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WORK AND HEALTH

Epidemiological studies of sickness absence and
mortality with special reference to work
environment, factors outside work and
unemployment

by

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To Sarah and Henrik

ABSTRACT

The level and costs of sickness absence in Sweden have fluctuated over time and there are also important regional variations within the country with a higher rate of sickness absence in the northern part. Sickness absence tend to be more common in women than in men and several factors, besides ill health, at a societal, organisational, social and individual level have been discussed as possible causes of sickness absence. Sweden has had a long tradition of low unemployment. During the last decade there have been substantial changes in the Swedish labour market that have resulted in an increased unemployment rate. Large studies have shown an increased mortality associated with unemployment but it is still controversial to what extent this represents a causal association.

The general aim of this thesis was twofold: Firstly, to study factors at work and outside work in relation to sickness absence in an integrated fashion and keeping a gender perspective. Secondly, to analyse unemployment in relation to subsequent mortality taking into account sociodemographic, lifestyle, personality and early childhood factors.

In the analyses of sickness absence the study population consisted of all employees in three of Sweden Post's regional organisations (n=3 470). Incidence of sickness absence in the study population was recorded during the period 1992-1994. An extensive questionnaire was sent out in 1994 including questions about factors at work and outside work of possible importance for sickness absence.

The association between unemployment and mortality was analysed using the younger cohort of the Swedish twin registry including all same sexed twin pairs born 1926-1958. The study population encompassed those responding to a comprehensive mailed questionnaire in 1973 reporting a job title (n=20 632 individuals). All causes of death as well as specific causes of death were followed between 1973 and 1996.

A decrease in the incidence of sickness absence was observed after the introduction of a qualifying day in 1993. The proportion of long-term sick-leave events (15-365 days) increased and among men, long-term events of sickness absence increased also in absolute terms. Long-lasting or serious illness and frequent colds showed strong associations with sickness absence. Subjects with high sickness absence frequently reported physical exhaustion after work and tiredness prohibiting leisure time activities. Among women, in particular complaints due to work in a forward-bent position, complaints due to heavy lifting, occurrence of bullying at the workplace and working while ill (sickness presenteeism) was associated with a high sickness absence. Among men, a high sickness absence was related to anxiety about reorganisation of the workplace, working while ill, no supervisor position and complaints due to heavy lifting. Concerning factors outside work, use of tranquillizers, and a need to recover from staying at home with sick children was associated with high sickness absence among women. In addition, for married/cohabitant women with children a high domestic workload increased the occurrence of sickness absence. Among men, experience of a relative's serious sickness, accident or death, use of alcohol as sedative, and divorce were suggested to be important determinants.

Unemployment was found to increase the risk of early death even after adjustment for several social, behavioural, health, personality, and early childhood factors among both women and men. Use of tranquillisers or sleeping pills, certain personality characteristics, low education, and serious or long lasting illness was found to further strengthen the association between unemployment and mortality. The increased mortality among unemployed subjects was in part attributable to an increased mortality from suicides and accidents or injuries with uncertainty if caused by accident or by intention.

In conclusion the results of this thesis suggest that changes in the sickness benefit system as well as several factors at work and outside work, besides ill health, influence the incidence of sickness absence. In addition, the results indicate that unemployment increases the risk of early death, in part due to an increased risk of suicides, in both men and women taking several sociodemographic, lifestyle, personality and early childhood factors into account.

LIST OF PUBLICATIONS

The thesis is based on the following papers, referred to in the text by their Roman numerals:

- I **Voss M**, Floderus B, Diderichsen F. Changes in sickness absenteeism following the introduction of the qualifying day for sickness benefit – findings from Sweden Post. Scand J Public Health 2001;29:166-174.

- II **Voss M**, Floderus B, Diderichsen F. Physical, psychosocial, and organizational factors relative to sickness absence: a study based on Sweden Post. Occup Environ Med 2001;58:178-184.

- III **Voss M**, Floderus B, Diderichsen F. How do job characteristics, family situation, domestic work, and life style factors relate to sickness absence? (Submitted).

- IV Nylén L, **Voss M**, Floderus B. Mortality among women and men relative to unemployment, part time work, overtime work, and extra work: a study based on data from the Swedish twin registry. Occup Environ Med 2001;58:52-57.

- V **Voss M**, Nylén L, Floderus B, Diderichsen F, Terry P. Unemployment and other factors preceding early cause-specific death. (Manuscript).

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TABLE OF CONTENTS

ABSTRACT	4
LIST OF PUBLICATIONS	5
TABLE OF CONTENTS	6
BACKGROUND.....	8
RECENT CHANGES IN EMPLOYMENT AND WORK ENVIRONMENT.....	8
HEALTH	9
<i>Disease, illness, sickness.....</i>	9
SICKNESS ABSENCE	10
<i>Measure of sickness absence</i>	11
<i>Short-term and long-term sickness absence.....</i>	11
FACTORS ASSOCIATED WITH SICKNESS ABSENCE.....	12
<i>Societal and community factors.....</i>	13
<i>Work place factors.....</i>	14
<i>Individual factors.....</i>	15
UNEMPLOYMENT.....	16
<i>Health behaviours</i>	16
<i>Mental health and well being.....</i>	17
<i>Disease and disability</i>	17
<i>Mortality</i>	17
<i>Specific causes of death.....</i>	18
<i>Selection or causation</i>	18
AIM OF THE THESIS	21
SUBJECTS AND METHODS.....	22
THE SWEDEN POST STUDY	22
<i>Study population.....</i>	22
<i>Sickness absence.....</i>	23
<i>Collection of exposure information</i>	24
<i>Statistical analyses</i>	25
THE TWIN COHORT STUDY	25
<i>Study population.....</i>	26
<i>Unemployment and time aspects of work.....</i>	26
<i>Social, behavioural, health and personality factors</i>	26
<i>Mortality</i>	27
<i>Statistical analyses</i>	27

RESULTS	29
THE SWEDEN POST STUDY	29
<i>Subjective symptoms and disorders</i>	32
<i>Factors at work and outside work relative to sickness absence</i>	32
THE TWIN COHORT STUDY	35
<i>Unemployment</i>	35
<i>Part-time work, overtime work and extra work</i>	35
<i>Prevalence of social, behavioural, health and personality factors</i>	36
<i>Unemployment and cause specific death</i>	36
<i>Interaction between unemployment and other risk factors</i>	36
<i>Mortality in unemployment-discordant twin pairs</i>	36
DISCUSSION	38
THE SWEDEN POST STUDY	38
<i>Presenteeism</i>	38
<i>Illness and symptoms</i>	39
<i>Assessment of sickness absence</i>	39
<i>Assessment of exposure</i>	40
<i>The structure of analysis</i>	40
<i>Non response and generalizability</i>	40
<i>Work related physical indicators</i>	41
<i>Organisational, psychosocial and behavioural indicators</i>	41
<i>Individual indicators</i>	42
<i>The balance between work and family life</i>	43
THE TWIN COHORT STUDY	45
<i>Exposure assessment</i>	46
<i>Mortality</i>	46
<i>Confounding</i>	46
<i>Non-respondents</i>	48
<i>Influence of general unemployment level</i>	48
CONCLUSIONS	49
SAMMANFATTNING (Summary in Swedish)	51
ACKNOWLEDGEMENTS	53
REFERENCES	55

BACKGROUND

In Sweden, as in Western countries in general, a gainful employment is of great psychological importance and having a job is often more than just a way of earning a living. It may give you a feeling of coherence, of life satisfaction, you belong to a group, and it may increase your self-esteem and social support. It may contribute to the perception of being needed and give you a time structure of the day (41,80). On the other hand, not all jobs are this rewarding and some can be both physically and mentally demanding and may subsequently cause accidents, injuries, disease, illness and sickness (81).

In this thesis certain aspects of the relation between work and health are focused. One aspect is how work as well as the situation outside work including behavioural factors effects sickness absence. The other aspect deals with the situation when an individual is no longer a member of the work force and instead experience unemployment and how this may cause health effects in terms of early mortality in a long-term perspective.

RECENT CHANGES IN EMPLOYMENT AND WORK ENVIRONMENT

During the last decades, there have been substantial changes in the Swedish labour market. Between 1975 – 1990, the proportion actively employed among women increased from 67 % to 81%, while the corresponding figures for men were 87 % and 85 %. During the recession in the 1990's the employment rates decreased temporarily, and in the year 2000 about 2 million women and 2.2 million men were actively employed, corresponding to 72 % and 76 %, respectively. It may also be noted that, in 2000, a total of 76% of women with children were part of the work force (97,100,122).

Permanent employment became less frequent during the 1990's, while time-restricted employment increased, especially among young people and more among women than among men. In an article on the influence of work life on public health, Aronsson concludes that there is an ongoing polarisation and differentiation of the labour market, with an increasing group of people in time-restricted employment and self-employment and a reduced number of core workers. This has lead to a greater need for adaptability among many employees (7,9). About four out of ten women in 2000 had a part-time job and among men about one out of ten.

The level of employment varies between regions in Sweden, with the highest levels in the counties of Kronoberg, Stockholm and Jönköping, all above 80%, while the counties of Norrbotten and Jämtland had a level of about 70% in 1999 (100). Non-Scandinavian immigrants have a substantially lower level of employment compared to native Swedes. Compared to other countries in the European Union, women in Sweden and in Denmark had the highest level of employment in 1999. Despite a favourable development of the level of employment for Swedish men during recent

years, higher employment rates have been reported from e.g. Denmark, The Netherlands, Portugal and Great Britain (103).

There have also been important changes in the work environment. For example, in 1999, 72% of women and 63% of men reported an increased speed at which work had to be performed within the same occupation compared to five years earlier. About 60% of men and women reported too much work to do in 1999, and about one out of two subjects considered work to be mentally stressful (98).

In parallel with these changes of the labour market and the work environment there are signs of an increase in work related diseases. In 1999 almost 20 000 reports of occupational diseases were registered (102). The most important causes of occupational diseases were ergonomic factors (about 65%) such as monotonous or strenuous movements or work posture. Seventeen percent of the reported occupational diseases in 1999 were assigned to organisational or social factors, and this corresponds to more than a doubled rate compared to 1997 (102).

HEALTH

Health is an important dimension of life and to keep people healthy and improve their health are important goals for governments as well as for the World Health Organisation (WHO) and the European Union. WHO's definition of health has changed from being a *state* of complete physical, mental and social well-being (126) to be a *resource* in the daily life to achieve the fundamental goals in life (128). The declaration from the Health Promotion Conference in Jakarta 1997 emphasises health as being a *process*:

...Health is a basic human right and essential for social and economic development. Increasingly, health promotion is being recognised as an essential element of health development. It is a process of enabling people to increase control over and to improve their health...(127)

It is important to have tools to describe and follow the health of the population, as health should be regarded as a resource for a nation to achieve economic growth and welfare. Studies of health in a population often imply studies of ill health, based on data from registers, questionnaires, interviews and observations. Usually the measurement of ill health is based on some kind of morbidity data - disease, illness or sickness, but there is also a long tradition of studies on mortality.

Disease, illness, sickness

The concepts of disease, illness and sickness are commonly used when describing ill health:

Disease is a state that in a certain culture and time can be diagnosed as a disease by the medical science.

Illness is defined as subjective symptoms experienced by an individual and identified as ill health. The symptoms can comprise physical, psychological and social factors.

Sickness is the social role given to or taken by an individual in a certain social context and normally in combination with illness and/or disease (2,3,75).

Sickness can be further described based on the causes involved (3):

- The sick role a person has chosen, or is forced into because of illness, which also has been defined as a disease by medical science.
- The sick role a person has taken because of experience of illness, which medical science does not recognise as a disease.
- The sick role a person has chosen or been given because of disease defined by medical science but not experienced as illness by the affected person.
- The sick role a person has taken without showing illness or disease (could be due to e.g. misdiagnosis). For some people, the sick role may be a desirable goal e.g. as an excuse to avoid demands, an excuse for failure, to get some extra attention or that the sick role is the main identity (2).

SICKNESS ABSENCE

A commonly used measure of sickness absence is the sick rate which represents the annual number of benefit days (full or partial) in total, in relation to the number of persons insured for sickness benefit at the end of the year. In Sweden, during the 1980's the sick rate reached a maximum in 1988 with 29 days per insured person for women and 22 days for men. After that it decreased to a lowest level in 1997 of 14 days per insured person for women and 9 days for men. Since then, the still increasing rate has about doubled, and the difference between women and men has increased. The cost for sickness allowance was 14 000 million SKr (0.8% of the GNP) in 1997. In 2000 the cost had increased to 31 000 million SKr (1.5% of the GNP). The mechanisms behind this increase in sickness absence during recent years are still largely unexplained.

