Sickness Absence with Musculoskeletal Diagnoses

–An Eleven-Year Follow-Up of Young Persons

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To the memory of my grandmother Sonja
Abstract

**Background:** In Sweden, as well as in most Western countries, sickness absence is a major public health problem that has increased in recent years. This is a complex phenomenon related not only to ill health factors, but also to other factors on the levels of the individual, the family, the workplace, and the society. Most studies of sickness absence are cross-sectional, which makes it difficult to investigate aetiological factors. A longitudinal study design is preferable, because sick-leave spells can have a long duration and are often due to chronic or recurrent disorders.

**Objectives:** The aim of the present research was to conduct a pilot study to gain further information about factors associated with sickness absence and disability pension, perceptions of contacts with rehabilitation professionals, and self-rated health over time among younger persons initially on sick leave with low-back, neck, or shoulder diagnoses.

**Material and methods:** An eleven-year prospective cohort study of all individuals who, in 1985, were aged 25–34 years, lived in the municipality of Linköping, Sweden, and had a sick-leave spell $\geq$ 28 days with low-back, neck, or shoulder diagnoses ($n = 213$, 61% women). The following information was obtained from registers: number of sick-leave days and spells in 1982–1984; diagnosis and demographical data in 1985 (age, sex, occupation, citizenship, marital status, and income); data on each sick-leave period (date, full/part time), disability pension (date, diagnoses, temporary/permanent, full/part time); emigration (date), and death (date, cause) from 1985 to 1 September 1996. In 1996, a questionnaire was sent to members of the cohort (response rate 73%). Different measures were used to analyse sickness absence and disability pension over the eleven-year period, possible risk factors for disability pension were tested by Cox regression, and possible factors predicting future low levels of sickness absence were tested by logistic regression. Based on the questionnaire perceptions of encounters with rehabilitation professionals were analysed with factor analyses and linear regression, and the so called health-line (a method to collect data on self-rated health over time) was tested, and the results were compared with data on sickness absence and disability pension.
Results: The members of the cohort turned out to be a high-risk group for disability pension. After 11 years, 26% of the women and 14% of the men had been granted such benefits, mainly due to musculoskeletal diagnoses, but also with psychiatric diagnoses for half of the men and 17% of the women. Full-time pension was granted more often to men than to women. The women had higher levels of sickness absence. An extended Cox regression model proved suitable for prediction of disability pension. Taking citizenship and long-term sickness absence into consideration, the women had a 1.9 times higher risk of being granted disability pension than the men. Predictors for future low levels of sickness absence were a history of low sickness absence, having a white-collar job, and being married. These associations were not discerned when a pathogenic approach was used, which implies that factors other than the opposite risk factor for disability pension are associated with future low sickness absence. Three dimensions of the individuals’ contacts with professionals were identified: supportive treatment, distant treatment, and empowering treatment. Women perceived both social insurance officers and health care professionals as more supportive than the men did. Contact with social insurance officers was experienced as more supportive and empowering by persons on disability pension than by those not receiving such benefits. Data collected using the health-line (i.e., self-rated health from 1985 to 1995) was correlated with data on annual mean number of sick-leave days and days on disability pension. No tendency to recall bias was noted.

Conclusions: Additional research is needed to elucidate the situation of women on sick leave with low-back, neck, and shoulder diagnoses. Further testing and practical application of statistical and epidemiological models for analysing sickness absence and disability pension data should be carried out to ascertain the validity and usefulness of such models.

Keywords: sickness absence, sick leave, ill health, disability pension, musculoskeletal diagnoses, low back, neck, shoulder, clients’ perceptions of treatment, health-line, self-rated health.
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PAPERS I-VI
List of papers

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


IV. Borg K, Hensing G, Alexanderson K. Prediction of future low levels of sickness absence among young persons sick listed with low-back, neck, or shoulder diagnoses. Submitted.


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Terminology

The field of research dealing with sickness absence is in its infancy. Consequently, the scientific jargon in this area of study includes a number of terms and concepts that are often poorly defined (1-4). In this thesis, the following terminology is used:

*Sickness absence* and *sick leave* — used as synonyms to indicate temporary absence from work due to reduced work capacity caused by disease or injury and registered at the Swedish social insurance offices. Qualifying circumstances are presented below.

*Sick-leave day* — a day when a person is on sick leave.

*Sick-leave period* — the continuous period of sick-leave days a sickness certificate is valid for. When such a period is certified by a physician the diagnosis, the degree (e.g., half time), and type of sick leave (e.g., work injury compensation) are constant. Sick-leave periods <8 days can be self certified.

*Sick-leave spell*—consists of one or more connected sick-leave periods, without any interruption.

*Sickness certification*—issuing of a medical certificate by a physician to confirm that a person has a reduced work capacity due to disease or injury.

*Disability pension*—temporary or permanent pension granted due to disability (in the literature, sometimes called early retirement on medical grounds); can be granted before the age of retirement to a person whose work capacity has been reduced for a longer period of time or permanently due to disease or injury.

*ICD*—International Classification of Diseases (ICD) published by the World Health Organization; ICD10 is the latest revision.
Background

In Sweden, as well as in most Western countries, sickness absence is a major public health problem that has increased in recent years (5-7). This is a complex phenomenon related not only to ill health, but also to other factors on the levels of the individual, the family, the workplace, and the society (8). Sickness absence has been a study object in several academic disciplines, including medicine, history, economy, and sociology (9), but the knowledge base on this subject is still limited. Also, the perspectives of researchers have varied, at times focusing on the individual, the workplace, health care, the social insurance offices, or society in general (4).

Most analyses of sickness absence are based on cross-sectional studies, which makes it difficult to investigate aetiological factors. A longitudinal design is preferable, because sick-leave spells can have a long duration and recurrent spells and chronic problems are common. Lately, discussions have concerned the diagnosis and its importance in sickness absence, although few reports in the literature deal with the subject. Furthermore, little information has been published about the contacts between people on sick leave and the rehabilitation professionals.

Data on sickness absence can not be used as a measure of morbidity, because sickness absence is related to the ability to work, which varies greatly with the occupation under consideration. The most common research approach has been to use data on sickness absence as a measure of social consequences of ill health (10). Data on sickness absence has also been used as a risk factor when analysing further sickness absence and disability pension, future ill health, and marginalisation in terms of decreased chances of returning to work (11-13). Few studies focus on predicting future low levels of sickness absence, which can be referred to as a salutogenic approach.

Musculoskeletal disorders constitute the most common diagnoses behind both sickness absence and disability pension in the working population (14-16). During the past few years, sickness absence due to these diagnoses has increased, more so among women than men. However, among persons who have been granted a disability pension in Sweden in 1995–2001, the proportion receiving such benefits due to psychiatric diagnoses has increased, both for women and men.
while the fraction explained by pension due to musculoskeletal diagnoses has decreased to about the same extent.

Health, disease, illness, and sickness
The broad concept of health has been the subject of extensive discussion and many definitions (18). Boorse (19) gave a biostatistical definition of health by first defining the word disease as a dysfunction within an organ or a system of an individual, and then describing health as the absence of disease. Nordenfeldt (20) presented a more holistic view, defining a healthy person as someone who is able to realise his or her vital goals or the set of goals that are necessary, and together sufficient, for minimal happiness. According to Nordenfeldt’s definition, a person can have a disease and still be healthy in terms of attaining vital goals. For example, a person with a disease such as diabetes is not necessarily unhealthy, as long as that condition does not stop the individual from attaining his or her goals in life. The classical definition of health coined by the World Health Organization (WHO) in 1948 referred to “a state of complete physical, mental, and social well being” (21). In 1986 (22), that definition was changed to indicate that health is a major resource in daily life that allows individuals to achieve the fundamental goals of social, economic, and personal development.

Studies have shown that self-rated health has a prognostic value for future morbidity and mortality (23, 24). However, methods of measuring self-rated health over time are seldom discussed, and few investigations have considered the relationship between sickness absence and self-rated health, none of which were conducted with a longitudinal perspective.

Ill health is often defined in terms of disease, illness, and sickness, and the interpretation of these concepts varies somewhat in the literature (18, 25-27). The following definitions of these terms are used in this thesis:

- **Disease** is the part of ill health that, at a certain point in time, can be diagnosed by medical science. Data on disease can often be obtained from different types of registers in Sweden.

- **Illness** is the symptom or symptoms of ill health that a person her- or himself registers and reports. Data on illness is often collected through interviews or questionnaires.
• Sickness is the social role assigned to or assumed by a person with a disease or illness in a specific culture and at a certain point in time, exemplified by the sickness absence of an individual. Data on sickness can be obtained through, among other channels, registers covering sickness absence, disability pension, or disablement benefits, or by the use of interviews or questionnaires.

The data underlying this thesis concerned sickness absence, disability pension, and self-rated health.

Low-back, neck, and shoulder disorders

Low-back disorders are very common today, and a historical review (28) has indicated that people have always suffered from complaints of this sort. Investigators in different studies have mentioned a life-time prevalence of 51–81%, indicating that up to 81% of the population will suffer from low-back pain at one time in their lives (29). Similarly, life-time prevalence of neck pain has been reported to occur in 67–71% of a population, and a prevalence of 17–19% was mentioned when considering such disorders that lasted at least three months (30).

