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**SOCIAL MOBILITY IN  
RELATION TO  
CARDIOVASCULAR AND  
PSYCHIATRIC HEALTH**

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“People should have the right  
to move –  
or not to move –  
following their dreams,  
without being constrained by their origins”

*Ingemund Hägg*

*To Göran, Niklas and Mattias*

## **ABSTRACT**

Social mobility describes shifts from one status position to another within a system of social stratification and can either occur within or between generations. Previous research has indicated that mobility between social class positions may influence an individual's health, both mentally and physically. The overall aim of this thesis was to study social mobility in relation to cardiovascular disease (CVD) mortality and psychiatric disorder in the Swedish working-age population. The target populations were identified in the Swedish censuses (1960, 1980 and 1990) with linkages to several nationwide registries. Information on CVD mortality was retrieved from the Cause of Death Register and psychiatric admissions were provided by the Patient Register.

The association between social mobility and CVD mortality and psychiatric disorder were analysed by logistic regression, alternating logistic regression and Poisson regression. Descriptive statistics and summary graphs were used to describe the social mobility patterns among psychiatric patients.

Individuals who were socially mobile between generations displayed different risks for CVD mortality. More specifically, the downwardly mobile typically had increased risks whereas the upwardly mobile generally had lower risks compared with the socially stable. Individuals who were stable in the manual class also exhibited an increased risk for CVD mortality. Between 1980 and 1990, individuals with a psychiatric disorder were not as likely to remain socially stable, or within the labour force, as the remaining part of the Swedish work-force. Inter-generationally downwardly mobile individuals had an increased risk of psychiatric disorder and the upwardly mobile had a lower risk when compared with the socially stable. Both childhood and adult social class were associated with CVD mortality and psychiatric disorder in men and women, but a unique effect of social mobility on the two studied outcomes could only be verified for men.

In conclusion, social class in adult life is an important determinant of CVD mortality and psychiatric disorder. Social class position as well as shifts in-between classes across the life course should be considered in health prevention. The findings are in accordance with the assumption that improvement in the daily life of psychiatric patients should include work rehabilitation to enable patients to remain in the labour force and maintain social stability.

# LIST OF PUBLICATIONS

This thesis is based on the following papers, which in the text will be referred to by their Roman numerals (I-IV):

- I. Tiikkaja S, Hemström Ö, Vågerö D.  
Intergenerational class mobility and cardiovascular mortality among Swedish women: a population-based Register study.  
*Social Science and Medicine* 2009;68(4):733-9.
- II. Tiikkaja S, Olsson M, Malki N, Modin B, Sparén P.  
Familial risk of premature cardiovascular mortality and the impact of intergenerational occupational class mobility.  
*Social Science and Medicine* 2012;75(10):1883-90.
- III. Tiikkaja S, Sandin S, Hultman CM, Modin B, Malki N, Sparén P.  
Psychiatric disorder and work life: A longitudinal study of intra-generational social mobility.  
*Submitted.*
- IV. Tiikkaja S, Sandin S, Malki N, Modin B, Sparén P, Hultman CM.  
Social class, social mobility and risk of psychiatric disorder – a population-based longitudinal study.  
*Manuscript.*

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## LIST OF ABBREVIATIONS

CVD	Cardiovascular diseases
MI	Myocardial infarction
IHD	Ischemic heart disease
SEI	Socioeconomic index
NRN	National registration number
OR	Odds ratio
RR	Relative risk
CI	Confidence interval
POR	Pairwise mean odds ratio
ARL	Alternating logistic regression
WHO	World health organisation
DSM	Diagnostic and Statistical Manual of Mental Disorders



# 1 INTRODUCTION

The occupational structure in a society is not constant over time but tends to fluctuate.<sup>1</sup> Sociologists have a long tradition of studying this phenomenon referred to as social mobility.<sup>1-3</sup> Social mobility can be defined as the shifts by individuals or groups from one status position to another within a system of social stratification.<sup>4</sup> At the group level, it refers to changes in the occupational structure of the society, and at the individual level it refers to a single person's movement from one position to another, either horizontally or vertically (up or down). Social mobility within and between generations has been extensively investigated in industrial societies as markers of equality in opportunity and social openness.<sup>3</sup> A high degree of social mobility in a country indicates that occupational opportunities are determined by educational qualifications, experience and skills rather than by social origin. A closely related, but somewhat broader, term is that of meritocracy, which refers to societies where people's success depend on their individual abilities (IQ and effort) rather than the wealth or position of their parents.<sup>5</sup> In meritocratic societies occupational status should be *achieved*, which corresponds with a high level of social mobility.

It is well established that social class (measured by occupation) is strongly linked to health.<sup>6,7</sup> Individuals in high social class positions most often have better health than those in low social class positions.<sup>7-9</sup> Factors related to social class that may influence health include income, education, housing, diet and working conditions. The social gradient in health is especially pronounced for cardiovascular disease (CVD) mortality and psychiatric disorder, which are major public health problems in Sweden.<sup>10-12</sup> Social mobility in relation to health can be viewed as a life course model<sup>13,14</sup> where different social mobility trajectories provide different prospects for an individual's health and life-expectancy across the life-span.

Research on social mobility in relation to CVD mortality and psychiatric disorder in Sweden is scarce, particularly among women. This thesis consists of register-based cohort studies, and explores social mobility in relation to CVD mortality and psychiatric disorder in the Swedish working-age population. Additionally, the impact of psychiatric disorder on social mobility in adult life is investigated. Social mobility is assessed both as broader categories of up- and downward mobility as well as by trajectory specific mobility. The most common social classes –non-manual and manual classes—are sometimes complemented by categories of self-employed and unclassifiable to get a more complete picture of how social mobility patterns are related to health among Swedish women and men.

## 2 BACKGROUND

Social epidemiology is defined as “*the branch of epidemiology that studies the social distribution and social determinants of states of health*”<sup>7</sup> or “*the study of relations between social factors and disease in populations*”.<sup>15</sup> Social epidemiology often involves a population perspective on how social conditions influences health through various pathways and different mechanisms.<sup>7</sup> This thesis focuses on social mobility (occupational class changes) and its relationship to two severe health outcomes: CVD mortality and psychiatric inpatient hospitalisations.

### 2.1 SOCIAL CLASS AND SOCIAL INDICATORS

The sociological ideas of Karl Marx and Max Weber have to a large extent influenced sociologists’ understanding of social class and health.<sup>7</sup> Marxian idea views society as stratified into classes. According to Marxian view, moreover, the first distinction of occupational classes has to do with owning the means of production. Self-employed and company owners hold their own companies. The employed, on the other hand, do not own their means of production, but instead sell their manpower to the company owners. In another view of reasoning, Weber claimed that a social class can be seen as a group of people who share the same “life-chances”, such as similar values and circumstances. He also believed that the production relations were linked to different “life-chances” in terms of economic goods or living conditions. The term “social position” indicates a particular structural location within society<sup>7</sup> and a social class consists of individuals who possess roughly similar capacities in terms of resources and economy.<sup>3</sup> Other social indicators, such as educational level and level of income, are strongly related to social class.<sup>9</sup> Education, income and occupational class are often used interchangeably. However, even though these socioeconomic indicators are correlated, there is evidence that each and every one of them have unique qualities, and accordingly, their own way of affecting people’s health and mortality risk.<sup>16-18</sup> Seen from a life-course perspective, these social characteristics are often determined at different stages of life.<sup>19</sup> This thesis focus primarily on social class changes, while sometimes also accounting for education and income (Study I and II).

#### 2.1.1 Education

An individual’s level of education is usually determined in early adulthood. The Swedish educational system is based on tax-financed education for all permanent residents in Sweden.<sup>20</sup> Individual factors such as aspiration levels<sup>21</sup> and intelligence<sup>22</sup> are known to influence the level of attained education. Familial factors such as parental education<sup>21</sup> have also been shown to influence the offspring’s educational attainment. The proportion of highly educated individuals has increased since 1975 in Sweden.<sup>23</sup> Education may be seen as a resource or knowledge-based asset,<sup>24</sup> facilitating for example, the handling of information and other non-material resources which may buffer against stress and promote healthy life styles.<sup>25</sup> Education is also a mechanism by which the adult labour market position is largely determined and an important mechanism behind upward social mobility.<sup>26</sup>

### 2.1.2 Income

Income is an indicator of material living standard<sup>24</sup> and of purchasing power.<sup>7</sup> A high income facilitates access to healthier food and leisure activities.<sup>7</sup> Income level is often related to educational level and occupational class.<sup>7</sup> A high social class is often accompanied by a high income. Income is a rather sensitive social indicator that can fluctuate over time.<sup>24</sup> There are different ways to measure income, for example through individual earnings (taxed salary) or household disposable income (income after taxation in the household, after adjustment for household size).<sup>27</sup>

### 2.1.3 Occupation and social class

Occupation reflects a person's place in society and is related to factors such as income, education and prestige.<sup>24</sup> It may be seen as an indicator of a person's social standing and is associated with varying degrees of social privileges such as access to health care and residential facilities. It may also reflect social networks, work-based stress, control, and autonomy.

Occupations can be classified into different social class categories.<sup>3</sup> The sociologist Robert Erikson and his colleagues constructed the Swedish Socioeconomic (SEI) classification in the 1970's,<sup>28</sup> which by and large corresponds to the Erikson, Goldthorpe and Portocarrero classifications of occupations (EGP).<sup>1</sup> The SEI classification distinguishes between employers and employees (see appendix). According to SEI, employees are divided into manual and non-manual occupations (based on union affiliation). The manual and non-manual occupations are then further divided into high and low, according to the required educational level for the occupation in question.<sup>29</sup> SEI classification also takes into consideration job responsibility levels, and specific duties or work tasks to be performed. Occupational class (SEI) is considered as a good social indicator for individuals above 30 years.<sup>30</sup>

The SEI scheme in the 1990's Census has 12 different occupational classes (including 3 categories of self-employed) together with 3 additional categories of respondents that could not be assigned to a social class (see appendix).<sup>31</sup> These categories are referred to as "unclassifiable employed" (employed individuals that could not be assigned to a social class), "missing SEI information" and "not in the labour force". It is problematic to place the self-employed into a social hierarchy among the employed.<sup>1</sup> In the occupational classification, those outside the labour force e.g. students, home-makers, unemployed and disability pensioners, are not included since they reside outside the labour force.

Social class can be measured at different time points across the life-course. An individual's own social class is an indicator of circumstances during adult working life. Social class in childhood is based on the parents' social class and serves as an important indicator of circumstances during early life. Parental social class is often determined by the head of the household ("the dominance order").<sup>32</sup> Social class (SEI) in the 1960 Census (which is used to assess parental class in this thesis) is not classified in the same way as adult class in 1990 Census. To obtain approximately comparable social class

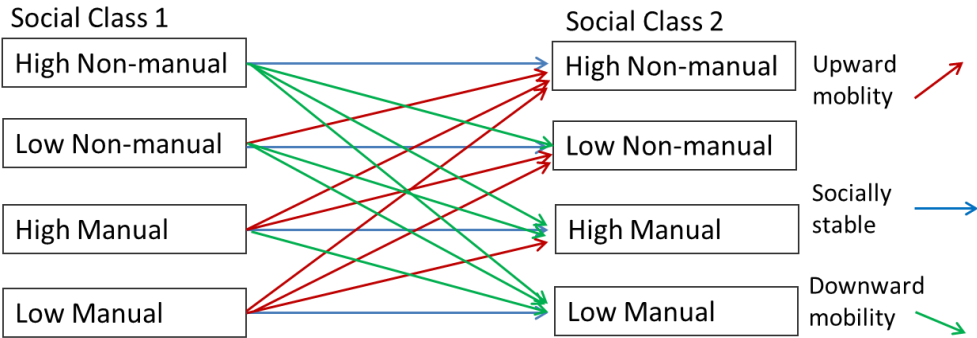
categories, the occupational information of the parents were re-coded in a similar fashion as the SEI 1990 code in this thesis.

Although there are problems with placing the self-employed into a social hierarchy and even though the unclassifiable do not constitute an occupational class in itself, it may still be informative to include these groups into analyses of social mobility. For example, the decrease in the number of self-employed between 1960 and 1990,<sup>33</sup> suggests that many of those with self-employed parents will end up in another adult class.

**2.2 SOCIAL MOBILITY**

Social mobility describes the shifts or stability between social class positions.<sup>1,3</sup> Inter-generational social mobility describes the change of occupational positions between generations, from parental class to own adult class, while intra-generational social mobility describes mobility within (a certain period of) an individual’s own working life (sometimes also called career mobility). Class of *origin* refers to social class conditions during upbringing (i.e. parental social class) while class of *destination* refers to the individual’s attained class at a certain point in adult life.

Commonly used social mobility categories are: *upward mobility* (e.g. from manual parental class to adult non-manual class), *stable* (e.g. same parental and adult class) and *downward mobility* (e.g. from non-manual parental class to adult manual class). Instead of collapsing all social mobility trajectories into categories of upward, stable and downward, some studies use specific social mobility trajectories.<sup>34,35</sup> Figure 1 illustrates an example of the social mobility trajectories and social mobility categories used in this thesis.



