low SEP was an additional factor that contributed to class inequities in health and social mobility.

Conclusion: Social patterning of health in this cohort was gendered and age specific depending on the outcome measures. Unfavourable school environment in early years had long lasting negative influence on later health, health behavior and SEP. The thesis supports the notion of accumulation of risk that social inequities in health occurs due to accumulation of multiple adverse circumstances among the lower SEP group throughout their life course. Schools should be used as a setting for interventions aimed at reducing socioeconomic inequities in health. The detailed policy implications for reduction of social inequities in health among men and women are discussed (*page 61*).

Key Words: social inequity, pathways, social causation, life course, gender, intersectionality, smoking, musculoskeletal disorders, obesity, social mobility, Sweden.

ORIGINAL PAPERS

The thesis is based on the following publications, which will be referred by their Roman numerals in the text.

- I Khatun M, Ahlgren C, Hammarström A. The influence of factors identified in adolescence and early adulthood on social class inequities of musculoskeletal disorders at age 30: a prospective population-based cohort study.
Int J Epidemiol 2004; **33**: 1353-1360.

Commentary: Difficulties in disentangling social class inequities in musculoskeletal health. By Zwahlen M & Jüni P
Int J Epidemiol 2004; **33**: 1360-1361.

- II Novak M (f Khatun), Ahlgren C, Hammarström A. A life-course approach in explaining social inequity in obesity among young adult men and women.
Int J Obesity 2006; **30**: 191-200.

- III Novak M, Ahlgren C, Hammarström A. Inequalities in smoking: influence of social chain of risks from adolescence to young adulthood: a prospective population-based cohort study.
Int J Behav Med 2007; **14**: 181-187.

- IV Novak M, Ahlgren C, Hammarström A. Social and health related correlates of inter-generational and intra-generational social mobility among Swedish men and women. (Submitted)

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BACKGROUND

Introduction

A boy child born in a Gothenburg suburb (Bergsjön) has a life expectancy that is nine years shorter than that of another child just 23 km away (Älvsborg), and among girls the difference is five years.^{1,2} Within this short distance, nine years difference in average life length in a country where many believe has no class inequity. There is no necessary biological reason to why a child should live nine years shorter than another child. In fact, like life length, most diseases follow a social gradient. Those in the upper social hierarchy are less ill and live longer than those below them.^{3,4} This trend has been and is present in Sweden as well as in countries all over the world, whether low-income, middle-income or high income.^{3,5-8} It is the systematic differences in the health of groups occupying unequal positions in society. Nonetheless, this social inequity in health tells us that some of us are not achieving our potential in health or in life length compared to our more fortunate fellow citizens.

The inequity in health persists from before birth and throughout the life span in both men and women. For instance, low birth weight is a marker for conditions encountered in the womb, and thus for mother's health, which is strongly associated with socioeconomic deprivation. The association between low birth weight and lower socioeconomic position has been found in Sweden as well as other Scandinavian countries like Denmark, Finland and Norway.⁹ Babies born with low birth weight are not only at increased risk of poor health during childhood but also face increased risk of coronary heart disease in middle age.¹⁰ Children with lower socioeconomic circumstances have higher risk of chronic diseases,^{11,12} injuries,^{13,14} and premature mortality^{14,15} than children born into higher socioeconomic circumstances. Although health inequity persists throughout the life span it differs by age, tending to be large in infancy and childhood,^{9,11,12} smaller or absent in youth,^{16,17} and then large again in adulthood^{18,19} and in old age.¹⁸⁻²¹

The persisting health inequities have been shown regardless of the social stratification used, i.e. income, education, occupation, employment status, or neighbourhood characteristics.⁴ Men and women who are better educated, have professional occupations, have higher incomes and live in less socioeconomically deprived neighbourhoods are likely to enjoy better health and live longer than those who have no qualification, are unemployed, or in low-skilled jobs, earn less and live in socioeconomically deprived neighbourhoods.

Health inequity, however, is not just evident between people with the most and the least socioeconomic deprivations, but is apparent at every step of social hierarchy.⁴ It is not that a group of people at the very bottom of the social hierarchy who have poor health while everyone else is fine. Instead, there is a steady gradation from the very top to the very bottom. This phenomenon has been called “the fine grain” of health inequity.^{22,23} In the UK for instance, data show that not only men in the occupational class I (highest professionals) lives longer than the men in the class V (lowest), but within class I men who own two cars have higher life expectancy than those owning only one car.²⁴ Data from Sweden has shown that it is not only that men and women with lowest education have higher risk of mortality compared to highest education group, but among men, physicians with a PhD have a 50 percent lower risks of dying than physicians without a PhD.²⁵ A slightly similar tendency was observed among women but it was not as marked as for men. The observed associations are unlikely due simply to material conditions. One of the plausible explanations may lie in the status and prestige attached to having extra years of education or owning extra cars relative to others. The higher the status, the healthier people are likely to be.⁴ That status matters for health can be illustrated by a study done on Hollywood actors, which showed that the Academy Award-winning actors and actresses lived four years longer than their co-stars and the actors who were nominated but did not win.²⁶

Nonetheless, studies have repeatedly shown, not just a difference in health between the top and the bottom of social hierarchy, but rather a ‘fine grained’ health gradient throughout the lifespan exists. This has led to the idea of life-course approach in understanding health inequity.²⁷⁻³⁰ The life-course approach implies that ill-health in adult life is a result of accumulated exposure to adverse socioeconomic positions across the life course. However, very few studies take account of lifetime circumstances or duration of exposure to particular factors, primarily because this requires a longitudinal data.

It is also important to recognise that gender is a key and powerful form of social stratification that interacts together with social class to create and maintain social hierarchies, which will lead to differentials in distribution of resources between men and women throughout their lifecourse.³¹⁻³³ As a result, there will be health inequities not only between men and women, but the gender inequity will be influenced by other power dimensions, such as social class.

The present thesis is an attempt to understand the mechanism by which health inequalities develop between socioeconomic groups in Sweden from a life course and gender perspective.

In this Introductory section, first, the distinction between the concept of health ‘inequalities’ and health ‘inequities’ is presented. This is followed by presentation of the concept of socioeconomic classification, the importance of gender perspective in understanding social inequities in health, theoretical explanations to social inequity in health, the concept and the importance of life course approach in understanding health inequities, and earlier research that explored different pathways for social inequity in health. The Introduction ends with a brief background to each paper that the thesis is based on.

Inequalities vs. inequities in health

Technically, the term ‘inequality’ means ‘the state of being non-equal’ and ‘inequity’ means ‘unfairness’. Inequalities in health, therefore, describe the observed differences in health between individuals or particular social groups (rich vs. poor, men vs. women, or people with different age, race, ethnic, religious or sexual orientation background etc) independent of any assessment of their fairness.

On the other hand, inequalities in health that is avoidable, unjust, and unfair constitute health inequities ^{5,34,35}. For instance, health differences that are determined by biology are more likely to be unavoidable or fair inequalities, example, men have prostate cancer and women have cervical cancer. In contrast, health differences arising from social determinants where the individual often have little choice, such as lifestyle, work and living conditions, or access to health services are more likely to be considered avoidable, unfair and are thus considered inequities.

Recently, Braveman argued that to determine whether a specific difference is unjust or unfair may be difficult or impossible to measure.³⁶ The author has proposed a more comprehensive definition of health inequalities and inequities to guide measurement. The proposed definition is as follows:

“A health inequality is a particular type of difference in health or in the most important influences on health that could potentially be shaped by policies; it is a difference in which disadvantaged social groups (such as the poor, racial/ethnic minorities, women or other groups that have persistently experienced social disadvantage or discrimination) systematically experience worse health or greater health risks than more advantaged group.”

Here, social advantage refers to one's relative position in the hierarchy determined by wealth, power, and/or prestige. With this definition, an important issue has been raised for common understanding that when health inequality is discussed it does not refer to all differences in health but rather a particular type of difference in health that could be shaped by policies. And also that pursuing equity would mean pursuing the elimination of such health inequalities.

Most recently, in 2005, The World Health Organisation established the Commission on Social Determinants of Health (CSDH). The CSDH is chaired by Michael Marmot and it is a global action initiated to promote health equity. CSDH adopted the term equity/inequity and defined health equity as the absence of systematic differences in health, both between and within countries that are judged to be avoidable by reasonable action.³ Throughout this thesis the term health inequity has been used.

Socioeconomic classification

Like gender and ethnicity, socioeconomic position (SEP) is one of the most important social stratifications, which describes the structural positions of individuals in society.^{37,38} It refers to an individual's place in the social standing or hierarchies built around education, occupation and income. These structural positions powerfully predict individuals' life chances and living standard and thus the likelihood of health-damaging and health enhancing exposures, behaviours and resources.^{37,38} A measure of a social stratification enables us to study how resources, living condition and lifetime opportunities are distributed according to individuals' structural positions in society and how it influences the likelihood of achieving good health.^{37,38} In health-related research, the most commonly used SEP indicators are occupation, education, and income.³⁷⁻⁴¹ Although interrelated, each of these indicators represent different features of SEP, has different advantages and drawbacks, and may capture different aspects of overall health risk.^{37,38,40,41}

Income

Income is the most direct measure of material resources aspect of SEP.^{37,38} It determines purchasing power and resources needed to maintain good health. For instance, higher income allows access to better housing, location of housing, clothing, food, transportation, health care, education, and easier access to recreational and physical activities. Higher income can also provide social standing and self-esteem and facilitate participation in society, which are beneficial for health. However, income from one point of life alone does not fully capture the economic status of individuals or households; life course accumulation of income and wealth need to be taken into consideration. To estimate individuals' health effect of income, household

rather than individual income is more important and needs also to be adjusted for the number of family members. One problem with household measures of income is that all household members—mainly women, may not have equal access to household income.⁴²⁻⁴⁴ Moreover, association between current income and health are subject to reverse-causation problem where people with poor health may suffer a loss of income.

Education

Education reflects the knowledge-related asset of an individual and the ability to turn information into practical measures and behaviors that are likely to promote healthy lifestyles.^{38,40,41} Higher levels of education are associated with better economic and psychological outcomes (i.e. better jobs, more income, more control, and greater social support and networking), and are therefore, beneficial for health outcome.³⁸ However, women and minorities may not achieve equal economic returns for the same level of education.³⁸ Educational level, therefore, may not be a direct measure of SEP within the social stratification. The main advantages of education are that it is relatively easy to measure, all individuals can be classified independent of age, gender and working circumstances, and it is less subjected to reverse causation problems in adulthood than income and occupation although childhood deprivation associated with low SEP may affect later educational attainment.^{37,38,41}

Occupation

Occupational based indicator of SEP is most commonly used in the UK and in other European countries.^{37,45} Occupational position represents the major structural link between education and income.³⁸ It represents the educational attainment required to obtain the job and income levels that vary with different jobs and within ranks of occupations. Additionally, it shows achievements and skills required for the job. Occupational position reflects certain physical and psychosocial characteristics of working conditions that are detrimental for health outcome. For instance, many occupations require exposure to physically hazardous environments such as chemicals, radiation, noise, heat cold, dust etc. Psychosocial dimensions of working conditions such as decision making ability and control, psychological demands on the job, and social support at work have been shown to be influential determinants of health.³⁸

Occupation also represents ones social capital in the form of social standing or status in community. Higher level of status may be related to health because certain privileges, such as better health care, education, and prestigious housing facilities are more easily accessible for them.^{37,46} Occupation-based indicator does not only capture more specific job-related

factors and its effect on health but also captures the effect of material resources as occupation is strongly related to income.⁴⁶ Although, occupational characteristics cover most relevant aspects of socioeconomic inequities, one drawback of occupation-based SEP classification is that it is limited to population in the labor force only. Most often, people who are unemployed, retired, students, work inside the home (mainly affecting women) as well as people working in unpaid, informal or illegal jobs are excluded.^{37,38} Exclusion of people who are outside the labour force such as unemployed people has been shown to result in underestimation of social inequity.⁴⁷ Another drawback of using occupational-based SEP classification is that later-career occupations are subject to reverse causation problems where people with poor health may suffer a loss of employment.

Gender perspective

Gender perspective in social inequities in health research

The two research paradigms ‘gender research’ and ‘social inequity in health research’ have expanded greatly over the past decade.⁴⁸ Gender research is based on analyses of the structurally organised relationship between men and women (power relations/distribution) as well as on the social and cultural constructions of gender in a society and how it affects health.⁴⁹ Research on health inequities, on the other hand, is mostly concerned with how one’s SEP influences one’s health.⁴⁸ Despite a growing amount of literature in social inequities in health over last decades, few attempts have been made to integrate gender perspective into the broader discourse of health inequities research.^{33,50}

Gender perspective in understanding social inequities in health

The concept of gender “is related to how we are perceived and expected to think and act as women and men because of the way society is organized, not because of our biological differences”.⁵¹ Gender is a structure of social relations within which individuals and groups act.⁵² Through our social interaction gender is constantly reproduced to which we all contribute in different ways. Gender as a social construct, varies by time, place and social context.⁵²⁻⁵⁴ Gender is also a key and powerful form of social stratification that interacts and intersects with other social features like age, social class or race/ethnicity,^{55,56} which is known as the theory of intersectionality.

The theory of intersectionality suggests that these socially constructed categories of differentiation do not function independently of one another, rather interact together to create and maintain social hierarchy, which produce both oppression and opportunities.^{31,32} That will lead not only to inequities between men and women, but also to inequities between different

groups of women and different groups of men. For example, we cannot claim that all men have better health than women when some groups of women have better health than men with minor ethnic background.⁵⁷ In her study on Swedish men and women, Wamala et.al. (2009)⁵⁷ found that women with high income born in Sweden have better health than men with high income born outside Sweden. Therefore, it is important to recognize that ‘men’ and ‘women’ are not homogenous categories.^{52,58} Women, like men are different in relation to their social class and ethnic background.