The prognosis is usually very good for people suffering from back problems, with a recovery from all symptoms within 10–15 days in more than half of the cases, and within six weeks for up to 90% of the cases (31). However, in a small proportion of these individuals, the problem remains or becomes chronic, which can result in decreased work capacity, eventually and leading to long-term sickness absence.

As mentioned above, low back, neck, and shoulder disorders constitute the most common diagnoses behind both long-term sickness absence and disability pension in Sweden as well as other Western countries (15, 32-36). Surprisingly, there are few, if any, effective rehabilitation programs for these disorders (37, 38). More studies have focused on low-back problems than on neck and shoulder disorders (15). Some studies have reported a higher prevalence of neck pain in women than in men (39-41) and also a higher prevalence in manual workers (42, 43). Furthermore, it has been indicated that back disorders are more common in persons with a lower socio-economic status (35).
Despite the widespread occurrence of the mentioned disorders, the aetiology of back pain is poorly understood (6). It has been estimated that only 20% of such pain can be attributed to physical risk factors (lifting, twisting, and bending), and the majority of people with back pain have no recognizable pathological lesion (35). Many of the reported disorders in the back region, especially those in the neck and shoulders, are subjective and difficult to correctly diagnose (44). Even though back disorders are the most common cause of sickness absence, not all back pain leads to sick leave. Linton et al. (40) found that 15% of a studied population reported having taken time off work due to low back or neck pain, although they had not used sick-leave days. In addition, many occupations involve work tasks that even a person suffering from a back disorder can perform, at least to some extent, and in such cases it is not always necessary to take sick leave. Taylor (45) found that, during a period of one year, men at a refinery who had no sickness absence nonetheless still had the same number of serious illnesses as those who were frequently on sick leave.

Factors associated with sickness absence

To study ill health in terms of sickness absence is, as previously mentioned, not an easy and straightforward task, since several factors other than ill health contribute to the phenomenon of sickness absence. As discussed below, the various factors associated with sick leave can be considered on three different structural levels: the society and community, the workplace, and the individual.

The society and community level

There are a number of factors on the society level that are associated with sickness absence. An example of this on a national level is the design and application of the sickness insurance system, which is well illustrated by the decrease in sickness absence seen in Sweden in 1993 after the introduction of a “qualifying day” without sick pay at the beginning of a period of sick leave (46, 47). Other factors on the society level that might affect sickness absence include the rate of unemployment (14, 48), recession (49), and the organisation and accessibility of health care (50). Sickness absence is also associated with the speciality of the physician certifying a period of sick leave. General practitioners have been shown to prescribe longer periods of leave than other types of physicians do (51). Moreover, compared to general practitioners, physicians
specializing in occupational health more often certify part-time sick leave (51). Furthermore, it has been shown that male physicians are more likely to prescribe activity restrictions for female patients than for male patients (52).

The workplace level

Both the physical and psychosocial work environments have been examined in numerous studies of sickness absence. Higher levels of sickness absence have been found to be related to physical factors such as heavy tasks, and to psychosocial aspects such as high demands and low control, monotony, and stress (35, 53-60). In addition, higher rates of sickness absence have been observed in the public sector than in the private sector in general and in the manufacturing industry (14, 34, 54, 61, 62). Also health care workers and teachers with difficulties to find a substitute when being sickness absent have lower levels of sickness absence (63, 64).

The individual level

A relationship with high levels of sickness absence has been reported for old age (34, 65, 66), as well as for female sex (57, 66-68), foreign ethnicity (69, 70), certain occupations (42), low socio-economic group (10, 61), and working long and/or irregular hours (14). The same association has also been observed among persons with a lack of work motivation (71, 72), smokers (73), and alcohol/drug abusers (74-76). In addition, previous sickness absence has been shown to predict further sick-leave spells in several studies (11, 12). It has also been noted that the attitudes of an individual towards sickness absence and work are related to the amount sick leave taken (14, 77). Linton (78) studied the general population and concluded that self-reported sexual abuse is an important variable signalling a risk for pronounced musculoskeletal pain in women, although other investigators have found only a weak association between violence, sexual abuse, and sickness absence in women (79). Sick leave has also been reported to be associated with work-related social support but not with social networks or support from outside the workplace (10, 54). In a study by Marhold et al. (80), teaching coping strategies to persons who had been on sick leave for 2–6 months led to a reduced number of sick-leave days during a follow-up period of up to six-months.

An association with sickness absence has also been reported for factors on a family level, such as being widowed, separated, divorced (14, 66, 68), or a single
mother (14, 81), and stress from unpaid work, such as household chores and child care (82).

The sickness benefit system in Sweden in 1985-1996

The purpose of the Swedish sickness benefit system is to compensate for loss of income due to disease and injury. From the age of sixteen, all residents of Sweden with an annual income of more than 6,000 SEK (670 EUR in Feb 2003) are covered by the sickness benefit system, which entitles a recipient to economic compensation for incapacity due to illness, disease, or injury. Students, housewives, the unemployed, and the self-employed are also covered.

According to the National Insurance Act, sickness benefit is payable in cases of disease or injury that reduce the work capacity by at least 25%. The benefit amounts to at least 70-80% of lost income, with an upper limit geared to the price index (25,390 EUR per year in Feb 2003). Sick-leave spells up to seven days can be self-certified. For longer spells a medical certificate is required that states the diagnosis and the degree of lost work capacity in relation to the particular work tasks performed by the patient. A social insurance officer decides whether a person is entitled to sickness benefit. Factors such as the situation on the labour market and financial and social aspects should be disregarded when making decisions on benefit entitlement. The benefit can be paid for full or part-time absence (75%, 50%, or 25%), depending on the extent of the loss of work capacity.

There is no time limit for the length of a sick-leave spell, and sickness absence payments can be granted for part or full time. A person can qualify for a temporary or permanent disability pension when the work capacity will presumably be lost for at least one year; the temporary disability benefit can be granted for one to three years, and the permanent benefit is continued until the inception of old-age pension. The decision to grant a disability pension is made by a social insurance board partly based on a more thorough assessment made by a physician. Payment of a disability pension amounts to at least 65% of lost income. Persons granted part-time temporary or permanent disability pension can be on sick leave the remaining part of their work requirement. From 1992, the social insurance offices were also responsible for co-ordinating rehabilitation measures; at that time, the need for such measures was to be
assessed and a detailed sickness certificate was required from the 28th day of a sick-leave spell.

During the studied period, the parental insurance in Sweden covered absence from work for the care of new-born infants (450 days) or sick children (60 days/year/child), but data on this type of absence were not included in the present research. Sickness, pregnancy, and parental benefits amounted to between 75% and 100% of lost income. The rules for sickness benefit insurance applied to sickness benefit was the same for all individuals considered in this study, and changes in the benefit system were regarded as having equivalent effects on all of them.

Changes in the benefit system in 1985–1996

Some modifications were made in the sickness benefit system during the years studied in the present research (1985–1996). One major change was that, starting in 1992, the employer had to pay benefits for the first 14 days of a sick-leave spell; this period was extended to 28 days from January 1997 to March 1998, but a 14-day period was subsequently reinstated. For persons with no employer, e.g. students, the social insurance offices paid the benefits during the first 14 days. Designating the first day of a sick-leave spell as a qualifying day was done in 1984–1987, and that stipulation was re-adopted in 1996 and has applied since then.

The changes made in the sickness benefit system make it difficult to compare the rate of sick leave during the studied period. Figure 1 illustrates the average number of sick-leave days per year per covered by the social insurance benefits in Sweden in 1984–2001 paid by the social insurance offices. The number of sick-leave days per person per year increased from 1984 to 1989, thereafter decreased until 1997, and since then has increased again to a level of almost 18 days per woman and eleven days per man in 2001. The decrease in 1992 was due partly to changes in the social insurance regulations, which led to non-inclusion of data on the first 14 days of a sick-leave spell. For all years included in Figure 1 (1984–2001), the number of sick-leave days per person per year has been greater for women than for men, and this difference has increased since 1997.
Figure 1. Average number of sick-leave days per person (benefits paid by the social insurance offices) per sick-leave insured person in Sweden 1984–2001. (Source: data from the National Social Insurance Board, diagram created by the author.)

Another way of describing the development over time is to use data on social insurance expenditures (Figure 2), comprising sick-leave benefits, disability pensions (including supplementary pensions), and other costs (rehabilitation allowances and occupational injury benefits). These expenditures have increased over the past few years, and the budgeted costs for 2003 are about 119 billion SEK (13.1 billion EUR in Feb 2003) (83). The increase since 1997 has been due chiefly to higher costs for sick leave.
Methodological aspects of studies on sickness absence

Epidemiological study design

A cross-sectional study design is used most often in research on sickness absence (3, 4). With this approach, data on exposure and on a certain outcome measure are obtained at the same point in time. This design is suitable for descriptive purposes, such as estimating the prevalence or the frequency distribution of a particular outcome in a population. An analytical survey must be performed to investigate associations between specific factors, and that can be achieved by conducting controlled experiments, although such an approach can be an ethical problem. Therefore, a longitudinal design, generally a case-control or a cohort study, is employed in aetiological surveys. In a case-control study, a group of individuals affected by a certain outcome measure is compared with a group of control subjects who are not affected by that outcome, and information is collected on the frequency of factors that might be associated with the outcome in question. In a cohort study, a population of individuals is selected using defined criteria and then followed over time, prospectively or retrospectively. The cohort is classified according to the factor or factors of
interest and followed over time, so that rates of occurrence of the outcome measure can be related to the classification of the aetiological factors.