*Figure 1: An illustration of possible social mobility trajectories and social mobility categories among non-manual and manual classes.*

In this thesis, all possible social mobility trajectories (including self-employed and unclassifiable) were examined for CVD mortality and psychiatric disorder. However, when the significance of social mobility on the outcomes was examined, the analyses were restricted to non-manual and manual classes as they can be ordered in a hierarchical fashion from high to low.

The structure of social classes, e.g. how parental class (origin) relates to the adult class (destination) may be calculated by outflows and inflows in social mobility tables.<sup>3</sup> The *outflow* from a social class describes the chances of ending up in a particular class of destination by class of origin. The *inflow* to a social class describes how heterogeneous a certain class is by describing its current composition in terms of where the class members came from.

The forces influencing social mobility are multiple and complex.<sup>36</sup> The social mobility patterns in a society depend on the overall social structure and of the possibility, for example by higher education, to change social classes.<sup>3,37</sup> As previously mentioned, the labour market structure has changed in Sweden during the past decades, with a dramatic decrease in the proportion of farmers and an increase in the size of the non-manual classes.<sup>38</sup> The educational level in the Swedish population has also increased since 1930.<sup>39</sup> As a result of the above-mentioned development, upward mobility is more common than downward mobility.<sup>40</sup> Social stability is also common among the high non-manual class in Sweden (45%). The social mobility rates in Sweden are high,<sup>1</sup> indicating that it is “relatively easy” to be socially mobile.<sup>40</sup>

### 2.3 SOCIAL MOBILITY AND HEALTH

Certain resources that are unequally distributed in society are systematically connected to social class position and health.<sup>7,41</sup> Social class in childhood and adult life and social mobility have been studied in relation to various health and mortality outcomes.<sup>9,42-44</sup> Two main hypotheses have been proposed to account for the link between social mobility and health: *social causation* and *health selection*.<sup>45</sup>

The “*Social causation hypothesis*” assumes that it is the social position (through e.g. work environment or diet) that influences health. In this case a low social position “causes” poor health, whereas a high social position “causes” good health.<sup>9</sup>

The “*Health selection hypothesis*” (sometimes referred to as social selection) assumes that people are selected to a social position according to their health status. This implies that poor health “causes” low social position<sup>9</sup> and that social mobility is a function of the individual’s health. Persons with poor health “drift down” (or fail to move up) the occupational hierarchy and individuals with good health “climb up” the occupational ladder.<sup>45</sup> Social selection can also refer to mobility between and within generations, between social classes, and into and out of the labour market. In addition, the “*social drift hypothesis*” proceeds from the idea that individuals with poor health are bound to become downwardly mobile. Poor health can be an important limitation for social mobility. On the other hand good health may “cause” upwards mobility.<sup>46</sup>

A person's health may improve or worsen conjointly with social class changes.<sup>47,48</sup> Individuals who change social positions possess the health attributes from the class they left, as well as the health attributes in the class they join.<sup>46</sup> Upwardly mobile individuals have (on average) better health than those in the class they left, but poorer health than the class they join.<sup>9</sup> Downwardly mobile individuals have (on average) poorer health than the class they left, but better health than the class they join. Furthermore, people who are mobile out of the labour market generally have poorer health than those who remain within it.<sup>49</sup> Socially mobile individuals may also change their life style habits<sup>34,50</sup> and adjust their manners to the class they join.<sup>51</sup>

There is also an on-going debate on whether social mobility leads to an increase<sup>52</sup> or decrease<sup>46</sup> in health inequalities. Thus, even though a high degree of social mobility is considered to be an indicator of social justice in a society, an increased social mobility may, as a result of health-selection, lead to an increase in figures reporting health inequalities. Since healthy individuals are more likely to experience upward mobility, while individuals with poor health are more likely to move downward the social ladder, this should cause the gap between higher and lower social classes to *widen*.<sup>52,53</sup> Other researchers have argued that health-related mobility rather *constrains* health inequalities since upwardly mobile individuals tend to have a worse health than those in the class they join, while downwardly mobile individuals tend to have a better health than those in the class they join, thereby leading to a decrease in figures reporting health inequalities.<sup>47,54</sup>

## 2.4 CARDIOVASCULAR DISEASES AND MORTALITY

Cardiovascular diseases (CVD) are a group of diseases of the heart and blood vessels.<sup>55</sup> CVD mortality is used as the main outcome in Study I and II, with Study I also including some cause-specific CVD outcomes. CVD is grouped into ischemic heart disease (IHD), stroke and "other CVD". IHD is a condition in which there is an inadequate supply of blood and oxygen to the heart,<sup>56</sup> examples of these are angina and acute myocardial infarction. Stroke results from an impeded blood supply to the brain. A stroke may result either from a rupture (haemorrhagic stroke) or a blockage (brain infarction also called ischaemic or occlusive stroke) of a blood vessel.<sup>56</sup> The group of "other CVD" includes e.g. rheumatic heart disease (damage to the heart muscle and heart valves from rheumatic fever) and congenital heart disease (malformations of heart structures existing at birth).

CVD occurs at earlier ages in men and the CVD incidence is higher in men than in women.<sup>57</sup> Men and women may express different symptoms of CVD events, with women being less likely to report chest pain, but more likely than men report fatigue, neck pain, right arm pain, dizziness, and jaw pain.<sup>58</sup> This may lead to differences in diagnosing female and male CVD.

The incidence is higher in men than in women, even when considering social class differences. In 1990–2001, the incidence of CVD was 800 per 100 000 for men in low manual class and 550 per 100 000 for men in high non-manual class.<sup>59</sup> The incidence

among women was lower, corresponding to 350 per 100 000 in low manual class and 200 per 100 000 in high non-manual class.<sup>59</sup>

Over 200 risk factors have been documented for CVD.<sup>60</sup> The main physiological cause of CVD is atherosclerosis, which is a hardening of the arteries leading to impaired blood circulation and lack of oxygen in the tissues.<sup>56</sup> Several types of risk factors influence the development of CVD.<sup>55</sup> These risk factors include behavioural, metabolic, demographic and other risk factors. *Behavioural risk factors* include smoking, physical inactivity, harmful use of alcohol or poor diet. *Metabolic risk factors* include high blood pressure (hypertension), high blood sugar (diabetes), high blood lipids (blood cholesterol) and overweight or obesity. *Other risk factors* include low social class, sex, age, genetic predisposition and stress (psychosocial factors).

CVD is a major cause of mortality in the world, responsible for over 17 million deaths in 2008. Death due to CVD is more common among men below the age of 75 years than among women in the same age group.<sup>61</sup> In Sweden, CVD mortality has decreased during the past three decades (1987–2011), from 128 to 46 per 100 000 women and from 352 to 114 per 100 000 men.<sup>62</sup> The decreased mortality is probably due to advancement in medication and CVD treatment as well as improvement in lifestyle factors and cessations of smoking.<sup>10</sup> Nevertheless, CVD mortality is still a leading cause of death in Sweden, responsible for about 40% of total mortality in the age-group 15-74 years.<sup>10,62</sup>

#### **2.4.1 Social class, social mobility and CVD mortality**

Low social class in childhood and in adult life has been linked to an increased risk of CVD mortality.<sup>44,63,64</sup> Among working-age Swedes, those belonging to the low manual class have a doubled risk of CVD mortality compared to those in high non-manual class.<sup>64</sup> Also when comparing CVD mortality between broader social class categories, those in the manual classes display an increased risks vis-à-vis those in non-manual classes.<sup>65</sup> Social mobility is also linked to the risk of CVD mortality.<sup>14,44,66,67</sup> Downwardly mobile individuals from non-manual to manual classes were shown to have a more than two-fold increased risk of CVD mortality, compared to the stable non-manuals.<sup>14,44,66</sup> Those who remain in the stable manual class have also been found to have an elevated risk of CVD mortality in relation to the stable non-manuals. Some studies also report lower risks of CVD mortality among upwardly mobile individuals,<sup>44,66</sup> while other research has pointed to increased CVD risks.<sup>14</sup>

### **2.5 PSYCHIATRIC DISORDER**

Psychiatric disorders are various conditions characterised by impairment of an individual's normal cognitive, emotional, or behavioural functioning. According to the World Health Organisation (WHO), about 10% of the adult population has a psychiatric disorder at some point in their life.<sup>68</sup> In Sweden, psychiatric disorders are the 5<sup>th</sup> most common reason for hospitalisation among men and the 6<sup>th</sup> most common among women.<sup>10</sup> It has been estimated that about 10–20% of the Swedish population will suffer from a psychiatric disease during their life, and of these about 2–3% will

receive treatment. In 1997, the majority of admitted psychiatric patients in Sweden suffered from schizophrenia and depression.<sup>69</sup> The lifetime prevalence of psychiatric disorders varies between countries as well as by age and sex.<sup>70,71</sup>

Psychopathology is most often viewed as a result of mutually interacting causal factors, with an interaction between characteristics of the person and characteristics of the surrounding environment. Thus, knowledge about factors initiating disease in a predisposed individual is important. The aetiology of most psychiatric disorders is multifactorial and is related to a complex interplay between genetic, social and environmental factors.<sup>72,73</sup> There are numerous risk factors that may influence the development of psychiatric disorders during the life-course.<sup>74</sup> Factors during childhood such as traumas and child neglect, low parental social class, parental psychiatric disorders, and scholastic failure are some examples.<sup>74</sup> During adult life, stress, social competence and poor work skills are examples of circumstances that may influence the development of psychiatric disorders.<sup>74</sup>

In this thesis, the following diagnostic groups of patients were included: *schizophrenia, alcoholism and drug dependency, affective psychosis, neurosis and personality disorders* (Study III and Study IV). The labelling of diagnoses has changed between the four used versions of International Classification of Disease (ICD-7; ICD-8; ICD-9; ICD-10), but are largely compatible. Neurosis was for example the diagnostic term used in earlier ICD versions (ICD-8; ICD-9) but in the ICD-10 codes it is labelled as depression and anxiety, whereas affective psychosis is comparable to bipolar disorder in ICD-10. The term neurosis is used in this thesis since this was the diagnostic term used at the time when the majority of the psychiatric patients included were diagnosed.

Schizophrenia is a severe and debilitating psychiatric disorder. It is characterised by disorganised thinking, hallucinations, inappropriate emotions and actions (delusions), disorganised behaviour and/or social/occupational dysfunction.<sup>75</sup> The lifetime prevalence of schizophrenia has been estimated to 1%.<sup>76</sup> Lifetime prevalence is the proportion of a population that at some point in their life (up to the time of assessment) have experienced the condition.<sup>15</sup> Alcoholism and drug dependency are disorders that are attributable to the use of one or more psychoactive substances. The lifetime prevalence of any substance use disorder is 15%.<sup>71</sup> Affective psychosis is a condition that includes episodes of severe low and high moods, sometimes with confusion, delusions and other psychotic symptoms.<sup>75</sup> The lifetime prevalence of affective psychosis has been estimated to 0.59%.<sup>76</sup> Neurosis and personality disorders include depression, anxiety (neurosis) and reactions to severe stress.<sup>75</sup> Depression is characterised by a combination of symptoms (depressed moods, feelings of worthlessness and diminished interest or pleasure in most activities). In a review, the lifetime prevalence of depression has been estimated to 8–16%.<sup>77</sup> Anxiety disorders are characterised by feelings of recurrent attacks of severe anxiety (panic) and has been estimated to 6%.<sup>71</sup> Reactions to severe stress can cause a psychiatric disorder called acute stress reaction, which may give rise to a variety of symptoms.



### **2.5.1 Social class, social mobility and psychiatric disorder**

Low social class in childhood and adult life has been associated with an increased risk of psychiatric disorder.<sup>42,78-80</sup> Psychiatric patients and their inter-generational social mobility patterns have been studied extensively,<sup>81-83</sup> with the finding that psychiatric patients more often experience downward social drift compared to psychiatrically healthy individuals. Social mobility has also been linked to the risk of (subsequent) psychiatric disorder.<sup>84,85</sup> Downwardly mobile from non-manual to manual class and stable manual class have been shown to have an increased risk of psychiatric disorders compared with those in stable non-manual class. Upwardly mobile had an increased risk of psychiatric disorders as well, but lower than the downwardly mobile. Moreover, men who were downwardly mobile during adult life (intra-generational mobility) had four times the risk of poor self-reported mental health compared to men who were upwardly mobile.<sup>86</sup> Women who were downwardly mobile in adult life had twice the risk of psychological distress, compared to upwardly mobile women.<sup>87</sup>

### 3 AIMS

The overall objective of this thesis is to study how social mobility associated with the risk of CVD mortality and psychiatric disorder in the Swedish working-age population.

The specific aims were to:

**Study I:** Study inter-generational social mobility and risk of CVD mortality among Swedish women, with a specific focus on whether certain social mobility trajectories are associated with an elevated risk of CVD mortality. A second aim was to assess the impact of childhood and adult class on female CVD mortality.

**Study II:** Investigate how parental and adult occupational class and inter-generational social mobility are associated with the risk of premature CVD mortality once CVD mortality among siblings and parents are accounted for. A second aim was to evaluate the magnitude of the CVD risk conferred to siblings.