One of the keys in understanding health inequities is to analyse the distribution and uses of power and resources between different social groups.⁴⁸ According to Connell (1996), every society has a gender order in which men’s domination and women’s subordination is maintained.⁵⁹ Accordingly, systematic gender differences can be found in access to economic resources where women are generally disadvantaged, and this is reflected in women’s occupation and wages relative to men’s.³³ Women tend to be employed in low status jobs and low status jobs are associated with unfavourable working conditions characterized by powerlessness and lack of control⁶⁰ which are detrimental for their health. For decades, Sweden and other Nordic countries have been well-known for their efforts in attaining class and gender equity.^{61,62} However, still in all SEP group women’s incomes are less than that of men.⁶³ Moreover, at the same level of employment women experience lower levels of control at work than men do.⁶⁴ Women have the primary responsibility for childcare and other unpaid household work⁶⁵⁻⁶⁸ which may cause higher physical and psychological stress and this may be a contributing factor to more muscle pain problems among women than among men that are observed in general.⁶⁸ This unpaid work at home also creates a situation of relative economic inequity for women relative to men. This unequal distribution of economic resources and power affects women health disproportionately.

Women are also disproportionately affected by the social construction of body image. For example, obesity is, in general, more stigmatised among women than among men in Western culture.⁶⁹ Even though the body image of men is becoming more and more exploited and men are becoming more body conscious,⁷⁰ thinness is still considered as the ideal and attractive body shape for women in Western culture. Thinness is also considered as a marker of social distinction in Western culture and more likely to be valued, particularly by women with higher SEP.⁶⁹ Likewise, evidence has consistently shown that women with higher SEP tend to have a lower risk of obesity than women with lower SEP, and the SEP effects are less consistent among men.^{71,72} Despite the lower risk of obesity among women with high

SEP, weight related issues are a major source of dissatisfaction among them than among men and among women with lower SEP.⁷³

The construction of gender is a continuous process, which could be seen in different kinds of social practices, such as health related behaviour.⁷⁴ Like other social practices, health related behaviours can be understood as a means for demonstrating masculinities and femininities.⁷⁴ The kind of unhealthy behaviours that men use to demonstrate their masculinities are intimately related to their social class position. Among other unhealthy behaviours, heavy drinking of alcohol is often adopted by the lower-status men to demonstrate masculinities. This may be an attempt to compensate for their subordinated position in society and this kind of unhealthy behaviour is readily accessible to those who may otherwise have limited social resources for constructing masculinity.

Femininities of working class women are constructed around relational orientations and assuming responsibility within a context of women subordination.⁷⁵ Therefore, women are more likely to adopt health related behaviours which are seen as compatible with fundamental aspects of traditional women roles. For instance, “heavy drinking may interfere with a women’s ability to meet traditional women responsibilities for child care and sexual restraint, and thus women are not expected to heavy drinking”.⁷⁶ This kind of femininity is beneficial for women’s health. However, their subordinate position in society may lead to other health damaging behaviours which are harmful.⁵⁸ As seen in the Western culture that smoking is changing from being predominantly a masculine activity to being a feminine activity, particularly among lower SEP groups.⁷⁷ This is possibly because it is a more socially acceptable way for women to relieve stress than alcohol or food consumption (associated to obesity).²⁹ Cigarettes for lower SEP groups are a cheap and effective coping mechanism for stress associated to deprived economic conditions and lack of control.^{4,78}

In summary, social inequities in health is best understood if one considers fundamental social constructs that include not only gender but also social class and race/ethnicity.^{48,57} An understanding of the relationship between social class, gender and ethnic background would provide better clues to differential health and illness patterns observed for men and women.

Theoretical explanations to social inequity in health

The Black Report (1980) is one of the first published reports in which the authors have proposed different theoretical explanations to why social class differences in health occur.⁷⁹ The proposed theoretical explanations are divided into four categories: artefact, cultural/behavioural explanations,

materialist or structural explanations, and theory of natural or social selection:

Artefact: This explanation recognizes that there are class inequities; however, observed class difference in health may partly be artificially produced due to measurement error related to social class or the health measures used. In other words, the size of the observed class inequities would vary depending on how the data on social class and the health measurements are collected and analysed.

Cultural/behavioural explanation: This explanation suggests that health behaviours are differentially distributed across social classes, where health damaging behaviours tend to cluster in lower social classes and contribute to the social class inequity in health and premature death.

Materialist/structural explanation: This explanation implies that class differences in health are causally produced as a result of unequal distribution of material and psychosocial resources between different occupational positions, such as income, housing condition, work condition etc. In other words, it is individuals' social class position that determines their health. This explanation is often referred to as *social causation* or *causal mechanisms*.

Natural or social selection: Contrary to materialist theory, this theory proposes that health determines social position not *vice versa*. According to this theory, social class difference in health occurs due to healthy people moving up the social hierarchy and unhealthy people moving down. This is also known as *drift-hypothesis* (drifting up or down the social hierarchy due to health). In health inequity research, the process is commonly referred to as *health selection*, *reverse causation*, *health-related social mobility*, or *discrimination on the basis of health*.

Psychosocial pathway

One important advance in the past decade has been recognition of the influence of psychosocial conditions on health inequities. Many studies have demonstrated how psychosocial conditions (not only material conditions) vary between occupational groups, and that is part of the explanations as to why lower social groups have higher morbidity. The common psychosocial conditions that have been shown to influence health inequities are, for example, job demand and control,⁸⁰⁻⁸³ social network^{81,82}, and social support.⁸¹⁻⁸³

Life course perspective

Recently, the importance of life course approach in understanding social inequities in health has increasingly been recognised.²⁷⁻³⁰ An integral part of this approach is to study how risk factors throughout the life course combine to influence adult health. The life course approach does not deny the importance of adult factors rather pays particular emphasis on the long term effects of childhood and adolescent factors on later diseases. “It includes studies of the biological, behavioural and psychosocial pathways that operate across an individual’s life course, as well as across generation, to influence the development of chronic diseases.”²⁷

It is also important to understand that since men and women occupy different social positions in a society (at work, home etc), the type and the extent of the exposure would be different throughout their life course. The purpose of life course approach is to study the contribution of early life factors together with later factors to identify risk or protective pathways across the life course. The social condition in which people are born, grow, live, work, and age is essential in understanding health inequities.^{3,84}

In health inequity research, a life course perspective takes account of how socially patterned exposures during gestation, childhood, adolescence and early adult life influence adult health and social position, and thus may account for social inequity in adult health and mortality. It suggests that class inequities in health are produced due to differential accumulations of and exposures to risk factors throughout the life course, with more unfavourable conditions experienced by the lower social classes. This approach may have important policy implications by highlighting the type (what factors) and timing (from which age or life stage) of interventions to achieve a maximum impact on health. Therefore, the use of longitudinal data collected from childhood throughout different stages of life is the key to address life course approach.

Life course approach proposes different hypothesized pathways through which exposures across life course may link to later health outcomes. The proposed pathways includes: *chain of risk* and *accumulation of risk*.²⁸ The pathways are described below.

Chain of risk hypothesis

The concept of chain of risk describes how a sequence of linked exposures that raise disease risks because one bad exposure tends to lead to another, and then another in a cumulative way continuing to adulthood. Similarly, a protective chain may also occur where one advantage lead to another advantage in a cumulative way, which in turn will leads to beneficial

outcomes. These models of hypothesis emphasize that adolescence and young adulthood are an important life stage because during this time many important transitions are negotiated. Of particular importance is education, which may act as the key link in the lifetime chain of advantage and adversity.

Accumulation of risk hypothesis

Different types of exposures gradually accumulate throughout the life course through episodes of illnesses, injuries, adverse environmental conditions, and health damaging behaviours, which increase the risks of morbidity and mortality. The extent of health damage may increase as the number, duration, or severity of exposures increase. Different risk exposures may affect health either independently or interactively. Accumulation of risk has been a key concept of life course approach to study chronic disease aetiology.

There are other suggested life course pathways, for instance, critical period, sensitive period, embodiment, induction and latency period and so on. For further reading see these referenced articles.^{27-29,85}

Earlier research on pathways of how social inequities in health emerge

Since the appearance of the Black Report in 1980, a large volume of research has been published with the main focus on how much each explanatory model (artefact/selection/causal/behavioural) can explain observed social inequity in health. Findings from these studies collectively suggest that observed health inequities between social classes are largely produced by social causation,^{23,86-90} selection or artefact mechanism is believed to have negligible impact,^{23,86,87,90-93} and it is not solely attributable to individual behaviours.^{23,86,94,95}

Life course approach is relatively a new concept. To address life course perspective, longitudinal studies with prospective information collected in childhood, adolescence, young adulthood, and older ages are sparse. A few prospective longitudinal studies, predominantly from the UK that are available today and provide valuable sources of evidence on the life course pathways. For instance, Power and colleagues study on 1958 British birth cohort showed that an accumulation of adverse material and psychosocial conditions from birth to age 33 contributed to subsequent social inequity in self-rated health among adult men and women.⁹⁶ The diverse factors for men and women include SEP at birth, SEP at adolescence, school qualification at adolescences, and psychosocial job strain at age 33. Additional key factors for men were adult smoking, and job insecurity, and for women, housing during childhood, adult income, and age at first child.

Another longitudinal study, on Scottish men with data on adult social position and retrospective data on father's occupation and own occupation at labour market entry, found that those who remained in less favoured circumstances throughout life had the highest mortality risk,⁹⁷ suggesting that risk accumulates over the life course.

A Swedish study with data from 1992-94 on all adults aged 45-70 years who lived in Stockholm (born during 1922-49), and record linkage data on their SEP from birth and onward showed that adverse SEP over the entire life course increases the risk of myocardial infarction among men and women (Stockholm Heart Epidemiology Programme, SHEEP).⁹⁸ Several other studies have demonstrated that accumulated exposures to adverse socioeconomic positions across the life course increases the risk of disease among men and women.⁹⁹⁻¹⁰⁷

Focus of the thesis

This thesis is an attempt to explore the material, psychosocial, and behavioural pathways by which health inequities develop between social groups in Sweden from a life course and gender perspective. The thesis focuses specifically on musculoskeletal disorders (MSDs), obesity, smoking, and social mobility.

MSDs

Pain is the primary symptom of most MSDs and may affect the body muscles, joints, tendons, ligaments and nerves. Most commonly MSDs affect the back, neck, shoulders and upper limbs areas. In Sweden, MSDs are the most prevalent reported causes for ill health^{108,109} and also are the leading causes for work absence, long-term work disability and early retirement.¹¹⁰ MSDs are strongly age, gender and class related, i.e. tend to increase by age, tend to occur more frequently among women than men, and men and women with lower social class report higher prevalence of MSDs than higher social class.¹¹⁰ Since 1990, class differences in MSDs among Swedish men have decreased, mainly due to decreased prevalence among blue-collar men, while class differences have remained unchanged among women. A better understanding is needed of the potential risk factors, which contribute to these gender-related class differences.

Obesity

The prevalence of obesity has increased dramatically worldwide, and today obesity is regarded as a major contributor to the global burden of disease and disability.¹¹¹ Numerous health risks are known to be associated with obesity, including coronary heart disease, hypertension, certain cancers (post-menopausal breast, colon, kidney, prostate, endometrial, etc.¹¹²), non-

insulin-dependent diabetes mellitus, MSDs, and infertility.^{111,113} According to some experts, the current generations of children are likely to have shorter life expectancies than their parents because of obesity¹¹⁴. High body fatness is a strong predictor of long-term sick leave¹¹⁵ and early work disability pension.¹¹⁶

Besides the physical health consequences of obesity, obese people, particularly obese women, suffer from social stigmatisation, prejudice, and discrimination, which may even influence their social class.^{117,118} Thus, both direct and indirect costs attributed to obesity are huge for any society. In Sweden, direct costs for obesity-related complications are estimated to be SEK 3 billion per year, and indirect costs (such as for sick leave, early pensions etc.) are presumed to be as high as for direct costs.¹¹⁹ Therefore, it is essential for a society to identify risk groups as well as underlying factors that contribute to the development of obesity. Across all industrial countries, considerable evidence suggests that people with low SEP are at greater risk of becoming overweight and obese than people with high SEP.^{100,101,120-124} Social differences in obesity are reported to be widening in Sweden, particularly among women.¹¹⁰ It is important to explore the mechanisms by which a social inequity in obesity is generated and maintained in a particular social context.

Smoking

Cigarette smoking varies markedly by time, place, gender, and SEP.¹²⁵ Smoking is known to spread through populations like an epidemic which proceeds in a 4-stage phase.⁷⁷ In stage 1, smoking is an exceptional behaviour and mainly adopted by upper class men. In stage 2, smoking becomes more common in men of all social classes, still with higher rates among higher social classes. In women, these patterns usually emerge 10-20 years after those of men. In stage 3, smoking rate decreases sharply, particularly among higher class men. However, upper class women reach their peak in the beginning of this stage, but at the end their rate also starts to decrease. In stage 4, smoking rate among men and women of higher social classes continue to decrease, but smoking becomes more prevalent among men and women of the lower social classes.

Smoking rate in the Northern European countries seems to be at stage 4, where smoking is found more prevalent among young adult men and women with lower social classes.^{126,127} In northern European countries smoking is now established as a marker of social deprivation.¹²⁸ Literature suggests that the pathway between social disadvantage and smoking is a process which requires an understanding of life-course influences.^{29,129} A life-course approach recognizes adolescence and young adulthood as an important life

stage for behavioural development.²⁹ However, few longitudinal studies have explored the pathways through which risks factors from different life stages are linked to socioeconomic variations in smoking behaviour among adult men and women.

Social mobility

The health selection hypothesis as proposed by the Black report is addressed in paper IV of this thesis. The health selection hypothesis has been one of the most controversial explanations of class inequities in health.^{130,131} The hypothesis proposes that it is the individuals' health status that determines their social position, which is closely related to the Darwinism view as it claims that those biologically fit are upwardly mobile. According to this hypothesis, social class difference in health occurs due to healthy people moving up the social hierarchy and unhealthy people moving down. Today, there is a substantial body of evidence to show that social mobility does not create or widen social class difference in health as it was originally believed but rather constrains it.^{87,91-93,132} In other words, social inequity in health would have been wider in the absence of social mobility. The narrowing of health inequity is suggested due mainly to the fact that the upwardly mobile tend to have better health than the class they left behind but poorer health than those they join, and *vice versa* for the downwardly mobile.^{87,91-93,132,133} Therefore, increasing social mobility is viewed as a desirable policy to reduce health inequity.¹³² In this context, it becomes important to explore what determines social mobility in a particular social context.