A case-control study is preferable to a cohort study when rare conditions are studied or when data has to be obtained more quickly. With a cohort study, several outcome measures can be studied simultaneously.

Another approach is to perform an ecological study in which the units observed are groups of people instead of individuals, but that method is not discussed further here.

Most of the longitudinal studies concerning sickness absence or disability pension have covered only a small number of years, although a few have considered a time span of five years or longer (Table 1).

Table 1. Longitudinal studies of sickness absence and/or disability pension.

<table>
<thead>
<tr>
<th>Author(s), year of publication</th>
<th>Country, study type, and time span</th>
<th>Title. Number (n), sex, and age of subjects studied. Statistical method(s). Outcome measure(s).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florvall Müller, 1999 (87)</td>
<td>Denmark, 15-year prospective cohort</td>
<td><em>The influence of previous low back trouble, general health, and working conditions on future sick-listing because of low back trouble.</em> n=538, both sexes, 30, 40, or 50 years. Method: logistic regression. Outcome: being on sick leave due to low-back trouble at least once during a 7-year period.</td>
</tr>
<tr>
<td>Hagen, 2000</td>
<td>Norway, 11-year</td>
<td><em>Socioeconomic factors and disability retirement from back pain.</em></td>
</tr>
</tbody>
</table>

1 Only the name of the first author is given, regardless of the actual number of authors. In cases when one project resulted in several papers, only one title is mentioned here.

2 How to define a cohort study as being prospective or retrospective has varied over the years and in the literature (84-85). The definition used in this thesis is as follows: individuals are included in a study because they meet specified criteria at time point \(T_0\), and the investigation is regarded as prospective if data on the exposure(s) and outcome are collected after \(T_0\), and it is considered to be retrospective if data on the exposure(s) are collected prior \(T_0\).
<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Country</th>
<th>Cohort</th>
<th>Study Title</th>
<th>Sample Size</th>
<th>Method</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kivimäki, 1997 (89)</td>
<td>Finland, 5-year prospective cohort</td>
<td><em>Psychosocial factors predicting employee sickness absence during economic decline.</em> n= 763, both sexes, mean age 41 years. Method: Poisson regression. Outcome: absence rate per 100 person-years.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pålsson, 1997 (93)</td>
<td>Sweden, 5-year prospective cohort</td>
<td><em>Sick-leave and disability pensions among female assembly workers.</em> n = 656, females, 15–62 years. Method: individual ratios of observed/expected no. of sick-leave days and disability pensions, respectively. Outcomes: sick-leave days per year, granted disability pension.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rodgers, 1998 (96)</td>
<td>Northern Ireland, 5-year retrospective cohort</td>
<td><em>A five-year study comparing early retirements on medical grounds in ambulance personnel with those in other groups of health service staff. Part I: Incidence of retirements.</em> n = 534, both sexes, up to 64 years. Method: standardized disability pension ratios. Outcome: disability pension.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The studies were divided into six categories according to two different dimensions of selection: (1) whether the study base consisted of a population, or
if it comprised individuals within a certain occupation or workplace; (2) whether all members of the study base were included, or if those chosen all had specified disorders or diagnoses some type (Table 2).

Table 2. Longitudinal studies* of sickness absence categorized according to population base and whether the investigated individuals were on sick leave at the time of inclusion.

<table>
<thead>
<tr>
<th>Type of study base</th>
<th>All members of the study base</th>
<th>Persons with certain diagnoses/disorders at time of inclusion</th>
<th>Persons on sick leave at time of inclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workplace/Occupation</td>
<td>86, 89, 91, 93</td>
<td>96**</td>
<td></td>
</tr>
<tr>
<td>Population</td>
<td>87, 88, 90, 92, 94, 95</td>
<td></td>
<td>This thesis</td>
</tr>
</tbody>
</table>

*The numbers in the table represent studies in the reference list
**Data on sickness absence was not included

Eleven longitudinal studies found in the literature covered at least five years, and only one of these investigations was retrospective. About half of the eleven were based on a certain workplace or occupational group, and the rest were population based. Only one was focused on persons with a certain disorder at the time of inclusion, namely subjects eligible to apply for disability pension. Seven of the investigations used disability pension as an outcome measure. Only the present study was based on persons already on sick leave at inclusion. Investigations with a shorter time span more often concerned patients (97, 98).

Terminology

A wide array of measures of sickness absence have been used in different studies, in the literature, and the terminology varies greatly (1, 99, 100). As early as 1963, Gaudet (101) stated that at least 41 different measures of absence from work had been used in the past. One explanation for this is that many of the measures have been developed to fulfill administrative purposes and have subsequently been adapted by scientific investigators to answer research questions. Another reason is that this is a fairly young area of research, thus there is an obvious need to develop not only measures, but also theories, concepts, and methods (2-4). This variation in both terminology and measures makes it difficult to compare the results of different studies, and it also emphasises the importance of using measures that are appropriate for the research problem.
Sickness-absence data

Analysing sickness-absence data entails many statistical challenges, some of which have been pointed out in previous studies (10, 99).

- Data on sickness absence often have a skewed distribution, since most sickness-leave spells are only a few days long, and very few cover longer periods, in Sweden even several years. This is a problem partly because many statistical methods require a normal distribution to be strictly valid.

- Another problem that has to be considered is that sickness absence can be a recurrent event. In a longitudinal study, people can be on sick leave more than once during a follow-up period. Many of the epidemiological models, such as survival analysis and logistic regression, are developed to predict one specific outcome, often death, and are not adapted to deal with recurrent events.

- The outcome measure can be of varying seriousness, as exemplified by sick leave and temporary or permanent disability pension, which are difficult to combine in the same analysis. Death is another outcome that should also be considered in this context.

- Both sickness absence and disability pension can be certified or granted for either full or part time, and, with most statistical methods, it can be difficult to combine such data in the same analysis.

- Sickness absence and disability pension can be due to different diagnoses, which is another feature of the measures that is often interesting to take into consideration.

- More specific characteristics of sickness-absence data, are that the degree, the type of sick-leave, and the diagnosis, can change during a single sick-leave spell, and there might even be several sub-diagnoses.

In other research areas in which epidemiological methods are often used, the outcome is often binomial (e.g., sick or not sick). By comparison, research concerning sickness absence and disability pensions is frequently more complex, and there is a need to develop various aspects of the techniques employed in such studies (2-4, 102). These methodological challenges have seldom been discussed in the scientific literature on sickness absence, and much remains to be done.
Different epidemiological models have been used in analyses of longitudinal data on sickness absence. For instance, survival analyses based on life tables have been applied to calculate the cumulative risk of a certain outcome, such as disability pension. Life tables make proper allowance for censored observations, and they also utilise the information on subjects up to the time when they are lost to follow-up. Two techniques that have been employed in aetiological analyses of sickness-absence data are logistic regression and Cox proportional hazard regression. The logistic model is used when the outcome measure is binomial, for example being or not being granted disability pension during a follow-up period. Nevertheless, a logistic regression model cannot take into account the time factor, which in this case concerns how long it takes before the pension is granted. The Cox proportional hazard model, however, does take this time factor into consideration. The standard Cox model requires that several assumptions be made, an example of which is that all the covariates must remain fixed during the follow-up period. In many cases, covariates change over time and are therefore often referred to as being time dependent, which means that the predictive value of more recent data is greater than that of older data. One way of ensuring proper application of these covariates is to use an extended Cox regression model, in other words, a model with a time-dependent covariate. The longer the follow-up period, the greater the importance of the time factor. This problem can be taken into account by using Cox regression with a time-dependent covariate, although it seems that this method has seldom been utilized in scientific studies.
Aims of the study

The general objective of the research underlying this thesis was to conduct a pilot study to gain a better understanding of the factors associated with sickness absence and disability pension, perceptions of contacts with rehabilitation professionals, and self-rated health over time among young persons initially on sick leave with back, neck, or shoulder diagnoses.

The specific aims of the studies were as follows:

- to examine sickness absence and disability pension over 11 years;
- to identify risk factors for disability pension over 11 years;
- to test the usefulness of a time-dependent Cox regression model to predict disability pension while adjusting for sickness absence during the follow-up;
- to analyse factors associated with future low or no sickness absence;
- to estimate how individuals with experience of sickness absence perceive their contacts with professionals at social insurance offices and in health care;
- to test the health-line as an instrument for obtaining data on self-rated health over time and to compare the results with sickness-absence data.
Material and methods

Study population

All six of the investigations included in this thesis were based on the same prospective cohort study. The first four papers concern sickness-absence and registry data, and the information considered in the last two was complemented with data collected using a questionnaire.

The cohort study that gave rise to this thesis is part of a large interdisciplinary research program being conducted at the Division of Social Medicine and Public Health Science at Linköpings universitet. The main objective of the overall project was to use both quantitative and qualitative approaches to identify factors that hinder and promote return to work.

An 11-year prospective cohort study was performed, and all individuals who met the following criteria in 1985 were included:

1. lived in the municipality of Linköping (population 117,000) in the county of Östergötland, Sweden;
2. were aged 25–34 years;
3. had a sick-leave spell that lasted at least 28 days with back, neck, or shoulder diagnoses (diagnostic codes according to the Nordic Medicostatistical Committee, based on ICD-8: displacement of intervertebral lumbar disc {725}, lumbago {7170}, sciatica {7288}, spondylosis {7131}, pain in the thoracic spine {7285}, other deformities {738r}, humeroscapular periarthritis {7171}, myalgia {7179}, cervicalgia {7280}, cervicobrachialgia {7282}, synovitis, bursitis, and tendovaginitis {731}.