There is a geographical variation in sickness absence in Sweden, with highest rates in some of the northern counties (110). In the beginning of the 1990's, major cities showed a higher incidence of sickness absence compared to more rural regions, based on data from Sweden Post (54,55). Regional differences have also been found in the United Kingdom (106,108). In a recent report from the Swedish Government it is suggested that regional variations in sickness absence probably are explained by differences in culture and attitudes toward sickness absence among citizens, physicians and social insurance personnel (93).

Closely related to sickness absence is the prevalence of disability pension with an increase in Sweden in both numbers of individuals and expenditures during recent

years. Statistics show that in 2001, a total of 120 000 individuals were on sick leave for more than one year and 450 000 people were on disability pension. Overall, nearly 16% of the women and about 10% of the men between 16-64 years of age, were on sickness allowance or disability pension this year in Sweden (93).

Changes in the sickness benefits may have influenced the sickness absence in Sweden. The reduction of benefits in 1991, corresponded to a cut from 100% of daily wages to 75% for the first three days of sick leave and to 90% for days four to 90. The following year, the responsibility of the sickness benefit for the first 14 days was transferred to the employers, and the benefit for absence of more than 90 days was reduced to 90%. Finally, a qualification day for sickness benefit was introduced in April 1993.

The sick role does not necessarily imply that a person is absent from work. In a situation when a person has a disease or illness, the decision on whether or not to take sick leave depends on several conditions, both at work and outside work. This includes the possibilities to adjust the work according to the current health status, e.g. by working in a lower tempo or with fewer tasks (29). Besides the opportunities of adjustment, the demands for attendance at work may vary, depending on the consequences for the employee, the work mates or some others, e.g. customers or clients. By "over use" of sickness absence it is meant that a person uses sickness absence more than he or she would have done for the same symptom, in another situation. "Under use" is when the sickness insurance system is used less than it would have been in another situation. Sickness presenteeism has shown to be more prevalent among people providing care and welfare services and among people in the education sector relative to other comparable groups (8,74).

Measure of sickness absence

Many different measures of sickness absence have been used in the literature. The sick rate is often used in descriptive statistics. Hensing suggests five basic measures of interest in epidemiological studies (34): frequency of sick leave, length of absence, incidence rate, cumulative incidence and duration of sick leave spells. The purpose of the study is essential for the measure that should be used. A basic measure, simple to calculate and to understand, is "frequency of sick leave" which corresponds to current or new sick leave spells during the study period divided by the number of persons in the study group. The measure of "incidence of sickness absence" takes into account both the frequency of events and the time at risk of a new event. The total number of sick leave spells during the study period is divided by the total number of days at risk for the persons during the study period.

Short-term and long-term sickness absence

In several studies a distinction has been made between short-term and long-term sickness absence. When comparing results from these studies one should be aware of the fact that often different definitions are used. Absence > 3 days, > 7 days and more than 10 weeks have all been classified as "long-term" sickness absence. In the Whitehall II study both long (>7 days) and short spells of absence (<8 days) seemed to

be health related, perhaps to a lesser extent the short spells (69). Similar results were found in a Swedish study (14).

Working conditions, conditions outside work (14), and in particular young age (69,122), low job satisfaction (69) and low support at work (83) has been found to be associated with short-term sickness absence. Long-term sickness absence has been linked to low employment grade (116), downsizing (117), and women with small children (14). In another study, associations for both short-term and long-term sickness absence were reported for employment grade, economy, low job satisfaction (men), low control of the work situation and low use of skills (83).

Blank et al. found that high physical demands at work, low job control and job strain were related to both repeated short-term and long-term sick leave and suggested that there was a common mechanism in explaining both outcomes. As repeated short spells are more common among young workers it might be seen as a predictor of more serious ill health later in life (14). This is consistent with a theory of coping, where the recurrent short-term sickness absence may be a means to reduce harmful effects on health by e.g. physical job demands (14,122).

FACTORS ASSOCIATED WITH SICKNESS ABSENCE

Sickness absence has a multifactorial aetiology including societal, workplace and community factors as well as individual factors. It has been emphasised that relations between individual risk factors and sickness absence need to be considered in a context of societal and workplace conditions, the individuals work environment, social and personal factors (59). Sickness absence can be seen as a type of coping behaviour, in reaction to sickness or symptoms or to the factors that caused the sickness or symptoms (60). The coping behaviour can be rational in view of the individual's wish to maintain her/his health and working capacity. Kristensen proposed the following basis for an integrated theory of sickness absence:

1. A theory of sickness absence should be holistic, incorporating factors at all levels.
2. A theory of sickness absence should consider the individual as a product of his or her environment and, at the same time, as a conscious actor who makes choices within a given social framework.
3. A theory of sickness absence should not regard absence from a normative point of view, i.e. see it as something bad that must be reduced or minimised. Such a theory should rather deal with the functions that absence serves for employees and attempt to uncover which type of absence is optimal seen from a health perspective.
4. Sickness absence is not a simple function of sickness but reflects a person's general subjective perception of his/her own health and the factors that influence it.

5. The greater the job demands and the fewer the coping possibilities in the work situation, the higher the sickness absence rate.

In particular three epidemiological studies have provided major contributions to new knowledge in the area of sickness absence:

The Whitehall II study which was based on a cohort of about 10 000 British civil servants who underwent a health screening examination in 1985-1988. Detailed data on work characteristics as well as information on psychosocial and behavioural factors were obtained together with data on sickness absence (27,68,69,82,83,86,94,95).

The "Sick leave registration project" which has the objective to assess the occurrence of sickness absence (its pattern, diagnoses and changes), to provide a basis for preventive measures and to evaluate occupational injuries and changes in the social insurance system. All sickness insured individuals (about 180 000) of Östergötland in 1985 were followed between 1985-1987 with regard to sickness absence (4-6,15,31,32,53,61,104,130,131).

The study of municipal employees including a cohort of about 1000 municipal employees from Raisio in Finland in the beginning of the 1990's which was later extended to encompass 8 towns in Finland. The specific studies are mainly focused on work organisation and psychosocial factors at work in relation to sickness absence (1,25,45-52,112-119,121).

Societal and community factors

An individual's inclination to take sick leave can be influenced by the social insurance system. (122). A study of the effect of the reduced reimbursement levels introduced in Sweden in 1991, showed that women reduced their short-term spells of sickness absence more than men, and groups at lower socio-economic levels more than groups at higher levels (17). The author concluded that it is possible to change the way people use welfare systems by means of economic incentives, at least as far as short-term sickness absence is concerned. The introduction of a qualifying day without sickness benefit in Sweden in April 1993 resulted in a clear reduction in sickness absence (23,88,123). In Denmark, the introduction of a qualifying day in 1983 was followed by a decrease in short-term sick leave (1-3 days), but also to some extent an increase in longer sick-leave events (>3 days) (36). A later report from the same Institute in 1989 concluded that neither the introduction, nor the withdrawal of the qualifying day in December 1986, influenced the sickness absence in Denmark (16). It has also been found that more or less generous interpretations of the rules for of disability pension can influence the level of sickness absence (122).

Knutsson et al found that high unemployment rates were associated with a low prevalence of long term sickness absence (> 29 days) for men while for women no such association was found (56). The economic growth or recession affects the structure of the work force. In times of high economic growth the work force expands and to a greater extent includes people with health problems, which affects the level of sickness

absence (122). The increased proportion of women with gainful employment has also been suggested as an explanation for an increase in sickness absence in Sweden during recent years (Vogel).

Work place factors

The size of the work place seems to be important for sickness absence. Larger work places have been found to have a higher level of sickness absence (107). The terms of employment may also be important. A recent study based on 5 650 hospital employees showed that temporary employees had a lower rate of medically certified sickness absence (>3 days) than permanent employees (121). Part-time employment has been associated with short and long spells of sickness absence for men while the number of short spells were reduced by part-time work for women (14). In a Swedish study, gender integrated workplaces had the lowest and the male dominated workplaces the highest rate of sickness absence, even after adjustment for occupational branch (5).

Physically demanding or monotonous work tasks may increase the risk of ill health (14,26,48,59,109,122). Even if the reporting of psychological and organisational causes of occupational diseases has increased, the most important causes of sickness absence in Sweden in 1999, according to national statistics, were ergonomic factors (102).

Regarding psychosocial and organisational factors at work, low job control has been associated with sickness absence (52,82,83). Low job control increased sickness absence with 60-80% in a Finnish study (118), after controlling for age, social class and health risk behaviours. In another study from Finland, control over working time, was related to low sickness absence among women but not among men (1). The authors emphasise the importance of control over working time in order to manage the integration of working life with private life. The combination of high job demands and low control of the work situation has been associated with higher rates of short spells of sickness absence in the lower employment grades (82). Low job demands, control and social support at work were associated with higher rates of short and long spells of absence in men and to a lesser extent in women. In a study by Vahtera and co-workers it was found that negative changes of the psychosocial work environment may have adverse effects on the health of employees in terms of an increased sickness absence (114).

Threat of redundancy has been associated with a decrease in medically certified sickness absence among employees under the age of 40, while other workers fearing job loss reported more illness and their periods of absence were significantly longer, especially for men. (12). Recent studies from Finland have also showed that downsizing may cause an increase in sickness absence (48,117).

Being a victim of bullying at the work place was reported by 5% in a cohort of Finnish municipal employees. This was associated with a higher body mass index, a higher prevalence of chronic diseases and higher rates of medically and self certified spells of sickness absence (45). In a recent study it was reported that both the victims and those who witnessed the bullying suffered from stress because of this and that the problem concerned the entire work unit not only the victims (120). In studies from the Nordic

countries, 4 - 9% has reported being victims of bullying at work (24,45,62). In national statistics from Sweden in 1999, the proportion reporting that they had been exposed to bullying at work was 9% among both women and men (98). The registered occupational diseases due to bullying or harassment has increased by 80% for women and 120% for men between 1996 and 1998 in Sweden which may indicate that bullying is becoming a serious problem in the work environment. Today, there are about 500 cases per year of reported occupational diseases due to bullying among women and 150 cases among men (101).

Individual factors

It is well established that ill health (illness, disease and sickness) is the main cause of sickness absence (19,69,106,122). Musculoskeletal disorders (48,85), mental health (91), psychiatric disorders (33), longstanding illness (122), sleeping problems (85,122) and headache (27,87) are examples of ill health parameters related to sickness absence. In the Whitehall II study respiratory disorders and gastro-enteritis accounted for 50-60% of all spells of sickness absence. Headache and migraine, musculoskeletal disorders, injury and neurosis accounted for an additional 20-30% (27). Similar results have also been presented by Chevalier (19).

In the Whitehall cohort, women had two to five times higher rates of short spells of sickness absence (<8 days) due to headache and migraine, neurosis, cardiovascular and genitourinary disorders compared to men. For spells > 7 days, women had two to three times higher rates of respiratory disorders, neurosis, surgery, ill defined conditions and genitourinary disorders.

Marital status have shown associations with sickness absence with a higher annual number of spells for widowed, separated or divorced women and men (19,86). Sickness absence is in general more common among the young and declines as age increases (14,39,105) but longer spells of sickness absence are more frequent among older people (108).

It has been suggested that the higher sickness absence rate among women compared to men partly can be explained by sickness absence during pregnancy. When pregnant women (5% per year) were excluded, the excess rate of sick leave among women was halved, but still 25% higher than the rate among men (6,104).

Some studies have shown that women with children have more sickness absence compared to men with children (122,130). In a study by Blank and co-workers, women with children showed a lower risk of repeated short spells of sickness absence while an increased risk of long spells was found. No corresponding associations were seen among men (14). Women with children (< 7 years of age) did not have a higher sickness absence than those without children. On the other hand, single mothers had higher sickness absence, mostly due to longer spells (122). In a French study, the proportion of women on sick leave was higher among those with more children (19).

Comparatively few studies have focused on the importance of individual characteristics including risk behaviour. Smoking (14,83) and use of alcohol (83,111) have been linked to high sickness absence. Financial difficulties have also been associated with sickness absence for both women and men (14,83). "Hostile" individuals had a higher risk of sickness absence in a study of municipal employees in Finland. (112,115).