**Study III:** Describe intra-generational social mobility within and out of the labour market for psychiatric patients versus non-patients. This is done to assess whether the proportions of social mobility and mobility out of the labour market differ between psychiatric patients and non-patients. A second aim was to describe the social mobility patterns by number of inpatient hospitalisations and by psychiatric diagnosis.

**Study IV:** Assess the possible effects of adult social class (as a time-varying covariate) and inter-generational social mobility on the risk of subsequent psychiatric hospitalisation among Swedish men and women.

## **4 MATERIALS**

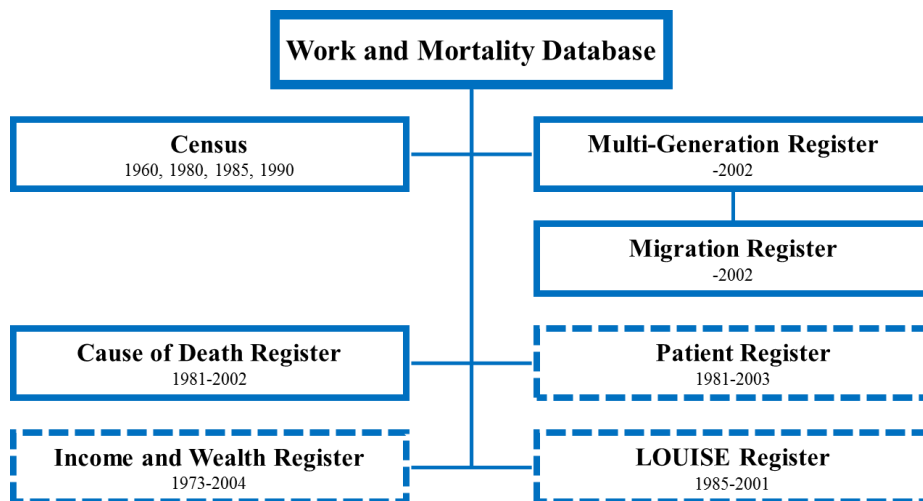
All four studies in this thesis used Swedish register-based data. Since 1947, all Swedish residents are assigned a unique personal identification number (NRN) consisting of a ten-digit code.<sup>88</sup> The NRN is extensively used by the Swedish authorities for general population registrations (e.g. social security, tax, military defence), and for health statistics (vital statistics and health care statistics).<sup>88</sup> The NRN code can be used to link population and health registries, but when the data are received (by researchers) the NRN code is replaced by a unique sequence number that does not allow identification of the individuals included. The Total Population Register in Sweden (TPR), established in 1961, contains all individuals born from 1932 and parents to those individuals who were resident and registered in Sweden from 1961. This is the basic register of the population of Sweden containing information about who lives in the country, NRN and migration and emigration.<sup>89</sup>

### **4.1 DATA SOURCES**

The data used were retrieved from several Swedish registers, locally merged into two databases. The Swedish Work and Mortality Database are hosted at Centre for Health Equity Studies (CHESS), Stockholm University/Karolinska Institutet and the Social Mobility Database is hosted at Department of Medical Epidemiology and Biostatistics, Karolinska Institutet.

### 4.1.1 The Swedish Work and Mortality Database

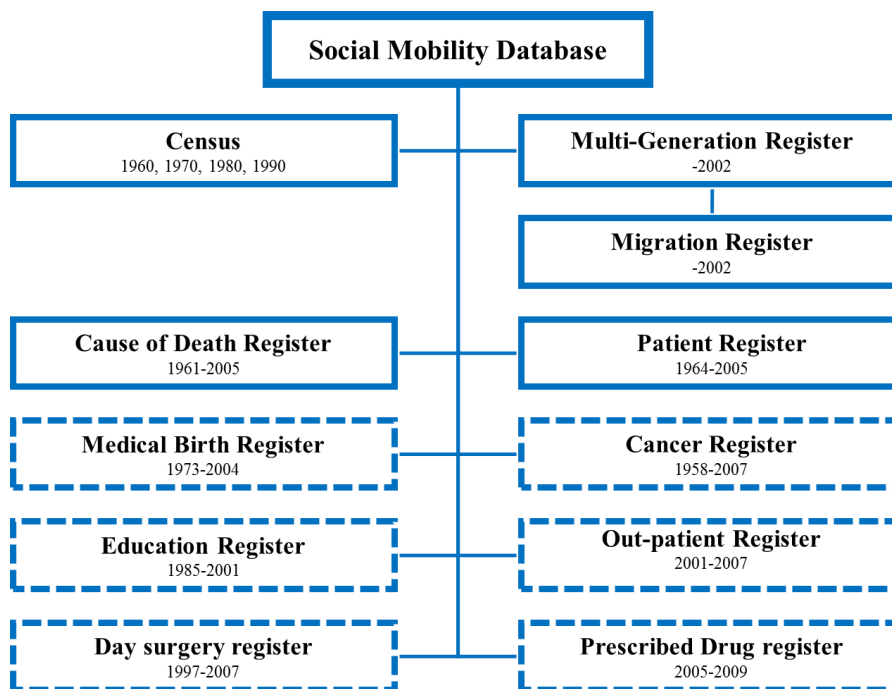
This database includes all individuals born before December 31<sup>st</sup>1985, who were nationally registered in December 31<sup>st</sup> 1980 or December 31<sup>st</sup> 1990 and those who immigrated between January 1<sup>st</sup> 1991 and December 31<sup>st</sup> 2002. Figure 2 illustrates the contents of the Swedish Work and Mortality database. Study I is based on this data material.



*Figure 2: Schematic illustration of the Swedish Work and Mortality Database. The dashed lines indicate registries that were not used in this thesis.*

### 4.1.2 The Social Mobility Database

This database includes all individuals registered in the Multi-Generation Register between 1932 and 2002 and the parents of these individuals along with individuals present in any of the censuses in 1960–1990. Figure 3 illustrates the contents of the Swedish Work and Mortality database. Studies II-IV are based on this data material.



*Figure 3: Schematic illustration of the Swedish Social Mobility Database. The dashed lines indicate registries that were not used in this thesis.*

### 4.1.3 The Population and Housing Censuses

The population and housing censuses were performed between 1960 and 1990 by Statistics Sweden. The Census questionnaires were sent to all nationally registered Swedish residents above the age of 16 years at the time of the Census (responding to these questionnaires was mandatory). The censuses contain detailed information of housing, civil status, highest attained level of education, income, occupations and social class. The question about occupation: “Which profession do you have?” concerns work during one year and was measured during October (1960 and 1990) or September (1980). If a person was temporally not working (due to disease or maternity leave) the respondent was asked to fill in the last occupation he or she held. The occupations were coded and verified with the Occupational Register.<sup>90</sup> Additionally, the occupational information was checked by control information from the employer. At the time of data collection, there was additional information about the censuses, in both writing and in an audiocassette tape, targeted e.g. for mentally disabled individuals.<sup>91,92</sup> If a respondent suffered from (severe) illness, a relative or some other significant person could fill in the questionnaire. The response rates in both the 1960 and 1980 Census was 99%, whereas in the 1990 Census it was 98%.<sup>92-94</sup>

#### 4.1.3.1 Variables used from the Census 1960

**Parental occupational status** (yrkesställning) was used to classify parental class into non-manual (1, 2, 4, 5), manual (3, 6) self-employed (7, 8) and unclassifiable (0) (Study I).

**Parental socioeconomic index** (SEI) was grouped into non-manual (05, 06, 09), manual (02, 07, 08), self-employed (01, 03, 04) and unclassifiable (10, 11, 12) parental social class (Study III).

**Parental occupation** as 3-digit occupational code (ranging from 1-999) was used to classify parental social class into similar SEI categories as those in the 1990 Census (high non-manual, low non-manual, high manual, low manual, self-employed and unclassifiable employed). This was necessary because the parental SEI code in 1960 did not distinguish between high and low manual and non-manual class (Study II and IV).

#### 4.1.3.2 Variables used from the Census 1980

**Adult socioeconomic index** (SEI) in 1980 was used to classify adult social class into high non-manual (including intermediate non-manual) (46, 56, 57), low non-manual (33, 36), high manual (21, 22), low manual (11, 12) (Study III).

#### 4.1.3.3 Variables used from the Census 1990

**Adult socioeconomic index (SEI)** was grouped into non-manual (33-57), self-employed (60-89), manual (11-22) and unclassifiable (91, *not in the labour force*) social class (Study I). This classification was used in order to maintain a similar classification as that of parental class in 1960 (Study I). SEI in 1990 was in Studies II-IV used to classify adult class into high non-manual (including intermediate non-manual) (46, 56, 57), low non-manual (33, 36), high manual (21, 22), low manual (11, 12), self-employed (79, 89, 60) and unclassifiable employed (91).

**Social mobility** Inter-generational social mobility was assessed by comparing parental class and adult class (Studies I, II, IV). Intra-generational social mobility was assessed by comparing adult class in 1980 and 1990 (Study III).

**Level of education** was categorised into low, medium or high (university, upper secondary and primary) (Study I-II). These categories reflect the highest educational degree from university/college, upper secondary school/gymnasium (12-13 years of education) or elementary schooling (9 years of education).

**Household disposable income** was categorised into quartiles: low (1) medium low (2), medium high (3) and high household disposable income (4) (Study I-II).

**Civil status** was categorised into married/cohabiting, divorced, widow/widowed and unmarried (Study II).

#### 4.1.4 The Multi-Generation Register

The Multi-Generation Register includes all individuals (children) registered in the TPR who were born from 1932 (as index persons) and parents of these children.<sup>95</sup> This register enables linkages between children and their parents (biological or adoptive) as well as identification of siblings within a family. This register was used in all four studies.

##### 4.1.4.1 Variables created by data from the Multi-Generation Register

**Family structure** among full siblings was identified by common biological parents. Half-siblings were identified by either a common mother or a common father. Family structure was categorised into full siblings, half-siblings and families with both full and half- siblings (Study II).

**Sib-size** was identified as number of siblings in a family and was categorised as lone child, 2 children, 3 children, 4 children and 5+ children (Study II).

**Birth order** was categorised into first-born and later-born child (Study II).

#### 4.1.5 The Cause of Death Register

Since 1951, the deaths among nationally registered Swedes are recorded according to the WHO's International Classification of Diseases (ICD).<sup>96</sup> The quality of deaths occurring in Sweden is good, but deaths occurring among emigrated individuals might be missed.<sup>97</sup> The Causes of Death Register are estimated to cover 99.5% of all deaths.

Any deaths due to CVD were used as a joint group in Study I and Study II. Study I also included one analysis in which CVD mortality was analysed by diagnostic groups of IHD, stroke and other CVD.

##### 4.1.5.1 Variables used from the Cause of Death Register

**Main cause of death:** ICD codes for CVD mortality.

**Table 1:** ICD codes for CVD mortality

<b>Individual CVD mortality</b>	<b>ICD-7 (1964-1968)</b>	<b>ICD-8 (1969-1986)</b>	<b>ICD-9 (1987-1996)</b>	<b>ICD-10 (1997-2005)</b>
IHD			410-414	I121-I125
Stroke			430-438	I160-I67
Other CVD			390-405, 415-429, 440-459	I00-I15, I26-I52, I70-I99
Any CVD			390-459	I00-I99
<b>Parental CVD mortality</b>	<b>ICD-7 (1964-1968)</b>	<b>ICD-8 (1969-1986)</b>	<b>ICD-9 (1987-1996)</b>	
Any CVD	400-468	390-458	390-459	I00-I99

**Date of death** was used to identify individuals who died (Study I-IV) or to censor Individuals (Study IV).

#### 4.1.6 The Patient Register

The Patient Register contains information on virtually all psychiatric hospitalisations since 1973.<sup>98</sup> Dates of inpatient admissions and discharge are recorded along with main and secondary diagnosis attained by the treating physician. The diagnosis is classified according to the ICD (ICD-codes). Table 2 displays the ICD codes used to select psychiatric inpatients which were mainly analysed according to joint group of psychiatric patients.



#### 4.1.6.1 Variables used from the Patient Register

**Main diagnosis:** ICD codes of admissions due to psychiatric disorder.

**Table 2:** ICD codes of admissions due to psychiatric disorder.

<b>Individual admissions</b>	<b>ICD-7 (1964-1968)</b>	<b>ICD-8 (1969-1986)</b>	<b>ICD-9 (1987-1996)</b>	<b>ICD-10 (1997-2005)</b>
Schizophrenia	300	295	295	F20
Alcoholism and drug dependency	322, 323	303, 304	291, 303, 305A, 292, 304, 305X	F10, F19
Affective psychosis	301	296	296	F30, F31
Neurosis/depression and personality disorder	310, 318	300-301	300-301	F32-F34, F41-F43
<b>Parental admissions</b>	<b>ICD-7 (1964-1968)</b>	<b>ICD-8 (1969-1986)</b>	<b>ICD-9 (1987-1996)</b>	
Any psychiatric disorder	300-326	290-315	290-319	

**Secondary diagnosis** was used to identify psychiatric patients with any contributory diagnosis for alcoholism diagnosis (ICD-7 322; ICD-8 303) alcohol psychosis (ICD-7 307, 322; ICD-8 291,303) and alcohol in combination with specified medicinal agents (only available in ICD-8 N979).