Excluded were diagnostic groups such as arthroses, rheumatic or inflammatory musculoskeletal diseases, and diagnoses primarily related to pregnancy.

The municipality of Linköping, located in south-eastern Sweden, has a wide variety of businesses and high-technology industries, a university, and a university-affiliated hospital.
Data

Register data

The people in the cohort were identified from the database created within the Sick-Leave Registration Project of Östergötland (57) and run at the Division of Social Medicine and Public Health Science at Linköpings universitet. This database comprises all sick-leave spells with a duration of seven days or more, for each of the years 1985, 1986, and 1987 in the county of Östergötland (about 180,000 spells), as well as data on social security number (which includes date of birth and sex), date of beginning and end of each sick-leave spell, diagnosis, and occupational code. Data were sent to the National Social Insurance Board, where a research database was created. Through linking with other databases, the following information was added for each individual: postal code, income, marital status, citizenship, number of children below the age of ten, and the number of sick-leave spells and sick-leave days during the previous three years.

Additional data on the members of the cohort were collected at the local social insurance offices. For the years 1991–1996, computer files were kept with information on the date of the beginning and end, type, and degree of each sick-leave spell. In addition, the computer files contained information on current address, and it was also noted if a person had been assessed for disability pension. For the years 1985–1990, these data were stored on microfiches.

Data on disability pension (date of beginning and end, type, degree, and diagnoses) were obtained from the National Social Insurance Board.

For comparison, data were collected on a cohort of all 246,000 inhabitants of the county of Östergötland, Sweden, who, in 1984, were aged 16–64 and entitled to sick-leave insurance. These data concerned the following: sickness absence in 1982–1987, disability pension, retirement pension, and mortality in 1985–1996.

Sickness-certification data

Detailed data on the sick-leave periods (e.g., diagnoses [up to four], occupation, marital status, citizenship, income, and, if the spells exceeded seven days, certifying physician and clinic) were collected from the sickness certificates filed at the archives of the local social insurance offices. These data were collected for each of the sick-leave periods that occurred in 1985–1996. In all, the members of the cohort had had 8,259 sick-leave periods during the follow-up years. For those persons who had moved during the studied period (n = 129),
data had to be collected from the local social insurance office he or she had belonged to while on sick leave (a total of 29 offices). Data obtained from the certificates for use in the present studies covered only data from the including sick-leave spell in 1985: diagnosis, citizenship, marital status, occupation, and taxed income for 1984. A special manual for data collection was developed and tested before it was used in this project. This handbook proved to be helpful in several ways, and it facilitated organisation of the gathering of information.

The diagnoses of the including sick-leave spell retrieved from the database were crosschecked with the diagnoses on the sickness certificate. The validity of sick-leave diagnoses can be discussed. In the Sick-Leave Registration Project of Östergötland, this was assessed in two ways (104): the accuracy of the coding of the diagnoses from the sickness certificates into the register was tested by studying 2,364 sick-leave spells; the validity of the diagnoses stated by the physician on the certificates was confirmed by reviewing the corresponding medical records of 299 sick-leave spells. In the former evaluation, 98% of the coding and registering of diagnoses was found to be correct. In the latter assessment, there was agreement between certificates and medical records in 82% of the cases. Initially, 220 people in the database were identified as filling the inclusion criteria. Their sick-leave diagnoses in the database were manually crosschecked with the diagnoses on the sickness certificates at the social insurance offices, and they were found to correspond for 213 of the persons. The remaining seven were excluded for the following reasons: four due to incorrect diagnoses; for one woman, the diagnosis was correct, but it was related to pregnancy; and two had not been on sick leave for at least 28 days. Accordingly, the cohort came to consist of 213 persons (61% women), and none of these individuals were self-employed or on disability pension at the time of inclusion.

**Questionnaire data**

In addition to registers and sickness certificates, a comprehensive questionnaire was used as a source of data in the present work. (Later, data were also gathered by conducting individual (105) and focus group (106) interviews with members of the cohort, but that information was not used in the current studies.)

The questionnaire was designed for this project. Early versions were tested in three different small pilot studies. The questionnaire included open and closed questions on health (in 1996 and retrospective), medical treatment,
demographics, coping strategies, perceptions of contacts with rehabilitation professionals, and three life-lines that respectively concerned health, family, and work. It took approximately one hour to answer the questionnaire. In the present investigations, data from two of the questions were of primary interest, and these dealt with the following: perceptions of contacts with professionals at the social insurance offices and in health care; and self-rated health over time, evaluated by use of the health line.

- The questions concerning contacts with professionals consisted of 16 statements, for each of which the respondent was asked to estimate to what degree he/she agreed with the options, which ranged from “to a great extent” (1) to “not at all” (4) (Table 1 in paper V).

- In the health-line question, the participants were asked to indicate graphically, on a line, how they rated their global health for each year during the period 1985–1995 (Fig. 1 in paper VI).

The questionnaire was sent to members of the cohort who had a Swedish mailing address in 1996 (n = 204). Six of the subjects had emigrated during the follow-up period, and two had died; also, one could not be traced in the official registers after October 1994, thus, from then on, that individual was assumed to have emigrated. After two reminders, persons who had not answered were asked to participate in a briefly interview by telephone. Altogether 149 persons answered the questionnaire (136 in writing and 13 by telephone), although one was excluded due to insufficient responses. Consequently, the response rate was 73%, which can be regarded as acceptable.

In the analysis of the external dropouts, people in the cohort who did answer the questionnaire were compared with those who did not, and it was found that the two groups showed no statistically significant differences in relation to the following: sex, diagnosis at inclusion (low back vs. neck/shoulder), whether they had received disability pension during the study period, or if they were or were not on sick leave at the time they answered the questionnaire.

The study design is summarised in Figure 3 and the characteristics of the data, outcome measures, and methods used in the six papers are summarised in Table 3.
Figure 3. Study design of the cohort study underlying this thesis.
Table 3. Characteristics of the data, outcome measures, and methods used in the six studies underlying this thesis.

<table>
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<tbody>
<tr>
<td>Sex</td>
<td>Males and females</td>
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<tr>
<td>Age in 1985</td>
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<td></td>
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<td>25–34 years</td>
<td></td>
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<tr>
<td>Geographical area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Municipality of Linköping, Sweden</td>
<td></td>
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<tr>
<td>N</td>
<td>213</td>
<td>213</td>
<td>213</td>
<td>213</td>
<td>97</td>
<td>73 and 93</td>
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<tr>
<td>Data source</td>
<td>Register Sickness certification</td>
<td>Register Sickness certification</td>
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<td>Register Sickness certification</td>
<td>Register Questionnaire Sickness certification</td>
<td>Register Questionnaire Sickness certification</td>
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<tr>
<td>Outcome measure</td>
<td>Sick-leave days per person per year</td>
<td>Days per sick-leave spell</td>
<td>Sick-leave spells per person per year</td>
<td>No. of sick-leave spells exceeding 14 days in 1992–1996</td>
<td>Disability pension</td>
<td>Experiences of contacts with health care and social insurance professionals</td>
</tr>
<tr>
<td>Statistical analyses</td>
<td>Pearson's chi-square test</td>
<td>Life tables and Cox regression</td>
<td>Logistic and linear regression</td>
<td>Time dependent Cox regression</td>
<td>Factor analyses and linear regression</td>
<td>Correlation analyses</td>
</tr>
</tbody>
</table>
Data analyses

The following applies to all six papers: differences between groups (e.g., regarding sex) were tested by Pearson's chi-square test, or, when appropriate, by Fisher's exact test. A p-value < 0.05 was considered significant in all analyses, and 95% confidence intervals were calculated.

All sickness absence and disability pension granted part time were registered as part time, regardless of whether a person had full or part-time employment. For example, a person employed halftime (i.e., a four-hour workday in Sweden) and on half-time sick leave still worked two hours a day, thus the absence was registered as half time. Thereafter, the number of partial sickness absence days were combined (e.g., two days of 50% absence were counted as one full day). In the analyses of disability pension, individuals did not contribute person time after emigration or death. Age standardisation was not done, because the members of the cohort were equally distributed between the ages of 25 and 34 years at the time of inclusion. Moreover, student's t-test showed no significant difference in mean age between those who had and had not been granted disability pension (30.0 and 29.3 years, respectively).