Social mobility may occur either at inter-generational or intra-generational transition periods. Individuals' occupational movement between class of origin and achieved social class as individuals move from adolescence into adulthood, i.e. movement "across" generations is referred to as inter-generational mobility. Individual movement within the adult class structures, i.e. movement "within" generation referred to as intra-generational mobility. Previous studies suggest that health,^{87,92,134-136} material deprivation,⁸⁷ psychosocial environment at school,¹³⁷ and health related behaviours¹³⁸ are linked to the chance and the direction of social mobility. However, these studies focus on men only,⁸⁷ combined men and women in analyses,¹³⁷ use limited indicators,^{87,137,138} or address mobility only at one transition (inter- or intra-generational).^{87,92,134-138} Prospective longitudinal analysis in determining social mobility both among men and women and both at inter- and intra-generational transition is lacking.

AIM

The overall aim of this thesis is to explore the patterns of health inequities and the pathways by which health inequities develop from a life course and gender perspective. The thesis also explores the pattern and the determinants of social mobility among men and women both at inter and intra-generational transitional periods.

Specifically this thesis addressed the following research questions:

1. How do gender and SEP intersects to determine the distribution of MSDs, obesity, and smoking among the study subjects during their adolescence to adulthood (*papers I, II, and III*)?
2. What is the importance of material, behavioural, health status, and psychosocial circumstances from adolescence to young adulthood in explaining social inequities in MSDs and obesity in men and women (*paper I, and II*)?
3. How are different social risks factors from different life stages linked to adolescent smoking and maintenance of smoking through to young adulthood (*paper III*)?
4. What is the extent and pattern of occupational mobility among men and women both at inter- and intra-generationally transition periods (*paper IV*)?
5. What impact do the various health related measures, health-behaviours, psychosocial environment at home and school, material resources, and ethnicity have on the chances and the direction of social mobility among men and women (*paper IV*)?

METHODS

All four studies of this thesis are based on quantitative analyses of a 14-year follow-up of the Northern Swedish Cohort (NSC) born in 1965.



Figure 1. Location of Luleå. Map of Sweden and other Nordic countries excluding Iceland.

Setting

The follow-up study was carried out in Luleå, Sweden. Luleå is situated in the north of Sweden approximately 100 km south of the Polar Circle (see Figure 1) and is the largest city of Norrbotten County. The area of Luleå municipality is 1810 km² and the number of inhabitants during the study was about 70,000. The average life expectancy in Luleå is 77.6 years for men and 82.2 years for women compared to 77.9 years for men and 82.4 years for women in the whole country during the period of 2001-2005.¹³⁹ As in all of Sweden, the major causes of death in Luleå are circulatory disease, cancer, accident and suicide.¹³⁹

Luleå represents a typical middle-ranged industrial city in Sweden. Besides the local government and the County Council, the steel factory Swedish Steel AB (SSAB) is the largest employer. Fourteen percent of the population is employed within manufacturing or mineral extraction. Luleå also has a technical university enrolling 10 000 students, mostly men. Luleå can therefore be characterised as a men-dominant city both in term of occupation and higher education. The economic prerequisite for iron production was made possible with the introduction of the “Ore railway” in 1906 allowing iron to be transported from the inland of Norrland to Luleå. After the Second World War the economy and steel industry in Sweden grew rapidly due to large export demands.

During the decade the study participants were born, 1960's, the Swedish economy and industry had a record growth, which lead to a large workforce demand. From 1960 to 1975 Luleå's inhabitants grew rapidly from 50,000 to 70,000 and many work force immigrants came from Finland. Eighty five percent (85%) of the study subjects had both parents as Swedish born, 14% had one or both parents born in Finland, and 1% had parents from other European countries. Other than native Swedish, still in the year 2009 the main ethnic group in Luleå is Finnish (27%).¹⁴⁰ In 1995 when the third data collection was performed, the proportion of smokers, overweight, obesity, and MSDs found among the study cohort members was quite comparable to Sweden as a whole (see Appendix 5).

Population and Data Collection

The baseline survey of the 14-year follow-up study was conducted in 1981. The survey included all 16-year-old pupils born 1964-1966 (95% were born in 1965), who attended or should have attended the last year of compulsory school in Luleå municipality. The total number of 16-year-old pupils that were surveyed were 1081 that included 575 boys and 506 girls (Table 1). The cohort was then followed up in 1983, 1986, and 1995, i.e. at ages 18, 21 and 30 years, with comprehensive self-administered questionnaires (Table 1).

The questionnaires were constructed from previously validated questionnaires.¹⁴¹⁻¹⁴⁵ The questionnaire consisted of information on social background, education, employment status, work condition, a wide range of both psychological and somatic health problems as well as health behaviours such as smoking, alcohol and drug use. The pupils were investigated during school hours at school both at age 16 and 18 years.

Table 1: A diagram of the 14-years follow-up surveys (1981-1995).

	16 years	18 years	21 years	30 years
Source	1981	1983	1986	1995
Subjects	Questionnaire	Questionnaire	Questionnaire	Questionnaire
School records	Register data			
School teachers	Interview	Interview		
School nurses	Interview			
No. of death	-----> 3		-----> 2	
	1081	1070	1060	1043
Total subjects	(99.0%)	(99.0%)	(98.1%)	(96.5%)
	575 boys	567 boys	560 men	547 men
	506 girls	503 girls	500 women	496 women

After compulsory schooling, about half of the study cohort members moved away from Norrbotten and about half of them moved back by 1995. This means that around 75% of the cohort members were living in Luleå at the time of survey in 1995. In 1986 and 1995, all cohort participants were invited to reunions with their class, during which they also filled in the questionnaires. Their addresses were obtained from the national population register. In Sweden, each individual is given a personal identification number, which makes it possible to find addresses of almost everyone who lives in the country.

Extensive work was carried out in order to reduce the non-respondent rate to a minimum. The project leader was present during all the class reunions and was able to answer questions regarding the questionnaires. Personal or telephone interviews were performed with participants with reading and writing difficulties, in which the interviewer read the questions and response categories exactly as written in the mailed questionnaire. Those who had moved or could not attend the class reunions received a mailed

questionnaire including a reminder. Those who still failed to reply were contacted by telephone and interviewed, if they agreed to participate. The total response rate was 96.5% throughout the 14-year follow-up. The response rates were slightly higher among women than among men during all four-phases of surveys (see Table 1), but the differences were not statistically significant.

In addition to the 14-year-follow-up surveys, register data from grade 9, *i.e.* the last year of compulsory schooling were obtained for all pupils (Table 1). Personal, standardised interviews about each pupil were performed by the project leader with all form teachers in 1981 regarding the teachers' opinions about the pupils' school situation, health, and future prospects on the labour market, as well as in relation to studies. A total of 65 form teachers were interviewed with previously validated questionnaires.^{146,147} In Sweden, the form teachers usually have regular contact with the pupils, teach at least one major subject, coordinate the class work, and have the main responsibility for contacting parents.

Additionally, personal standardised interviews about each pupil were performed by the project leader with all school nurses in grade 9 regarding the health situation of the pupils. Also registered data from the school health records were obtained such as height, weight, etc.

In Sweden, the school nurse was first introduced in 1919, but school physicians were already introduced in the middle of the 1800s.¹⁴⁸ The school physicians' main task was to provide health care to the poor students. With school nurses, the primary aims were to work preventively with pupils to promote healthy lifestyles and also follow the pupils' development and health. The school nurse provides each pupil at least three health controls (e.g. measuring weight, height, etc.) from age 6 to 16 years, evenly distributed during their school period. Additional controls of eyesight and hearing are also performed. A school nurse has 3 yrs of university nursing education and an additional one year training/education. A school nurse is a full time occupation, and today one nurse is responsible for one or more schools. Other than routine health checkups, a school nurse is present during one or more school days of the week and provides consultation and or services to students in need. There is also at least one school physician per city available for further consultation.

The pupils' questionnaire was constructed mainly using questions from well-known and validated questionnaires which were accessible during the different phases of surveys.^{142,143,149-151} In 1981, the questions about alcohol,

tobacco, and drug use were tested for their reliability and results were found to be satisfactory.¹⁵²

The study was approved by the ethics committee of Uppsala University and Umeå University. The important ethical considerations were that the study participants and schools authorities were given sufficient information regarding the aims of the study, the methodologies to be employed, and the expected results. Additionally, each participant was informed that they were free to abstain from participation in any part of the study at any time, ensured absolute anonymity of the respondents when answering the self-administered questionnaire, and all measures were to be taken to respect the individual's privacy. The participants' consents were obtained explicitly before participation, and school authorities' consents were obtained regarding whether they would allow a survey to take place in their schools.

In all four studies of this thesis, data from follow-up questionnaires, school records, teacher interview, as well as school nurse interview were used.

Study variables, definitions and classifications

Socioeconomic classifications for this thesis:

Definition of Occupation

For ages 21 and 30 years, the Swedish Socioeconomic Classification (SEI) schema¹⁵³ was used for classification of their current occupation. The SEI classification take into consideration the educational background needed, job responsibility levels, and specific duties to be performed. The SEI classification schema consists of six groups in aggregated level:

1. *Unskilled and semiskilled manual workers*: occupations normally require less than 11 years of schooling (e.g. drivers, shop assistants)
2. *Skilled manual workers*: occupations normally require 11 years or more of schooling (e.g. mechanics, nursing assistants)
3. *Lower non-manual workers (assistant non-manual)*: occupations normally require 11 years but not 12 years of schooling (e.g. secretaries)
4. *Intermediate non-manual workers* occupations normally require 12 years but not 15 years of schooling (e.g. registered nurses, mechanical engineers)
5. *Higher non-manual workers (employed and self-employed professionals, higher civil servants and executives)*: occupations

normally require at least 15 years of schooling (e.g. teachers, government administrators)

6. *Self employed other than professionals*: self employed and farmers.

In this thesis, in order to avoid smaller sample size in certain cells the six categories were merged into two groups where manual workers were grouped into blue-collar and non-manual into white-collar workers. At age 30 years 93.7% of the population (94.3% men, 93.0% women) could be classified by their occupation. At age 21 years 80.8% of the population (77.1% men, 84.9% women) could be classified by their occupation. Among the unclassified groups at ages 21 and 30 years, those who had educational level ≤ 11 years were included in the blue-collar group and those who were studying at the university or had educational level ≥ 12 years were included in the white-collar group.

At age 16, the subjects reported regarding their parents occupation, which was coded according to SCB (Statistiska Centralbyrån) classification.¹⁴⁵ The SCB classification consists of three categories: 1) high, 2) middle, and 3) low SEP. The three categories were then merged into two groups where categories 1 and 2 were grouped into white-collar and category 3 into blue-collar workers. For age 16 years, the thesis used primarily the father's occupation, but in single-mother households the mother's occupation was used.

Definition of educational level

At ages 21 and 30, educational level ≤ 11 years of schooling was categorised as low and ≥ 12 years was categorised as high educational attainment.

Definition of SEP in this thesis and in the four papers

For papers I and IV, an occupational-based classification was used as the measure of SEP. For paper II, both educational and occupational based measures were used. For paper III, an index of SEP at age 16 was constructed by adding the following three variables: parents' occupation as white versus blue collar (0, 1); living condition as owned house or owned apartments versus rented apartments (0, 1); and overcrowding as participant had an own room versus had no room (0, 1). The index range was 0–3, where 0 referred to the most socioeconomically advantaged and 3 referred to the least socioeconomically advantaged. This SEP index was treated as a continuous variable in paper III.

From age 16, primarily fathers' occupation was used. For paper IV, a separate analysis was also done by using mothers' occupation, where social

mobility patterns both among men and women were found similar (data not shown). Theoretically, both parents' occupations as a combined indicator of SEP for age 16 would have been optimal. However, as parents' occupations were coded according to SCB classification consisted of the three categories low, medium and high SEP. Combining both parents' occupation resulted in a very large numbers in the medium SEP groups. Merging this medium group into either high or low SEP would have given an extreme SEP group. Merging into two groups was necessary in order to avoid smaller sample size in some cells. An optimal SEP grouping would have been to have 3 grouping for age 16 as well as for ages 21 and 30. However, data did not allow this due to a small sample size. It is important to mention that additional analyses were done by combining the SEI code 3 (lower non-manual workers) into blue collar worker which, however, did not alter the results or the conclusions of the thesis.

Since SEP was defined differently for the four paper of this thesis, for the simplification of the presentation (particularly results section) the term low SEP or high SEP is used. Where low SEP would mean either blue collar worker or educational level ≤ 11 years or socioeconomically disadvantaged and high SEP would mean white collar worker or educational level ≥ 12 years or socioeconomically advantaged.

Measures of school qualification:

The **school grades** at age 16 were taken from the school register. The average score ranged from 1-5, where 1 referred to the lowest and 5 referred to the highest grade.

Measures of material condition:

At age 16 years

Have own room (yes/no);

Number of siblings (≤ 2 or ≥ 3); and

Unemployed family member during last 12 months (no/yes).

At ages 21 and 30 years

Having **restricted financial resources** was included which was assessed based on a question reading "can you raise a sum of US\$ 1000 in a week by any means?" (no/yes). At age 30, the amount asked about was US\$ 1860.

Unemployment was measured as those who were unemployed for more than six months between the ages of 21 and 30 (no/yes).

Measures of social and psychosocial circumstances:

At age 16 years

Parental divorce was defined as if the participants were living with one parent.

Parental support in education was assessed based on teachers' assessments of parental support in their children's studies with the response ranged from 1–5 (very low to very good). Those who were reported to have low or very low support from parents were defined as having poor parental support.

An index of **contact with parents** was constructed based on participants' assessment of two separate questions related to contact with father and mother. The alternative responses were on a five-grade scale ranging from very bad to very good. Those who reported having bad or very bad contacts with one or both parents were defined as having poor contacts with parents.