**Date** of admission and date of discharge, were used to assess number of inpatient events and length of inpatient admission (Study III). The date of admission was also used to censor psychiatric patients (Study IV) and to identify year of first diagnosis (Study III).

## 4.2 STUDY DESIGN, POPULATION AND STATISTICAL METHODS

### Overview of study design and study population in Studies I-IV.

<b>Study</b>	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>
<b>Research question</b>	Is inter-generational social mobility related to CVD mortality among women?	Is inter-generational social mobility related to CVD mortality when considering familial effects of CVD mortality?	Are the intra-generational social mobility patterns different for psychiatric patients vs. non-patients?	Is inter-generational social mobility related to psychiatric disorder when using adult social class as a time-varying covariate?
<b>Design</b>	Register-based cohort	Register-based cohort	Register-based cohort	Register-based cohort
<b>Study Population</b>	Women born in 1945–59, N= 791 846	Men and women born in 1939–1959, N=1 861 728	Men and women born in 1939–1949, N=876 738	Men and women born in 1949–1959, N=1 016 276
<b>Analysis</b>	Logistic regression	Alternating logistic regression	Descriptive statistics	Poisson regression
<b>Effect of mobility assessed by</b>	Synergy Index	Interaction between parental and adult class	Wilcoxon rank-sum test	Interaction between parental and adult class

#### **4.2.1 Study I: Inter-generational social mobility and the risk of CVD mortality among women**

This is a population-based cohort study in which the risk of CVD mortality is investigated by inter-generational social mobility trajectories among Swedish women. The impact of parental and adult class on CVD mortality was also examined. The data used are from the Swedish Work and Mortality Database, using information from the 1960 and 1990 censuses, Multi-Generation Register and Cause of Death Register.

The study population is defined as women born in 1945–1959, who had parental class information in the 1960 Census and adult class information in the 1990 Census. Women who lacked parental class information were excluded (18%), the majority whom were immigrants. In all, 791 846 women were included and 2 019 CVD deaths occurred during the follow-up period 1990–2002. The main outcome of interest was CVD mortality, which was in some analysis further categorised into IHD, stroke and other CVD.

Both parental and adult class were categorised into non-manual, manual, self-employed and unclassifiable, which were used for establishing social mobility trajectories.

Logistic regression models were used to estimate odds ratios (ORs) with 95% confidence intervals (CIs) of CVD mortality by inter-generational social mobility as well as for parental and adult class. Crude and adjusted (for birth cohort, educational level and household disposable income) estimates were calculated. The ORs for CVD mortality according to social mobility were calculated by the individual trajectories, using the stable non-manual class as the reference group.

For women encompassing in the non-manual and manual occupations, CVD mortality was also analysed for IHD, stroke and other CVD categories. Among the non-manual and manual classes, Synergy Indexes (SIs) were calculated to examine if the combined effects of parental and adult class were greater (synergy) or smaller (antagonism) than what could be expected from the independent class effects.<sup>99</sup> The analyses were performed using SAS version 8.3 (SAS Institute Inc. Cary, NC, USA).

#### 4.2.2 Study II: Inter-generational social mobility and familial risks of CVD mortality

This is a population based cohort study of Swedish men and women, considering families as clusters. Parental class, adult class, and social mobility were studied in relation to CVD mortality, with simultaneous consideration of families as clusters. Additionally, the risk of CVD mortality among full and half siblings was examined. The full siblings were identified by biologically common parents and half siblings were identified by either a common mother or father. The data in this study are from the Social Mobility Database and information from the 1960 and 1990 censuses, Multi-Generation Register and Cause of Death Register is used.

Swedish individuals born in 1939–1959, who had parental class information in the 1960 Census and adult class information in the 1990 Census were included (1 861 728). The study cohort was chosen to include up to five siblings per family and spanned over 1 044 725 families. We excluded 11% of the total birth cohort because of missing information of adult or parental class, because they had a birth order higher than five, because they were half siblings without either a common father or mother, or because they died before the start of follow-up. The class categories (1960 and 1990) included was high non-manual, low non-manual, high manual, low manual, self-employed and unclassifiable employed. The outcome was overall CVD mortality (14 667 deaths) with a follow-up period from 1990–2003.

Alternating logistic regression (ARL), a model for clustered data, was used to estimate the OR with 95% CI for CVD mortality. The ARL model consists of two parts: one part is for estimating the population mean in which the effects of covariates on the outcome are estimated (corresponding to a logistic regression model) and one part is for estimating the clustering (i.e. the association within families among sibling pairs).<sup>100</sup> The risk for CVD mortality by social mobility trajectory was calculated by using two different reference groups, the socially stable in each social class and the trajectory of stable high non-manuals. Among the non-manual and manual classes social mobility was treated as an interaction term between parental and adult class.

ORs for CVD mortality were estimated for parental and adult class. The ORs for social mobility were calculated for all trajectories. Adjustments were made for birth cohort, birth order, sib-size, parental CVD mortality, years of education and civil status. Pairwise mean odds ratio (POR) was used for estimating additional effects of full and half siblings, brothers vs. sisters, born close in time vs. born further apart in time, and same adult class vs. different adult class. Men and women were analysed separately in additional analyses. The analyses were performed using SAS version 9.1 and 9.2 (SAS Institute Inc. Cary, NC, USA).

### **4.2.3 Study III: Psychiatric disorder and intra-generational social mobility**

This is a descriptive study of intra-generational social mobility both within and out of the labour market among psychiatric patients and non-patients. Mobility patterns among employed individuals in 1980 were followed to 1990 and compared between psychiatric patients and non-patients. The data in this study are from the Social Mobility Database and information from the 1960, 1980 and 1990 censuses, Multi-Generation Register, Patient Register and Cause of Death Register is used.

Swedes born in 1939–1949, who were employed and belonging to the non-manual and manual social classes in the 1980 Census (N=885 418) were included. We excluded 26% of the total birth cohort based on the following criteria: born outside of Sweden, psychiatric diagnosis before the assessment of adult class in 1980, emigration or did not belong to the manual or non-manual classes in 1980. Psychiatric patients were identified by first event of a psychiatric inpatient admission during 1964–1980 due to affective psychosis, neuroses and personality disorder, alcoholism and drug dependence or schizophrenia (N=18 998).

In the analyses, the psychiatric patients were merged into one group, except in the part of the analysis in which social mobility by diagnosis groups was examined. Individuals without hospitalisation for these psychiatric diagnoses were used as a comparison group. Psychiatric admissions were considered as the exposure variable and intra-generational social mobility as the outcome variable. Adult class in 1980 was categorised into high non-manual, low non-manual, high manual and low manual. Follow-up in 1990 included additional categories of self-employed, unclassifiable employed, missing SES, not in the labour force and deceased. Adult class was based on 1980 and 1990 SEI information while parental class was based on 1960 SEI information. Social mobility among the non-manual and manual classes was analysed as categories of upwards, stable and downwards mobility, while accounting for the other additional social class categories.

The social mobility patterns for psychiatric patients in comparison with non-patients were described by summary statistics and graphs. Graphical presentations were shown with side-by-side bar charts, with bar segments being proportional to the number of subjects in each category. The graphs were presented by adult class and social mobility for psychiatric patients and non-patients. Additional comparisons of the social mobility patterns included number of inpatient hospitalisations and psychiatric diagnosis.

A stratified Wilcoxon rank-sum test was used to test whether social mobility among the non-manual and manual classes differed between psychiatric patients and non-patients.<sup>101</sup> Statistical tests were done with two sided 95 % CI. The analyses were performed using SAS, version 9.2 (SAS Institute Inc. Cary, NC, USA).

#### **4.2.4 Study IV: Social class, inter-generational social mobility and the risk of psychiatric disorder**

This is a population-based cohort study in which the risk for psychiatric disorder is investigated by adult social class and social mobility. The data used in this study are from the Social Mobility Database, using information from the 1960, 1980 and 1990 censuses, Multi-Generation Register, Patient Register and Cause of Death Register.

Swedish individuals born in 1949–1959 (N=1 016 276) who could be linked to an occupational class (manual, non-manual or self-employed) both by parental class in 1960 and own adult class in 1980 or 1990 were included. Individuals who could not be assigned to an occupational class or who had a psychiatric hospitalisation prior to 1980/1990 were excluded (13%). We defined psychiatric patients (N=24 659) as those with a first psychiatric inpatient admission in the period 1980-2005 that was caused by schizophrenia, alcoholism and drug dependency, affective psychosis, neurosis and personality disorder.

The psychiatric patients were treated as one outcome group in the analysis. Five social class categories were used for adult and parental class (1960, 1980 and 1990): high non-manual, low non-manual, high manual, low manual and self-employed (including farmers). Adult class was based on the SEI information and parental class was based on parental occupation, classified into SEI 1990 categories.

Poisson regression was used to estimate the rates per 100 000 person-years for psychiatric disorder by adult social class. Relative risks (RRs) for psychiatric disorder (with 95% CIs) were first calculated by adult social class (adjusted for sex and age at diagnosis), to examine the reduction in risk after additional adjustment for parental class and parental psychiatric disorder. Second, the risk for psychiatric disorder was assessed by inter-generational social mobility trajectories, among the non-manual and manual classes. Adult social class in 1980 and 1990 was treated as a time-varying covariate and the follow-up period was until 2005. Social mobility (from 1960 to 1980/1990), among the four non-manual and manual classes was treated as an interaction term between parental and adult class. In the social mobility analysis the socially stable individuals were used as reference group. The RRs for psychiatric disorder by adult class and social mobility trajectories were also calculated for men and women in separate analysis (shown in appendix). The analyses were performed using SAS version 9.3 (SAS Institute Inc. Cary, NC, USA).

## 5 RESULTS

### 5.1.1 Study I: Inter-generational social mobility and the risk of CVD mortality among women.

In this study population, 46% of the women belonged to the *manual class* in childhood and 49% of the women belonged to the *non-manual class* in adult life. About 60% of the women were inter-generationally mobile.

Among the socially stable trajectories, women in manual (OR= 2.10, 95% CI 1.79-2.47) and unclassifiable (OR= 4.29, 95% CI 3.23-5.71) positions displayed increased risk of CVD mortality compared to women in the stable non-manual class. The stable self-employed group did not show increased risk of CVD mortality (OR= 0.43, 95% CI 0.18-1.05) when compared to the stable non-manual class. When comparing the mobility trajectories representing social mobility from parental to adult social class position, the estimates varied from OR= 0.74 (95% CI 0.58-0.96; from self-employed to non-manual class) to 4.62 (95% CI 3.86-5.82; from manual class to unclassifiable). Adjustment for educational level reduced the estimates considerably. The estimates were less affected by adjustment for household disposable income.

The ORs for the social mobility trajectories among women in the non-manual and manual classes showed that all other trajectories were associated with an increased risk for CVD mortality when compared with the stable non-manual class (Table 3, Model 1). Women who were downwardly mobile (from non-manual to manual class) and socially stable in the manual class, had about twice the mortality from IHD, Stroke, other and all CVD, compared to women in the stable non-manual class. Upwardly mobile women also displayed an increased risk for CVD mortality, but it was lower (OR=1.26, 95% CI 1.05-1.50). Additional adjustment for educational level reduced the ORs (Table 3, Model 2).

**Table 3: Odds ratios from logistic regression of CVD mortality in 1990-2002 by inter-generational class mobility among women (born in 1945–1959) in the non-manual and manual classes (N= 492 692).**

Trajectories	Model 1	Model 2
<b>IHD (N=371)</b>		
Non-manual stable	1	1
Manual - Non-manual	0.98 (0.71-1.35)	0.82 (0.59-1.13)
Non-manual - Manual	<b>2.19 (1.54-3.12)</b>	<b>1.47 (1.01-2.14)</b>
Manual stable	<b>2.30 (1.75-3.02)</b>	<b>1.42 (1.05-1.94)</b>
<b>Stroke (N=386)</b>		
Non-manual stable	1	1
Manual - Non-manual	<b>1.37 (1.04-1.82)</b>	1.22 (0.91-1.63)
Non-manual - Manual	<b>1.93 (1.36-2.75)</b>	<b>1.48 (1.02-2.15)</b>
Manual stable	<b>1.76 (1.34-2.31)</b>	1.28 (0.94-1.74)
<b>Other CVD (N=320)</b>		
Non-manual stable	1	1
Manual - Non-manual	<b>1.44 (1.04-2.00)</b>	1.24 (0.89-1.74)
Non-manual - Manual	<b>2.09 (1.39-3.13)</b>	1.49 (0.97-2.39)
Manual stable	<b>2.05 (1.37-3.07)</b>	<b>1.54 (1.09-2.17)</b>
<b>ALL CVD (N=1 077)</b>		
Non-Manual stable	1	1
Manual - Non-manual	<b>1.26 (1.05-1.50)</b>	1.08 (0.90-1.30)
Non-manual - Manual	<b>2.06 (1.66-2.54)</b>	<b>1.49 (1.19-1.86)</b>
Manual stable	<b>2.10 (1.78-2.47)</b>	<b>1.41 (1.17-1.69)</b>

Model 1 Adjusted for birth cohort.

Model 2 Adjusted for birth cohort and educational level.