UNEMPLOYMENT

Sweden has a long tradition of comparatively low unemployment due to economic growth and efforts by the government. During the post war period the unemployment rate did not exceed 3.5%. In 1991 the unemployment rate started to increase and reached a maximum between 1993 and 1997 with a rate of 7-8% for women and 9-10% for men. After that it has decreased, and in 2000 a total of 4% of women and 5% of men were unemployed. The rate of unemployment differs not only between men and women but also according to age, occupation, education, and country of birth. The rate is highest in the ages below 25, and among those 60-64 years of age and lowest in ages 35-54 years old. During the 1990's, unemployment among non-Scandinavian immigrants increased markedly, from five to 33% in 1997, but has to some extent decreased thereafter (97,100).

It is well known that unemployment is associated with several health outcomes including an increased utilisation of health care, physical and mental ill health, as well as mortality (10,21,22,40,43,44,58,67,70,71,73,77-79,92,99,129). Unemployment has also been found to increase general distress, anxiety, depressed mood and activity fall (30). Harmful effects of unemployment like psychosocial stress or stigmatisation, have been suggested to be more pronounced in times of low unemployment (71).

Health behaviours

One of the earliest and most obvious consequences of unemployment, despite a more or less generous unemployment insurance system, is a deterioration of the economic situation. Economical problems may lead to a change in social status, increased psychosocial stress, impaired self confidence, which in turn may lead to a variety of coping behaviours that may have health consequences.

Previous studies have shown that unemployment seems to affect health behaviours such as smoking and alcohol consumption, physical exercise and diet (43,44,73,129), but with some inconsistencies in the results. There are studies reporting that losing a job may increase smoking and alcohol consumption but other studies have failed to show any such association. There are even examples of reduced levels of smoking and alcohol consumption associated with unemployment (10,43,44,129). In a British study, adjusting for smoking and alcohol consumption had little effect on the relative risk of mortality, suggesting that neither smoking nor alcohol explain the difference in mortality risk (77). Unemployment may lead to reduced alcohol consumption due to economic difficulties as well as an increase due to more leisure time and a need for alcohol as sedative (43,44). The reviews of the literature suggest that health behaviours may both contribute to and be a consequence of unemployment and that the long-term

effects of smoking and alcohol consumption should be taken into account in analyses of morbidity and mortality.

Mental health and well being

Increased levels of depression and anxiety have been reported among unemployed. From longitudinal studies there are also results showing that unemployment has an impact on mental health and well being (44,58,73,129). In addition reemployment has been reported to be associated with a reduction of mental ill health (44).

Unemployment has also been associated with family problems, including marriage breakdown, domestic violence and parents being unable to take care of their children. It has also been found that those who were unemployed were more likely to encounter new unemployment and downward social mobility (44,79,129). Among women married to men who were unemployed and among children to unemployed parents an increased mortality has been reported (44,129). Moser found an increased risk of mortality for women married to unemployed men. (78).

Disease and disability

A significantly higher hospital admission rate and ambulatory care utilisation has been found among unemployed compared to those employed. In a study by Kraut et al, the incidence of hospital admissions for the treatment of injury and poisoning was increased among unemployed subjects (58). Differences between unemployed and employed in the prevalence of chronic physical illness including bronchitis, obstructive lung disease and ischaemic heart disease have been reported from cross-sectional studies (44,129).

Mortality

The association between mortality from any cause and unemployment has been documented by several studies which is illustrated by Table 1 (21,40,67,70,71,77-79,92,99). The observed relative risk has ranged between 1.2 and 2.0 depending on e.g. the study period, country and the possibility to adjust for potential confounding factors. Previous studies have mostly focused on the relation between unemployment and mortality for men but some studies also concern women (40,67,71,99), and most of them showed a significant association between unemployment and mortality also for women (40,67,71).

Previous studies were to a large extent based on census data and just a few were able to address the important question of potential confounding such factors have mostly been limited to sociodemographic variables such as age and social class. In the British Regional Heart Study the association between unemployment and mortality remained after adjustment also for other factors including smoking and alcohol consumption (77).

Specific causes of death

An overview of major studies from recent years regarding associations between unemployment and specific causes of death for women and men is presented in Table 2. Results from several of these studies show that unemployment may be associated with an increased mortality from suicide, cardiovascular disease and lung cancer.

In all of the studies presented in Table 2 an increased mortality from violent causes, in particular suicide, among unemployed subjects was found. The Danish study by Iversen showed similar results for both women and men with relative risks for suicides and accidents of about the same order (40).

Stefansson found only a slight change in the relative risk of early deaths for long term unemployment after removing suicides and alcohol related causes of death, suggesting that the excess mortality among unemployed men must at least in part be due to other causes (99).

An increased mortality from cardiovascular diseases has been reported from Finland, Denmark, Italy and Britain (21,40,70,79). Conventional cardiovascular risk factors such as smoking and hypertension were not taken into account in these studies. The increased risk of mortality from lung cancer seen in some studies suggest a higher prevalence of smokers among unemployed subjects (66,70,79). Differences in smoking habits were, however, not considered as a full explanation of the increased risk of lung cancer mortality reported by Lynge (66).

Selection or causation

Despite several studies of the relation between unemployment and adverse health effects it is still unclear to what extent this constitutes a causal relation. There is general agreement of a health selection mechanism into unemployment exists, where ill health in combination with personal characteristics, behavioural and sociodemographic factors increase the risk of impaired illness and unemployment. Workers with poor health status are more likely to lose their jobs and are also less likely to find new jobs (40,71,77). On the other hand, as noted above there is evidence from several studies that unemployment has an influence on health behaviours as well as on morbidity and mortality. The main part of these studies are consistent with both a selection and a causal relation (11,40,44,70,71,77-79).

Morris et al. have suggested that there was a selection of men with poor health into unemployment in the British Regional Heart Study (77). By excluding subjects who reported that the unemployment partly was due to ill health they could analyse "healthy" unemployed men. Results from these analyses showed a higher risk of mortality for unemployed compared to those never unemployed. The unemployed differed compared to the never unemployed according to social class, smoking and alcohol consumption but controlling for these factors did not change the association with mortality.

Table 1. Estimated relative risk with 95% confidence interval for all cause mortality in relation to unemployment in studies published after 1980.

Author, year	Country	Study base and definition of unemployment	RR with 95% CI*
Moser, 1984	England & Wales	Men 15-64 y followed 1971-81. 1% census sample (n=161699). Seeking work the week before the 1971 census.	1.21 (1.08-1.35) ¹⁾
Moser, 1987	England & Wales	Men 16-64 y followed 1981-83. Included in 1981 census (n=163 680). Seeking work the week before the 1981 census.	1.47 (1.18-1.80) ¹⁾
Iversen, 1987	Denmark	Subjects 20-64 y followed 1970-80. Total labour force (n=2 million). Unemployment on the census day.	1.50 (1.33-1.69) ²⁾ (W) 1.48 (1.41-1.53) ²⁾ (M)
Costa, 1987	Italy	Men 15-59 y followed 1981-85. Seeking job before 1981 census (n=13462). Seeking job the week before the 1981 census	2.56 (2.09-3.08) ³⁾ 1.87 (1.59-2.22) ⁴⁾
Sorlie, 1990	USA	Subjects >24 y followed 1979-83. Representative sample (n=452 192). Available for work the survey week.	1.6 ⁵⁾ (M)
Martikainen, 1990	Finland	Men 30-54 y followed 1981-85. Total 1980 census (2.7 million person years). Unemployed any period during the year before the census.	1.93 (1.82-2.05) ⁶⁾
Stefansson, 1991	Sweden	Unemployed subjects followed 1980-86. Long-term unemployed > 300 or >450 days 1980-83 (n=28846).	1.14 (0.91-1.42) ⁷⁾ (W) 1.61 (1.42-1.84) ⁷⁾ (M)
Morris, 1994	England	Men 40-59 y followed 1983-90. British Regional Heart Study (n=6191). Any unemployment during a five year period.	1.95 (1.57-2.43) ⁸⁾ 1.47 (1.10-1.96) ⁹⁾
Martikainen, 1996	Finland	Population of Finland 25-59 y followed 1991-93. Total 1990 census (7.5 million person years). Unemployed >30 days some time 1987-92.	1.61 (1.09-2.36) ¹⁰⁾ (W) 2.11 (1.76-2.53) ¹⁰⁾ (M) 1.30 (0.97-1.75) ¹¹⁾ (W) 1.30 (0.97-1.75) ¹¹⁾ (W)
Lynge, 1997	Denmark	Subjects 20-64 y followed 1970-75/1986-90. Two cohorts based on national censuses 1970 and 1986 (n=5823134). Unemployed at least 30% of the year.	1.71(1.43-2.05) ¹²⁾ (W)

1) Adjusted for age and socio-economic group. 2) W = women; M = men. Adjusted for age and socio-economic group. 3) Unemployed both in 1976 and 1981, no information about adjustment. 4) Unemployed in 1981, no information about adjustment. 5) Adjusted for age, family income and education. 6) Adjusted for age, socio-economic state, education, marital status, use of reimbursable medicines, number of sick allowance days. 7) Adjusted for age. 8) Adjusted for age, town, social class, smoking, alcohol intake, pre-existing disease. 9) 'Healthy' subjects at baseline, adjusted for age, town, social class, smoking, alcohol intake, pre-existing disease. 10) Period of 'low' unemployment in Finland, adjusted for education, occupational class, marital status. 11) Period of 'high' unemployment in Finland, adjusted for education, occupational class, marital status. 12) Study period=1970-75, adjusted for age. 13) Study period=1986-90, adjusted for age.

Table 2. Estimated relative risk with 95% confidence interval for specific causes of death in relation to unemployment in studies published after 1980.

Author	Country	Cause of death	RR with 95% CI*	
			Women	Men
Moser 1984	England	Malignant neoplasms		1.28 (1.03-1.55) ¹⁾
	Wales	Lung cancer		1.54 (1.13-2.02) ¹⁾
		Accidents, poisoning and violence		1.49 (1.08-1.96) ¹⁾
		Suicide		1.69 (1.02-2.54) ¹⁾
Moser 1987	England	Lung cancer		2.09 (1.12-3.36) ¹⁾
	Wales	Circulatory diseases		1.59 (1.16-2.10) ¹⁾
		Ischaemic hart disease		1.82 (1.29-2.45) ¹⁾
		Accidents, poisoning and violence		2.40 (1.21-3.99) ¹⁾
Iversen 1987	Denmark	Cardiovascular disease	1.41 (1.08-1.83) ¹⁾	1.28 (1.18-1.39) ¹⁾
		Other diseases	2.55 (1.98-3.27) ¹⁾	2.26 (2.04-2.51) ¹⁾
		Accidents	2.71 (1.83-4.00) ¹⁾	2.55 (2.17-3.00) ¹⁾
		Suicides	2.45 (1.72-3.49) ¹⁾	2.51 (2.12-2.97) ¹⁾
		Cancer		1.33 (1.21-1.47) ¹⁾
Costa 1987	Italy	Malignant neoplasms		1.75 (1.37-2.16) ²⁾
		Circulatory diseases		1.68 (1.25-2.05) ²⁾
		Digestive diseases		3.16 (2.24-4.35) ²⁾
		Accidents, poisoning and violence		2.45 (1.87-3.13) ²⁾
		Other causes		2.20 (1.53-3.06) ²⁾
Sorlie 1990	USA	Other than cancer and cardiovascular	1.08 ³⁾	1.55 ³⁾
Martikainen 1990	Finland	Lung cancer		1.43 (1.12-1.85) ⁴⁾
		Acute myocardial infarction		1.36 (1.18-1.56) ⁴⁾
		Other ischaemic heart disease		1.77 (1.44-2.17) ⁴⁾
		Cerebrovascular disease		1.54 (1.21-1.96) ⁴⁾
		Other circulatory diseases		2.08 (1.59-2.72) ⁴⁾
		Diseases of respiratory system		3.32 (2.14-5.13) ⁴⁾
		Alcohol related diseases		5.24 (4.21-6.52) ⁴⁾
		Other diseases		2.67 (2.03-3.51) ⁴⁾
		Suicide		1.92 (1.62-2.27) ⁴⁾
		Traffic accidents		1.88 (1.47-2.40) ⁴⁾
		Alcohol poisonings		4.62 (3.59-5.95) ⁴⁾
		Other accidents and violence		3.01 (2.54-3.56) ⁴⁾
		Total ICD codes E800-E999		2.51 (2.28-2.76) ⁴⁾
Lynge 1997	Denmark	All cancer:	1.38 ⁵⁾	1.70 ⁵⁾
		<i>Cancer of:</i>		
		- Digestive organs	1.27 ⁵⁾	1.41 ⁵⁾
		- Respiratory organs	1.56 ⁵⁾	1.91 ⁵⁾
		- Breast	1.35 ⁵⁾	2.42 ⁵⁾
		- Female genital organs	1.29 ⁵⁾	-
		- Male genital and urinary organs	1.63 ⁵⁾	1.54 ⁵⁾
		- Haematopoietic system	1.38 ⁵⁾	1.55 ⁵⁾
		- Other sites	1.38 ⁵⁾	2.00 ⁵⁾

* Relative risk with 95 percent confidence interval. 1) Adjusted for age and socio-economic group. 2) Unemployed in 1981, no information about adjustment. 3) Adjusted for age, family income and education. 4) Adjusted for age, socio-economic group, education, marital status, use of reimbursable drugs, number of sick allowance days. 5) Study period=1986-90, adjusted for age.