A composite index of **school control** was constructed based on three questions: 1) ability to decide in school; 2) ability to pursue own interests; and 3) if anything they learnt at school could be useful in future. The alternative responses to each question ranged from 1–5 (very little to very much) and the composite index range was 3–15. The index was then dichotomised according to the 75 percentiles.

An index of **being liked in school** was constructed based on teachers' assessment of two questions related to how the students were liked among students and among teachers. The alternative responses were on a six-grade scale ranging from least to most liked (1–6). The index range was 2–12. The index was then dichotomised according to the 75 percentiles. The correlation coefficient of these two variables was 0.62.

Peer narcotics use—It has been shown that young people who use narcotics have very high rates of smoking.¹⁵⁴ Therefore, due to lack of peer smoking information (smoking information of peers was not asked in the questionnaire, only peer narcotic use was asked), peer narcotics use was included as a proxy measure of peer influence. Participants were asked if they had any friends or peers who use narcotics with responses of yes or no.

Ethnic background was assessed as having one or both parents not born in Sweden (no/yes).

At age 30 years

Marital status was defined as married or cohabiting versus single or never married.

The number of children at age 30 ranged from 0–4.

Experience of physical **violence** and or threats in the last year was coded as no versus yes.

The **social network**—the perceived availability of social network and social support was assessed. The social network index represented the number of persons with whom links were recognised (range 4–24).

The **social support** index reflected the degree of emotional and material support received when needed (range 6–23).

Social activity was assessed by the participation or non-participation in any association. Which type of association was not specified in the questionnaire but associations could for example be related to sport-, cultural-, or political activities etc.

Work environment was assessed based on physical and psychological characteristics of their job at age 30:

Respondents were asked if their **work was physically heavy** (no/yes).

Psychological job characteristics were assessed using two 6-item scales adopted from Karasek and Theorell model of job demand and job control.¹⁵⁰ The **job demand** scale refers to quantity of work, intellectual requirements, and time constraints of the job.

The **job control** scale refers to the possibilities of making decisions, being creative and using and developing one's own abilities. Both scales ranged from 6 to 24. The scales were then dichotomised according to the median split (median was 9 for men and 8 for women).

Measures of health status:

Musculoskeletal disorders (MSDs) at age 30 was used as an outcome variable in paper I. MSDs were ascertained based on a question “Have you in the last 12 months had any of the following illnesses or ailments?” Three items in the list of illnesses or ailments concerned aches and pains in the back/hip, neck/shoulder, and hand/elbow/knee regions. For each item 0 indicated no pain, 1 mild and 2 severe pain. We used factor analysis to select items for an index of MSD and included factors loading higher than 0.50. This resulted in the inclusion of items on back/hip and neck/shoulder pain only. The composite index ranged from 0–4 and internal consistency was 0.81. A value of 0 on the MSD index indicated the absence and values

between 1 and 4 the presence of disorder. Because of the low prevalence of severe disorders (4.9%) we combined mild and severe disorders and dichotomised MSD index.

For each age, four different health related measures, namely weight, height, chronic symptoms, and psychological distress were determined.

The BMI (kg/m²) at age 30 was used as an outcome variable in paper II. The BMI was calculated from measured weight and height data recorded in school health records at age 15 (measured by the school nurses), but from self-reported data at age 30. The BMI at 30 years was categorised according to the criteria recommended by WHO.¹⁵⁵ The categories for men and women are: *non-overweight* <25 kg/m²; *pre-obesity (or overweight)* 25–30 kg/m²; and *obesity* >30 kg/m². Due to the low prevalence of obesity (men 7.4% and women 3.8%), the outcome variable was dichotomised by combining pre-obesity and obesity together. Non-overweight was used as a reference category. The BMI at 16 years was categorised according to the international reference values recommended by Cole and colleagues¹⁵⁶ as follows: *overweight* 23.90–28.88 kg/m² for boys and 24.37–29.43 kg/m² for girls, *obesity* >28.88 kg/m² for boys and >29.43 kg/m² for girls.

An index of **chronic symptom** was constructed based on six items - impaired hearing, poor eyesight, asthma, diabetes, eczema and epilepsy. The index ranged from 0 to 6, where value 0 indicated no symptoms and 6 indicated the presence of all 6 symptoms.

Psychological distress was measured as an index of six symptoms of depression, nervousness, sleeping problems, restlessness, concentration problems, and anxiety, as used and validated in Scandinavian research.¹⁴¹ The index ranged from 0 to 6, where value 0 indicated no symptoms and 6 indicated the presence of all 6 symptoms.

The girls' **age at menarche** was measured with a question asked at age 21 about how old they were in years when they had their first menstruation.

Measures of health related behaviour:

Factors used as measures of health behaviour were smoking, alcohol consumption, physical activity, and TV viewing.

Smoking was measured with a single question: “do you smoke?” Response options were “never”, “stopped” and “yes” followed by the number of cigarettes smoked per day. Response options were then dichotomized as non-smokers (never and stopped) versus smokers (0, 1). Smoking status at age 30 was used as the outcome variable in article III.

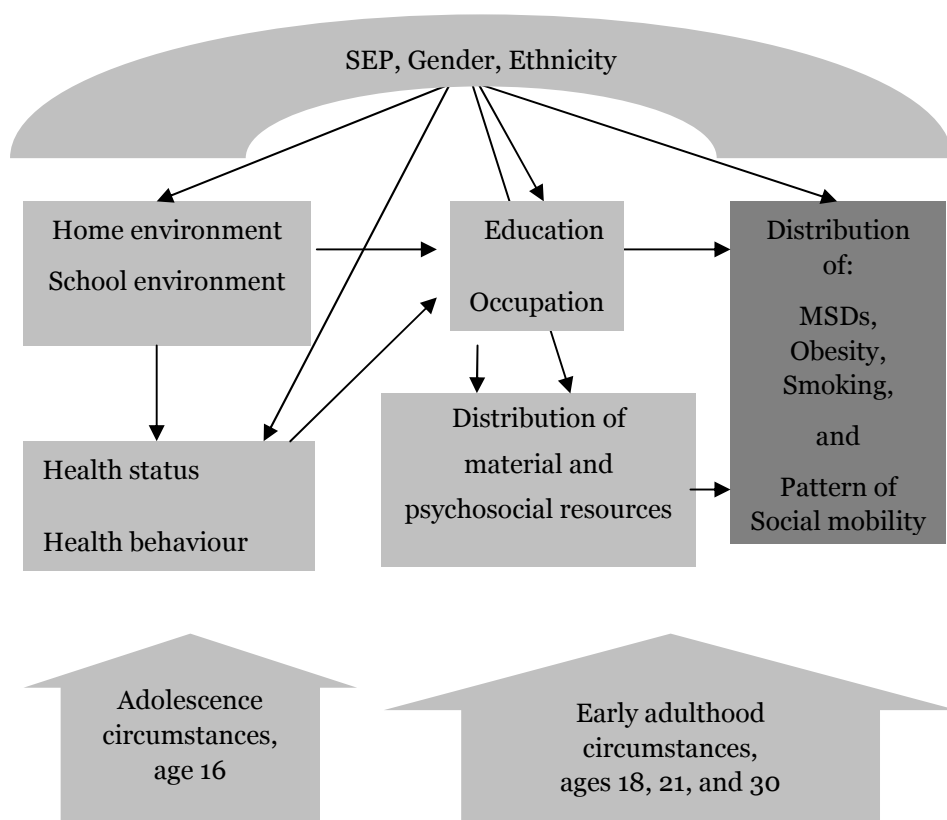
Alcohol consumption was the approximate estimation of pure alcohol consumed in deciliters per year. This variable was treated as a continuous variable in this thesis. The details estimation of alcohol consumption is given elsewhere.¹⁵⁷ In brief, the volume of alcohol content in different consumed alcoholic beverages were converted into deciliters of pure alcohol (beer was considered to contain 4.5%, wine 10% and spirits 40%), which was then multiplied by the number of occasions per year at which alcohol was drunk.

The frequency of **physical activity** was assessed using a score from 0 to 2, with 0 indicating regular, 1 infrequent, and 2 no activity.

At age 16 and 21, the subjects were asked to report how many **TV** programmes they watched. Alternative responses were from less than one programme/week to several programmes/day (scale 1–5). At age 30, TV viewing was ascertained as number of hours per week.

See **Appendix 6** for a summary of how all variables of this thesis were coded.

Figure 3: Pathways between adolescence and adulthood circumstances and adult health, health behaviour, and social mobility: a life course conceptual framework.



This is an overview of the hypothetical underlying pathways linking adolescence and early adulthood life circumstances to adult health, health behaviour, and occupational mobility among the study cohort (Figure 3). The important adolescence circumstances that are assessed in this thesis were home and school environment, which is assumed to have influence on their health and health behaviour. All these adolescence circumstances will have influence on their later educational attainment and occupational position, which in turn will determine the availability of material and psychosocial resources. Consequently, these circumstances will influence the distribution of the outcome variables. Distribution of all these selected circumstances throughout life course of an individual would be different depending on his/her SEP, gender, and ethnicity.

Statistical analytical approach using life course perspective

The implementation of life course perspective requires longitudinal data on SEP, health, health-related behaviours, social and psychosocial factors throughout the life course. As life course approach is a relatively new concept, it is still restricted by limited experience on how to analyse such large and complex datasets.^{28,158}

One of the most common analytical techniques used is a series of multivariate logistic regression analyses that explicitly require a temporal ordering of exposures and their inter-relationship.^{159,160} In papers I and II this technique of analysis was applied. This was done by both univariate and a series of multivariate logistic regression analyses. First, Odds Ratio (OR) for an ill-health variable is estimated for low SEP group, taking high SEP as a reference category called the base model. Each selected factor was then entered separately in the base model. Then we determined whether the adjustment for a single factor in the base model resulted in a reduction of the OR of the ill-health. The percentage reduction in the OR was determined by the following formula¹⁶¹ :

$$\frac{(\text{unadjusted OR} - \text{adjusted OR}) \times 100}{(\text{unadjusted OR} - 1)}$$

Factors that resulted in a reduction of the OR were then selected for inclusion in a subsequent multivariable model. A stepwise approach was used to construct this model, following a temporal sequence. First adolescence factors were included and then adulthood factors. The method allowed for the timing of particular events and circumstances, providing an indication of the relative and cumulative effects of particular explanations.¹⁵⁹ Collinearity between the explanatory variables was explored using the technique developed by Wax.¹⁶²

Structural equation model (SEM) ¹⁶³ is another innovative modelling approach used in life course epidemiology. The SEM modelling approach was used in paper III concerning smoking inequity. First, a theoretically hypothesized path model relating pathway from social position to smoking was formulated. Then, hypothesized variables from adolescence to adulthood were fitted to the model. To assess the fit of the model(s) to the data, several fit indices were used including chi-square in relation to degrees of freedom (X^2/df), normal fit index (NFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). A good fit of the model to the data is indicated by a ratio of X^2/df less than 3.0, values of NFI and CFI greater than 0.90, and values of RMSEA less than 0.08. ^{163,164}

Multilevel modelling is another analytical technique suggested for implementing life course approach. However it requires a minimum of five repeated measurements of a cohort. So far the thesis cohort data consisted of four measurements. Other suggested analytical techniques are latent models and graphical chain models.

In paper IV in order to evaluate the associations between the study variables and the chances and direction of social mobility, unconditional logistic regression analysis was used to calculate ORs, and 99% confidence intervals (CIs) was considered significant.

Statistical analyses were performed in SPSS version 11.5 and 15.0 (SPSS Inc., Chicago, IL, USA), Epicalc (Brixton health, UK), and Amos version 5 for SEM model. All the indexes were constructed based on factor analysis (varimax), and items with factor loading ≥ 0.50 were included in the indexes. For men and women, all the variables were defined separately and also all analyses were performed separately.

RESULTS

Research Question 1: *How do gender and SEP intersect to determine the distribution of MSDs, obesity, and smoking among the study subjects during their adolescence to adulthood (papers I, II, and III)?*

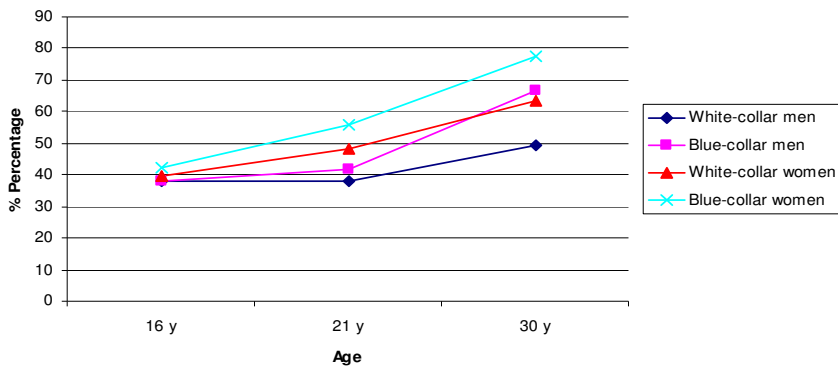
The prevalence of MSDs, obesity, and smoking stratified by age, gender and SEP are presented in Graphs 1 (a), 1 (b), and 1 (c). The results revealed that there were no class or gender differences in MSDs and in obesity during adolescence, but significantly more girls than boys were smokers. Class and gender differences had emerged when they reached adulthood, when more women reported having MSDs but more men were overweight and obese. Women continued to be smokers at a higher rate than men through to adulthood, particularly women with low SEP.

Further, men and women with low SEP were at higher risk of having MSDs, obesity and also being smokers compared to men and women with high SEP. However, this pattern was gendered, for instance, at age 30, men with high SEP had lower prevalences of MSDs and smoking than women with high SEP; and these high SEP women had lower prevalence of MSDs and smoking than men with low SEP. The worst-off group was women with low SEP. The obesity pattern was quite the contrary, where women with high SEP had a lower prevalence of obesity than women with low SEP; and these low SEP women had a lower prevalence of obesity than men with high SEP. The worst-off group was men with low SEP.