Stable non-manual class serve as reference group.

Women who were mobile from manual to non-manual class had lower ORs (< 1.5) than women who were mobile from non-manual to manual class: ORs (>1.9) for all CVD outcomes. No evidence for synergy between parental and adult class was found for the non-manual and manual trajectories: Synergy Index was 1.11 for IHD, 0.59 for stroke, 0.83 for other CVDs and 0.83 for all CVD.

Both childhood and adult class contributed independently to women's overall CVD mortality, but the women's own class seemed to be more important than her parental class after mutual adjustment. The ORs after adult class (adjusted for educational level) was lower for the self-employed (0.69, 95% CI 0.50-0.95), whereas manual (1.28, 95% CI 1.14-1.44) and unclassifiable (2.54, 95% CI 2.23-2.86) positions showed increased risks, compared to the non-manual class.



### 5.1.2 Study II: Inter-generational social mobility and familial risks of CVD mortality

In this study cohort the manual and self-employed classes decreased in size, whereas the non-manual class increased in size from 1960 to 1990. The risk of CVD mortality increased with lower parental and adult class. ORs for adult social class ranged from 1.45 (95% CI 1.37-1.53) for the adult low non-manual class to 2.37 (95% CI 2.21-2.54) for the employed unclassifiable compared to the high non-manual class. Adjustment for parental class had only a negligible effect on the adult social class risks.

Roughly 70% of the study subjects were socially mobile. Social mobility patterns (using the socially stable as reference group) generally displayed lower risks for the upwardly mobile and increased risks for several downwardly mobile trajectories, both in the crude and adjusted model. Individuals with unclassifiable parental occupations, showed a decrease in CVD mortality, when they were mobile to the non-manual or manual classes (ORs ranging from 0.41-0.70) (Table 4 Model 1). Individuals mobile from the self-employed to the manual classes increased their risk of CVD mortality, whereas those who were mobile into the high non-manual class lowered their risk (OR=0.71 95% CI 0.63-0.80). Mobile individuals from the low manual class had lower risks the further up they moved on the social class ladder as adults.

When using the stable high non-manual class as a comparison group, almost all other trajectories showed an increased risk of CVD mortality. Individuals who were upwardly mobile from the manual classes displayed lower risks than the socially stable (Table 4, Model 2a), but they never reached the low risk of the stable high non-manual class (Table 4, Model 2b).

The interaction term between parental and adult class (social mobility) was statistically significant among the manual and non-manual classes when treating class as an ordinal scale variable (assuming an order) in the full cohort ( $p=0.0005$ ) and among men only ( $p=0.0029$ ), but not among women ( $p=0.08$ ).

The pairwise mean odds ratios (PORs) among full siblings were 1.78 (95% CI 1.52-2.08) and 2.24 (95% CI 1.04-4.83) among half siblings, indicating that the risk of CVD mortality increased by a factor between 1.5 and 2.1 among individuals who had a full sibling who died in CVD, compared with those who did not have a full sibling who died of CVD.

**Table 4: Odds ratios (ORs) for CVD mortality by social mobility trajectory for individuals born in 1939–1959 (N=1 861 728; CVD deaths=14 667).**

Parental class	Adult class	Model 1	Model 2 <sup>a</sup>	Model 2 <sup>b</sup>
High non-manual	High non-manual	1	1	1
	Low non-manual	<b>1.38 (1.21-1.58)</b>	1.13 (0.98-1.29)	1.13 (0.98-1.29)
	High manual	<b>1.71 (1.48-1.99)</b>	<b>1.25 (1.07-1.46)</b>	<b>1.25 (1.07-1.46)</b>
	Low manual	<b>2.20 (1.93-2.52)</b>	<b>1.54 (1.34-1.76)</b>	<b>1.54 (1.34-1.76)</b>
	Self-employed	<b>1.45 (1.20-1.75)</b>	<b>1.24 (1.02-1.50)</b>	<b>1.24 (1.02-1.50)</b>
	Employed	<b>1.72 (1.45-2.05)</b>	<b>1.33 (1.10-1.61)</b>	<b>1.33 (1.10-1.61)</b>
Low non-manual	High non-manual	<b>0.61 (0.51-0.72)</b>	<b>0.74 (0.62-0.88)</b>	0.96 (0.84-1.09)
	Low non-manual	1	1	<b>1.30 (1.11-1.51)</b>
	High manual	1.22 (0.99-1.50)	1.13 (0.92-1.38)	<b>1.46 (1.23-1.74)</b>
	Low manual	<b>1.35 (1.11-1.64)</b>	1.19 (0.98-1.43)	<b>1.54 (1.31-1.80)</b>
	Self-employed	0.97 (0.75-1.27)	1.00 (0.77-1.30)	<b>1.29 (1.02-1.64)</b>
High manual	Employed	<b>1.54 (1.22-1.94)</b>	<b>1.44 (1.13-1.84)</b>	<b>1.87 (1.50-2.32)</b>
	High non-manual	<b>0.60 (0.54-0.66)</b>	<b>0.77 (0.70-0.86)</b>	<b>1.15 (1.03-1.27)</b>
	Low non-manual	<b>0.86 (0.76-0.96)</b>	0.91 (0.81- 1.02)	<b>1.35 (1.19-1.52)</b>
	High manual	1	1	<b>1.48 (1.34-1.64)</b>
	Low manual	<b>1.16 (1.06-1.27)</b>	<b>1.10 (1.01-1.21)</b>	<b>1.64 (1.48-1.81)</b>
Low manual	Self-employed	0.86 (0.74-1.00)	0.92 (0.79-1.07)	<b>1.36 (1.16-1.59)</b>
	Employed	<b>1.27 (1.09-1.47)</b>	<b>1.25 (1.06-1.47)</b>	<b>1.85 (1.56-2.19)</b>
	High non-manual	<b>0.53 (0.48-0.58)</b>	<b>0.72 (0.66-0.79)</b>	<b>1.16 (1.05-1.28)</b>
	Low non-manual	<b>0.73 (0.66-0.81)</b>	<b>0.82 (0.74-0.91)</b>	<b>1.32 (1.17-1.48)</b>
	High manual	<b>0.83 (0.77-0.90)</b>	<b>0.87 (0.80-0.95)</b>	<b>1.40 (1.27-1.55)</b>
POR Full siblings	Low manual	1	1	<b>1.61 (1.46-1.77)</b>
	Self-employed	<b>0.77 (0.67-0.88)</b>	<b>0.86 (0.75-0.99)</b>	<b>1.39 (1.20- 1.61)</b>
	Employed	<b>1.45 (1.29-1.63)</b>	<b>1.49 (1.31-1.71)</b>	<b>2.41 (2.08-2.79)</b>
	POR Half-siblings	<b>1.91 (1.64-2.23)</b>	<b>1.78 (1.52-2.08)</b>	<b>1.78 (1.52-2.08)</b>
POR Half-siblings		<b>2.41 (1.12-5.19)</b>	<b>2.24 (1.04-4.83)</b>	<b>2.24 (1.04-4.83)</b>

Model 1 adjusted for sibling dependency, sex, birth cohort, parental class and adult class.

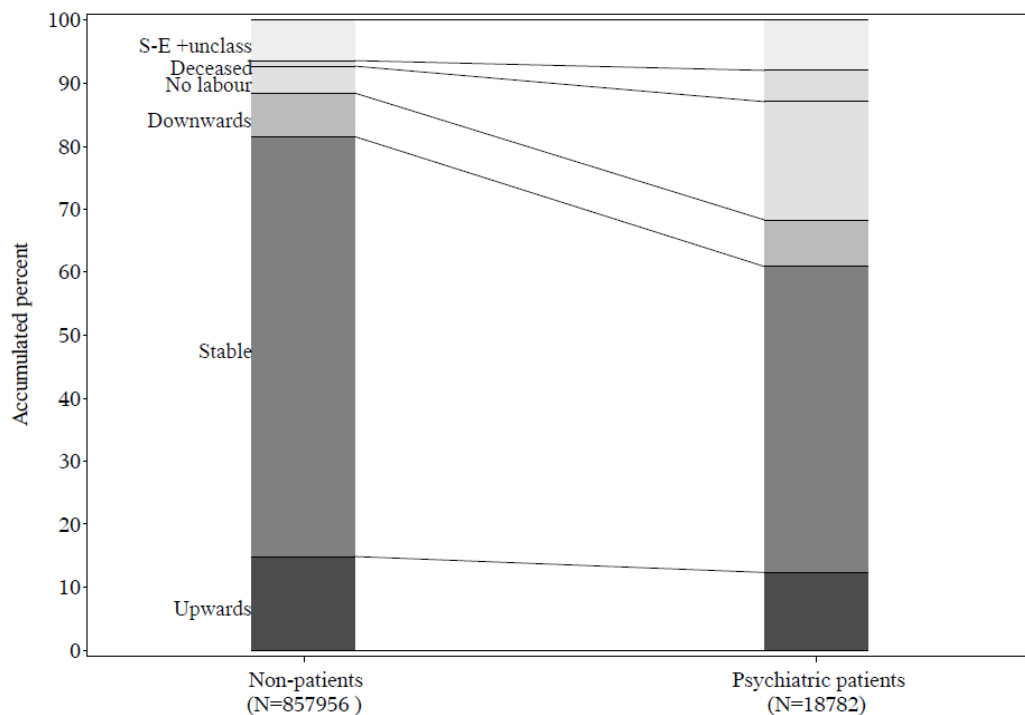
Model 2<sup>a</sup> and 2<sup>b</sup> adjusted for sibling dependency, sex, birth cohort, birth order, sib-size, parental CVD mortality, parental class, adult class, years of education, civil status and interaction between years of education and sex.

All stable in each occupational class serve as reference group in Model 1 and Model 2<sup>a</sup>. The stable non-manual class serve as reference group in and 2<sup>b</sup>

### 5.1.3 Study III: Psychiatric disorder and intra-generational social mobility

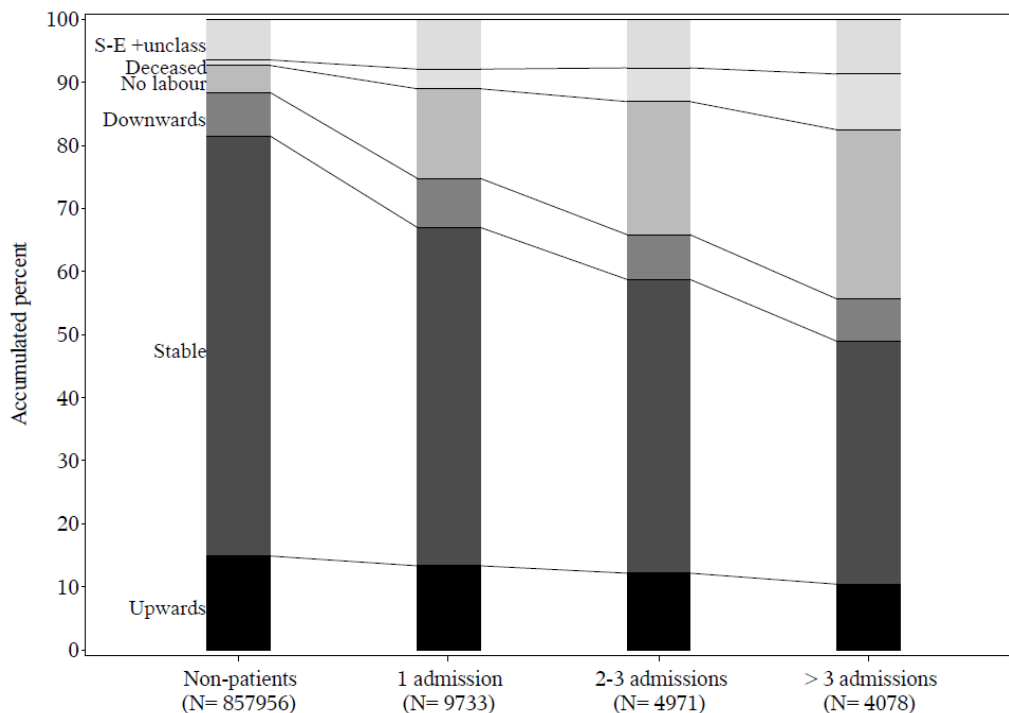
In this study, the majority of psychiatric patients started out in 1980 in a lower social class (44% in the low manual class) than the non-patients (28% in the low manual class). Large social class differences between psychiatric patients and non-patients were also seen ten years later in 1990, even though no corresponding differences existed in relation to parental class in 1960.

The social mobility patterns revealed that psychiatric patients had lower proportions of socially stable (within the non-manual and manual classes), compared to non-patients (49% versus 67%). Further, the psychiatric patients had larger proportions of mobility out of the labour force than non-patients. The proportions of upward and downward mobility within the non-manual and manual classes were similar for psychiatric patients and non-patients (Figure 4).



**Figure 4:** Social mobility between 1980 and 1990 for psychiatric patients (N=18 782) and non-patients (N=857 986). Social mobility as upwards mobility, socially stable and downward mobility among the non-manual and manual classes; additional categories of self-employed (s-e) and unclassifiable employed (unclass), deceased and not in the labour market.