AIM OF THE THESIS

The general aim of this thesis was to study factors at work and outside work in relation to sickness absence and to analyse unemployment in relation to subsequent mortality. The intention was to study these relations with a gender perspective.

The specific objectives of the thesis were to address the following questions:

- Was the introduction of a qualifying day for sickness benefit associated with a change in the incidence of sickness absence? If such an association was present, was it modified by socio-economic (education, marital status, children, economy) and occupational factors (working hours, heavy lifting)?
- Which work-related factors are associated with the occurrence of high sickness absence? Are these factors in common for women and men or are they gender specific?
- Which factors pertaining to social situation, family life and behaviour are associated with the occurrence of high sickness absence? Are these factors in common for women and men or are they gender specific?
- Which factors are important determinants for high sickness absence, considering both subjective reports of illness, work related as well as non-work related factors?
- To what extent does unemployment predict early death adjusting for a potential influence from sociodemographic, life style, personality and early childhood factors?
- To what extent does unemployment predict early death from specific causes?
- Is the relation between unemployment and mortality further strengthened by the presence of other risk indicators?

SUBJECTS AND METHODS

Five papers were derived from two epidemiological studies; analyses of sickness absence at Sweden Post and analyses of unemployment and mortality using the Swedish twin registry. Subjects and methods for the two studies are described separately.

THE SWEDEN POST STUDY

In 1989, a comprehensive work environment program – Post Environment 2000 – was launched by Sweden Post together with researchers from the National Institute for Working Life (the former Swedish National Institute of Occupational Health) (54,55). The aim was to identify hazardous jobs and employees with the most adverse work environments and, to initiate and implement programs for improving the work environment. Further co-operation with three of Sweden Post regions has been essential for this thesis. Paper I, II and III were based on data from this study and the objectives are indicated by the paper titles below

- I. Changes in sickness absenteeism following the introduction of a qualifying day.
- II. Physical, psychosocial, and organisational factors relative to sickness absence.
- III. Job characteristics, family situation, domestic work, and life style factors relative to sickness absence.

Study population

The study population consists of all employees in three of Sweden Post's regional organisations: Letter Division Sundsvall, Letter Division Umeå, and Sales Division Sundsvall. The reason for choosing this population from Sweden Post was the research project mentioned above. These three organisations showed an interest in thorough investigation of the relation between sickness absence and the situation at work and outside work.

Encompassed by the study were all women and men with regular employment contracts (full-time or part-time) since July 1, 1992, who were employed for at least six months during 1993, and who were still employed in the same region in September 1994. These were in total 3,470 persons of which 1,557 women and 1,913 men. They represented occupational tasks with considerable variation in terms of work environment: administrators, cashiers, mail handling staff, rural mail carriers, office personnel, office-cleaning staff, computer personnel and technicians.

Sickness absence

From Sweden Post's register of absenteeism, we collected information about all types of absenteeism for each individual for 1992, 1993 and 1994. The register is based on reports from the personnel department and is the base for calculation of the salary as well as reports to the Social Insurance Office for disbursement of sickness benefits. Data on sickness absence as well as on absences from work due to vacation, leave of absence and compensatory leave were recorded.

Paper I

Incidence of sickness absence 1992-1994: For each group that was studied, we calculated the incidence of sickness absence for 1992, 1993 and 1994, by dividing the number of sickness events by "days at risk". Days at risk were obtained by taking the number of calendar days for the study period, and subtracting the number of days of absence from work during the same period, regardless of cause. Incidence of sickness absence was expressed as number of sickness events per 10,000 days at risk and was also calculated quarterly for the years of 1992, 1993 and 1994.

Short-term and long-term sickness absence 1992-1994: For the total study population each event of sickness absence for the year 1992, 1993 and 1994 was categorised according to duration: 1-3 days, 4-14 days and 15-365 days.

Incidence of sickness absence relative to the qualifying day: Incidence of sickness absence was calculated separately for the periods of April 1, 1992 to March 31, 1993 and for April 1, 1993 to March 31, 1994.

In order to study changes in incidence of sickness absence a classification of none, low, and high sickness absence was formed using the 1993 incidence distribution. The classification was formed so that each class would encompass roughly the same number of individuals.

No sickness absence = persons taking no sick-leave (32%)

Low sickness absence = persons with 0-56 sickness events per 10,000 days at risk (32%)

High sickness absence = persons with > 56 sickness events per 10,000 days at risk (36%)

Individuals whose sickness absence changed from a higher to a lower group after the introduction of the qualifying day - *reduced incidence* - were compared with those who did not change their sickness absence - *reference group*. Likewise, individuals whose sickness absence had changed from a lower to a higher group after the introduction of the qualifying day - *increased incidence* - were compared with the same reference group.

Duration of sick-leave events relative to the qualifying day: Mean and median duration of sick-leave events for each individual who had answered the questionnaire (2,628) were calculated for the period of April 1, 1992 to March 31, 1993 and for April 1,

1993 to March 31, 1994. The difference in mean duration of sick-leave events the year before and the year after the introduction of the qualifying day was also calculated.

Paper II and III

High and low incidence of sickness absence: In the analyses of paper II and III, we distinguished between subjects with a “low” and a “high” sickness absence, respectively. The low sickness absence group (60%) comprised people with no sickness absence (30% among women, 34% among men) or less than 55.25 sickness events per 10 000 days at risk which corresponded to, approximately, less than two events per year. The high sickness absence group (40%) comprised people with more than 55.25 sickness events per 10 000 days at risk, which corresponded to about two or more events per year.

Collection of exposure information

A questionnaire was mailed in the autumn of 1994. Non-respondents were approached through three reminders by letters and new questionnaires to induce a higher response rate. Finally, we telephoned 208 non-respondents selected at random, which resulted in 76 additional participants. Of the remaining non-respondents, 54 (26%) refused to participate without any explanation and the other 78 were either difficult to get in touch with or had specific reasons for not taking part. The total response rate was 76%, with a higher proportion among women (79%) than among men (74%).

The questionnaire comprised nearly 240 questions covering the following areas:

- The workplace and the work
- Environmental physical factors and work load
- Working hours
- Work mates and managers
- Work organisation
- Psychological traits
- Relation between work, family life and leisure time
- Health
- Family, domestic work and economy
- Life style factors

Often, we used the questions or scales developed in previous studies, e.g. (13,96).

Statistical analyses

Paper I

In the univariate analyses age-adjusted odds ratios with 95% confidence intervals were computed using the Mantel-Haenzel method. Multivariate analyses were performed by logistic regression (90).

Paper II and III

In general, the exposure variables were dichotomised into “exposed” and “unexposed” categories. When several levels/categories were analysed dummy variables were used. In the first phase of the analyses high sickness absence was analysed in relation to each variable separately adjusting for age differences. In the second phase variables within a certain study area (e.g. physical work environment and work load) showing a significant association (age adjusted) with sickness absence (or with an OR \geq 2.0) were further studied in a multivariate model within that study area. Subsequently, we analysed simultaneously variables from the different study areas (family, domestic work and economy; life style factors; physical, psychosocial and organisational work situation; health parameters). Variables associated with a high sickness absence in the previous multivariate analyses were selected according to the same criteria as before and were included in the final multivariate model. All multivariate analyses were performed by logistic regression, yielding odds ratios (OR) with 95% confidence intervals.

In paper II, factors showing significant associations with sickness absence for women and men, respectively, were analysed regarding possible synergistic effects (the extent to which the presence of one factor influenced the effect of the other). A synergy index (SI) was calculated according to methods suggested by Rothman (89), and with CI according to Hosmer and Lemeshow (37). A synergy index of 1 means no interaction, and a synergy index of 2 means an effect among those with combined exposure that is twice as high as would be expected from additivity of the two exposures. The analyses were carried out by computer programs described by Lundberg et al (65).

In paper III we estimated the attributable fraction (AF) for work-related symptoms/disorders as a measure of the proportion of all cases with a high sickness absence that could be explained by these symptoms given a causal association.

THE TWIN COHORT STUDY

The Swedish twin registry was first compiled in 1960 and extended ten years later. This registry includes in principle all same sexed twin pairs born 1886-1958 where both twins in the pair were alive at the time of registry compilation (18). Paper IV and V were based on the younger cohort comprising 18 516 women and 18 020 men born in Sweden between 1926-1958 (76). The objectives are indicated by the following titles.

- IV. Mortality among women and men relative to unemployment and time aspects of work.

V. Unemployment and other factors preceding early cause-specific death.

Study population

In the Swedish Twin registry there were 15 683 women and 14 287 men who answered a comprehensive mailed questionnaire in 1973. The overall response rate for this questionnaire was 85% for women and 79% for men.

The study population composed subjects responding to the 1973 questionnaire who reported a defined job title, i.e. 9 500 women and 11 132 men. A defined job title means that the subject had specified a main occupation in the questionnaire. Housewives, students, pensioners, persons on disablement pension, and persons in military service were not included.

Unemployment and time aspects of work

A short occupational history was recorded in the 1973 questionnaire including unemployment and the occupational factors focused in this study. In study IV three different measures of unemployment were analysed: ever unemployed, unemployed in 1973 and unemployed earlier but worked in 1973 (current, ever, former unemployment). These measures were constructed from the questions "Are you now or have you earlier been unemployed?" and "Are you employed at the present time?".

The analysis of overtime work was based on the question "How many hours/week do you work overtime?". For extra work (other than permanent work) the questions were "Have you now or have you earlier had an extra job? How many hours/week?".

In study V we also analysed short term versus long term unemployment, the former corresponding to unemployment less than one year in 1973, the latter corresponding to unemployment at least one year.

Social, behavioural, health and personality factors

In the analyses of the influence of unemployment on mortality a number of social, behavioural, health and personality factors were taken into account:

Marital status, children, education, smoking and alcohol habits, use of sleeping pills and tranquillisers, stress, shift work, personality factors (instability/extraversion), long-lasting or serious illness and socio-economic status.

The variables were dichotomised as follows: unmarried/divorced/widowed versus married and cohabiting; no children versus one or more children; elementary school versus more than elementary school; former smoker/smoker versus non-smoker; no alcoholic beverages/> 250 g alcohol/month versus 1-250 g alcohol/month; sleeping pills taken regularly or occasionally versus hardly ever; tranquillizers taken regularly or occasionally versus hardly ever; stressful life versus no stress; shift work versus no shift work; unstable personality (>4 points) versus stable personality (<5 points);

extravert personality (>4 points) versus introvert personality (<5 points); ever long-lasting or serious illness versus never long-lasting or serious illness.

A stressful life was measured by the question "Do you experience your everyday life as being very "stressful"?. The personality factors "instability" and "introversion-extraversion" were based on nine items each, selected from the "neuroticism" and "extraversion" dimensions of the Eysenck personality inventory. These short scales were developed to be used in comprehensive questionnaire investigations (28). The question "Have you ever had any long-term or serious illness?" was used as a global measure of ill health.

In study V we also took into account unskilled/skilled workers and low-level white-collar workers compared to medium- and high-level white-collar workers.

Mortality

Information about deaths in the twin registry is obtained on a regular basis by linkage to the National Causes of Death Registry. In study IV, mortality from any cause, from January 1973 to August 1997 was analysed in relation to unemployment. Mortality was analysed over the entire 24-year period as well as for different time windows, the first five years including 1973, the subsequent ten-year period and the remaining nine years of observation.

In study V, the cohort was analysed regarding mortality from specific causes of death from January 1, 1973 to December 31, 1996. Deaths were coded according to the International Classification of Diseases (ICD), eighth revision between 1973-1986, ninth revision between 1987-1996, and the two revisions were harmonised. The following underlying causes of death were analysed: malignant neoplasms ICD8 codes (140-209), malignant neoplasms of trachea, bronchus and lung (162), diseases of the circulatory system (390-459), ischaemic heart diseases (410-414), injuries, intoxications and other external causes (E800-E999), suicide (E950-E959), undetermined causes of deaths with uncertainty if caused by accident or by intention (E980-E989), alcohol related diseases (303, 571, 577) and other diseases (001-139, 210-389, 460-799).