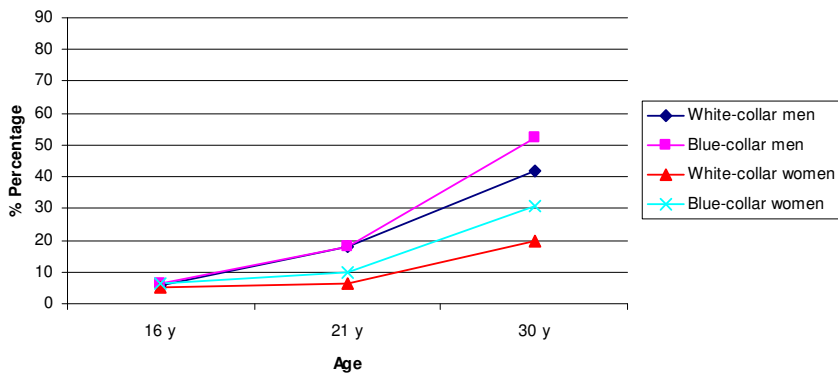
The prevalence of MSDs and obesity increased gradually over the life course regardless of gender and SEP (Graph 1a, 1b). The smoking pattern over time according to SEP and gender was quite complex (Graph 1c). Among men and women with low SEP, smoking rate increased from age 16 to 21 and stayed the same level until age 30. Among women with high SEP, smoking tended to gradually decrease by age. However, among men with high SEP smoking rate increased from age 16 to 21 and then decreased by a half at age 30.

Note: The statistical differences in the prevalence of MSDs, obesity and smoking by age, gender, and SEP are shown in Appendix 1.

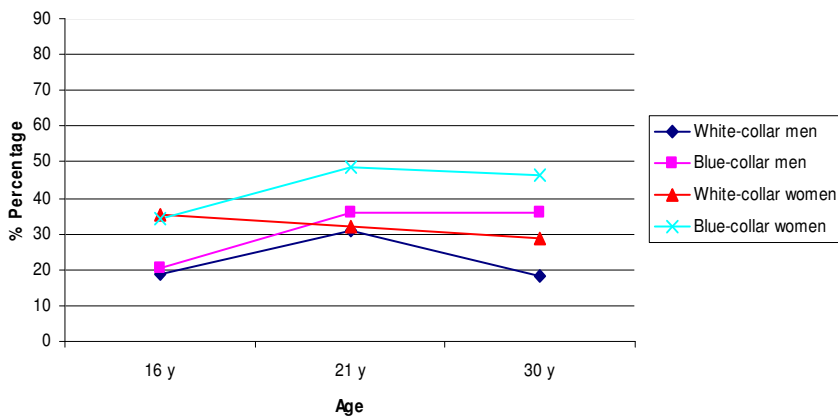
Graph 1 (a): Prevalence of MSDs stratified by age, gender and SEP



Graph 1 (b): Prevalence of Obesity stratified by age, gender and SEP



Graph 1 (c): Prevalence of smoking stratified by age, gender and SEP



Research Question 2: *What is the importance of material, behavioural, health status, and psychosocial circumstances from adolescence to young adulthood in explaining social inequities in MSDs and obesity in men and women (paper I, and II)?*

In order to understand how class inequities in MSDs and obesity developed, the thesis focused on the contribution of factors from adolescence to early adulthood that were related to material, behavioural, health status, and psychosocial circumstances at home, school, and work. The results showed that both early and recent life factors contributed to class gradients. However, several factors from adolescence appeared to be more important for women while the recent factors were more important for men.

The factors that contributes to social class differences in MSDs among men were low school grades at age 16; being single and alcohol consumption at age 21; having children, restricted economy, physical inactivity, alcohol consumption, smoking, low job control and physically heavy work conditions at 30 (Table 2). For women, parents with manual professions, low school grade, smoking and physical inactivity at 16; being single at 21; low job control and physically heavy work conditions at 30 were important. The dominant factor that contributed to class inequity in MSDs for men and women was physical heavy working conditions. After adjusting for all the selected factors from adolescence to early adulthood, class differences were no longer significant for men and women. This means that the selected factors played a significant role in explaining social inequity in MSDs.

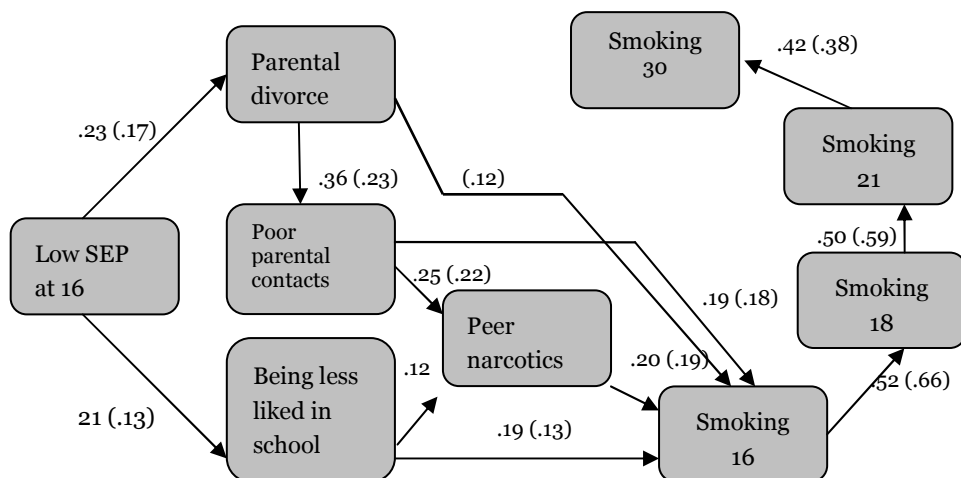
The occupational position was not associated with obesity either among men or women but educational level was. The factors that explained the educational gradient in overweight among men were low parental support in education during adolescence; and physical inactivity, alcohol consumption and non-participation in any association during young adulthood (Table 2). The educational gradient in overweight in women was explained mostly by adolescence factors, which included early age at menarche, physical inactivity, parental divorce, not being liked by the students and the teachers in school and low school control. Restricted financial resource during young adulthood was an additional explanatory factor for women. All these factors were significantly more common among men and women with low education than those with high education.

Table 2: List of factors that showed significant association with the outcome variables in papers I, and II.

Papers	I		II	
	Men	Women	Men	Women
Material circumstances:				
Parent with blue-collar profession		x		
Restricted financial resources at 30	x			x
Psychosocial circumstances:				
Divorced parents				x
Low parental support in education			x	
Being less liked by teachers & students				x
Low school control				x
Low school grade	x	x		
Single at 21	x	x		
Have children at 30	x			
Low job control	x	x		
Physically heavy working condition	x	x		
Health related behaviour:				
Physical inactivity at 16, never		x		x
Physical inactivity at 30, never	x		x	
Currently smoking at 16		x		
Currently smoking at 30	x			
Alcohol consumption at 21	x			
Alcohol consumption at 30	x		x	
Non-participation in any association, 30			x	
Health related factors:				
Early age at menarche				x

Research Question 3: *How are different social risks factors from different life stages linked to adolescent smoking and maintenance of smoking through to young adulthood (paper III)?*

Using structural equation model analysis, the analyses identified a strong chain of risk pathways from age 16 to 30 years, linking SEP and current smoking at age 16 and maintenance of smoking throughout age 30 (Figure 3). The risk pathway indicates that adolescents with low SEP were more likely to come from a divorced family. Being from a divorced family influenced girls smoking behaviour directly. Also, being from a divorced family as well as having poor contact with their parents influenced their smoking behaviour directly and indirectly through peers (both girls and boys). Being less liked by the teachers and students were more common among adolescents with adverse SEP. Being less liked in school also affected their smoking behaviour directly and through peers. The majority of these socially disadvantaged participants who were smokers during adolescence maintained their smoking habits through the ages of 18, 21 and 30. This was a major important pathway from age 16 linking to smoking at age 30. The risk pathways were similar for both men and women. Social risk factors from age 30 such as history of unemployment, financial restriction and low job control were not associated with smoking at age 30 for either men or women.



Source: Novak et al, *Int J Behavioral Medicine* 2007; 14(3): 181-187.

Figure 3. Estimates of standardized path coefficients of hypothesized model linking social risk factors to smoking during adolescence to young adulthood. Coefficients for men are shown without parentheses and for women within parentheses.

Research Question 4: *What is the extent and pattern of occupational mobility among men and women both at an inter- and intra-generationally transition period (paper IV)?*

At age 16 around 50% of boys' parents 45% of girls' parents were in blue collar professions (Table 3). By age 21 when cohort members were classified by their own occupation, a larger proportion of men and women were in blue collar professions. By age 30, a larger proportion men and women had white collar occupations.

Comparing the two generations (parent occupation at age 16 and own occupation of cohort member at age 30) the size of the white collar profession had increased by around 4% (men) to 5 % (women) at age 30.

Table 3: Social class distribution (%) among men and women during three life stages.

Social class	Men		Women	
	White	Blue	White	Blue
At age 16 (N=540/490)	49.6 (n=268)	50.4 (n=272)	54.7 (n=268)	45.3 (n=222)
At age 21 (N=541/489)	32.7 (n=177)	67.3 (n=364)	42.1 (n=206)	57.9 (n=283)
At age 30 (N=546/495)	54.4 (n=297)	45.6 (n=249)	60.0 (n=297)	40.0 (n=198)

Source: Novak et al, 2009, Submitted manuscript

The mobility pattern among men and women is shown in Table 4. Upward mobility was more common than downward mobility both among men and women and for both inter- and intra-generational transition periods (Table 4).

In regard to inter-generational mobility (Table 4a), a similar proportion of men and women were downwardly mobile as well as a similar proportion of men and women were stable white. However, men whose parents had blue-collar profession were more likely to stay in blue-collar profession while women were more likely to be upwardly mobile. Intra-generational mobility pattern was similar for men and women (Table 4b).

Table 4: Proportion of (a) inter-generational social mobility (i.e. mobility from parent's occupation at age 16 years to own occupation at age 30 years), and (b) intra-generational social mobility (i.e. mobility from own occupation at age 21 years to own occupation at age 30 years) among men and women.

(a) Social class at age 16	Social class at age 30		(b) Social class at age 21	Social class, age 30			
	White-collar	Blue-collar		White-collar	Blue-collar		
White-collar	Men, n=268	178 (66%)	90 (34%)	White-collar	Men, n=177	146 (83%)	31 (17%)
	Women, n=267	171 (64%)	96 (36%)		Women, n=206	170 (82%)	36 (18%)
Blue-collar	Men, n=271	114 (42%)	157 (58%)	Blue-collar	Men, n=363	147 (41%)	216 (59%)
	Women, n=221	123 (56%)	98 (44%)		Women, n=281	124 (44%)	157 (56%)

Source: Novak et al, 2009, Submitted manuscript

Research Question 5: *What impact do the various health related measures, health-behaviours, psychosocial environment at home and school, material resources, and ethnicity have on the chances and the direction of social mobility among men and women (paper IV)?*

Health status measured as chronic symptoms, psychological distress, weight and height was not associated with mobility in this cohort for either men or women, neither inter- nor intra-generationally. The exception was for height at age 16 which predicted upward mobility at age 30 for women but not for men.

The factors that predicted mobility at inter-generational transition period were - being liked by the teachers and the students in school years which predicted upward mobility for both men and women in adulthood. Additionally, higher height at 16 and no smoking predicted upward mobility in women but not in men. Downward mobility was predicted by being less liked in school and smoking in both men and women. Additionally, material deprivation measured by having an unemployed family member (for men) and not having an own room during adolescence (for women) predicted downward mobility.

At intra-generational transition period - less alcohol consumption for men and better financial resources for women predicted upward mobility. Downward mobility among men was predicted by smoking and restricted financial resources. Downward mobility among women at intra-generational transition period was not predicted by any of the selected factors of the study.

See Table 5 for the summary of all the factors described above that were associated with upward and downward mobility among men and women.

Table 5: List of factors that showed significant association with inter- and intra-generational mobility among men and women in paper IV.

		Inter-generational ¹		Intra-generational ²	
		Men	Women	Men	Women
Health related measure	Higher height at 16		↑ ³		
Health behaviour	Currently smoking at 16	↓ ⁴	↓		
	Currently not smoking at 16		↑		
	Currently smoking at 21			↓	
	Less alcohol consumption at 21			↑	
School environment	More liked by teachers & students	↑	↑		
	Less liked by teachers & students	↓	↓		
Material resources	Unemployed family member at 16	↓			
	Had no own room at 16		↓		
	Restricted financial resources at 21			↓	
	Better financial resources at 21				↑

¹ Mobility between class of origin at age 16 and achieved class at age 30 years.

² Mobility between achieved class at age 21 years and achieved class at age 30 years.

³ Upward mobility

⁴ Downward mobility

DISCUSSION

Main Findings

Results presented in this thesis indicate that the social patterning of health in this cohort is gendered and age specific depending on the outcome measures.

During adolescence, no gender difference was found in the prevalence of MSDs and obesity. But significantly more girls were smokers than boys. No social class gradients in MSDs, obesity and smoking were observed during adolescence. These findings support the view that class gradients in health are less apparent during adolescence or early youth.^{16,17} It is suggested that peer groups and youth culture cut across those of family background in such a way to reduce class differences in health.