For psychiatric patients, the proportion of individuals who were socially stable within their occupational class decreased with the number of inpatient admissions, whereas the proportion of individuals outside the labour force and number of deceased individuals increased with the number of inpatient admissions (Figure 5).



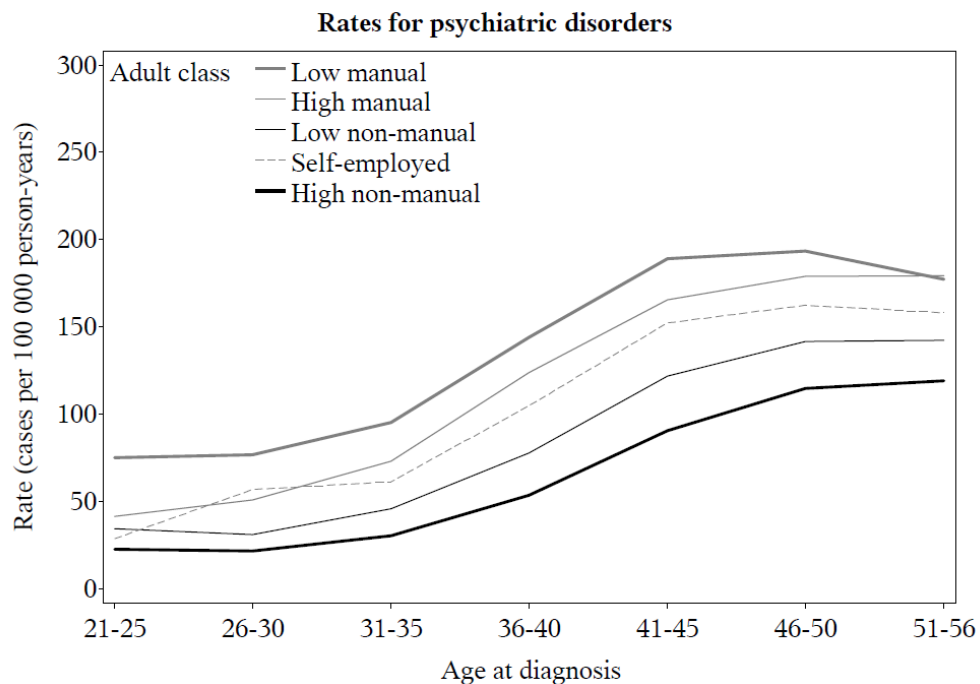
**Figure 5:** Social mobility between 1980 and 1990 for psychiatric patients (N= 18 782) and non-patients (N=857 986). Social mobility as upwards mobility, socially stable and downward mobility among the non-manual and manual classes; additional categories of self-employed (s-e) and unclassifiable employed (unclass), deceased and not in the labour market.

Based on diagnostic groups, the proportion of socially stable individuals also varied substantially in the psychiatric patient group. Patients admitted for affective psychosis (59%) and neuroses and personality disorder (53%) had larger proportions of socially stable individuals than patients admitted for substance dependency (38%), alcoholism (41%) or schizophrenia (43%). A reverse pattern between diagnostic groups was seen for mobility out of the labour force. Patients diagnosed with affective psychosis or neurosis and personality disorder (15%) had lower proportions of mobility out of the labour force than patients diagnosed with substance dependency or alcoholism (20%) or schizophrenia (32%).

The Wilcoxon rank-sum test revealed statistically significant ( $p < 0.0001$ ) differences between psychiatric patients and non-patients in the social mobility proportions for the non-manual and manual classes.

### 5.1.4 Study IV: Social class, inter-generational social mobility and the risk of psychiatric disorder.

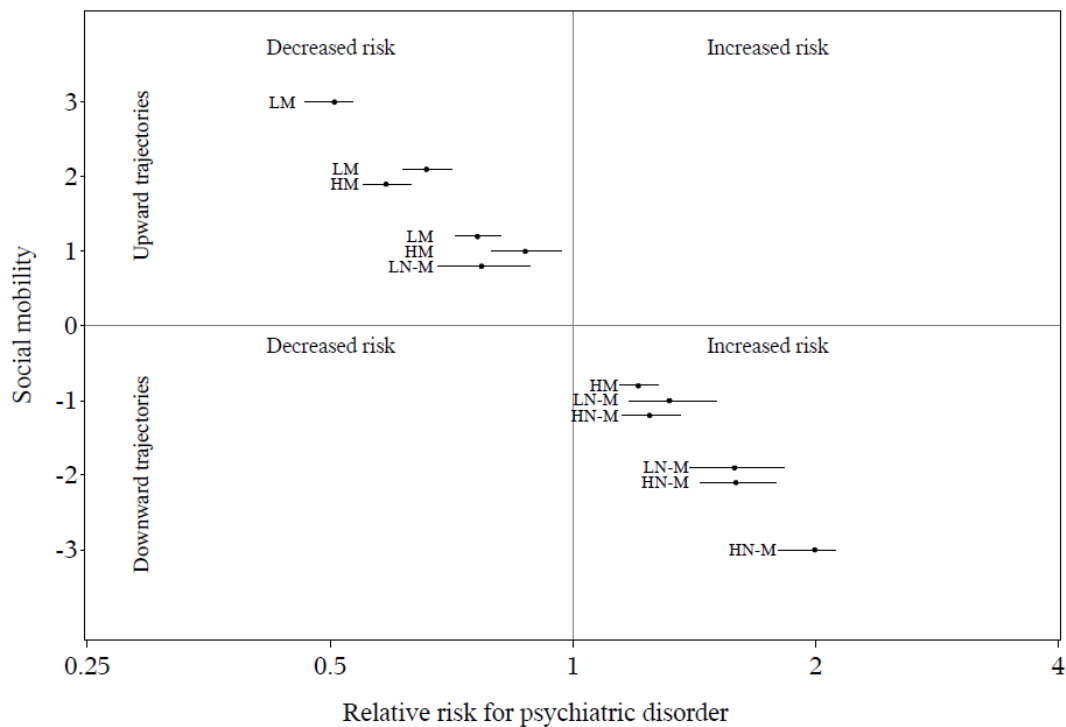
In this study, the rates (per 100 000 person-years) of psychiatric disorder were found to vary by adult and by parental social class. Between ages 41 and 45 years, rates by adult social class ranged from 90 (95% CI 86-95) for the high non-manual class to 189 (95% CI 181-197) for the low manual class. The rate of psychiatric disorder among the self-employed was in-between the risks of the non-manual and manual classes (152, 95% CI 139-166) (Figure 6).



**Figure 6:** Adult social class rates for psychiatric disorder by age at diagnosis ( $N=1\,016\,276$  psychiatric patients= $24\,659$ ).

The RRs were also patterned by adult social class. Adjustment for parental class and parental psychiatric disorder had only a minor influence on the risks by adult social class. The relative risks for psychiatric disorder by social mobility trajectories among the non-manual and manual classes were calculated using socially stable as reference group. The RRs for psychiatric disorder by social mobility trajectories among the non-manual and manual classes were calculated using the socially stable as the reference group.

As Figure 7 shows, all upwardly mobile individuals had lower risks for psychiatric disorder and all downwardly mobile had increased risks for psychiatric disorder, regardless of parental class or number of social mobility steps. Individuals who were upwardly mobile by +3 steps had the lowest risks of psychiatric disorder, whereas individuals who were downwardly mobile by -3 steps had the highest risk for psychiatric disorder. Individuals experiencing similar social mobility patterns, either upward or downward one or two steps, had similar risks for psychiatric disorder.



**Figure 7:** Inter-generational social mobility trajectories among non-manual and manual classes (N=798 660, psychiatric patients N=19 553). Socially stable in each class serve as reference group. Trajectories start from high non-manual (HN-M) parental class, low non-manual (LN-M) parental class, high manual (HM) parental class, low manual (LM) parental class by upward(y-axis +1, +2, +3) and downward mobility (y-axis -3, -2, -1) with their corresponding RRs and 95% CIs.

The interaction term between parental and adult class among the non-manual and manual classes was not statistically significant (p=0.17). However, when men were analysed separately, a correspondingly statistically significant interaction effect was revealed (p=0.03).

## 6 DISCUSSION

The main finding of this thesis is that social class of origin and social class of destination, as well as shifts in-between them, are important social determinants of CVD mortality and psychiatric disorder in the male Swedish working-age population. Overall, downward social mobility was associated with increased risks, while upward mobility was associated with lower risks, of the two studied health outcomes. Whereas both childhood and especially adult social class were independently related to the two studied health outcomes also among the corresponding group of women, social mobility in itself did not exhibit any significant effect on health in itself. Another finding of this thesis is that people with a psychiatric disorder are considerably less likely to remain socially stable or within the labour force compared to other members of the Swedish work force. Before discussing the findings from each of the four studies in more detail, ethical and methodological considerations, common to all of the studies, will be addressed.

### 6.1 METHODOLOGICAL CONSIDERATIONS

#### 6.1.1 Cohort study

In epidemiology, a cohort is defined as “any designated group of persons who are followed or traced over a period of time”.<sup>102</sup> A cohort refers to a group of people that share a common experience or condition, (e.g. the same period of birth).<sup>15</sup> A cohort study consists of individuals who are either exposed or unexposed to certain conditions, and who are followed over time. In prospective cohort studies, the exposure is assessed at the start and additional information can be collected during follow-up. At the end of the follow-up, the exposed group is compared with the unexposed group for occurrence of an outcome. All studies in this thesis were cohort studies, using prospective collected data thereby avoiding potential problems (e.g. recall bias) that can arise from retrospectively collected data.<sup>103</sup>

#### 6.1.2 Errors in epidemiological studies

Epidemiological studies are based on measurements that are more or less prone to error. Two main types of error may be present: systematic and random. Internal validity refers to absence of systematic errors (whether a study correctly estimates what it aims to estimate). There are three broad categories of biases that can threaten internal validity: selection bias, information bias and confounding.

##### 6.1.2.1 *Internal validity and precision*

Precision refers to absence of random errors. Random errors are caused by chance, but can be dealt with by increasing the sample size. The *reliability* of a study refers to the degree to which the results of a measurement can be replicated.<sup>102</sup> The reliability of a measurement depends on both validity and precision.

**Selection bias** may occur in the process of selecting study participants, or from factors that influence study participation.<sup>15</sup> If the risk of an outcome influences the probability of being included in the exposed/unexposed group, or influences the way in which exposure was defined, selection bias exists. Because the focus of this thesis is to study social mobility in relation to health, the individuals included were selected by their labour market status. In Study I, individuals with parental as well as own adult social class information were selected. This study also included a category of *unclassifiable social class* (housewives, students, disability pensioners). In Studies II and IV, individuals with parental and adult social class information were once again selected, here with the additional inclusion of a more “narrow” category of *unclassifiable social class among employed individuals* (i.e. employed individuals that could not be assigned to a social class). In Study III, only individuals in the non-manual and manual classes were selected, in that the purpose was to study the impact of psychiatric disorder on intra-generational social mobility. The individuals included in Studies II-IV are probably healthier than those excluded in the sense that they were able to work, while the severely ill and chronically disabled tend to be outside the labour force.<sup>104</sup>

**Information bias** occurs when information of the exposure or outcome for the study participants is incorrect.<sup>15</sup> The probability of being misclassified can sometimes differ across groups of study subjects (*differential misclassification*). *Non-differential* misclassification occurs when, e.g. groups or categories of a variable (whether exposure, outcome, or covariate) have the same error rate or probability of being misclassified for all study subjects. While differential misclassification can either underestimate or overestimate an effect, non-differential misclassification usually dilutes an effect.

Evaluations of the Swedish SEI classification have shown that it is a good measurement of social class among the employed.<sup>105</sup> Adult social class was assessed with SEI (1980/1990) and parental social class (1960) was classified similarly as the SEI 1990, by using information of the parents’ occupation. In all studies, the social class was collapsed into fewer categories than the original SEI grouping. The SEI information was based on the study participants’ occupation and was additionally confirmed through information from the employer.<sup>31</sup> Information bias may be present among those who were *unclassifiable* (Study I) and *unclassifiable employed* (Study II, III and IV). The latter category consisted of employed individuals (as reported by the employer) but they could not be assigned into a social class with certainty. This was either due to missing information (i.e. that the question of occupation was not answered) or that the occupational information could not be deciphered (e.g. due to poor handwriting) (Personal communication Leif Haldorson, Statistics Sweden). Misclassification of parental class may be present in Study I, among those who were around 20 years in 1960. In study I, up to five siblings per family were included and all siblings in a family were assigned the same parental class.