Socioeconomic group (107) was coded according to data on occupation (108) at the time of the sick-leave spell that qualified a person for inclusion in the study (referred to as the including spell). In the studies reported in papers II and IV, the ten factors listed in Table 4 were used, and, to facilitate interpretation of the results, the continuous variables (i.e., the last four listed in the table) were divided into categories. The number of sick-leave days per spell and the mean number of sick-leave days per year in 1982 until inclusion in 1985 were divided into three and four groups, respectively, according to classification routinely used at the social insurance offices and in studies of sickness absence. The number of sick-leave spells per year during the same period was divided into five categories to allow the predictive value of this factor to be scrutinised in greater detail.
Table 4. Categorisation of the factors considered in papers II and IV.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Category (n)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis</td>
<td>Low back (152), neck/shoulder (61)</td>
</tr>
<tr>
<td>Sex</td>
<td>Male (84), female (129)</td>
</tr>
<tr>
<td>Citizenship</td>
<td>Swedish (203), other (10)</td>
</tr>
<tr>
<td>Occupation</td>
<td>Technical, scientific (12), health (50), administrative (17), commercial (12), agriculture (5), transport (6), manufacturing (55), service (48), student (5), unknown (3)</td>
</tr>
<tr>
<td>Socioeconomic group</td>
<td>Blue collar (154), lower white collar (23), higher white collar (22), student (5), unemployed (9)</td>
</tr>
<tr>
<td>Marital status</td>
<td>Unmarried (101), married (93), divorced (19)</td>
</tr>
<tr>
<td>Income in 1984</td>
<td>≤ 50,000 SEK (54), 50,000–100,000 SEK (131), ≥ 100,000 SEK (28)</td>
</tr>
<tr>
<td>Sick-leave days</td>
<td>≤ 7 (23), 7–28 (92), 29–90 (71), ≥ 90 (27)</td>
</tr>
<tr>
<td>Sick-leave spells</td>
<td>≤ 1 (11), 1 (34), 2 (43), 3–5 (75), ≥ 5 (50)</td>
</tr>
<tr>
<td>Days per sick-leave spell</td>
<td>≤ 7 (90), 8–14 (79), ≥ 14 (4)</td>
</tr>
</tbody>
</table>

* The numbers are the one used in paper II, where all 213 persons were included.
1 At time of inclusion in 1985.
2 Sick-leave days per year from 1 Jan 1982 until the including spell in 1985.
3 Sick-leave spells per year from 1 Jan 1982 until the including spell in 1985.
4 Days per sick-leave spell from 1 Jan 1982 until the including spell in 1985.

Different versions of SAS and SPSS software were used to process the data.

Paper I

Sickness absence and disability pension were examined in the work described in paper I. The following data were used for the 213 members of the cohort:

- number of sick-leave spells and sick-leave days from 1 January 1982 until 1 September 1996, as well as sex;
- date and diagnosis for temporary or permanent disability pension from 1 January 1985 until 1 September 1996;
- dates of death and emigration until 1 September 1996.
**Statistical methods**

The following measures of sickness absence were used:

- mean and median number of sick-leave days per person per year;
- duration, considered as the mean and median number of days per sick-leave spell;
- frequency, counted as the mean and median number of sick-leave spells per person per year;
- number of people granted disability pension (including full or part time, and temporary or permanent disability pension);
- mean and median number of sick-leave days and disability-pension days per person per year;
- mean and median number of sick-leave days and disability-pension days per spell.

Median, mean, and 95% confidence intervals were calculated for the measures.

**Paper II**

Possible risk factors for disability pension were analysed in the study reported in paper II. The following data were used for the 213 persons in the cohort:

- number of sick-leave spells and sick-leave days from 1 January 1982 until date of inclusion in 1985, sex, age, citizenship, income, occupation, socioeconomic group, and marital status at inclusion (Table 4);
- information on temporary or permanent disability pension from 1 January 1985 until 1 September 1996;
- dates of death and emigration until 1 September 1996.

The ten factors considered to be possible risk factors for disability pension and their categorisation are listed in Table 4.

**Statistical methods**

Life tables were used for the following: to calculate the cumulative risk of being granted disability pension within ten years of the including spell for different levels of ten independent variables; to estimate the risk for each of the ten years and the changes in such risk over time. Standard Cox regression was used to
estimate relationships between the number of calendar days from the first day of the including sick-leave spell until the person was first granted disability pension or 1 September 1996, and between the possible risk factors. A standard Cox regression was employed, because a graphic examination of the hazards (the log[-log] survival curves) indicated that all the variables were independent of time.

Paper III
The ability of a time-dependent Cox regression model to predict disability pension in relation to sex and citizenship was tested in this study (paper III). The following data on the 213 members of the cohort were used:

- number of sick-leave spells and sick-leave days from the including spell in 1985 until 1 September 1996;
- data on sex and citizenship at inclusion;
- information on temporary or permanent disability pension from 1 January 1985 until 1 September 1996;
- dates of death and emigration until 1 September 1996.

There were reasons to assume that disability pension would be better predicted by more recent than by earlier sick-leave spells, hence a time-dependent covariate that could take advantage of that effect was designed. Another purpose with paper III was to see whether the differences in gender and citizenship would remain if data on sickness absence was updated during the follow-up period.

Statistical methods
A time-dependent Cox regression model was used to exploit the presumably greater value of more recent sick-leave spells (as compared to earlier spells) in predicting disability pension. The time-dependent covariate was updated for every year and included sick-leave data for the past two years. The dependent variable was therefore the same as used in the study reported in paper II, that is, being granted disability pension during the follow-up period.

The time-dependent covariate—sickness-absence data from inclusion in 1985 until 1 September 1996—was used as a measure of sickness absence during the previous two years. The time window was updated from one
year to the next to improve the predictive value: the first period lasted from the first day of the including sick-leave spell (≥28 days) in 1985 until 31 December 1986; each of the subsequent periods comprised two years, and they overlapped, so that the second period started on 1 January 1986 and ended on 31 December 1987, the third period was from 1 January 1987 to 31 December 1988, and so forth (Fig. 1 in paper VI).

To define the time-dependent covariate, the duration of individual sick-leave spells was categorized on two levels: <90 days and ≥90 days. Thereafter, the variable was dichotomised into one category comprising time windows containing an ongoing sick-leave spell ≥90 days, and one that included time windows that did not contain such a spell. In this way, a kind of two-year prevalence measure was created, which, for every time window, revealed the proportion of persons in the cohort who had had a sick-leave spell that lasted at least 90 days.

None of the interaction terms in paper II were significant, accordingly they were not included in the present study. The other non-significant variables were also excluded from these analyses.

**Paper IV**

Possible factors associated with future low sickness absence were analysed in the investigation described in paper IV. The following data on the 213 members of the cohort were used:

- number of sick-leave days and spells from 1 January 1982 to the time of inclusion in 1985, as well as sex, citizenship, income, occupation according to the Nordic Occupational Classification (108), socioeconomic group (107), and marital status at the time of inclusion (Table 4);
- data on temporary or permanent disability pension from 1 January 1985 to 1 September 1996;
- dates of death and emigration until 1 September 1996.

The cohort was divided into three groups according to the level of sickness absence during the last five years of the follow-up (1992–1996): no sick-leave spells exceeding 14 days (group 1); at least one sick-leave spell longer than 14
days (group 2); on disability pension at the end of the study, 1 September 1996 (group 3).

The period 1992–1996 was chosen for two reasons. First, because the social insurance system had been changed so that, from 1992 and onwards, only sick-leave spells exceeding 14 days were registered at the social insurance offices. Second, the objective was to study a follow-up period that occurred as long as possible after the inclusion date and was also of sufficient length to minimise the random effect of examining a period with low levels of sickness absence.

**Statistical methods**

Univariate and multiple logistic regression were used, and the outcome measure in both analyses was sickness absence status (i.e., assigned to group 1, 2, or 2+3) on 1 September 1996. Two models were computed, one in which group 1 was compared with group 2, and a second in which group 1 was compared with both group 2 and groups 2 and 3 combined (i.e., respectively including and excluding disability pensioners).

**Paper V**

The two questions from the questionnaire that concerned how members of the cohort experienced contacts with health care professionals (n = 90) and social insurance officers (n = 73), respectively, were examined in the study presented in paper V.

The following were analysed:

- sex and data on diagnosis (back or neck/shoulder) at the time of inclusion in the study;
- information on temporary and permanent disability pension from 1 January 1985 until 1 September 1996;
- questionnaire data on perceptions of contact with health care professionals and social insurance officers, self-rated general and mental health.

Except the two questions this paper was focused upon, the experienced contacts, another two questions from the questionnaire were analysed. In the question on self-rated health, the respondents were asked to rate their general health as excellent, very good, good, moderate, poor, or very poor. In the analysis, the answers were ranked 1 (excellent) to 6 (very poor). For the question on mental
health, it was possible to answer yes or no in relation to having (since 1985) often experienced the following: tiredness; sleeping problems, headache/migraine, fear/worries/anxiety, stomach pain/diarrhoea/constipation/nausea, and sadness/depression/irritability. A shorter version of the latter item was included in the Swedish Investigation of Living Conditions used to measure mental health (109).

Analysis of the internal dropout showed that a larger proportion of the disability pensioners, as compared to other members of the cohort, had answered the question about contacts with social insurance officers and health care professionals. In addition, the indicated question was answered to a greater extent by individuals with a neck/shoulder diagnosis than by those with a low back diagnosis at the time of inclusion, which indicates an over-representation of persons who had had repeated contact with the social insurance offices and health care.

**Statistical methods**

Factor analyses and multiple linear regression were conducted. The former method was used to structure results of the 16 items concerning the question on perception of contacts into underlying factors. This analysis was conducted with a principal component varimax rotation, and it gave a set of three empirical factors with an eigenvalue greater than one. To analyse the perceptions in relation to the three underlying factors found, indices were created for each factor. These indices were calculated as the means of the ratings of the items in each factor. This was done separately for the two questions analysed, and that approach yielded one index for each factor, type of professional, and respondent.