During adulthood, significantly more women reported MSDs and also were smokers compared to men. But more men were overweight and obese than women. However, when intersection between class and gender is considered, a more complex picture emerges. For example, not all women had more MSDs or smoked more than men. Men with high SEP had lower prevalences of MSDs and smoking than women with high SEP; and these high SEP women had lower prevalences than men with low SEP. The worst-off group was women with low SEP. The obesity pattern was quite the contrary, where women with high SEP had a lower prevalence of obesity than women with low SEP; and these lower SEP women had a lower prevalence of obesity than men with high SEP. The worst-off group was men with low SEP. These results of the thesis support the notion that social inequity in health is best understood if one considers the intersection between gender, and class as well as race/ethnicity.^{31,55} In a study on Swedish men and women, Wamala et.al. (2009)⁵⁷ found that men born in Sweden and with high income have better health than women born in Sweden and with high income; furthermore these high income women have better health than men born outside Sweden and with high income. The worst-off group was women born outside Sweden, particularly those in households with high income levels.⁵⁷

In this thesis, the importance of ethnicity could not be assessed as such because the study population consisted mainly of native Swedish (85%) and Finnish (14%). This means that the Luleå population is quite homogenous and environmental and cultural factors between Sweden and Finland are relatively similar. In paper IV, the results showing that the chances and the directions of occupational mobility were not influenced by ethnic background of this cohort. This could be due to the fact that the study

population is quite homogenous. Furthermore, the study cohort is the 2nd generation, generally mobility is reported to be difficult for the first generation of ethnic minority due to language barriers in addition to trying to adjust to the new environment and culture.^{165,166}

Regarding overweight and obesity, our finding partly contradicts the general trend that has been observed in the WHO MONICA study on 48 different European countries where women were more likely than men to be obese, whereas men were more likely to be overweight (age 35–64 years).¹¹¹ However, the prevalence rate of overweight and obesity found among men and women in this thesis is quite comparable to the national statistics for Sweden. Although comparison was problematic since prevalence rate applies to a specific age group, i.e. 30 years, while a wider age range is used in the national statistics. The closest age range available for comparison was between 25–34 years from the survey year 1998, where overweight and obesity prevalence for men was given as 43% and 6%, respectively, and for women the corresponding rates were 25% and 5%.¹⁶⁷ These findings are close to the prevalence rates with 39.7% and 7.4% for men and 20.3% and 3.8% for women found in this thesis (with the survey year 1995).

In this thesis, occupational position was not associated with overweight for either men or women but educational level was. A review by Sobal and Stunkard¹⁶⁸ revealed that in many countries, low occupational position is strongly associated with high obesity among women but less consistent among men. Differences in physical demands in men's and women's occupation have been put forward as one possible explanation for these inconsistent findings.⁷² The authors suggest that low-status jobs for women are more sedentary, while men's jobs are more physically demanding, which might be protective against obesity. In the Swedish context, low-status jobs for women are not necessarily characterised as sedentary. For instance, nursing assistants or cleaners are typical women's jobs and are also physically demanding.¹⁶⁹ On the other hand, some typical men's jobs such as drivers may be more sedentary.¹⁶⁹

Low job control was suggested as another reason for the association found between low occupational position and obesity among women. Low job control is associated with low-status jobs, and is more common among women than in men.^{60,64} Low job control might make it difficult for women to manage time effectively or to adopt a healthy lifestyle, leading to obesity. In paper II, low job control among women was as common as among men. This could be a possible explanation for the lack of association found between occupational position and overweight for women. On the other hand, education may be related to obesity primarily through generating

knowledge about eating behaviour, physical activity, and the negative health effect of obesity.¹⁷⁰ Therefore, one might expect an equivalent effect of education for both men and women. The association found between education and obesity for men and women is consistent with other studies.^{72,99,171}

Using education or occupational-based SEP, the magnitudes of class gradients are very much the same for men and women for MSDs and smoking. However, social class gradient in obesity was wider among women than among men. This indicates that obesity is not clustered among men of lower SEP, but relatively more clustered among women of lower SEP. The pattern of strong inverse correlation between social class and obesity among women but less strong or inconsistent among men has been documented in earlier studies from high-income countries.^{72,168} The observed association between class and obesity among men and women can be discussed in relation to theories about the gendered meaning of and societal attitude towards obesity. Obesity is, in general, more stigmatised among women than among men in Western culture.⁶⁹ Even though the body image of men is becoming more and more exploited and men are becoming more body conscious,⁷⁰ thinness is still considered as the ideal and attractive body shape for women in Western culture. Thinness is also considered as a marker of social distinction in Western culture and more likely to be valued, particularly by women with higher SEP.⁶⁹ Obesity and its associated stigma among women could also encourage women to adapt health behaviours that are different from men. For instance, a higher rate of smoking among women with high SEP than men with high SEP found in this thesis could be because alcohol or food consumption would lead to obesity but smoking will not.

Even though obesity is more stigmatised among women in general, thinness is more prevalent among women with high SEP and several explanations appear plausible to this observation. Women with higher SEP have better access to financial resources that facilitate better diets and physical activity. Nutritious foods are, in general, more expensive than foods with high fat and sugar content. Therefore, it is easier to keep up with the healthy diets for women with higher SEP, resulting in a decrease risk of obesity among them. Women with higher SEP not only have better financial resources but also have better control over time, which provides them more leisure time and opportunities for physical exercise. For instance, low job control is associated with low-status jobs, and low job control might make it difficult for women to manage time effectively or to adopt a healthy lifestyle, leading to obesity. Women with higher SEP are also highly educated, which provides

them with increased knowledge about nutrition, healthy diets, and benefits of exercise etc.

The results of this thesis also provide evidence that unequal distribution of martial, psychosocial, health and health related behavioural factors during three life stages accounted for the observed social class gradients in MSDs, obesity, smoking, and pattern of social mobility.

Material circumstances and social inequity in health

In line with earlier studies,^{90,92,96,99,100,102,104,172-184} this thesis shows that adverse socioeconomic circumstances in childhood and in adulthood have influence on later health and wellbeing. The results of the thesis indicate that adolescents whose parents had manual occupations were more likely as adults to be smokers (men and women) and have MSDs (women). Women who did not have their own room, and men who had an unemployed family member while they were children were more likely as adults to be downwardly mobile. Also, men who had better financial resources during young adulthood were more likely as adults to be upwardly mobile. Those who had restricted financial resources during adulthood were at risk of being obese (in women) and having MSDs (in men).

Psychosocial circumstances and social inequity in health

The results of the thesis revealed that unfavourable psychosocial environment at home and school during early years as well as working conditions during adulthood influences later health and well being. Adult men and women whose parents were divorced during their adolescence and also had bad contact with their parent were smokers throughout adolescents to adulthood. Parental divorce was also directly associated with smoking and was also strongly associated with later obesity in women but not in men. In a Swedish study of school children (9–12 years), parental divorce was found to be associated with somatic ill health and stress among girls.¹⁸⁵ Boys, on the other hand, were reported to react differently to the same situation, increasing their alcohol consumption.¹⁸⁶

Among men, but not among women, low parental support in education during adolescence explained a large part of the class variance in later obesity. Lissau and Sorensen,¹⁸⁷ in their longitudinal study conducted in Copenhagen, showed that low parental support during childhood (9–10 years) was a strong predictor of later obesity (19–20 years). In our study, we have assessed parental support in relation to the participants' education only, whereas later studies have assessed parental support in general. Nevertheless, it is interesting that this factor had an influence on later obesity in both studies. In the study by Lissau and Sorensen,¹⁸⁷ men and

women were analysed together, so it is not known whether parental support had a similar effect for both men and women.

In our study, it is not clearly understood why parental support in education during adolescence is less important for girls. However, in relation to parental support in education during adolescence, one may discuss it from the perspective of gender construction in society. Girls are expected to do well and take responsibilities both for themselves and for others from an early age.¹⁸⁸ Therefore, guidance or support from parents in schoolwork might be more beneficial for boys in school performance as well as attaining higher education. Low education is known as a strong predictor of obesity. Lack of parental support in education during adolescence may be associated with later obesity through educational attainment, whereby boys with low parental support in education may do poorly in school, and consequently attain low education as adults.

The thesis results also show that low school control was associated with later obesity in women. Further, men and women who were less liked in school (both among students and teachers) during adolescence were more likely as adults to be smokers, to be obese (only women), and also downwardly mobile. Our study also indicates that being less liked by the teachers and students was more common among adolescents whose parents had low SEP. The indicators of school control and being liked in school were taken as a proxy indicator for school environment.

The relationship between unfavourable school environment during adolescence and the later health and wellbeing is complex, but several potential mediators appear plausible. Adolescence is an important period of life for an individual course of development. School is one of the most important social settings for children for development of their identity and self-worth. An unfavourable environment during this period might negatively affect their self-worth and also cause stress. Negative self-worth and stress due to unfavourable circumstances may lead to unhealthy behaviours, and also result in an increased risk of obesity. Evidence from an earlier study conducted on our study cohort suggests that both among boys and girls the lack of school control at age 16 was significantly associated with increased alcohol consumption at the age of 18 and the association was stronger among girls than among boys.¹⁸⁶

Adolescence is also a key life stage when many important life transitions are negotiated during this time, such as decisions about further education or training etc. Experiences during school years play a significant role in making those decisions. Unfavourable school environment, as indicated by

being less liked in school during adolescence may be associated with later downward mobility through low educational attainment. Those adolescents who were less liked by the student and teachers in school are less likely to be interested in pursuing higher education, hence downwardly mobile. School context, defined by students own opinions on liked being at school and most teachers were willing to help when needed was analysed using a Scottish longitudinal data by Glendinning et.al. and found that young people who were dissatisfied with school and had poor relationship with teachers were much more likely to leave school with fewer educational qualifications and to be economically active earlier than their peers.¹³⁷ Studies on the 1953 Stockholm cohort demonstrated that higher peer status (defined as number of nominations received for work partner from peers) was common among children whose parents had high SEP¹⁸⁹ and that lower peer status was associated with the higher level of overall adult disease risk¹⁹⁰ as well as lower educational attainment in adulthood.¹⁸⁹

The results of this thesis may imply that better parental support in education and a favourable school environment during adolescence would have long lasting positive effect on their life trajectory through higher educational attainment, and consequently better health outcome in later life.

In paper I of this thesis results revealed that men and women who were single at age 21 were less likely as adults to have MSDs. The indicator of being single and its' association with MSDs has not been described before. The mechanism of such an association might be that being single may reflect a more career-oriented lifestyle and being devoted to skill development through higher education and training. In turn, a more secure job as an adult may in turn expose them to lesser risk factors associated with class-based working conditions and health behaviour in general. Evidence of a strong positive influence of educational achievement and skills on both occupational position¹⁹¹ and better health behaviour¹⁹² are well documented.

Family formation factor, i.e. having children by the age of 30, seemed to be associated with social class gradient among men only. This result contradicts the findings of the British birth cohort study,⁸⁸ where having children by age 23 was found to be negatively associated with class differentials in psychological ill health for women only. In the Swedish context, the irrelevance of having children for women might be due to the fact that childcare benefits (day-care, free meals, etc.) and child support (through maternal leave and money transfer) are provided by the welfare state across all socioeconomic groups. Both men and women receive these benefits but mostly women, since they still take the major responsibility for child care.¹⁹³

Unfavourable occupational conditions in adulthood, as indicated by physically heavy work and low job control were the most important factors that contributed to class differentials in MSDs for both men and women. These findings are consistent with numerous earlier studies.^{80,82,89,96,194,195} However, it has been suggested that the associations found between subjective job stress and subjective health outcome is a result of reporting bias.^{196,197} People who report higher stress may also feel ill without having any evidence of a higher amount of disease. For instance, the Whitehall II study⁸⁰ showed that self-reported job stress was associated with only a self-reported symptom (angina) but not with an objective measure of heart disease (ischemia). However, psychosocial work related condition and its association with the misclassification of MSDs was studied by Fredriksson *et.al.* and no exposure-dependent misclassification was found.¹⁹⁸ On the other hand, others have reported that psychological stress,^{68,199} anxiety and or depression²⁰⁰ are associated with MSDs. However, psychological distress defined as depression, nervousness, sleeping problems, restlessness, concentration problems and anxiety was not associated with MSDs in our study. Thus, it seems unlikely that our results were seriously affected by reporting bias.

Health related factors and social inequity in health

As shown in a previous study,¹⁶¹ early menarche was found to be one of the explanatory factors for a higher rate of obesity among women with low SEP in our study. Though early menarche was not more common among girls in lower than in higher SEP groups in the present study, it is plausible that early menarche in combination with other adverse behavioural factors among the lower SEP group (for instance, physical inactivity and high alcohol consumption) may make them more prone to develop obesity. Although the mechanism of the association between early menarche and adult obesity is uncertain, it has been suggested that it might be both biological and sociocultural. Various endocrine factors influence the accumulation of body fat²⁰¹ and also that those girls who mature early are fatter at the time maturation begins than other girls of the same age.²⁰² Because of the differences in body appearance between early and late maturing girls, early mature girls may develop a negative body image. A negative body image is found to be one of the main causes of depressive symptoms among adolescent girls,²⁰³ which may lead to comfort-eating behaviour or withdrawal from group activities such as school sports or physical activities, which in turn predisposes them to obesity. In previous studies, early maturing girls were reported to have negative body image, lower self-esteem²⁰⁴ and to be physically less active than late maturing girls of the same age.²⁰⁵

In regards to social mobility in paper IV, health status measured as weight, chronic symptoms and psychological distress did not influence the chance and direction of the mobility among men and women. This finding is consistent with other studies reported from the UK and Finland.^{206,207} However, being taller at age 16 predicted upward mobility at age 30 among women, but not in men. The association between height and subsequent mobility was shown for both men and women in earlier studies from Swedish populations^{134,135} as well as from other countries.^{92,130,136,208} The fact that height did not show any association with mobility among men in our study could be because of low statistical power due to small sample size.

The mechanisms by which height could influence social mobility might be through educational attainment. Short stature is suggested to be a reflection of a number of adverse economic and psychosocial conditions during childhood.^{87,209} For example, smoking habit of expectant mother is known to influence birth weight and length negatively, and smoking is more common among lower SEP group. Nonetheless, childhood deprivation may motivate individuals to start working and earning in earlier age than acquiring higher education, hence reduced chances of upward mobility.

Discrimination based on height has been speculated as an another potential explanation for short stature and downward mobility.²¹⁰ Magnusson et al. have demonstrated that after controlling for cognitive ability, achieved height at age 18 years strongly predicted later educational attainment among Swedish men born 1950-1975.²¹⁰ Their study found that men taller than 194 cm were two to three times more likely to obtain a higher education compared with men shorter than 165 cm. The author suggested that this may reflect educational discrimination based on height.