CVD mortality was the outcome variable in Studies I-II and this information was retrieved from the Cause of Death Register. The major source of error here is how doctors determined and reported the cause of death.<sup>106</sup> Autopsy is a thorough way of



determining cause of death, but the proportions of death determined by autopsies have decreased from 50% in the 1970s to 14% in 2003. Furthermore, the death cause information is more accurate among younger than older individuals. Still, the coverage of deaths is good (99.5%) and the coding error for ICD (3-digit ICD code) is low (3%).<sup>97</sup>

Psychiatric disorder served as an exposure in Study III and as the outcome variable in Study IV. The information of psychiatric admissions was retrieved from the Patient Register, a register that includes virtually all psychiatric hospitalisations since 1973. Over 97% of the admitted patients had a main diagnosis reported to the Patient Register.<sup>107</sup>

The attending clinician formulates the discharge diagnoses, which is based on observations made during hospitalisation, evaluation of the service user and medical records at discharge. The ICD discharge diagnoses for psychiatric disorders have been found to be in agreement with diagnoses based on the Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria, as well as with those based on semi-structured interviews and medical records.<sup>108-110</sup> In Study IV, the follow-up period comprised the time when Sweden experienced a psychiatric care reform (from the 1990s),<sup>111</sup> which involved downsizing of psychiatric hospital care and opening of outpatient care clinics. Therefore the number of inpatient hospitalisations decreased during the follow-up of this study, whereas outpatient care (not captured by our measure of psychiatric disorder) increased.<sup>98,111</sup>

**Confounding** is a mixing of effects that distorts the association between exposure and outcome.<sup>15</sup> An association between exposure and outcome can be underestimated, overstated or even reversed through a confounding factor. A confounding factor has an effect that is imbalanced between the compared exposure groups. A confounding factor is associated both with the disease (as a cause or proxy for a cause, but not as an effect of the disease) and the exposure, but is not on the causal pathway between the exposure and outcome (i.e. a confounder should not be an effect of the exposure).<sup>112</sup>

At the design stage, *restriction* is one way to handle the problem of confounding. In Studies II-IV, the study population was restricted to employed individuals, in that occupational information is one presumption of studying social mobility. This restriction automatically also leads to exclusion of individuals who are not healthy enough to work (“the healthy worker effect”), thereby “handling” some of the problems that might otherwise have generated reverse causation.<sup>113</sup> In Study IV, restriction involved exclusion of individuals with previous psychiatric disorder before first measurement of adult class, which may have introduced confounding (reverse causation) since psychiatric disorder was the outcome variable. All four studies were restricted to Swedish-born individuals.

At the analysis stage, confounding may be dealt with by adjustment. In Studies I, II and IV confounding (of the available factors) were assessed by adjustment in the regression models. Incorporating sibling correlations within families through pairwise

mean odds ratio (POR) in the analyses was an advanced way of adjusting for familial confounding (Study II). Parental psychiatric disorder and parental CVD mortality was used to adjust for genetic confounding in Studies II and IV. Yet, the register-based data used in this thesis lack information about lifestyle factors such as diet, leisure activities, smoking, medication or treatment that may affect the relation between social mobility and health, which may introduce residual confounding in our studies. Such socioeconomic factors as income and (to a lesser extent) education may also be considered as mediators (something that occurs on the causal pathway)<sup>102</sup> between social class, social mobility and health. Adjustment for these factors is an attempt to assess how much of the association between social class and health that can be attributed to the specific covariates.

**Precision** is defined as the degree to which a measurement is free of random errors.<sup>15</sup> High precision of estimates makes chance a less likely explanation of the findings. One way to increase the precision in a study is to have a large sample size. The confidence interval around a point estimate gives information about the random error in the analysis. The precision of an estimate is reflected by the width of the confidence interval. The significance level of 95% was considered in all studies and confidence intervals and p-values were used to assess the precision of the results. Because all the studies included in this thesis consist of large cohorts, the precision in general should be good. However, some of the investigated groups within the cohorts are small and therefore involve a larger statistical uncertainty. The confidence interval for POR among half siblings was rather wide, indicating lower precision of this estimate in comparison with the confidence interval for full siblings.

#### *6.1.2.2 External validity*

External validity concerns the extent to which the study results can be generalised to other populations and to other historical periods.<sup>15</sup> The papers included in this thesis are population-based cohort studies based on Swedish registries. Overall, the results should be generalisable to the employed Swedish population in 1980–1990. Study I only comprises women and which means the results cannot be generalised to men. Moreover, because CVD mortality increases with age, the results of Studies I and II cannot be generalised to older cohorts. Nor can the results of Studies III and IV be generalised to other psychiatric diagnoses or to psychiatric patients with a less severe diagnosis who are treated in outpatient care. Individuals with “milder” psychiatric symptoms have been found to have increased risk for inpatient care.<sup>114</sup> However, the findings might be generalised to Norway because of the similar social mobility patterns that have been noted between Sweden and Norway.<sup>115</sup> Other countries (e.g. the USA, Britain and Germany) have lower possibilities of social mobility.<sup>115</sup>

#### *6.1.2.3 Reversed causality*

Reversed causality may occur when the outcome is a predictor of the exposure (e.g. if poor health causes downward mobility). If the participants in Studies I, II and IV had symptoms or a diagnosis of either CVD or of a psychiatric disorder at the beginning of follow-up, this may have introduced reversed causality. In other words, individuals

with poor health may be downwardly mobile due to their poor health rather than that social mobility leads to poor health. In study IV, individuals with psychiatric hospitalisation before assessment of adult class were excluded, which reduces the risk of reversed causality. Excluding individuals outside the labour force in studies II, III and IV was also an attempt to minimise reversed causality.

## **6.2 ETHICAL CONSIDERATIONS**

According to Swedish Law,<sup>116</sup> all studies based on sensitive personal information must be approved by an ethical committee before study commences. The purpose is to protect the individual and to respect human dignity in research. The ethical committee will only approve research that “can be conducted with respect for human dignity and human rights and fundamental freedoms are consistently heeded”.<sup>117</sup> The ethical committee judges whether the potential benefit from studies outweighs the potential harm. There are also ethical codes that apply to the individual researcher, such as honesty, not to cheat or modify results, which are important for trustworthiness.<sup>118</sup> Information about millions of individuals was used in this thesis. All data were de-identified and no names or personal identification numbers were provided to the researchers from the responsible authorities (Statistics Sweden and National Board of Health and Welfare). The potential harm from violation of integrity by the studies comprised by this thesis is minimal. All studies were approved by the Regional Ethical Review Board at Karolinska Institutet (Study I-IV, dnr numbers 02-481, 02-410, 03-466).

## **6.3 MAIN FINDINGS**

Because the overarching purpose of all four studies was to examine social mobility in relation to health (CVD or psychiatric disorder), the main findings of the four studies are discussed first, followed by a general discussion of social class, social mobility and the possible mechanisms underlying the results.

### **6.3.1 Study I: Inter-generational social mobility and the risk of CVD mortality among women**

The study showed that social class was inversely associated with CVD mortality. The risks were more pronounced in relation to adult class than to parental class. Women who were self-employed had a lower risk of CVD mortality, whereas women in the manual class and in the unclassifiable category had increased risks compared with those in the non-manual class. Adjustment for level of education led to a substantial reduction in the risk estimates. These results are firmly in line with previous studies, also demonstrating a social gradient in the risk of CVD,<sup>119-121</sup> CVD risk factors<sup>122</sup> as well as CVD mortality among women.<sup>123,124</sup>

The social mobility trajectories among women in the non-manual classes demonstrated that downwardly mobile, upwardly mobile and socially stable in the manual class had increased risks of CVD mortality compared to the stable non-manual class. However,

there was no evidence of synergy in CVD mortality among the non-manual and manual classes. Only small risk variations were observed by diagnostic groups for CVD mortality. When analysing all possible combinations of social mobility trajectories, women from the self-employed class displayed lower risk than the stable-non-manual class. Overall, the unclassifiable women (both by parental and adult class) had the greatest risk of CVD mortality. Our results are largely consistent with previous studies using a cumulative approach of social class, in that women exposed low social class at several time-points had higher risk of CVD<sup>125</sup> and CVD risk factors.<sup>126</sup> The findings of variation in risk by social mobility are consistent with a study in which women who were stable in the manual class had a nearly two-fold increased risk for hypertension (a known risk factor for CVD).<sup>122</sup> The high risk of CVD among women outside the labour force (unclassifiable) is also in agreement with previous findings.<sup>123</sup>

### **6.3.2 Study II: Inter-generational social mobility and familial risks of CVD mortality**

The study showed that the risk of CVD mortality increased with lower parental and adult social class. Almost all upward trajectories showed a lower risk and almost all downward trajectories had increased risk of CVD mortality when compared to the socially stable in each social class. The risks decreased the further up, and increased the further down, they moved on the social ladder. The risk of CVD mortality was elevated for almost all trajectories in relation to the stable non-manual class. The stable self-employed and those who were mobile from self-employed to the non-manual classes showed a similar risk as the stable non-manual class. Even if those who were mobile from low manual class had lower risk of CVD when they were upwardly mobile (compared to the stable) they did not reach as low a risk as those in the stable non-manual class. The findings among the non-manual and manual classes are in agreement with previous studies<sup>66,127,128</sup> showing that individuals who are stable in the manual class have more than a doubled risk of CVD mortality than those in the stable non-manual class.

The sibling association within families (POR) was significantly higher in the full and half sibling groups. This effect was significant even after adjustment for parental CVD mortality, parental social class, adult social class and educational level. The POR estimate, however, was larger among half siblings than among full siblings. Results indicated that the risk of CVD mortality increased with a factor between 1.5 and 2.1 among individuals who had a full sibling who died in CVD, compared to those who did not. The sibling association (POR) was in accordance with previous studies reporting twice as high<sup>129</sup> or even higher risk of CVD among siblings.<sup>130,131</sup>

### **6.3.3 Study III: Psychiatric disorder and intra-generational social mobility**

This study showed that psychiatric patients were not able to remain socially stable in an occupational class during adult life to the same extent as the non-patients. Previous studies confirm the finding that social stability is lower among individuals with psychiatric disorder compared with individuals without psychiatric disorder.<sup>132,133</sup> The

present results also indicated that downward and upward social mobility was experienced to a similar extent among both psychiatric and non-psychiatric individuals. Mobility out of the labour force and premature mortality, however, were much more common among the psychiatric patients than among non-patients. Several studies have reported that upward mobility is lower or similar for individuals with psychiatric disorders, compared to individuals without psychiatric disorder.<sup>132,133</sup> Our findings do not confirm that individuals with psychiatric disorder experience downward mobility to a greater extent than individuals without psychiatric disorder.<sup>87</sup> At least one previous study supports our finding that psychiatric patients are more often mobile out of the labour market.<sup>134</sup> Social stability decreased and mobility out of the labour market increased by number of inpatient admissions and by severity of the psychiatric diagnosis. Previous studies have also shown variation in labour force participation,<sup>135</sup> as well as in intra-generational social mobility by psychiatric diagnostic groups.<sup>132</sup> It should finally be noted that according to Swedish law on employment (from 1982),<sup>136</sup> a disorder is per se not a reason for dismissal, a condition that most likely increased labour force participation among psychiatric patients in the present study.

#### **6.3.4 Study IV: Social class, inter-generational social mobility and the risk of psychiatric disorder**

The findings in study IV showed that the rates and RRs of psychiatric disorder were negatively associated with adult social class. Individuals in the low manual class had a doubled risk of psychiatric disorder, compared to those in the high non-manual class. These results are in accordance with previous findings.<sup>83,137</sup> Adult class was strongly linked to the risk of psychiatric disorder, which also is in line with previous studies.<sup>85,137,138</sup> The results also showed that downward social mobility was associated with an increased risk of psychiatric disorder, whereas upward social mobility was associated with a decreased risk, compared to the socially stable individuals. Several previous studies have also shown increased risks for psychiatric disorder among downwardly mobile individuals.<sup>35,85,86,139</sup> In contrast, lower risk among the upwardly mobile has only been confirmed for some social mobility trajectories.<sup>35</sup>

This study also showed that individuals that experienced the same magnitude of social mobility (such as number of steps up or steps downwards) had similar risks for psychiatric disorder (regardless of the class they started out from) compared to those who remained socially stable. Parental psychiatric disorder had a minor influence on the participants' risk of contracting a psychiatric disorder. It is, however, possible that the true influence of parental psychiatric history for adult psychiatric disorder was not entirely captured in this study since parental disorder that occurred before measurement of adult class was used. Moreover, the parents may have had a psychiatric hospitalisation before the Patient Register was established in 1964.

#### **6.3.5 Social mobility among non-manual and manual classes**

The risks of both CVD mortality and psychiatric disorder were found to increase with decreasing social class in adult life. Adjustment for parental class had a minor effect on

the association, both in the analyses of CVD mortality and psychiatric disorder. Thus, for the two class measures, social class of *destination*, rather than social class of *origin*, emerges as the most important determinant for the two health outcomes examined in this thesis. Nevertheless, parental class had a significant, but considerably smaller effect on both CVD mortality and psychiatric disorder.

Possible effects of social mobility were examined using the synergy index (Study I) by interaction terms between parental and adult class (Study II and Study IV) and the Wilcoxon rank-sum test (Study III). A review on this topic suggests that there is some support for a unique effect of social mobility on health,<sup>13</sup> but the majority of studies in this area of research do not consider the effect of the interaction between parental class and adult class on the studied health outcome.

There was no indication of a unique effect of social mobility for women on the two outcome measures, regardless of whether the synergy index (additive) or the interaction term (multiplicative) was applied. In line with these findings, interactions between parental and adult class were not significant for CVD risk factors (e.g. hypertension and blood cholesterol) or for psychiatric outcomes (depression symptoms or anxiety symptoms) among women in a British study.<sup>140</sup> The variations in risk of CVD mortality and psychiatric disorder observed by social mobility trajectories among women thus largely seem to be attributable to the main effect of adult class.