Statistical analyses

Relative risks (hazard rate ratios) were estimated with 95% confidence intervals by means of Cox proportional hazards regression (20). In these analyses PHREG of the Statistical Analysis System (SAS 6.12) was used.

Firstly, the association between unemployment and mortality was studied with adjustment for age only. Secondly, potential confounding factors were analysed in relation to mortality. The factors yielding a RR > 1.30, or a lower confidence limit > 1.00 for either the entire study period or for the first five-year period were retained in a final regression model. Also, factors with a point estimate and an upper confidence limit < 1.00 were retained. The factors retained according to the criteria described were, for women: age, marital status, smoking and alcohol habits, use of tranquillisers, extraversion as a personality factor, and long-lasting/serious illness. For men, the

corresponding factors were: age, marital status, smoking and alcohol habits, use of sleeping pills, instability as a personality factor, and long-lasting/serious illness.

In study V differences in social, behavioural, health and personality factors between subjects with and without experience of unemployment were analysed by age adjusted prevalence differences with 95% confidence intervals.

Possible synergistic effects between unemployment and social, behavioural, health and personality factors were analysed according to methods suggested by Rothman, and based on odds ratios from logistic regression (89). Individuals unexposed to both unemployment and the other factor under study constituted the reference group. The synergy index was computed (65), indicating to what extent the presence of a certain factor influenced the effect of unemployment on mortality.

In the analyses described above the twin subjects were treated as a sample of individuals from the general population disregarding the twinship (18). To ensure that confidence intervals were not erroneously narrowed due to similarities within pairs we performed proportional hazards analyses that adjusted variance estimates for correlated outcomes (64,124,125). We accomplished this through the use of a SAS macro that stems from the same theoretical background and yields the same results as the published Fortran program of Lin (63).

The twin cohort opened a unique possibility to take into account a broad range of potential confounding factors including social class and environmental factors during early childhood and youth as well as social, behavioural, health and personality factors of adult life. We analysed mortality from all causes among 1 067 twin pairs discordant for unemployment, i.e. one of the twins was unemployed and the other was not. We used conditional logistic regression for matched data (PHREG of the Statistical Analysis System), to estimate the relative risk of death for the twin who had experienced unemployment, with his/her twin as reference.

RESULTS

THE SWEDEN POST STUDY

Paper I

Questions: Was the introduction of a qualifying day for sickness benefits associated with a change in the incidence of sickness absence? If such an association was present, was it modified by socio-economic (education, marital status, children, economy) and occupational factors (working hours, heavy lifting)?

A decrease in incidence of sickness absence was found for both women and men between 1992 and 1994, but a higher incidence for women compared to men remained throughout. The incidence of sickness absence varied over the year, and was highest during the period October to March. For the quarter prior to the introduction of the qualifying day, the incidence of sickness absence for both women and men was slightly higher compared with the corresponding quarter the year before.

The proportion of short periods of sick leave (1-3 and 4-14 days) of the total number of sick-leave events decreased between 1992 and 1994 and consequently the proportion of long-term sick leave (15-365 days) increased. For men an increase in long-term sick-leave events was also found in absolute numbers, from 460 events in 1992 to 502 events in 1994. Between 1992 and 1994 the proportion of subjects with no recorded events of sick leave increased slightly from 28 to 40 % for women and from 29 to 44% for men.

The incidence rate the year before the introduction of the qualifying day was 67 sickness events per 10,000 days for women and 57 events for men. The corresponding figures for the year after were 49 and 41, for women and men respectively. The incidence of sickness absence for subjects below the age of 40 showed a greater decline than that for older workers.

The decline in incidence of sickness absence was less pronounced in women with a long-term or serious disease than in other women. Unmarried or single men showed an indication to reduce their sickness absence to a lesser extent than married or cohabitant men. Among men with small children (0-6 years) there was a tendency to reduce the sickness absence, compared to men with no children at home. No association was found for the indicators of economic situation.

Men reporting heavy lifting at work had approximately 50 percent excess risk of increasing their sickness absence, and women showed a similar tendency. In addition, men in the oldest age group more often showed an increase in sickness absence than the youngest group of men.

Paper II

Questions: Which work-related factors are associated with the occurrence of high sickness absence? Are these factors in common for women and men or are they gender specific?

For women the strongest association with sickness absence was found for problems related to working in a forward bent position. These problems more than doubled the risk. Women with problems related to heavy lifting or monotonous movements also showed an increased risk of sickness absence. Furthermore, occurrence of bullying at the workplace almost doubled the risk of being in the high sickness absence group. Other features associated with a high sickness absence were "workplace with more than 50 people", "being a work team member", "seldom/never possibilities to discuss with the supervisor", and "social relations by trade-union work". Women who had been working instead of taking sick leave when ill also showed an elevated sickness absence. An interaction (synergy) was suggested among younger women with respect to "working instead of taking sick leave" and "complaints due to heavy lifting" (Figure 1). Overtime-work more than 50 hours during 1993, "seldom/never information meetings" and "work-related contacts outside the workplace", was associated with a lower sickness absence.

For men, anxiety of reorganisation of the workplace showed a strong association with sickness absence. After adjustment for other factors, the risk of being in the high sickness absence group was twice that of men who did not worry about reorganisations. Problems related to heavy lifting or to monotonous movements were also associated with sickness absence. Men reporting exposure to noise had a greater risk of an elevated sickness absence. The same was observed for "no supervisor position" and "would have preferred flexible working hours". As for women, men who reported that they had been working instead of taking sick leave when they were ill had a greater risk of high sickness absence. How the work was handled in case of sickness absence was also linked to sickness absence. A high sickness absence was associated with situations where colleagues or temporarily employed could take care of the duties in case of sick leave. A synergistic effect between "working instead of taking sick leave" and "anxiety about reorganisation" was found for men (Figure 1). A threefold increase in the relative risk was seen for men with both exposures. A decreased risk of sickness absence was found for men who reported over-time work more than 50 hours during 1993, and for men who experienced anxiety about downsizing.

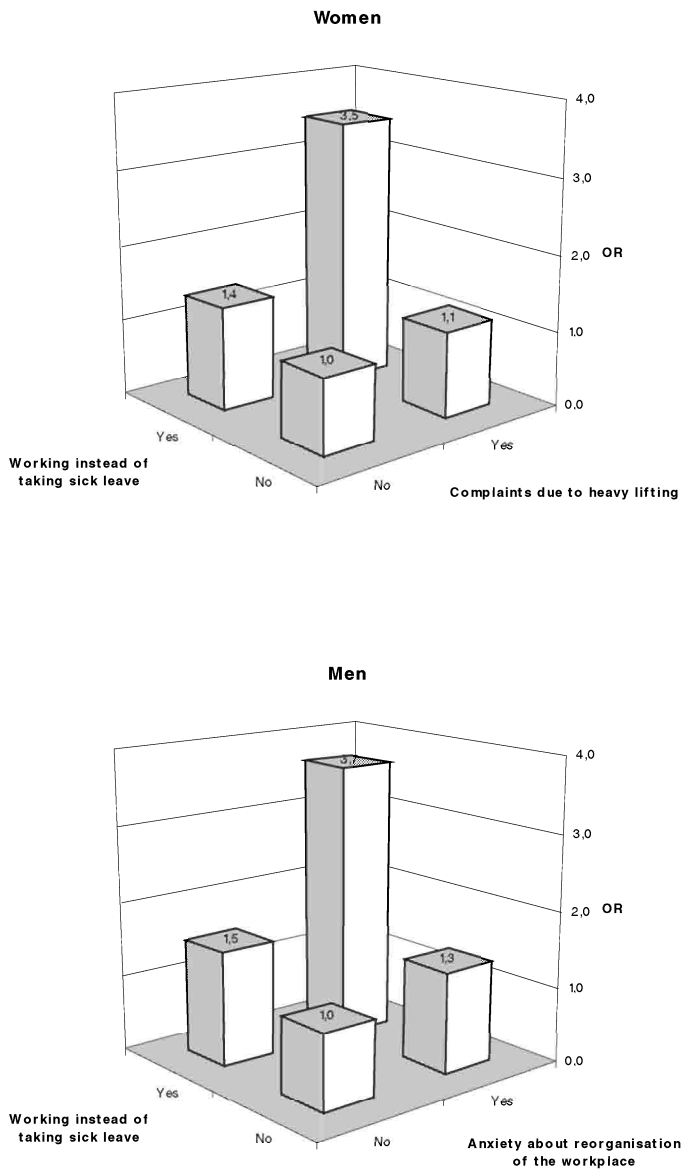


Figure 1. Incidence of sickness absence relative to the joint occurrence of sickness presentism and some other risk indicators.

Paper III

Questions: Which factors pertaining to social situation, family life and behaviour are associated with the occurrence of high sickness absence? Which factors are important determinants for high sickness absence, considering both subjective reports of illness, work related as well as non-work related factors?

Subjective symptoms and disorders

A high sickness absence was particularly common in subjects who had stayed at home due to unspecified uneasiness at work, with an OR (95% CI) of 3.9 (1.6-9.4) for women and OR of 5.9 (2.6-13.2) for men. Asthma related to work also showed a strong relation to sickness absence for both genders. For both these factors, however, the number of subjects exposed was rather small, and in terms of the attributable fraction (AF), taking into account the frequency of exposure, other factors were of greater importance in relation to a high sickness absence. These were: physical exhaustion after work (AF 26% for women and 28% for men), tiredness with inability to engage in activities after work (AF 24% for women and 27% for men), neck-shoulder complaints (AF 25% for women and 17% for men) and back complaints (AF 16% for women and men). The proportions of the study population reporting these problems were between 53% to 72%. Work related headache showed an increased risk of high sickness absence for both women and men. The difference in prevalence and OR between women and men resulted in an AF of 18 % for women compared to 8 % for men. The same difference in AF between women and men was also found for work related neck-shoulder complaints.

Factors at work and outside work relative to sickness absence

Women and men who had stayed at home more than two times during 1993 due to cold had a four-fold risk of high sickness absence. Long-lasting or serious illness more than doubled the risk of being in the high sickness absence group. Other important factors in common for women and men were complaints due to heavy lifting at work and working instead of taking sick leave. More than 50 hours over-time work during 1993 showed for both women and men a negative association with sickness absence.

The strongest association with high sickness absence for women was use of tranquillisers, with a four-fold risk compared to other women. Complaints due to work in a forward-bent position and need for recovery from staying at home with sick children were factors that more than doubled the risk of high sickness absence. Other determinants of high sickness absence were: a workplace with more than 50 employees, social contacts by active participation in trade union work, occurrence of bullying at the workplace, and regular smoking or snuffing. A negative association with sickness absence was found for seldom or never information meetings, work related contacts outside the workplace, and never at home taking care of sick children.

For men, anxiety about reorganisation of the workplace, adverse life events, being divorced and use of alcohol as sedatives doubled the risk of high sickness absence. Other factors associated with high sickness absence for men were difficulties in

making ends meet, no supervisor position, complaints due to monotonous movements, noise, desire to have flexible working hours, and fellow-worker or temporary employees taking care of the duties in case of sickness absence. On the contrary, anxiety about downsizing at the work place was associated with a decrease in sickness absence.

Among women, high domestic workload implied no association with sickness absence compared to women with lower domestic workload. But for married/cohabitant women with children at home a high domestic workload increased the risk by 60%. When also stratifying for working hours, high domestic workload among women working 40 hours or more per week showed an increased risk of 130% for high sickness absence. When stratifying the group of married women with children at home according to their economic situation, we found that a high domestic workload implied an increased risk of sickness absence among those with no economic difficulties. When analysing the effect of high domestic workload for married/cohabitant women with no children at home we found a decreased risk compared to women with low domestic workload. This reduced risk associated with high domestic workload was even more obvious in the subgroup of women who in addition worked less than 40 hours per week.