Behavioural factors and social inequity in health

Smoking and alcohol consumption are considered as markers of social deprivation.^{128,211} As in our Paper II, the results revealed that smoking is a reflection of multiple socioeconomic and psychosocial chains of risks experienced by the men and women with low SEP during their upbringing. A population based cohort study of 576 men from the West of Scotland showed that exposure to disadvantaged social circumstances across the life course is associated with heavy alcohol intake in later middle age.²¹¹

High alcohol consumption and smoking were the most important health behaviour that contributed to the social differences in health and social mobility of our study cohort, and this influence was found to be gender specific. Among men, the higher level of MSDs and obesity observed was partly due to a higher level of alcohol consumption. Similarly, upward social

mobility among men was partly due to less alcohol consumption. No such alcohol related association was found among women, which may be due to that women had significantly lower level of alcohol consumption throughout young and adulthood compared to men.

In line with our study, Emslie et. al. (2009) found that adult men's overall alcohol consumption was substantially higher than women in all three cohorts born in 1930s, 1950s and 1970s in the UK.²¹² However, gender differences in alcohol consumption were found to be smallest in the youngest cohort i.e. cohort born during early 1970s. Our study concerns one generation of Swedish cohort born 1960s only.

Women in our study, on the other hand, had significantly higher smoking rate compared to men throughout adolescence to adulthood. Furthermore, smoking was another important health behaviour explaining social differences in MSDs and downward social mobility in both men and men. The differential pattern of health behaviour among men and women indicates that as this cohort grows older there will be significant gender and class differences in health which are related to smoking and alcohol consumption in the future.

General comments

The analyses in papers I (MSDs) and II (obesity) demonstrated that the explanatory factors to class inequities were different for men and women, where several factors from adolescence appeared to be more important for women while the recent factors were more important for men. The explanation for this finding is not clearly understood. As Connell (1996) points out that every society has a gender order, generally characterised by men's domination and women's subordination.⁵² For example, there are systematic gender differences in access to economic resources where women are generally disadvantaged and this is reflected in women's occupation and wages relative to men's.²¹³ Even though Sweden is known to be one of the most egalitarian countries in the world,⁶² women tend to be employed in low status jobs and in all SEP groups women's incomes are found to be less than that of men.^{63,213} It is plausible that because of the gender order, e.g. men's higher job positions and higher income than women, may help men to compensate better for their childhood adversities than women. Therefore, earlier adversities may continue to have higher negative influence on women's life than men's.

The adverse material, social, psychosocial, and behavioural factors from different life stages that accounted for the class inequities in our study tended to be more common among men and women with lower SEP than

with high SEP (see Appendix 3). All these factors were interrelated to each other. The results of the thesis support the accumulation of risk hypothesis as indicated that social inequities in MSDs, smoking, and social mobility occurred due to accumulation of multiple adverse circumstances among the lower SEP group throughout life course compared to more favourable circumstances experienced by the higher SEP groups.

Methodological considerations

The strength of the present study includes the availability of longitudinal data on men and women, collected prospectively throughout their different life stages, i.e. adolescence, young adulthood, and adulthood. The life-course approach, therefore, could be applied to understand the social factors from each life stage that affect later health and health behaviour outcomes. Additionally, health and other background characteristics prior to mobility could also be analysed both inter- and intra-generationally, which is relatively sparse in social mobility research. Thus, our study is less subject to the problem of reverse causality (i.e. early poor health status may influence later social class position). This means that it is possible to disentangle the direction of causation between health and the subsequent social mobility in our study.

The longitudinal data employed here are also unique for the extremely high response rate during a 14-year follow-up (96.5%). High response rate is believed to provide a fair picture of the studied population. Furthermore, the questionnaire was sent to all the 16-years-old ninth-grade school pupils of Luleå city. The pupils who had dropped out of the school were also included. Therefore, no selection bias is present in this study. Selection bias refers to systematic differences in characteristics between those who are selected for the study and those who are not.

Luleå represents a typical middle-ranked industrial city of Sweden and this cohort could be representative of young people of similar cities in Sweden, particularly for the young people born in 1960s. Because, the data on a cohort members reflects, in part, aetiology of ill health that is prevalent at the time of data collection,^{214,215} which may not be the same as for those who are born today. Overall, the proportion of smokers, overweight, obesity, and MSDs found in 1995 among the study cohort members is also quite comparable to Sweden as a whole (see Appendix 5).

The study has some methodological limitations. One of the major limitations of this study includes the use of self-reported measures of BMI at age 30 in paper II. The misclassification associated with self-reports may cause bias in the prevalence of overweight and differentials between population groups,

for example, between social classes.²¹⁶ In a Swedish study, underestimation of BMI was found among all SEP groups but the highest underestimation was found among men with high SEP and women with low SEP.²¹⁶ Therefore, it is suggested that using self-reported BMI the class differences in overweight and obesity may be overestimated among men but underestimated among women.²¹⁶ If so, it would imply that the class differences observed in our study might be smaller among men and larger among women than was reported.

The problem of misclassification associated with self reported BMI can easily be minimised and corrected. The detail method of correction can be found in the article by Giacchi *et.al.*²¹⁷ In brief, in order to correct would require collecting weight and height measurements data on a sub-sample of the original sample by using simple random sampling. Unfortunately this was not done for the 14-year follow-up but this has been performed in a later follow-up on our study cohort.

We have also analysed peer use of narcotics as a proxy for peer smoking, due to lack of information on peer smoking. This proxy indicator may only identify a small proportion of peer smokers. The association found between peers' and participants' smoking status might therefore be underestimated. Despite this, it is interesting to note that this indicator had a significant influence on adolescence smoking, a similar finding to that reported by earlier studies^{218,219} that assessed peer smoking rate, not peer narcotic use rate.

The kind of indicators of SEP to use is an ongoing debate in health inequity research.^{33,37,41,56,220-224} Issue has been raised on whether the individual or the household level of SEP should be used to define men and women. Some have pointed out that education, income, and occupation-based measures as indicators of SEP cannot be used interchangeably as the effect on various health outcomes differ.⁴¹ Others have suggested to take account both partners occupation-based measures of SEP,²²⁴ particularly for women.²²⁵ For instance, individual income and occupational position were shown to have independent effects on Swedish men's mortality, but no association was found between women's income and mortality.²²⁵ Instead, status score defined from both partners occupation was shown to have an independent effect on women's mortality.²²⁵ However, if one wants to study the effect of the work environment, individual occupation is a better measure. As higher income makes it possible to acquire health enhancing resources, households total income should be measure as both partners are likely to benefit from it. One problem with household measure of income is that all household members—mainly women may not have equal access to household income.⁴²⁻

⁴⁴ Collectively these arguments suggest that whenever possible occupation, education and income should be measured in a way that they reflect the SEP, income level and the educational level of the both partners, as one partners SEP would have a spill-over effect on the other partner. Available data on our cohort at age 16 provide information only on occupation of both mother and father. At ages 21 and 30 only individual educational level and occupational positions are collected; no SEP information on their partners is available. The data material could be further enhanced by collecting detailed SEP of both partners (occupation, education, income, wealth, neighbourhood, etc.).

The categorisation of low (≤ 11 years) and high (≥ 12 years) educational groups in our study requires further discussion. In other countries, ≤ 11 years of schooling may not be considered low education. In Sweden, education is free and 9 years of schooling (elementary) is compulsory for all. Moreover, after 12 years of schooling students get a monthly government allowance of US\$ 235, and a study loan is available for all irrespective of socioeconomic background. In our cohort, more than 85% of the subjects went to two or more years of upper secondary schooling. Therefore, 11 years of schooling was taken as a cut-off point.

Some important limitations regarding the content of questionnaires need to be highlighted. For instance, the questions included on violence. The violence questions were asked at age 30 only, which read as follows: 1) In last 12 month, have you been threatened by violence, which was so severe that you were afraid? 2) In the last 12 month, have you experienced any physical violence? 3) Did you need medical attention because of the physical violence? Alternative responses to all these questions were yes/no. The last question asked was the place where the threat or physical violence took place with three alternative responses: at work, home or other. The majority of the women reported that the physical violence and threat took place at home (data not presented), and also that the women who had ever experienced violence were from lower SEP group (see paper II, Table 3). Nonetheless, these violence questions neither characterised the frequency, severity, or duration of the violence experienced. Nor did it describes the different forms of violence they have experienced (physical, sexual, verbal, etc).

As we know violence, particularly domestic violence, is a significant threat to women's health worldwide. Major depressive disorders, anxiety as well obesity are well documented consequences of gender-based violence among women. A recent study from the US reported that lifetime intimate partner violence, defined as lifetime threatened, attempted or complete physical or sexual violence by an intimate partner, was associate with 10% increase risk of currently being obese in women.²²⁶ Not only adulthood experience of

violence, but study have shown that women who experienced sexual abuse as a child and as an adult were 32% more likely to be currently obese.²²⁷ No association between violence and obesity could be confirmed by our study (see paper II), mostly may be because of the questions limitations described above.

There are new and better measures and tools have been established to collect important information that is unique to women, such as violence. This cohort data material could be enhanced by collecting information on these issues in the future follow-up surveys. This would enhance its potential to address this important issue and enable us to understand women's health better.

CONCLUSIONS

- Social patterning of health in this cohort was gendered and age specific depending on the outcome measures.
- No class or gender difference was evident during adolescence in the prevalence of MSDs, obesity, and smoking. One exception was that significantly more girls were smokers than boys through to their adulthood. The result supports the view that class gradients in health are less apparent during adolescence.
- Class and gender differences had emerged when they reached adulthood, where the observed differences not only depended on the outcome measures but also were determined by the intersection between class and gender. The thesis findings provide indication of the complexity of the association between gender, SEP and health, which underlines the need to consider intersections between different social constructs such as class and gender in understanding health inequities.
- Upward mobility was quite common among this cohort and the mobility pattern was similar between men and women. The thesis provides little evidence that health status influences the chance and the direction of social mobility. Material deprivation, economical deprivation, unfavourable health behaviours, and unfavourable school environment remained the main determinants of downward mobility.
- Unfavourable family, school, work, and health related behavioural exposure throughout three life stages accounted for the observed social class gradients in MSDs, obesity, and smoking. These unfavourable circumstances were interrelated and were found to be clustered in lower SEP group.
- Among the explanatory factors, being less liked in school showed consistent association with all outcome measures in this thesis. Results indicated that being less liked by the teachers and students was more common among adolescents whose parents had low SEP. Men and women who were less liked in school during their adolescence were more likely as adults to be smokers, obese (only women), and also downwardly mobile.
- Among lower SEP group, alcohol consumption was predominately a men and smoking was predominately a women behaviour, which had significant negative consequences on their health and well being.
- The results supports the accumulation of risk hypothesis that social inequities in health occur due to multiple adverse circumstances experienced by the lower SEP group throughout their life compared to more favourable circumstances experienced by the higher SEP groups.

POLICY IMPLICATIONS

The results of the thesis suggest that health inequities develop as a result of various socially pattern exposures and behaviours starting early in life through to later life. Reducing social inequity in adult health thus requires a range of targeted intervention strategies for each life stage starting from early years. Adolescence is an important life stage because many important life transitions are negotiated during this time, such as decisions about further education or training, which may act as key links in the lifetime chain of advantage and adversity. Experiences during school years play a significant role in making those decisions.

The results presented in this thesis indicate that being less liked by the teachers and students was more common among adolescents (both boys and girls) whose parents had low socioeconomic position. Men and women who were less liked in school during their adolescence were more likely as adults to be smokers, obese (only women), and occupationally downward mobile.

In this thesis we have used teachers' assessment of degree of liking by the teachers and the students. Other studies conducted on the 1953 Stockholm cohort, for example, assessed students status with their peers (defined as number of nominations received for work partner from peers) and found that higher peer status was common among children whose parents had high socioeconomic position¹⁸⁹ and that lower childhood peer status was associated with the higher level of overall adult disease risk¹⁹⁰ and with lower educational attainment in adulthood.¹⁸⁹ Glendinning *et.al.* found that those young people who had poor relationship with teachers and were dissatisfied with school were much more likely to leave school with fewer educational qualifications, hence, this would influence their future socioeconomic position negatively.¹³⁷ Findings from these mentioned studies^{137,189,190} suggest that childrens' relationship with their peers or teachers have long term effect on their later health and well being.

A future challenge for public health research is to identify the mechanisms of how teachers as well as peer relationships associate with students' future health and well beings; most importantly how gender, socioeconomic position and ethnic background of the student interact to influence such mechanisms.

It has been suggested that "school tends to reinforce the social inequalities observed in our society by being best fitted to those students who come from upper social classes and who have positive attitudes towards and interest in school".²²⁸ Further research is needed to explore: how teachers assess their

students, and based on what aspects? If and why students with low socioeconomic position are assessed as less liked in school? How the assessment/treatment affects students' education and future socioeconomic position trajectory? Could it be that students are likely to be treated the way they are assessed by the teachers? For instance, in terms of taking interest to help when needed or assigning grades. Even if we assume that the grading aspect is neutral and objective, evidence suggests that how an individual is judged and/or treated can change self confidence and eventually affects his/her performance. For example, an experimental study was conducted by the World Bank²²⁹ on 11-12 years old boys in India where two groups of boys with mixed high and low caste¹ background were asked to perform an intellectual test under monetary incentives. In one group the subjects' caste identity was anonymous but in the other group their caste identity was verbally revealed in the class before the test. The result revealed that the low caste subjects in the anonymous condition performed equally well as high caste subjects; but when caste identity was publicly revealed, low caste subjects performed significantly worst than the high caste subjects. This may be an extreme example for the Swedish context but the important meaning is that how students are judged or treated may also influence their self confidence and performance. Further research on the above mentioned issues would help to identify effective strategies as to how schools can work against any negative influence of students' socioeconomic background.

An important policy implication of the thesis results is that schools should be used as a setting for interventions aimed at reducing socioeconomic inequities in health.