Multiple linear regression was carried out to analyse how the individuals scored each factor in relation to the following five variables: sex, disability pension, back versus neck/shoulder diagnosis at inclusion, self-rated general health, and self-rated mental health.

**Paper VI**

The study reported in paper VI was conducted to examine responses to the question concerning self-rated general health over time (n = 97).

More precisely, the following were analysed for each subject:
• data on number of days per sick-leave spell in 1989–1991;
• data on number of sick-leave and disability pension days in 1985–1995 (in this paper collectively referred to as “absence days due to ill health”);
• sex and data on diagnosis (back or neck/shoulder) at the time of inclusion in the study;
• information on temporary or permanent disability pension from 1 January 1985 until 1 September 1996;
• questionnaire data on self-rated general health 1985–1995 (Fig. 1 in paper VI).

Analysis of the internal dropout for the health-line question revealed a difference in response rate between individuals with few sick-leave days and those on disability pension: few sick-leave days in 1989–1991 indicated a higher response rate compared to being granted disability pension, which suggests an under-representation of persons on disability pension.

The health-line was divided into sex categories indicating "very poor health" to "excellent health". Results obtained using the health-line were analysed for the first and second half of each year, because many individuals had drawn the line over several categories during a particular year. Thereafter, a mean was calculated for each year. For each person, the mean number of absence days due to ill health was calculated for each year from 1985 to 1995.

To determine whether the health-line ratings differed between individuals with a high, medium or low mean number of sick-leave days, respectively individuals granted disability pension, the subjects were assigned to four different groups:

1. less than seven sick-leave days (n = 27)
2. 7–60 sick-leave days (n = 37)
3. more than 60 sick-leave days (n = 16)
4. granted a disability pension during the studied period 1985–1995 (n = 17).

Groups 1–3 were based on the mean number of sick-leave days in 1989–1991. This three-year period was chosen in light of the following: (a) data from a single year might be biased by random intra- and/or interindividual differences; (b) after 1992, the social insurance offices did not register sick-leave spells shorter than 15 days; (c) as recent data as possible were considered preferable
and the period used for categorising the individuals according to level of sickness absence was therefore limited to 1989-1991.

The data on absence days due to ill health and the data on the health-lines for two different periods, 1985–1989 and 1991–1995, were compared to ascertain whether they differed in regard to correlations, that is, whether a stronger correlation with self-rated health existed for more recent than for older data on absence days due to ill health.

Statistical methods

Means and 95% confidence intervals were calculated for the number of absence days due to ill health and the health-line results. Pearson’s correlation coefficient was calculated between the mean rating of for the health-line and the number of days due to ill health for each of the 11 years.

Ethical considerations

The Sick-Leave Registration Project of Östergötland was approved by the Research Ethics Committee at the Faculty of Medical Sciences at Linköpings universitet and by the National Data Inspection Board in 1984. In 1984, the public was given information about the project, and it was stated that everyone had the right to decline inclusion. The follow-up project comprised in the present studies and the different types of data collection were also approved by the Research Ethics Committee at the Faculty of Medical Sciences at Linköpings universitet and the National Data Inspection Board, and later by the Act Relating to Personal Data as well. Furthermore, a letter stating that participation was completely voluntary was sent to those who received the questionnaire in 1996.
Results

Sickness absence and diagnoses over 11 years (paper I)
This study was focused on the extent of sick leave and disability pension during the 11-year follow-up period. The investigation focused on differences between the sexes in relation to various measures of sickness absence and disability pension, and the type, degree (full or part time), and diagnosis of disability pensions.

Considering differences between the sexes, women were found to have higher levels of sickness absence regardless of the measures used, with the exception of mean sick-leave spells per person per year, for which there was no difference (Table 2 in paper I). Furthermore, with respect to disability pensions, the women were granted such benefits earlier than the men (Figure 2 in paper I). Moreover, after 11 years (by September 1996), 46 (22%) of the 213 persons in the cohort had been granted temporary or permanent disability pension, more women (26%) than men (14%). There were also differences between men and women in regard to forms of disability pension (i.e., partial/full and/or temporary/permanent; Table 1 in paper I). Of all those on disability pension, partial benefit was initially granted to 59% of the women but only 17% of the men. The main diagnosis for disability pension was a psychiatric disorder for 50% of the men but for only 6% of the women. Full-time disability pensions were more often approved for psychiatric diagnoses (8 of 8) than for musculoskeletal diagnoses (14 of 36).

Predicting disability pension over eleven years (paper II)
The 11-year prospective study described in paper II was conducted in an attempt to identify risk factors for disability pension. The work was based on demographic data from the time of inclusion in 1985, together with retrospective sickness-absence data for a period of three years.

The risk of being granted disability pension varied between the sexes and in relation to the number of days per sick-leave spell before inclusion in 1985. There was a clear association between number of days per sick spell in 1982–1985 and the cumulative risk of being granted disability pension (Fig. 1 in paper II). Many of the women with more than 14 days per spell were given disability
pension after only a few years. Also, the women with 8–14 days per sick-leave spell had a higher cumulative risk of being on disability pension compared to all the men.

The results of multivariate Cox regression analysis suggested that sex, citizenship, and the number of days per sick-leave spell from 1 January 1982 until the including spell in 1985 were predictors of disability pension. None of the interaction terms had a significant impact. The cohort members with more than 14 days per sick-leave spell were at three times higher risk of being granted a disability pension than those with less than seven days per spell. The women had 2.4 times higher relative risk of disability pension than the men. Also, the subjects who were foreign citizens at the time of inclusion had a higher relative risk (3.6) of being granted disability pension than the Swedish citizens.

**Prediction of disability pension with a time-dependent covariate (paper III)**

In the work reported in paper III, a Cox regression model with a time-dependent covariate was used to predict disability pension.

One hundred forty-eight of the 213 members of the cohort had at least one sick-leave spell exceeding 89 days during the eleven-year follow-up, and the rate was higher among the women than the men. Two of the women on disability pension had not had any such prolonged spells, and one woman had had such a spell in 1985 but did not receive a pension until 1992. In all, about one third of the 148 people with one or more sick-leave spells longer than 89 days were granted disability pension during the follow-up period.

All three of the included covariates turned out to be related to the risk of being granted disability pension, and the strongest predictor was “having a sick-leave spell exceeding 89 days during the two last years”. The relative risk of disability pension increased 9.3 times for each such prolonged spell. Also when recent sickness absence (i.e., a spell > 89 days during the past two years) was taken into consideration, the risk of disability pension was still higher for women than for men, as well as for foreign citizens compared to Swedes.
Prediction of future low levels of sickness absence (paper IV)

In the study presented in paper IV, a salutogenic approach was applied to sickness-absence data to predict future low levels of sickness absence. In 1992–1996, 34% of the 213 people in the cohort had not had any sick-leave spells longer than 14 days, 45% had had such spells, and 21% were on disability pension at the end of the study. No differences in relation to sex were found in the group with no sick-leave spells longer than 14 days in 1992–1996.

Compared to blue-collar workers, the white-collar workers had a 2.6 times higher odds of not having any sick-leave spells exceeding 14 days in 1992–1996 (Table II in paper IV). The odds were 4.1 that those who were married at the time of inclusion, compared to those who were divorced, would not have any sick-leave spells exceeding 14 days during the last five years of the study period.

A lower number of both sick-leave days per year and sick-leave spells per year during the period 1982–1984 were associated with low level of sickness absence in the future.

Perceptions of contacts with rehabilitation professionals (paper V)

Questionnaire data on how the studied individuals perceived their contacts with social insurance and health care professionals were investigated in paper V. Factor analyses identified three dimensions of these perceptions that were almost identical for the two types of rehabilitation agents. The first dimension was called “supportive treatment” and included positive statements made by the responding individuals indicating that they had experienced the following: attention being focused on their needs, co-operation, support/encouragement, being listened to, being shown concern, receiving adequate information, and being taken seriously and treated respectfully. The second dimension, “distant treatment”, contained more negative statements indicating that the respondents had encountered opposition, had felt that no one wanted to deal with their problem, had been met with a wait-and-see and an authoritarian attitude, experienced long waiting periods, and had frequently changed contact person. The third dimension, called “empowering treatment”, comprised two statements suggesting that the respondents felt that they received support for their own suggestions and their own responsibility.
The ratings of contacts with social insurance and health care professionals were tested by multiple regression analyses in relation to sex, general health, mental health, disability pension status, and diagnostic group (low back vs. neck/shoulder) at the time of inclusion in the study. Women rated the contacts as more supportive than the men did. Also, compared to the women, the men felt they had received more distant treatment from the social insurance officers. Individuals with mental problems reported experiencing more distant treatment from both types of rehabilitation agents, and also that health care professionals gave less supportive treatment. Individuals who had been or were on disability pension, compared to those who had never been granted such benefits, rated treatment by the social insurance officers as more supportive and empowering. In addition, compared to individuals with a back diagnosis at inclusion in 1985, those with a neck/shoulder diagnosis treatment in health care as more empowering.

The proportion of the variance that is attributable to variation in the material ($R^2$) is indicated in Table 5.

Table 5. Percent of variance attributable to variation in the factor analysis of clients’ perceptions of rehabilitation agents.