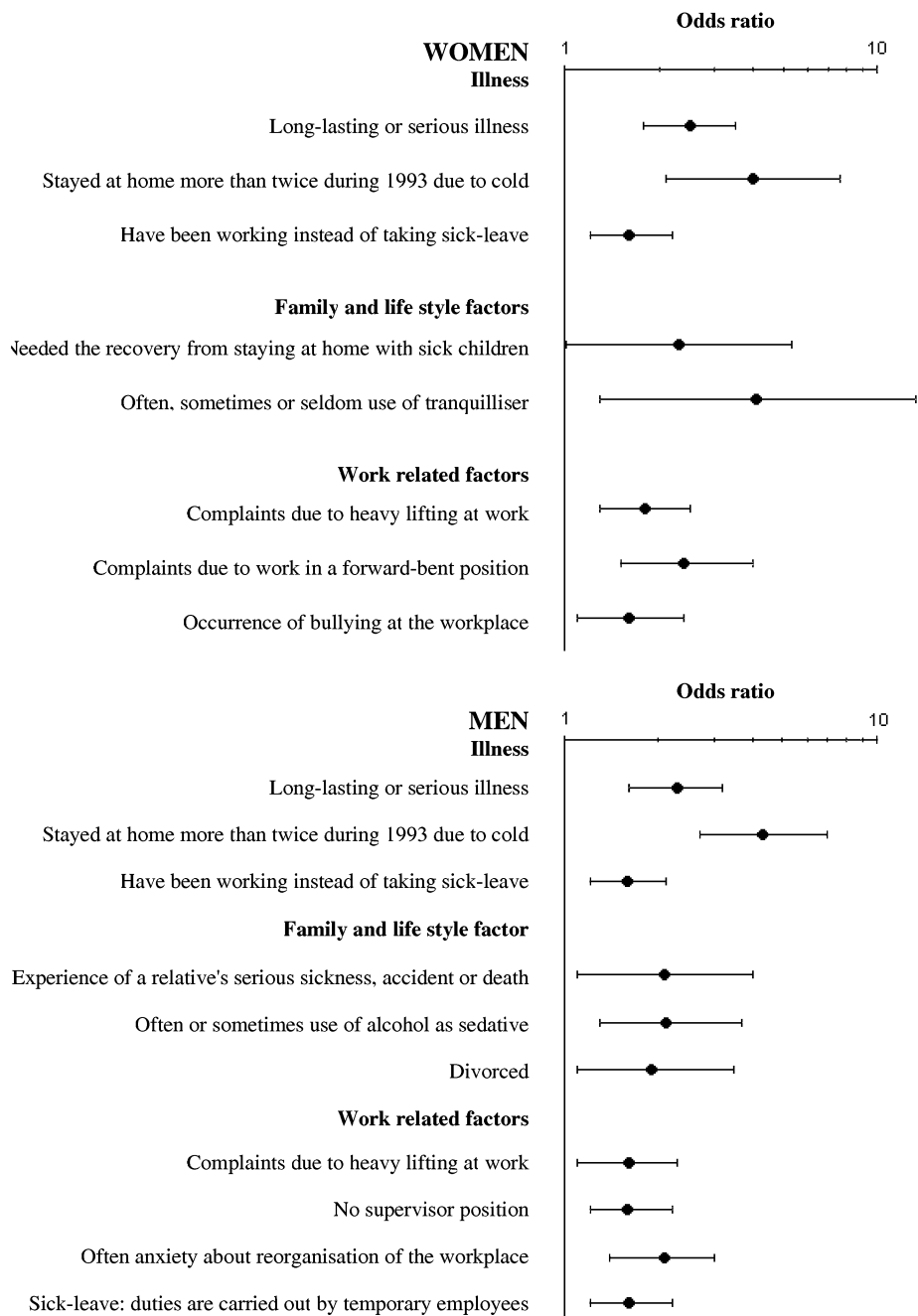


Figure 2. Important determinants of sickness absence for women and men. Odds ratios with 95 % confidence intervals.

THE TWIN COHORT STUDY

Paper IV

Questions: To what extent does unemployment predict early death, adjusting for potential influence from sociodemographic, life style, personality and early childhood factors?

Unemployment

For the 24-year follow-up, a more than doubled mortality rate was found for women who were unemployed in 1973 and a 40 percent increase in risk was found for those who reported that they had been unemployed earlier but worked in 1973. Ever unemployment yielded a 70 percent increase in risk. After adjustment for confounding, unemployment in 1973 still showed a clear association with mortality, but on a lower level.

Also for men an increased mortality was found for the 24-year period. The association was further strengthened in the analyses of the first five years of follow-up where an almost five-fold increase in mortality was found for those who were unemployed in 1973. The relative risks were somewhat lower when controlling for confounding.

Part-time work, overtime work and extra work

Men with part-time work showed an increased mortality even after adjustment for the confounding factors considered. For women no association between part-time work and mortality was found.

Men with overtime work, but less than 5 hours per week in 1973, showed a reduced mortality compared to those with no overtime at all. This finding also remained after adjustment for confounding. The same tendency was found for women. Overtime work of more than five hours per week was associated with an increased mortality among women. For men a similar relation was found only for the first five years of follow-up.

The mortality for men with extra work, but less than five hours per week was elevated compared to those with no extra work for the first five years of follow-up. Extra work more than five hours per week was associated with an elevated mortality rate among men, and this was more evident for the first five years of follow-up. For women no association was found for extra work after adjustment for confounding.

Study V

Questions: To what extent does unemployment predict early death from specific causes? Is the relation between unemployment and mortality further strengthened by the presence of other risk indicators?

Prevalence of social, behavioural, health and personality factors

For women elementary school, smoking, use of alcohol, use of tranquillisers, shift work, personality factors, illness and low socio-economic status showed at least a 10% higher prevalence among short-term and/or long-term unemployed compared to never unemployed. Being divorced and use of sleeping pills was also significantly more prevalent in the unemployed groups. A higher prevalence (a difference of $\geq 10\%$) among unemployed compared to employed men was observed for: unmarried, no children, smoking, use of tranquillisers, personality factors, illness and low socio-economic status. Furthermore, being divorced, use of sleeping pills, and shift work showed a significantly higher frequency among the unemployed, but with a prevalence difference less than 10%.

Unemployment and cause specific death

For unemployed women, external causes of death showed a doubled increase for the 24-year follow up period and a four fold increase in rate for the 10-year follow up period, adjusted for potential confounding factors. The association was attributable to suicides, and undetermined cause of death (with uncertainty if injury is caused by accident or by intention), but the cases were few for the latter category.

For men, the strongest association with unemployment was found for death from undetermined cause of deaths – with an almost six fold increase in mortality for the 24-year and the 10-year follow up when adjusted for potential confounding factors. An association was also found for deaths from all types of external causes.

In analyses adjusting for correlated outcomes, the confidence intervals of the mortality rate ratios were in general identical to those of the unadjusted analyses, showing little influence from the paired nature of the data.

Interaction between unemployment and other risk factors

The association between ever unemployed and mortality was strengthened by simultaneous exposure to some other characteristics. For women, a synergy index of 7.0 was found for the joint presence of experience of unemployment and use of sleeping pills. This indicates an effect on mortality seven times higher than expected if the effects of the two factors are added. For women three other exposures in combination with unemployment showed a synergistic effect on mortality, although the precision was weak due to small numbers: use of tranquillisers, extravert personality, and unstable personality. For men, elementary school, use of sleeping pills, long-lasting or serious illness, in combination with unemployment showed a mortality risk ratio that exceeded expectancy based on additivity.

Mortality in unemployment-discordant twin pairs

In the analysis of mortality within twin pairs, where one twin had experienced unemployment while the other had not, the estimated relative risk of the twin ever unemployed was 1.5 (CI=0.7, 3.1) for women. A corresponding estimate of 1.4 (CI= 1.0,

2.0) was found for men. Controlling, in addition, for social, behavioural, health and personality factors pertaining to adult life, lowered the relative risks marginally, 1.4 (CI=0.6, 3.4) and 1.3 (CI=0.9, 1.9) for women and men respectively. For women and men combined a 30% increase in mortality was found for the unemployed twins (RR 1.3, CI=0.9-1.8) compared to their co-twin without experience of unemployment.

DISCUSSION

THE SWEDEN POST STUDY

Several theories of the aetiology of sickness absence have been suggested. In this thesis the objective has been to identify exposures at work and outside work that may contribute to a high sickness absence. The integration of factors concerning different aspects of life, both at work and outside work, in the analyses is hoped to contribute to a more comprehensive understanding of this complex phenomenon. The work has been designed and carried out in the spirit of Kristensen (59) suggesting that single factors influencing sickness absence should not be regarded isolated from other factors. To our knowledge no previous study has had the possibility to simultaneously take into account a large variety of factors at work as well as outside work in the analyses of sickness absence.

The results showed that the introduction of a qualifying day was associated with a decrease in incidence of sickness absence and an increase of the mean duration of sick leave events. Furthermore, the results indicated that physical, psychosocial and organisational work environment factors as well as the situation outside work has an important influence on sickness absence for both women and men.

Presenteeism

Between 1992 and 1994 the proportion of subjects with no events of sickness absence increased from 28% to 42% in this study population. This period was characterised by recession, and the change in sickness absence may have different explanations. In part it is possible that some "over use" of the sickness benefit system was reduced. It is also likely that people to an increased extent was working in spite of illness. We do not know how this increase in presenteeism affects the individuals health in the long run but it can not be ruled out that it is associated with an increased ill health. Varying fractions of presenteeism (subjects with no sickness absence) have been reported in other studies – between 30% and 70% on a yearly basis (19,72,85,122). The variation can be explained by several factors e.g. country, growth or recession in the economy, and level of employment.

In general, it is desirable that a person suffering from illness is on sick leave in order to recover. In our study 37% of women and 56% of men reported that they had been working instead of taking sick leave in case of illness with a higher prevalence among those with high sickness absence. That subjects with a high sickness absence also more often than others are working when they are sick could be due to more health problems in general in this group. It may also suggest that working instead of taking sick leave leads to increased ill health and subsequently more sickness absence. How this "under use" of sickness insurance benefits affects the individuals in the long run is

not known but it is possible that it will cause more serious diseases or illness with longer periods of sick leave and prolonged rehabilitation. Sickness presenteeism has been found to be more prevalent among people in care and welfare service and in the sector of education (8,74). High sickness presenteeism has previously been found to be associated with high sickness absence and also with low income and "being hard to replace" (8). For men reporting that either colleagues or temporary workers took over the duties in case of sick leave there was an association with high sickness absence in the present study. This is consistent with the previous finding that people who were hard to replace to a higher degree reported sickness presenteeism (8). The gender difference found in the present study was not observed in the study by Aronsson et al. (8).

Illness and symptoms

The strong associations between sickness absence and long-lasting or serious illness and common colds was expected and indicates that sickness absence largely reflects disease or illness of an individual (19,69,122).

Physical exhaustion after work and tiredness with inability to engage in activities after work were the two most frequently reported symptoms in relation to sickness absence for both women and men. The association between neck-shoulder complaints and sickness absence was present in both genders. In national statistics of reported symptoms within the Swedish work force physical exhaustion is the most common symptom, although at a lower level (45%) than in this study (70%) (98). Pain every week in the upper parts of the back or neck was reported by 42% of the women and 24% of the men of the Swedish work force in 1999 (98), which is below the prevalence in this study. The differences between national statistics and our results can be due to physically heavy tasks being more prevalent in Sweden Post.

In the present study, 36% among women and 25% among men reported presence of recurrent headache. This is comparable to the figures for Sweden in 1999 where headache (every week) was reported by 33% of the women and 20% of men (98).

Assessment of sickness absence

There are several different measures of sickness absence described in the literature (34). In 1989 when the first part of the Sweden Post study started, we developed a measure of incidence of sickness absence with the purpose to identify workplaces with high sickness absence (55). This measure show how long time on average a person has been working before a spell of sick leave occurs. The incidence of sickness absence is most closely related to short-term sickness absence but it also takes long-term absence into account in the calculation of days at risk. The detailed data on sickness absence available from the Sweden Post register of absenteeism made it possible to calculate the incidence of sickness absence for each individual. The completeness and accuracy of the data was probably high, since the register of absenteeism was used for salary payments. Another advantage with use of this register was that it also included sickness absence < 15 days. Since 1992 when the employers were given the

responsibility for the sickness benefit, national data on sickness absence < 15 days are incomplete. Extensive efforts were made to calculate the “true” denominator (days at risk of sickness absence). All new events of sickness absence within five days of termination of a previous event for an individual were considered to belong to the same episode of sickness absence.

Assessment of exposure

Information about exposure was obtained from self-administered questionnaires. The questions were often based on earlier studies as well as national studies of the Swedish work force (13,96). Probably, the exposure assessment entails some misclassification. A non-differential misclassification of exposure (i.e. similar for subjects with and without a high incidence of sickness absence) would tend to dilute associations between exposure and sickness absence. This may have caused some actual associations to remain undetected. The exposure information pertaining to 1973, was collected the following year, i.e. after the year of sickness absence. It is possible that reports on exposure were influenced by the sickness absence during the preceding year, or by changes over time in the perception of the exposure. If the exposure assessment was influenced by the sickness absence this could introduce a differential misclassification of exposure (recall bias) that would influence estimates of associations between exposure and sickness absence in either direction from the true value. We do not believe that our results are influenced greatly by a differential misclassification of exposure. We used an independent data source for assessment of sickness absence and the exposure factors were in general simple and not controversial.