School is an important social setting where almost all adolescents could be reached and where they spend most of their time. School environments need to be improved in such ways which facilitates equal support for all children, especially ensuring extra support for those who are socioeconomically disadvantaged. Additional analysis on this cohort data has shown that adolescent boys and girls coming from families with low socioeconomic position and who continued to study at least an extra two years after leaving compulsory school had significantly lower rate of smoking, obesity and

¹ The caste system in India is a highly stratified social hierarchy in which the high-caste groups were the traditional landlord, warrior, priestly and trading castes; the low-caste were historically denied political and civil rights, opportunities for economic mobility, and allowed only unclean jobs. The low castes are commonly known as *Dalits (broken people)*, untouchables, and *outcaste*. Even though the caste system was abolished in 1950s, it is still widely practiced.

musculoskeletal disorders in their adulthood than those who did not continue their studies (see Appendix 4). Targeted school interventions that are designed to assist higher educational attainment of the socioeconomically disadvantaged youth would help to break the social chain of risk experienced during this time and alter their life course path in ways that would reduce subsequent social inequities in health and wellbeing.

In adult life, the thesis results show that heavy work condition is a major contributing factor for social inequity in musculoskeletal disorders for both men and women. In Sweden there is a long tradition of policies to improve working condition. For the adult life stage, policies should continue to focus on working condition as well as other known risk factors, such as smoking, alcohol consumption, musculoskeletal disorders, and obesity, because their contribution to health inequities is firmly established.

Furthermore, as shown in this thesis that among lower socioeconomic group, alcohol consumption is predominately men's and smoking is predominately women's behaviour. This gendered pattern of health behaviour implies that as this cohort grows older there will be significant gender and class inequities in morbidity and mortality associated to smoking and alcohol consumption. Reductions in smoking among women and alcohol consumption among men with low socioeconomic position are particularly important for preventing future rise of its associated health burden.

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APPENDICES

Appendix 1. Prevalence of MSD, obesity, and smoking stratified by age, gender and SEP¹.

MSDs (Paper I)									
	16 years			21 years			30 years		
	Blue	White	<i>P</i> <i>value</i>	Blue	White	<i>P</i> <i>value</i>	Blue	White	<i>P</i> <i>value</i>
Gender									
Men	38.2	38.1	ns	41.7	37.9	ns	66.5	49.5	0.001
Women	42.3	39.6	ns	56.1	48.5	ns	77.3	63.3	0.001
<i>P value</i>	ns	ns	-	0.01	0.05	-	0.01	0.001	-
Overweight² (Paper II)									
	16 years			21 years			30 years		
	Blue	White	<i>P</i> <i>value</i>	≤11 yrs	≥12 yrs	<i>P</i> <i>value</i>	≤11 yrs	≥12 yrs	<i>P</i> <i>value</i>
Gender									
Men	6.3	6.0	ns	17.9	18.2	ns	52.4	41.6	0.05
Women	6.3	5.2	ns	10.1	6.4	ns	30.6	19.9	0.05
<i>P value</i>	ns	ns	-	ns	0.01	-	0.01	0.01	-
Smoking (Paper III)									
	16 years			21 years			30 years		
	Blue	White	<i>P</i> <i>value</i>	≤11 yrs	≥12 yrs	<i>P</i> <i>value</i>	≤11 yrs	≥12 yrs	<i>P</i> <i>value</i>
Gender									
Men	20.6	19.0	ns	35.9	31.1	ns	36.1	18.0	0.01
Women	34.2	35.1	ns	48.7	32.2	0.05	46.4	28.8	0.05
<i>P value</i>	0.05	0.05	-	0.05	ns	-	0.05	0.05	-

¹at age 16 parent occupational position; and at ages 21 and 30 own occupational position for MSDs, and own educational level for overweight and smoking was used.

² includes obesity.

P values in the columns indicate the differences between social classes within men and within women. P values in the rows indicate the differences between men and women within each social class.

ns = non significant.

Appendix 2: Characteristics of the study population

	Men (n = 547)	Women (n= 496)
At age 16:		
Parents' social class (blue-collar worker)	50.3	45.0
Unemployed family member in last 12mo	22.1	19.7
Type of housing: Villa	68.6	69.2
Owned apartment	5.2	5.5
Rented apartment	25.9	24.9
Have own room	93.1	91.6
Foreign born parent (mainly from Finland)	16.6	12.5
Number of siblings, ≥ 3	19.6	18.2
Divorced parents	22.6	21.0
Low parental support in education	22.6	21.0
Poor contact with parents	20.1	32.6
Being liked in school, $> P_{75}$	15.3	20.1
Low school control	35.7	34.6
Average school grade	2.94 (SD \pm 0.76)	3.24 (SD \pm 0.76)
Average height (cm)	168.6 (SD \pm 8.7)	163.5 (SD \pm 6.3)
Underweight	34.2	27.8
Overweight	8.3	6.3
Obesity	0.7	0.8
Musculoskeletal disorders (MSDs)	37.7	40.2
Psychological distress, none out of 6 items	34.0	13.9
Chronic symptoms, none out of 6 items	71.7	71.8
Age at menarche (yr)	----	12.7 \pm 1.2
Physical activity: never	11.6	7.2
Currently smoking	18.5	34.0
Peer narcotic use	10.2	18.8
Alcohol consumption, median (P_{25} - P_{75})	1.2 (0.0-12.5)	1.4 (0.0-9.7)
TV viewing (several programmes/day)	39.9	17.0
At age 21:		
Own social class (blue-collar worker)	67.3	57.9
Average education (yr), mean (\pm SD)	11.1 (SD \pm 0.9)	11.3 (SD \pm 1.0)
Unemployed for >6 month during last 5 years	15.2	16.7
Restricted financial resources	21.3	33.9
Single	80.0	51.0
Have children	5.9	13.5
Underweight	1.5	8.0
Overweight	16.7	7.6
Obesity	2.4	0.8
Musculoskeletal disorders (MSDs)	39.1	52.3
Psychological distress, none out of 6 items	34.7	24.5

Appendix 2: cont.....

	Men (n = 547)	Women (n= 496)
Chronic symptoms, none out of 6 items	79.0	75.5
Physical activity: never	24.8	23.3
Currently smoking	32.2	42.3
Alcohol consumption, median (P ₂₅ - P ₇₅)	16.9 (7.3-40.9)	5.1 (2.1-11.5)
TV viewing, several programme/day	9.3	13.5
At age 30:		
Own social class (blue collar worker)	45.6	40.0
Average education (yr), mean (\pm SD)	11.9 (SD \pm 1.6)	12.3 (SD \pm 1.7)
House type: Villa	32.5	44.7
Owned apartment	18.7	13.9
Rented apartment	45.3	38.0
Restricted financial resources	14.5	29.8
Unemployed for >6 month during last 5 years	9.3	6.8
Single	33.7	21.2
Divorce	7.4	8.8
Have children	46.1	68.7
Average height	180.0(SD \pm 7.0)	166.5 (SD \pm 6.5)
Underweight	0.8	4.0
Overweight	39.7	20.3
Obesity	7.4	3.8
Musculoskeletal disorders (MSDs)	57.6	69.0
Psychological distress, none out of 6 items	35.8	23.7
Chronic symptoms, none out of 6 items	70.7	72.2
Physical activity: never	28.4	27.2
Currently smoking	25.2	34.2
Alcohol consumption, median (P ₂₅ - P ₇₅)	17.7 (9.1-33.8)	5.6 (2.61-13.2)
Average number of hours TV viewing	4.4 (SD \pm 1.2)	4.0 (SD \pm 1.2)
Experienced physical Violence in last 12 mo	6.1	4.3
Experienced threat for violence in last 12 mo	7.6	6.1
Violence, physical and/or threat in last 12 mo	9.7	8.0
Non-participation in any association	60.9	62.3
Poor social network	32.6	44.1
Poor social support	44.0	60.5
High job demand	48.0	48.9
Low job control	36.1	40.0
Physically heavy working condition	44.8	48.4

Values are percentages of subjects unless stated otherwise; n = number of participants, P₂₅ = 25th percentile, P₇₅ = 75th percentile; SD = standard deviation.

Appendix 3: Distribution of factors that showed significant association with the outcome variables in papers I, II, III, and IV according to adult socioeconomic position.

	Men White- collar	Blue- collar	Women White- collar	Blue- collar
Material circumstances:				
Unemployed family member at 16	20.5	23.7	16.5	24.7
Had no own room at 16	5.8	8.1	6.8	10.8
Restricted financial resources at 21	16.0	27.5	24.8	47.4
Restricted financial resources at 30	7.5	24.5	18.5	47.7
Social and Psychosocial circumstances:				
Divorced parents	20.5	26.7	18.7	27.3
Low parental support in education	46.5	68.5	50.9	73.1
Bad contact with mother	7.1	6.0	8.4	11.1
Bad contact with father	14.1	24.9	26.9	35.4
Being liked in school, > P ₇₅	21.7	7.8	26.6	12.3
Low school control	26.5	46.5	27.9	44.8
Average school grade	3.3±0.7	2.5±0.7	3.5±0.6	2.8±0.7
Single at 21	83.6	75.6	55.6	43.3
Have children at 30	42.4	50.6	62.7	77.6
Low job control	22.1	54.7	32.4	53.4
Physically heavy working condition	24.6	68.7	30.0	75.9
Behavioural factors:				
Physical inactivity at 16, never	7.9	16.6	3.1	13.4
Physical inactivity at 30, never	21.4	38.7	24.6	30.4
Currently smoking at 16	13.0	26.9	25.9	47.9
Peer narcotic use at 16	7.3	13.6	15.8	21.6
Currently smoking at 21	24.2	41.5	35.5	53.1
Currently smoking at 30	18.9	35.8	29.3	45.9
Alcohol consumption at 21, median (P ₂₅ –P ₇₅)	16.1 (8.1–40.4)	19.1 (10.1–33.8)	5.6 (2.4–11.3)	6.0 (2.6–15.0)
Alcohol consumption at 30, median (P ₂₅ –P ₇₅)	16.6 (8.9–33.1)	19.3 (9.3–33.8)	5.6 (2.6–13.2)	5.7 (2.6–13.9)
Non-participation in any association at 30	54.3	68.9	57.0	73.1
Health related factors:				
Height at 16	169.4±9.1	168.5±8.5	163.7±6.3	163.2±6.3
Age at menarche	-	-	12.7±1.3	12.7±1.1

Values are percentages of subjects unless stated otherwise; n = number of participants, P₂₅ = 25th percentile, P₇₅ = 75th percentile; SD = standard deviation.

Appendix 4: Proportion of smoking, overweight and MSDs by educational level among adults whose parents were blue-collar workers during their adolescence.

Education	Smoke	Overweight	MSDs
≥11 yrs	25.0	32.6	47.0
<11 yrs	38.0	43.3	70.2
<i>P-value</i>	<i><0.01</i>	<i><0.05</i>	<i><0.01</i>

Appendix 5: Proportion (%) of smoking, overweight and obesity at age 30 (in 1995) among Luleå cohort versus National Statistics, Sweden.

		Men	Women
Smoking	Luleå	27	36
	Whole Sweden	22	30
	Middle range cities ^a	23	36
Overweight	Luleå	40	20
	Whole Sweden	43	25
Obesity	Luleå	7	4
	Whole Sweden	6	5
MSDs	Luleå	58	69
	Middle range cities ^a	70	75

^a Number of inhabitants are between 27,000 – 90,000.

Data source for national statistics: SCB webpage, 1995.

Note: Age range used in national statistics is 25-34 yrs.

Appendix 6: Coding of each variable that was used in this thesis.

Variables	Preliminary coding	Final coding
Socioeconomic circumstances:		
Occupation	0 = non-manual worker 1 = manual worker	0 = white-collar 1 = blue-collar
Education	Year of education	0 = ≥ 12 years = high 1 = ≤ 11 years = low
School grade, age 16	scale 1–5 (low–high)	continuous variable
Have own room, age 16	Yes/no	Yes/no
Number of siblings	0 = ≤ 2 siblings 1 = ≥ 3 siblings	0 = small family 1 = large family
Have unemployed family member in last 12 months, age 16		No/yes
Financial resources	0 = can get amount asked 1 = can not get	0 = good 1 = restricted
Unemployed for >6 months between the ages 21–30 years		No/yes
Social and psychosocial circumstances:		
Parental divorce	0 = live with both parents 1 = live with only one parent	0 = not divorced 1 = divorced
Contact with parents	scale 1–5 (very bad – very good) 1 = very bad and bad; 0 = above medium	0 = good contact 1 = poor contact
Parental support in education	scale 1–5 (very low– very good) 1 = very low and low; 0 = above medium	0 = good support 1 = low support
School control	scale 3–15 (very little – very much)	dichotomised at 75%
Being liked in school	scale 2–12 (least liked – most liked)	dichotomised at 75%
Peer use narcotic	-	No/yes
Ethnic background	One or both parent born outside Sweden	No/yes
Marital status, age 21 & 30	0 = live alone 1 = married or cohabiting	0 = single 1 = not single
Have children, age 21 & 30	ranged 0–4 (no children–4 children)	0 = no children 1 = have children
Social network	scale ranged 4–24 (no. of contacts)	median split
Social support	scale 6–23 (very little – very much)	median split
Experience of physical violence and or threats in last year, 30		No/yes
Heavy work condition	-	No/yes
Job control	scale 6–24 (very little – very much)	median split
Job demand	scale 6–24 (very low – very high)	median split
Health related and behavioural factors:		
MSDs	scale 0–4 (no pain – light & severe)	0 = 0 (no pain) 1 = 1–4 (have pain)
Psychological distress	scale 0–6 (none to all 6 symptoms)	0 = no distress 1–6 = have distress
Chronic symptoms	scale 0–6 (none to all 6 symptoms)	0 = no symptoms 1–6 = have symptoms
BMI	weight in kg/(height in metre) ²	WHO and Cole ^a
Smoking	0 = stopped + do not smoke 1 = all other smokers	0 = non-smoker 1 = smoker
Alcohol consumption	in decilitres pure alcohol/year	continuous variable
Physical activity	0, 1, 2 = regular, sometimes, never	0 = reference category
Watch TV	Number of hours/programmes/day	continuous variable

^a see page 33 for detail categorisation of BMI.