<table>
<thead>
<tr>
<th>Rehabilitation agency</th>
<th>Supportive treatment</th>
<th>Distant treatment</th>
<th>Empowering treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social insurance office</td>
<td>20</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Health care</td>
<td>9</td>
<td>11</td>
<td>5</td>
</tr>
</tbody>
</table>

Retrospectively self-rated health: the health-line (paper VI)

Paper VI describes a method called the health-line, which is used to collect information on self-rated general health over time. The health-line was tested, and data collected with this tool were compared with data on sickness absence and disability pension for each year during the period 1985–1995.

Among those who filled out the health line the mean number of days absent due to ill health (days on sick leave + days on disability pension) decreased from 97 in 1985 to 76 in 1995. During the same period, the health-line ratings for the whole group increased from 2.8 in 1985 to 3.7 in 1995, corresponding to the categories “fairly good health” and “good health”, respectively. For the entire
period and for each year separately, there was a statistically significant negative correlation between the mean number of absence days due to ill health and health rated on the health-line (r = –0.55), which implies that, on average, having a large number of absence days due to ill health is associated with low self-rated health on the health-line and vice versa.

No tendency towards differences in recall between the health-line ratings and absence days due to ill health was found for the two periods 1985–1989 and 1991–1995. More specifically, the correlation between the two types of information was of similar magnitude for the two periods (r values of –0.54 and –0.53, respectively).
Discussion

This thesis is based on a pilot study using data from a prospective, population-based cohort study of younger people initially on sick leave with back diagnoses. In the present studies, this cohort was followed for eleven years, and data on sickness absence and disability pension during this period, as well as questionnaire data on self-rated health and perception of contacts with rehabilitation professionals, were collected and analysed. Detailed data were gathered on sickness absence and disability pension over a long period of time, which is unusual in research on sickness absence or disability pension. The members of the cohort, especially the women, turned out to be at high risk of being granted disability pension early in life. Different types of epidemiological methods were tested, and the extended Cox regression model seemed to be appropriate for analysis of sickness-absence data over time.

The cohort proved to be a high risk group for disability pension. During the 11-year follow-up period, 22% of the people in the cohort were granted permanent or temporary disability pension. This rate is strikingly high compared to the corresponding value for all inhabitants of the municipality of Linköping who, in 1985, were in the same age group as the studied cohort and were entitled to sickness benefits. Considering all individuals in Linköping who had not previously received disability pension (n = 17,175), 3% had been granted such benefits in 1996. This finding indicates that, compared to all residents of Linköping in the same age group, the members of the cohort were at more than seven times greater risk of disability pension during the 11-year period.

Large differences related to sex were found when considering sickness absence and disability pension, which confirms the results of other studies (29, 36, 57, 61, 62, 88, 90, 110-114). Irrespective of the measure of sickness absence used in the present investigations, the women in the cohort had more absence than the men during the follow-up period, with one exception: the mean number of sick-leave spells per person per year did not differ between the sexes. Twenty-six percent of the women and 14% of the men were granted disability pension. Considering all 741 persons aged 25–34 in Linköping in 1985 who had had a sick-leave spell that lasted 28 days or longer with diagnoses not related to back/neck/shoulder problems, it was observed that 13% of this group had been granted disability pension in 1996 (13% of the women and 12% of the men). The differences
between the cohort investigated in the present studies and the group with other diagnoses were statistically significant for the women, but not for the men. Accordingly, young women on sick leave for four weeks with neck, shoulder, or low-back diagnoses were apparently not only at high risk of being granted disability pension early in life, but also at much higher risk of receiving such benefits compared to both women and men on sick leave with other diagnoses, as well as men with the mentioned diagnoses. Further studies on this subject are warranted, since comparable results have not yet been reported in the literature.

The larger number of women in the cohort and their higher level of sickness absence were expected. However, it was not anticipated that the female members of the cohort would also be at higher risk of disability pension. Analysis of the data indicated that, compared to the men, the women were at 1.9 times higher risk of being granted a disability pension during the eleven-year period. This is a substantial difference, considering that this risk estimate was adjusted for both long-term sickness absence and citizenship. This means that, if a woman and a man had an equal number of sick-leave spells lasting 90 days or longer during the previous two years, the risk of being granted a disability pension was 90% higher for the woman. This seems even more remarkable when considering that the risk of being included in this cohort was also higher for women than for men.

Differences related to sex were also detected when comparing full and part-time disability pension, as well as when examining the disability pension diagnoses, which will be discussed below. Surprisingly, the proportion of the cohort with low future sickness absence was almost the same for women and men. Differences associated with sex are discussed in detail later in the text.

*Prior level of sickness absence* was found to predict disability pension, as well as, future low levels of sickness absence, when ten factors (Table 4) considered before or at the time of inclusion were analysed. It has been known for many years that sickness absence is a risk factor for further sickness absence (11, 12, 115, 116). It seems logical that the extent of prior sickness absence, especially longer spells, is related to disease. Being on prolonged sick leave early in life can enhance an adaptation to a sick-role, that is, identifying oneself as sick (117), which might also explain why prior sickness absence has a predictive value.
An association was noted between performing white-collar work (but not blue-collar work) and future low sickness absence, which is in line with what has been found in other studies (9, 113, 118-120). There are several theories on why there is generally less sickness absence among white-collar than blue-collar workers (121, 122). When focusing on sickness absence with back diagnoses, other aspects might also be important. The tasks performed by blue-collar workers are often physically heavier, and, in addition to being risk factors for neck, shoulder, and back disorders, they might also be more difficult to carry out once such disorders arise, which would increase the risk of sickness absence. Another aspect is referred to as the sickness flexibility of a workplace (123) (i.e., the extent to which work demands can be altered to suit changes in work capacity due to health problems), which is probably greater in white-collar than in blue-collar occupations in relation to neck, back, and shoulder disorders. Moreover, white-collar workers often have a higher education, which offers greater opportunities to change from jobs entailing tasks that are difficult to perform when suffering from the mentioned disorders. However, members of the cohort who had lower socioeconomic status and/or did manual labour were not found to be at higher risk of receiving disability pension. One explanation for this is the study design that was used, which resulted in a cohort comprising persons primarily from lower socioeconomic groups. Another possible reason is that the white-collar workers may have had more serious disorders when they were included in the study, and they were therefore not at lower risk of being granted disability pension than the blue-collar workers.

Marital status had a statistically significant value as a predictor of future low sickness absence. That is, married persons, as compared to those who were divorced, were more likely to have low levels of sickness absence during the final five years of the study period. No association was found between marital status and disability pension. Rael et al. (124) studied 4,202 British civil servants and observed that, compared to married/cohabiting men, single men were at higher risk of both short- (< 7 days) and long-term sickness absence (adjusted for age and socioeconomic level). In that study, it was also reported that widowed men were at higher risk of short-term sickness absence than married/cohabiting men, but they could not find such a relationship between marital status and sickness absence in women.
Compared to the cohort members with Swedish citizenship, those who were foreign citizens had a higher relative risk of becoming disability pensioners, which agrees with other studies conducted in Sweden (125) and Norway (126). Unfortunately, the foreign citizens were too few in number to be included in the analyses of future low sickness absence. In some countries, women are most often housewives, whereas women in Sweden are expected to contribute to the family income. Consequently, being on sick leave or disability pension might be a way for immigrant women to deal with the conflict between the different cultural expectations (117). Four of the foreign citizens in the cohort were women, and three of those four were granted disability pensions. Other possible explanations for the higher rate of disability pensions among the foreign citizens are a more limited labour market, different work tasks, and lower socioeconomic status.

When summarising the results of the prospective analyses, prior level of sickness absence was the only factor associated with both disability pension and future low sickness absence in this cohort. Other factors seemed to be associated with only one of the outcome measures used. These findings strengthen the suggestion that factors that predict low levels of sickness absence are not necessarily the opposite of the risk factors for disability pension, and that both these approaches should be kept in mind when, for example, deciding upon future rehabilitation measures.

Two other aspects were analysed by using data from the questionnaire: contacts with rehabilitation professionals and a method to gather data on self-rated health over time. Considering perceptions of contacts with health care professionals and social insurance officers, other investigators (127) have emphasised, among others things, the importance of a good relationship between these two groups in dealing with back and neck pain. The objective of the present study was to gain further knowledge about various aspects of the way the members of the cohort experienced their contacts with the indicated professionals, and to investigate associations with certain factors. Women perceived health care workers and social insurance officers as being more supportive than men did. Bäckström (128) examined how men and women experienced such contacts, and she found that women were generally more satisfied, which was interpreted as being due to women having fewer expectations.
Respondents who had self-rated mental health problems perceived contacts as more impersonal than did those without such problems. A reason for this might be that professionals treated these clients in a distant manner due to differing levels of prestige among medical specialities, and that health care professionals not specialised in the field of psychiatry are unwilling to handle these patients (129). A possible relationship between sickness absence and the way members of the present cohort perceived contacts has not yet been analysed.

The other main question analysed in the present study asked the respondents to retrospectively indicate their self-rated general health on a so-called health-line. The aim was to test and evaluate the practicability of this simplified method of obtaining information on self-rated general health in a longitudinal perspective. The results suggest that the technique is useful, and the health-line data correlated well with the number of days per year on sick leave and on disability pension.

In summary, the findings of the analyses of the retrospective data from the questionnaire regarding perceptions of contacts with rehabilitation professional indicated that there were differences between women and men, between individuals with and without self-rated mental health problems, and between those with a low back diagnosis and those with a neck/shoulder diagnosis at inclusion. Furthermore, the analyses of the health-line indicated an association between self-rated general health and prior sickness-absence and/or disability-pension days per year.