The structure of analysis

The structure of the analysis was decided with the intention to select markers/factors from different areas of the individual’s current life conditions that showed a strong independent relation to sickness absence. Even if several of these factors within a certain area were associated with sickness absence by a pathway in common, they were all included in the same regression model, in order to adjust for mutual dependence. Subsequently, the factors selected from each study area were evaluated jointly relative to sickness absence in order to compare the levels of association adjusting for mutual dependence. This could for example mean that more complex variables such as education were not retained in the final model. Instead, more specific variables like heavy lifting and exposure to noise (probably associated with education) were selected as significant markers for increased sickness absence.

For some factors, the inclusion in the regression models was coherent with a control for confounding, i.e. control for co-variation between factors of importance for the outcome measure, but through different causal pathways.

Non response and generalizability

The response rate of the present study was 76% which was normal for this type of study at the time of the data collection. As in every study, non-response is an important issue in particular regarding the generalizability of the results. Non

respondents had a higher sickness absence compared to those who answered the questionnaire. They were of similar age but the response rate was higher in women than in men. Besides these factors we did not have any information about the non-responders of the questionnaire which leaves some uncertainty regarding the comparability of respondents and non-respondents. It seems unlikely, however, that the associations between factors at work or outside work respectively and sickness absence would have been very much different if the non-participants had been included in the study.

From a previous study of sickness absence in the Sweden Post we know that there is an uneven distribution of sickness absence among different regions of Sweden (54,55). Major cities had higher incidence of sickness absence compared to more rural regions. The regions covered in this study comprise both rural and urban areas but subjects from big cities were not included. The dynamics of sickness absenteeism may be different in the larger cities and this may restrict the generalizability of the present results.

Work related physical indicators

The strong associations between physical workload and sickness absence found for both women and men in this study were expected. Several previous studies have also found these relations (14,26,48,59,109,122). In contrast to most previous studies we had the possibility to adjust in the analyses for several lifestyle and behavioural factors as well as health problems. Even if the reporting of psychological reasons for occupational diseases has increased, the most important causes of sickness absence in Sweden in 1999 were still ergonomic factors such as monotonous or strenuous movements or work postures (102). Noise was reported by 50% of the men and showed an association to high sickness absence of similar order as complaints due to heavy lifting and not having a supervisor position.

Organisational, psychosocial and behavioural indicators

Psychosocial and organisational factors at work have been found to be of importance for sickness absence, in particular low job control (52,82,83). This is further supported by the results of this study. In the present study, however, the importance of the psychosocial and organisational factors at work differed between women and men. It is generally accepted that social contacts and social networks may have a different meaning for women and men (86). Women who actively participated in trade union work had a comparatively high sickness absence in our study. Their work in the trade union might in part have been to help union members in difficult situations because of downsizing in the Sweden Post during this period. The lower risk of sickness absence among those seldom or never attending information meetings may reflect that recurrent information meetings were associated with negative information of e.g. reorganisation and downsizing.

For women there was an association between being at a workplace with more than 50 employees and high sickness absence, which is in accordance with other studies

(107,117). Smaller workplaces reduce anonymity and probably increase the perception of being needed. In addition it is possible that the social support is stronger at smaller work places.

We found that men reporting anxiety about reorganisation of the workplace had a doubled risk of being in the high sickness absence group. Threat of reorganisation of the workplace may have a negative influence on the psychosocial climate at work with effects on health and well being. Anxiety about downsizing, when also controlling for anxiety about reorganisation was associated with a decreased risk of sickness absence. The threat of losing the job may force an individual to attend at work in spite of health problems. The results are partly coherent with results from Finland (50,117).

Occurrence of bullying at the workplace was reported by 16% of the women and showed an association with sickness absence. Occurrence of bullying at a work place may reflect a bad psychological work environment. This is supported by a study of Vartia et al. where both the victims and those who witnessed the bullying experienced stress because of this (120). In the present study 8% of the women and 7% of the men reported being a target of bullying which is comparable with other studies from the Nordic countries where about 4% to 9% reported being victims (24,45,62).

The previously reported results about gender integrated showing reduced rates of sick leave was not supported by this study. It may be that Sweden Post differ in this respect compared to other workplaces (5).

Individual indicators

The strong association between use of tranquillisers and sickness absence for women may reflect a stressful situation, some psychiatric disorder or both. Previous studies have shown that women have higher rates of psychiatric disorders compared to men and this is associated with an increased sickness absence (33,94). In the Whitehall II study psychiatric disorders were the second most common cause of long spells of sickness absence (>21 days) for both women and men (94). On the other hand, we know from National statistics that work demands have increased during the 1990's for many workers which may have caused a stressful situation (98). In 1999, 72% of the women and 63% of the men in the Swedish Labour Force Survey reported an increase in the speed at which work was performed during the last five years (for those in the same occupation/profession).

For men, the associations found between sickness absence and experience of a relative's serious sickness, accidents or death, alcohol used as sedative, divorce and economic difficulties can be expressions of a strenuous situation. These unfavourable circumstances seem to affect health in a negative way and may lead to use an increased sickness absence. It is also possible that sickness absence for these men in part was a means of coping with a stressful situation (59). Our results are not consistent with those of Kivimäki et al. who found that stressful life events did not predict high sickness absence among men (52).

The balance between work and family life

Women in Sweden live longer than men and employed women have a better health than women outside the work force. In addition, women in Sweden have almost the same employment grade as the Swedish men, although they work part time to a greater extent, 41% among women and 9% among men. At the same time, women still have the main responsibility for the unpaid work concerning the family, children and the household.

In a study from Sweden, women spent significantly more time with unpaid work than men – with a mean time per week for women of 19 hours and for men of 12 hours. Typical for women's work were more time pressure and hindrance (due to different aspects of the work organisation) as well as high demands of attendance and long travelling time to work (38). Concerning the private sphere, women largely had the main responsibility for home, family and domestic work and they also spent more time with these duties compared to men.

In the present study, having children at home was not associated with high sickness absence for either women or men. This is consistent with the results of Vogel et al. (122) who showed that both women and men with children (<7 years) had the same number of sick leave events as women and men without children. In addition, having children has shown to be associated with a lowered risk of repeated short spells of sickness absence but an increased risk of long spells among women (14). In contrast, a French study showed that the proportion of women absent from work increased with increasing number of children (14,19). A lower sickness absence among men with children than among women with children has also been reported (14,130). Single mothers have been found to have higher sickness absence compared to married and co-habiting mothers, mostly due to longer spells (14,122).

We observed that women who reported that they needed recovery from staying at home with sick children showed a high sickness absence. One possible explanation for this could be that infectious diseases are transferred from the child to the mother. This is also consistent with our observation of a protective effect from never having been at home with sick children. In the study by Mastekassa it was found that both women and men with small children had a higher sickness absence due to respiratory conditions (72).

Sickness absence and other morbidity differences between women and men are often explained by the double burden among women. The doubled role may consist of both role overload (too much to do) and a role conflict (conflicting expectation and demands). This situation could be detrimental to health or it could give positive health effects – the role enhancement theory. In one study sickness absence was analysed relative to the combination of paid work and marital status and number and ages of children as a measure of family obligations (72). The results could not support either the role overload or the role enhancement and the author concluded that these factors probably counterbalanced each other. In another study Hibbard (35) concludes that "the combination of employment and domestic roles apparently poses no health threat

to women, and may provide some advantage". Krantz et al. studied more detailed information of domestic workload relative to subjective symptoms and found that the double exposure (high domestic responsibility and experience of job strain) increased the odds for common symptoms in employed Swedish women (57).

To our knowledge there are no other studies that have analysed sickness absence relative to more detailed information about domestic workload in combination with paid work. In the present study, 67% of women and 6% of men carried out the main part of the everyday domestic work, and this showed no association with sickness absence. When analysing subgroups of married/cohabitant women we found that high domestic workload increased the risk of sickness absence among married/cohabitant women with children at home and this association was stronger for women who also worked 40 hours or more per week. The protective effect of high domestic workload among married/cohabitant women with no children at home might imply that high domestic workload in this situation is not as extensive as for women with children and therefore it does not reach a "high-strain level". From these results it seems as if the total level of workload from gainful employment and domestic work is of importance for sickness absence.

High control over working time has recently been suggested as a condition that makes it easier to combine working life with private life – especially for women (1). In this study we did not find any support for this among women while for men a desire to have flexible working hours was associated with a high sickness absence. A desire to shorten or lengthen the hours of work was not associated with sickness absence.

Pregnancy has been discussed as an explanation for some part of the higher sickness absence among women. In this study, we could not separate sickness absence related to pregnancy from other causes of sickness absence. In one study it was found that exclusion of pregnant women (5% per year) in the analyses resulted in that the excess female rate of sickness absence was halved, but was still 25% higher than for men (6,104). With the same proportion of sickness absence due to pregnancy in our study about 30 (5% of 604 women) to 36 (6%) women should have been pregnant during 1993. The inclusion criteria for the study of being at work during the main part of 1993 and still employed in September 1994 imply that some of the pregnant women were not included. It is possible that the estimated rates of incidence of sickness absence and the number of spells among women were slightly overestimated due to pregnancies (Study I). In the studies of risk factors of sickness absence (Study II and III) some women were probably included in the high sickness absence group due to pregnancy. If these pregnant women have physically or mentally demanding work tasks and report this in the questionnaire it could have given a stronger relation between sickness absence and work related factors. On the other hand, if these women had less physically and psychosocially demanding jobs this may have reduced some of the observed associations.

THE TWIN COHORT STUDY

The Swedish twin registry linked with the Swedish causes of death register provided a possibility to study the relation between unemployment and premature mortality, taking into account several potential confounding factors. Previous studies have in a consistent way shown an increase in mortality among unemployed individuals, as shown in Table 1. Most of these studies have had limited prerequisites to control for confounding, and the strength of the present study is the possibility to adjust for a wide range of characteristics that may be linked to unemployment.

Also in this study, unemployment was followed by increased mortality among both women and men in a short but also in a long-term perspective. The relative risk of overall mortality for the first ten years of follow-up was of the same order as for the 24-year follow-up. A follow-up of 24 years is considerably longer than that of previous studies (cf. Table 1), where the time of observation has varied between three and ten years. When comparing results across studies it may be crucial to consider the length of the study period. Our results indicated based on a small number of exposed cases, that this may be essential for some specific causes of death.

Some individuals tend to experience a descending spiral in which they become increasingly at risk from one form of disadvantage after another (79). This is in general not addressed in epidemiological studies to the extent it deserves. One method of evaluating the importance of an accelerating risk accumulation is analyses of interaction. The association between unemployment and mortality was in this study even more pronounced among women who also reported use of sleeping pills or tranquillisers, and among men a simialar effect was seen for men with low education, and/or serious or long lasting illness.

Injuries, intoxications and other external factors were important causes of death among the unemployed, particularly suicides and undetermined causes, the latter meaning that there was uncertainty if injury was caused by accident or by intention. This is consistent with results from other studies. Previous findings of an increased risk of cancer mortality and death from ischaemic heart disease among unemployed was partly supported by the present results but the precision was comparatively weak (cf. Table 2).

According to Jahoda the effects of unemployment, besides the economic deterioration, may be the loss of social contacts, work identity and time structure of the day (41). Nordenmark has emphasised the importance of the extent to which the unemployed is able to cope with the situation of unemployment (81). He found strong support for the view that employment contributes to life satisfaction. In addition, unemployed individuals that subsequently found a paid job seemed to improve their mental health compared to those who continued to be unemployed. In a study by Stefansson it was suggested that having a job is of less importance for women compared to men (99), while other studies indicate that employment is of similar importance for both men and women. In a Swedish study, unemployed women missed their job to the same extent as unemployed men (80).

Exposure assessment

Information on current or previous experience of unemployment was collected at one specific point in time. This gave incomplete information on how many times and for how long the individual had been unemployed. In addition, we had no information on unemployment during the follow-up, i.e. after 1973. Some of those classified as employed at base line probably became unemployed later, and among those classified as unemployed there may be a great difference of unemployment and recurring events after 1973. It is reasonable to assume that the information on employment status has a better validity for the time period closer to the data collection.