Among men, the effect of social mobility (as tested with an interaction-term between ordinal scales of parental and adult class) was statistically significant in relation to both CVD mortality and psychiatric disorder. This finding indicates that social mobility indeed does have a unique link to men's risk of psychiatric disorder and CVD mortality. These results are in accordance with at least one previous study on CVD mortality among men.<sup>141</sup> The interaction-term between parental and adult class was also significant for obesity<sup>142</sup> among men, but not for other CVD risk factors or psychiatric symptoms.<sup>140</sup> Overall, the risk estimates for CVD mortality and psychiatric disorder by social mobility were higher for men than for women.

Differences in intra-generational mobility were significant for both men and women, with the largest difference observed between patients and non-patients in social stability (Wilcoxon rank-sum test); no corresponding differences were found regarding upward or downward social mobility (Study III).

## **6.4 GENERAL DISCUSSION OF SOCIAL MOBILITY AND HEALTH**

There are different theories and explanations behind social class differences in life-course studies.<sup>14,143</sup> The critical period model assumes an effect of social exposure during a specific sensitive period in life, which has lasting effects on adult health. The cumulative risk model focuses on accumulation of risk across the whole life course on health. However, the social mobility model is concerned with the effect of the change (or movement) itself from one class position to another on health (i.e. effect of the direct social class effects that automatically becomes intertwined in any measure of social mobility trajectories). It has been suggested that these three models provide a

good prediction of social differences in health, at least for CVD mortality.<sup>14</sup> As pointed out by Hallqvist,<sup>144</sup> however, it is difficult to disentangle these different models from each other as they are strongly inter-related:

*"To have differential accumulation there must be some social mobility and the exposure to presumed critical periods will depend on the mobility category"*

A disadvantage with the social mobility model is that social class is often measured at two or more time points during life.<sup>13</sup> However, the possibility to study individual trajectories is an advantage. Social mobility in relation to health is commonly analysed as categories of upward, stable and downward mobility.<sup>14,43,49,86,122</sup> Recently, some studies have also analysed social mobility using several individual trajectories.<sup>34,35,144</sup>

Social mobility in relation to health is less studied among women than among men,<sup>13</sup> probably because of a lack of data or difficulties in assigning women to a social class.<sup>145</sup> Moreover, some argue that marital mobility (using the husband's social class) gives a broader picture of women's social class changes.<sup>146,147</sup> Still, using the woman's own *attained* social class might capture something more intrinsic and genuine than what is captured by *ascribed* status through marriage. The self-employed and unclassifiable categories are seldom included in studies of social mobility. In this thesis, many trajectories involving the self-employed displayed lower risk or similar risk as the stable non-manual class for CVD mortality. In contrast, trajectories involving the unclassified were often associated with increased risks.

## **6.5 POSSIBLE MECHANISMS UNDERLYING THE MAIN FINDINGS**

Social conditions influence our health through access to various resources that help us to avoid health risks.<sup>148</sup> According to the theory of fundamental causes, an important reason that social class is related to multiple disease outcomes, through multiple pathways that change over time, is that individuals and groups deploy resources to avoid risks and adopt protective strategies. Several key resources such as money, power, prestige, knowledge and beneficial social connections can serve to enhance health, no matter what the risk and protective factors are in a given circumstance.<sup>149</sup> In other words, these key resources are flexible and span over both individual and contextual resources.

Previous studies have also shown that socially mobile individuals may change their health behaviours. Health compromising behaviours were more frequently observed among downwardly mobile individuals, and less frequent among upwardly mobile compared to the socially stable in studies of younger adults.<sup>34,50</sup> Leisure time physical activity is more common among women who remain stable in non-manual classes or are mobile to adult non-manual classes, than among women in manual classes.<sup>150</sup> Less favourable alcohol behaviour has also been observed among downwardly mobile men.<sup>151</sup> These observations suggest that people tend to adjust their health behaviour in accordance with the social class they enter.

Stress is another possible explanation for the observed results of CVD mortality and psychiatric disorder by social mobility. Resources connected to low social class across the life course may induce chronic stress, which, in turn, may trigger the development of CVD<sup>152,153</sup> or psychiatric problems.<sup>154,155</sup> It has also been suggested that socially mobile individuals experience stress because of the social class change itself,<sup>156</sup> and that downward mobility should be more disruptive than upward mobility.<sup>51</sup> Downward mobility may create feelings of inadequacy or shame that may add negative effects in the lowering of social class. The upwardly mobile may possess coping skills to handle these stressors (e.g. because of a higher educational level),<sup>154</sup> but they may experience distress due to feelings of not fitting into the new class.<sup>51</sup> Even though it may be a source of stress, it has been suggested that the upwardly mobile may benefit even more from the rewards of success.<sup>84</sup>

The finding that psychiatric patients were not able to remain as socially stable as non-patients suggests that the negative effects were caused by the psychiatric disorder itself. Working life places a multitude of demands on people and individuals with psychiatric problems in particular find it difficult to hold down a job.<sup>135</sup> Moreover, psychiatric patients may face additional difficulties at the labour market owing to the negative attitudes that they may sometimes evoke in co-workers and supervisors.<sup>157</sup> Negative attitudes toward psychiatric patients and psychiatric treatment may thus also play a role.<sup>158</sup> The (cognitive) function and behaviour of psychiatric patients are other aspects that influence their ability to manage social relations or various tasks at work.<sup>135</sup> The negative attitudes toward psychiatric patients also influence their possibilities to gain employment.<sup>159</sup> Unemployment may, in turn, lead to poor self-esteem and add to the person's social isolation, a condition likely to worsen the prognosis for mental illness. To have employment is important for recovery from psychiatric disorder.<sup>135</sup> Even though many individuals with psychiatric disorder have reduced work capacity, they often state a desire to have an employment.<sup>160</sup>

### **6.5.1 Implications**

The present results show that the upwardly mobile usually have a lowered risk of CVD mortality and psychiatric disorder and that the downwardly mobile often have a correspondingly increased risk. Upon closer examination, an effect of social mobility per se was verified among men but not among women. Accordingly, social mobility does not seem to be an important factor for women's CVD mortality or psychiatric disorder. Instead, the main effects of women's own adult class appear to be important for both outcomes among the Swedish women analysed in this thesis. Because social mobility rates are high in Sweden and assumed to increase in the future,<sup>161</sup> people's social situation throughout life should be considered for improving health, particularly among men who experience downward mobility or stay socially stable in the low manual class.

In this thesis, individuals with psychiatric disorder were found to be less able to remain socially stable or within the labour force compared to other members of the Swedish work force. These results are in accordance with the assumption that improvement in the daily life of psychiatric patients should include work rehabilitation



as an important and integral part of the rehabilitation process.<sup>160</sup> Such an effort should enable mentally disabled individuals to remain in the labour force and maintain social stability.

## **6.6 FUTURE PERSPECTIVES**

Because social mobility will likely increase in the future and because the Swedish labour market is changing, there is a need to further study social mobility in relation to health. Future studies would probably benefit from studying social mobility in relation to outpatient care, particularly for psychiatric disorder since many patients receive outpatient care only and possibly are employed. Social mobility studies using data on drug prescription may also be important in understanding variations in health and mortality, because there are social class differences in drug utilisation.<sup>162</sup> Social mobility studies of health among women, might gain new insight by comparing social mobility between mothers and daughters, because the Swedish labour market is rather gender segregated,<sup>163</sup> and women may have other domestic responsibilities than men.<sup>164</sup> Another interesting aspect to investigate is if social mobility involves changes in working hours (particularly among women) and if that in turn leads to changes in health. Finally, I think that a broader view of social mobility (e.g. to include mobility in and out of the labour market) is of importance as a means to deepen our understanding between social mobility and health.

## **6.7 CONCLUSIONS**

The results of this thesis show that almost all downward trajectories are associated with increased risks for CVD mortality and psychiatric disorder, whereas lower risks are found in almost all upwardly moving trajectories. Class of destination was of great importance for both outcomes. In families where one sibling died of CVD the other siblings in the family ran a higher risk of dying from CVD. Many psychiatric patients were not able to remain socially stable or within the labour force. Another finding was that individuals experiencing the same magnitude of social mobility in adult life had similar risks of contracting a psychiatric disorder. A unique effect of social mobility itself on the risk of CVD mortality and psychiatric disorder was verified for men, but not for women.

In conclusion, the present findings suggest that social class in childhood, and especially in adult life, are important determinants of CVD mortality and psychiatric disorder. Social class position as well as shifts in-between classes across the life course should be considered in health prevention. The results of this thesis are also in accordance with the assumption that improvement in the daily life of psychiatric patients should include work rehabilitation to enable patients to remain in the labour force and maintain social stability.

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## 9 APPENDIX: SOCIAL CLASS VARIABLES

### 9.1 SWEDISH SOCIO-ECONOMIC CLASSIFICATION (SEI)

[http://www.scb.se/Grupp/Hitta\\_statistik/Forsta\\_Statistik/Klassifikationer/\\_Dokument/SEI-AGG\\_Eng.pdf](http://www.scb.se/Grupp/Hitta_statistik/Forsta_Statistik/Klassifikationer/_Dokument/SEI-AGG_Eng.pdf)

#### **Manual workers**

Occupations normally organised by LO (The Swedish Trade Union Confederation)

#### **11 Unskilled employees in goods production**

Less than 2 years of post-comprehensive school education

#### **12 Unskilled employees in service production**

Less than 2 years of post-comprehensive school education

#### **21 Skilled employees in goods production**

2 years or more of post-comprehensive school education

#### **22 Skilled employees in service production**

2 years or more of post-comprehensive school education

#### **Non-manual employees**

Occupations normally organised by TCO (The Swedish Confederation of Professional Employees) or SACO (The Swedish Confederation of Professional Associations)

#### **33 Assistant non-manual employees, lower level**

Less than 2 years of post-comprehensive school education

#### **36 Assistant non-manual employees,**

higher level 2 but not 3 years of post-comprehensive school education

#### **46 Intermediate non-manual employees**

3 but not 6 years of post-comprehensive school education

#### **56 Professionals and other higher non-manual employees**

At least 6 years of post-comprehensive school education

#### **57 Upper-level executives**

Upper-level executives in private enterprises or organisations with at least 100 employees or in public service

#### **Employers**

#### **60 Self-employed professionals**

At least 6 years of post-comprehensive school education

#### **79 Self-employed other than professionals -and farmers**

#### **89 Farmers**

## 9.2 OCCUPATIONAL AND SEI VARIABLES IN THE CENSUSES

### Yrkes Ställning FoB60

- 1 Arbetsledare (anställda ej medhjälpande)
- 2 Andra tjänstemän (anställda ej medhjälpande)
- 3 Arbetare (anställda ej medhjälpande)
- 4 Arbetsledare (anställda medhjälpande)
- 5 Andra tjänstemän (anställda medhjälpande)
- 6 Arbetare (anställda medhjälpande)
- 7 Självständiga yrkesutövare (företagare)
- 8 Yrkesutövare med anställda (företagare)
- 0 Övriga ej förvärvsarbetande personer

### SEI 1960

- 01 Företagare inom jordbruk, skogsbruk m m
- 02 Arbetare inom jordbruk, skogsbruk m m
- 03 Företagare inom industri-, handels-, transport- och serviceyrken
- 04 Företagare inom fria yrken (läkare, advokater m fl)
- 05 Företagsledare (anställda)
- 06 Tjänstemän (arbetsledare, tekniker, kontors- och handelspersonal m fl)
- 07 Arbetare andra än i grupp 2
- 08 Anställda inom serviceyrken
- 09 Militärer
- 10 Personer med ej identifierbara yrken
- 11 Studerande (ej förvärvsarb)
- 12 Övriga ej förvärvsarbetande eller studerande

### SEI FoB 80

- 11 Ej facklärdd i varuproduktion
- 12 Ej facklärdd i tjänsteproduktion
- 21 Facklärdd i varuproduktion
- 22 Facklärdd i tjänsteproduktion
- 33 Lägre tjänsteman I
- 36 Lägre tjänsteman II
- 46 Tjänsteman på mellannivå
- 56 Högre tjänsteman/ledande befattningar
- 60 Fria yrkesutövare med akademiska yrken
- 79 Företagare (exkl. lantbrukare)
- 89 Lantbrukare
- 91 Oklassificerade anställda
- 95 Pensionär
- 96 Hemarbete
- 97 Studerande
- 98 Deltidsarbete
- 99 Uppgift saknas

**SEIFoB90**

- 11 Ej facklärd i varuproduktion
- 12 Ej facklärd i tjänsteproduktion
- 21 Facklärd i varuproduktion
- 22 Facklärd i tjänsteproduktion
- 33 Lägre tjänsteman I
- 36 Lägre tjänsteman II
- 46 Tjänsteman på mellannivå
- 56 Högre tjänsteman
- 57 Ledande befattningar
- 60 Fria yrkesutövare/akademiska yrken
- 79 Företagare (exkl. lantbrukare)
- 89 Lantbrukare
- 91 Oklassificerade anställda
- 99 Uppgift saknas
- . Ej förvärvsarbete