An obvious problem when comparing studies of unemployment is the great variation in the definition of the unemployed. In many of the census studies referred to in the thesis the unemployed were those who were seeking a job on a fixed day or week (21,40,70,78,79,92). Apparently subjects experiencing only a very short period of unemployment were included in the exposure group in these studies together with other categories of unemployed, while other studies only considered subjects with long-term unemployment. In addition, there may be individuals outside the work force with different types of ill health or other problems that do not even consider themselves available for joining the work force and thus will not be considered as unemployed.

Mortality

Vital status was assessed by linkage to the nation-wide cause of death register, which has essentially no loss of deaths. The validity of specific causes of death is dependent on the quality of the death certificates and the prevalence of autopsy. Even if the proportion of autopsies has decreased in Sweden during the last decades, the validity of the diagnostic information should still be satisfactory for the type of analyses conducted. Notably, one reason for the difference in results concerning suicides in different studies could be attributable to differences in the diagnostic codes.

Among women, the number of overall and cause specific deaths during the first five and ten years was small, which sometimes lead to imprecise results. Among men, the precision was also decreased due to small numbers of deaths, particularly for the shorter time periods. On the other hand, the estimates for all causes of death were higher for the first five-year period when unemployment in 1973 was analysed, and also for the ten-year follow up when ever unemployed was analysed. This could partly be due to changes over time in employment status that would tend to reduce the relative risk estimates after several years of follow-up.

Confounding

In the discussion about associations between unemployment and health, confounding has often been brought up as a problem of interpretation. In accordance with other studies several factors related to mortality were significantly more prevalent among the unemployed compared to the never unemployed in the present study (42,66,77). A major advantage was the possibility to control for several potential confounders in the

analyses, such as marital status, having children, education, smoking and alcohol habits, use of sleeping pills and tranquillisers, stress, shift work, personality factors and long-lasting or serious illness as well as socio-economic background and other conditions of early childhood and youth. After adjustment for these factors, the relative risks were reduced but still suggesting an effect from unemployment on mortality. Despite an extensive control for potential confounders in the present study, there might still be residual confounding, for example due to misclassification. The results suggest that crude associations between unemployment and subsequent mortality to some extent is influenced by confounding.

The association between unemployment and mortality may in part be due to a selection of subjects with an impaired health status, that people are predisposed for unemployment due to ill health. It may also be that unemployment induces risk behaviours and risk conditions (40,42,70,71). In the present study the cross sectional data for both unemployment and the social, behavioural, personality and health indicators did not permit a clear determination of the chronological sequence, i.e. covariates preceding unemployment and covariates following unemployment - or to what extent both mechanisms were operating. Low education, shift work, personality factors, serious or long-lasting illness and low socio-economic status should be comparatively stable over time and it is likely that they preceded unemployment. These characteristics could therefore be interpreted as potential determinants for selection into unemployment rather than a consequence of unemployment.

It is possible that divorce, use of sleeping pills and use of tranquillisers could be consequences of unemployment. This is consistent with our result that among women there were associations for these factors with long-term but not with short-term unemployment. For men, divorce, smoking, and use of sleeping pills were also more common among long-term compared with short-term unemployment. To adjust for covariates that constitute a link between the exposure and the outcome, could mean that the effect of the exposure that is focused is eliminated or reduced incorrectly. It is possible that such effects influenced some of our relative risk estimates.

A twin population offers additional analytical possibilities to adjust for confounding compared to a representative sample from the entire population. The twin control method is based on pairs where one twin is exposed and the other unexposed. In comparisons within these pairs, common early environment and shared genetic factors are taken into account.

In this study, one twin had experienced unemployment and the other had not. The result showed an increased risk of death before the age of 70 for the exposed twin compared to his/her co-twin, but the analyses were based on a small number of cases. It is notable, that the twin pair analyses, incorporating control of early childhood factors as well as factors during adult life, yielded risk estimates comparable to the analyses based on individuals.

Non-respondents

Higher rates of mortality were found among those who did not answer the 1973 questionnaire compared to the respondents (10.5 % versus 7.5 % among women and 7 % versus 4.5 % among men) (84). It is possible that the non-respondents comprised an excess number of unemployed subjects. It may be reasonable to assume that the mortality among unemployed was of at least the same magnitude in non-responders as in responders and that the difference in mortality between unemployed and employed was of about the same order in non-responders as in those responding to the questionnaire. Therefore, we think that a potential selection bias has reduced rather than produced the associations found between unemployment and mortality.

Influence of general unemployment level

It has been suggested that the general level of unemployment is of importance for the health effects that may follow, with stronger effects for example during times of low levels of unemployment (71). In the present study unemployment refers to 1973 and earlier when the level of unemployment was comparatively low. The potential for effect modification by the prevalence of unemployment is an interesting question also in studies exploring the potential health effects among those who were unemployed during the 1990's when the levels were high. If the relationship between unemployment and mortality is modified by the current prevalence, this could also in part explain differences in results across time and place.

CONCLUSIONS

Changes in the sickness benefit system influence sickness absence. A decrease in sickness absence was observed after the introduction of a qualifying day. The proportion of long-term sick-leave events (15-365 days) increased; among men, long-term events of sickness absence increased also in absolute terms.

Few factors seem to modify the reduction in sickness absence following the introduction of a qualifying day. Exceptions were that women with long-term or serious disease did not show a reduction to the same extent as others and men with heavy lifting at work showed more often than others an increase in incidence. There were no suggestions of the individual's economic situation being an important determinant for a reduction in sickness absence.

Ill health is, compared to other factors, the most important determinant for sickness absence. Long-lasting or serious illness and frequent colds showed the most significant associations with high sickness absence. Among both men and women, the most common subjective symptoms among those with a high sickness absence were physical exhaustion after work and tiredness prohibiting leisure time activities.

Conditions of working life and private life are related to sickness absence. Taking into account the mutual dependence of factors at work and outside work:

The strongest work related determinants for high sickness absence were for women: complaints due to work in a forward-bent position, complaints due to heavy lifting, occurrence of bullying at the workplace, and working while ill (sickness presenteeism). For men, the most prominent characteristics were anxiety about reorganisation of the workplace, working while ill, no supervisor position and complaints due to heavy lifting.

Among factors outside work, women with high sickness absence reported more often than others use of tranquillisers, and a need to recover from staying at home with sick children. Among married/cohabitant women with children, a high domestic workload increased the occurrence of high sickness absence. Among men, experience of a relative's serious sickness, accident or death, use of alcohol as sedative, and divorce were important determinants.

There may be an excess of vulnerable individuals who encounter unemployment, but unemployment seems to increase the risk of early death even after adjustment for several social, behavioural, health, personality, and early childhood factors. Among both women and men, unemployment was associated with increased mortality before 70 years of age. The association between unemployment and mortality was even more pronounced among women using sleeping pills or tranquillisers and/or with certain

Work and health

personality traits, and among men with low education, and/or serious or long lasting illness.

The increased mortality among unemployed women and men was mainly attributable to an increased mortality from suicides and accidents or injuries with uncertainty if caused by accidents or by intention.

SAMMANFATTNING (Summary in Swedish)

Förekomst och kostnader för sjukfrånvaro i Sverige har varierat väsentligt under senare år. Det finns också betydande regionala variationer i förekomst av sjukfrånvaro inom landet med en högre frekvens i de norra delarna. Flera studier har visat att sjukfrånvaro tenderar att vara vanligare bland kvinnor än bland män och ett stort antal faktorer förutom nedsatt hälsa har diskuterats som möjliga orsaker till sjukfrånvaro.

Sverige har en lång tradition av låg arbetslöshet. Under senare år har det skett betydande förändringar på den svenska arbetsmarknaden som bland annat har medfört en ökad arbetslöshet. Stora befolkningsbaserade studier, genomförda bland annat i de Nordiska länderna, har visat att arbetslöshet har ett samband med ökad risk för tidig död. Det är dock oklart i vilken utsträckning detta återspeglar ett orsakssamband mellan arbetslöshet och dödlighet.

Det övergripande syftet med denna avhandling var dels att studera faktorer i och utanför arbetet i relation till sjukfrånvaro där dessa faktorer analyseras i ett sammanhang och utifrån ett gender perspektiv. Det andra syftet var att analysera samband mellan arbetslöshet och total dödlighet samt även dödlighet i specifika dödsorsaker med hänsyn tagen till sociodemografiska faktorer, levnadsvanor, personlighet samt uppväxtmiljö.

I analyser av sjukfrånvaro utgjordes studiepopulationen av samtliga anställda vid tre regioner inom Svenska Posten (n=3 470). Sjukfrånvarodata för perioden 1992-1994 från Postens eget frånvaroregister ligger till grund för beräkning av sjukfallsincidensen, dvs antal sjukfall i relation till antal dagar under risk att insjukna. Ett omfattande frågeformulär utsändes 1994 med frågor om den fysiska och psykosociala miljön i arbetet samt om frågor angående familjesituation, hushållsarbete, ekonomi, hälsa och fritidssysselsättning.

Studien grundas på data från det svenska tvillingregistret. Cirka 30 000 tvilling-individer födda 1926-1958 besvarade 1973 ett omfattande frågeformulär. Studiepopulationen utgörs av de som i formuläret uppgav en yrkestitel (n=20 632 individer). Dödsfall totalt sett samt för olika dödsorsaker analyserades i relation till arbetslöshet under perioden 1973-1996. Totalt inträffade 424 dödsfall bland kvinnorna och 836 dödsfall bland männen. Dödlighet analyserades med hänsyn tagen till möjliga confoundingfaktorer, dvs ålder, socioekonomisk grupp, utbildning, civilstånd, barn, rökning, alkohol, stress, bruk av lugnande medel och sömnmedel, personlighet, långvarig eller allvarlig sjukdom samt uppväxtmiljö.

En minskad incidens i sjukfrånvaro observerades efter introduktionen av en karensdag 1993. Däremot ökade andelen långa sjukfall (15-365 dagar bland både kvinnor och män – för männen även i absoluta tal. Långvarig eller allvarlig sjukdom liksom återkommande förkylningar var förenade med en hög sjukfrånvaro. Personer med hög

sjukfrånvaro rapporterade ofta fysisk utmattning efter arbetet och trötthet som omöjliggjorde fritidsaktiviteter. Bland kvinnor observerades ett samband med sjukfrånvaro framförallt för besvär på grund av arbete i en framåtböjd arbetsställning och till följd av tunga lyft, förekomst av mobbning på arbetsplatsen och arbete trots sjukdom (sjuk-närvaro). Bland män förelåg en ökad sjukfrånvaro för personer som rapporterade oro för omorganisation av arbetsplatsen, arbete trots sjukdom, avsaknad av chefsställning och besvär till följd av tunga lyft.

Beträffande faktorer utanför arbetet var användande av lugnande medel och "att vara hemma för vård av sjukt barn ger en nödvändig återhämtning för att orka med arbetet" relaterat till en ökad risk för sjukfrånvaro bland kvinnor. För gifta eller sammanboende kvinnor med barn innebar huvudansvar för hushållsarbete också en ökad risk för sjukfrånvaro. Bland män innebar erfarenhet av allvarlig sjukdom, olycka eller död för en anhörig, användning av alkohol som lugnande medel och skilsmässa att risken för sjukfrånvaro ökade.

Arbetslöshet var förenat med en ökad dödlighet bland både kvinnor och män efter det att hänsyn tagits till ett flertal sociodemografiska faktorer, levnadsvanor, hälsoförhållanden, personlighet och tidiga uppväxtförhållanden. Dessa samband föreföll att förstärkas om arbetslöshet kombinerades med användning av lugnande medel eller sömnmedel, vissa personlighetsegenskaper, låg utbildning eller långvarig eller allvarlig sjukdom. Den ökade dödligheten hos personer med erfarenhet av arbetslöshet kunde till en del tillskrivas en ökad dödlighet till följd av självmord och skador där det förelåg oklarhet om den orsakats av olycka eller avsikt.

Sammanfattningsvis tyder resultaten i denna avhandling på att förändringar i sjukersättningsystemet liksom ett flertal faktorer i och utanför arbetet, förutom nedsatt hälsa, påverkar risken för sjukfrånvaro. Några av dessa faktorer var betydelsefulla för både kvinnor och män, men de flesta var specifika. Dessutom talar resultaten för att arbetslöshet ökar risken för tidig död bland både kvinnor och män, delvis till följd av en ökad risk för självmord, och att denna ökade risk inte kan förklaras av skillnader avseende sociodemografiska faktorer, levnadsvanor, personlighetsfaktorer och tidig uppväxtmiljö.

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