**Diagnoses legitimating for disability pension**

The diagnosis behind the including sick-leave spell was a low back disorder for 71% of the cohort and a neck/shoulder disorder for 29%. The array of diagnoses changed over the years, and, for those granted disability pension, the main diagnoses were musculoskeletal conditions (78%), psychiatric disorders (17%), and other types of disorders (4%). There was a difference between the sexes in regard to the type of disorder underlying disability pension: 50% of the men, but only 6% of the women, had a psychiatric diagnosis. However, contrary to expectations, none of the men with psychiatric problems had an alcohol or drug diagnosis (74). Changes from a musculoskeletal diagnosis to a psychiatric one may have occurred because the psychiatric disorders were not recognized at an early stage, or because physicians were reluctant to write such diagnoses on the
sickness certificate (130). Another plausible explanation is that musculoskeletal disorders or long-term sickness absence may increase the risk of subsequent psychiatric disorders (131), possibly due to pain, negative effects of social isolation, and deterioration of the personal financial situation that is often associated with long-term sickness absence. Paid employment gives opportunities for social contact with and support from workmates, which might be highly important for individuals with a small social network outside the workplace. Furthermore, gainful employment may contribute to the feeling of being needed and give each day an organized time structure (132). These explanations do not, however, clarify the observed differences between the sexes in this context, thus additional research is needed in this area.

In a search of the literature for studies focused on sickness-absence, no investigations were found that dealt with the relationship between sick-leave diagnoses and diagnoses that later qualified for disability pension. About half of the cohort members were granted a partial (25% or 50%) disability pension the first time they received such benefits. Again, there was a difference between the sexes: 59% of the women, but only 17% of the men, were granted partial pensions. This dissimilarity might have arisen because more men than women were given a pension with a psychiatric disorder, and it may be more difficult to work full time with such a diagnosis. Another explanation often mentioned in the literature is that the women, probably to a larger extent than the men, were asked whether they could perform any domestic work despite their medical condition, and, if they answered yes to that question, they were not granted a full-time disability pension (112).

Factors that may influence differences between the sexes

There are several possible explanations for the differences between men and women in regard to sickness absence and disability pension. One is that women have higher morbidity than men (16), and there are three main explanatory models for this difference: the biology or genetic model, the socio-cultural model, and the methodological model (133). Some other possible explanations for the higher levels of sickness absence among women are also important to discuss (134).

The sex segregation of the labour market has been shown to entail higher levels of sickness absence for women than for men (57). Furthermore, there is evidence
of sex bias in the types of rehabilitation offered employees on prolonged sick leave (114, 128), which might influence the rate of long-term sickness absence and disability pensioning. At the level of the workplace, there are differences in the environment in terms of ergonomic, chemical, physical, and psychosocial (including sexual harassment) exposures. The level of the individual can include factors such as illness behaviour or coping strategies, attitudes toward sickness absence, and willingness to accept a sick role (130, 135). Other factors are level of education, socioeconomy, unpaid work, and social network. Furthermore, women might have other diseases or other patterns of comorbidity, or seek medical care later than men, leading to a more difficult rehabilitation process (27, 136). In Sweden, it has been shown that men on sick leave are given more expensive rehabilitation programmes (137). One important reason for the sex-related difference in sickness absence among people aged 16–44 years is sickness leave during pregnancy (138, 139). Women with pregnancy-related back diagnoses were excluded from the present study, although all diagnoses, even those related to pregnancy, were included in the follow-up. That might explain some of the higher sickness absence among women during the follow-up period, since they were all of child-bearing age throughout those years. Notwithstanding, these diagnoses can not explain why more women than men were granted a disability pension.

Methodological considerations

This pilot study was conducted to gain a better understanding of factors associated with sickness absence and disability pension, perceptions of contacts with rehabilitation agents, and self-rated health over time. To be able to isolate factors associated with high levels of sickness absence and disability pension, a group that was at high risk of those outcomes was chosen. More precisely, one of the inclusion criteria used was having a sick-leave spell of 28 days or longer with back, neck, or shoulder diagnoses. A period of at least 28 days was chosen for a number of reasons, one of which was that the social insurance staff is obliged to evaluate all sick-leave spells of that length with regard to the need for rehabilitation measures. Furthermore, other investigators (37, 140) have used this criterion which has proven to facilitate comparisons, and it has also been discussed whether four, but not eight, weeks of sickness absence with back disorders should be considered a risk factor for disability pension (29, 141).
Nevertheless, it is difficult to determine what effect a longer or shorter sick-leave spell at the time of inclusion would have in terms of a risk for disability pension or other such events.

The cohort examined in the present studies was selected to comprise younger persons, because compensation paid in the form of sickness benefits and disability pension to individuals in that age group represents a large cost to both society and employers, and such expenditures increase the earlier in life a person is granted disability pension. The economic situation of the individual is also affected, since the sickness and disability benefits are lower than the ordinary income. To keep individuals healthy and working, it is essential to promote well-being in different ways.

Back, neck, and shoulder diagnoses were investigated in the present research, because, in 1985 as well as today, they constitute the most common disorders behind both sick leave and disability pension (15, 34).

The current studies represent population-based research, because all persons in the municipality of Linköping that fulfilled the specified inclusion criteria were considered members of a cohort. Many investigations of sickness absence with back disorders have included patients at specific clinics or persons employed in only one or a few occupations or workplaces (35, 97, 98, 100, 142), leading to possible selection bias. In contrast, the present study population comprised all residents of a large community, including students and the unemployed, who had been classified as having a reduced work capacity caused by back disorders, regardless of the examining physician or health care facility visited, or the type of employment.

The study had a long follow-up period, eleven years. By comparison, most prospective studies on this subject cover only one to three years, which is seldom long enough to detect consequences of sickness absence, such as disability pension (143). The appropriate time frame depends partly on the topic being addressed and the period of time that is considered long enough for predictive factors to have an impact on the outcome. Factors that are associated with prolonged sickness absence or disability pension (e.g., aspects of an occupation or workplace) may have a life-long course of events, thus it is important to have a longer follow-up period. One negative aspect of a long follow-up period is that several factors considered at the time of inclusion might
change over the years (e.g., employment and family situation). This constitutes a problem in all prospective studies, unless data are continually updated. Nevertheless, the present results show that data from inclusion in 1985 had a predictive value when factors associated with disability pension and future low sickness absence were analysed.

Moreover, minor changes were made in the sickness insurance system during the studied period, but these were the same for all members of the cohort. Other aspects related to the fact that the cohort was established in the mid 1980s (e.g., changes in the labour market and attitudes towards sick leave and disability pension) must also be taken into account when comparing the present results with those of other studies.

Due to the small size of the cohort, women and men could not be analysed separately, even though that has been recommend (144) to deal with possible differences between the sexes in regard to the paths leading to both sickness absence and disability pension. Also because of the limited cohort, no attempts were made to separately analyse temporary and permanent disability pension, or full and partial disability pension. In addition, no conclusions could be drawn about the outcome “death”, since it could not be analysed separately because only two members of the cohort died during the follow-up period. Also, there were only ten individuals (less than five % of the cohort) who were foreign citizens at the time of inclusion in 1985, thus the findings regarding citizenship should be interpreted with caution.

Validity

In Sweden, data on sickness absence and disability pension can be obtained from registers at the local social insurance offices and from the National Social Insurance Board. These registries keep computer records on the degree (e.g., full time) and date of the start and end of sick-leave spells, or, more specifically, information on the number of days for which sickness benefits are paid. As mentioned, the registers are maintained for administrative reasons, not for research purposes, and they are regarded as being very accurate and valid. Since 1992, records of sickness absence and payment of sickness benefits during the first 14 days of a sick-leave spell are kept by employers. The present research was based on register data on sickness absence and disability pension, not self-reported data, as have been used in many studies in this area. In general, little
attention has been paid to the accuracy of self-reported sickness absence (145, 146). The accuracy of the inclusion diagnoses, identified through the database in the Sick-Leave Registration Project of Östergötland (57), was validated by manually checking the diagnoses on the actual sickness certificates filed at the local social insurance office. The validity of the diagnoses in the database of the Sick-Leave Registration Project has previously been tested and found acceptable (104, 147). In the present analyses, the diagnoses were divided into two main categories: low-back and neck/shoulder diagnoses.

Seven different levels of marital status were registered in the official records at the social insurance offices, but none of the seven represented cohabitation, which is common in Sweden. This should be taken into consideration when drawing conclusions about the results concerning the group of unmarried individuals in the cohort.

Regarding the validity of the part of the questionnaire concerning how the cohort members perceived contacts with rehabilitation professionals, face validity could be claimed, since this question was developed from the results of a qualitative study (148) and in co-operation with several professionals experienced in the rehabilitation field. The question consisted of 16 different randomly alternating positive and negative statements, thus it may have yielded some faulty answers. On the other hand, this design may have prevented respondents from giving routine answers without considering each statement carefully. The $R^2$ value can be regarded as low, indicating that the factors included could only explain a part of the variation in the material.

The questions about contacts with rehabilitation professionals spanned the entire 11-year study period, hence the answers may refer to various contacts with people in different positions and reflect several experiences. Consequently, some respondents may have had difficulty giving a comprehensive picture of the whole period. Some individuals had recovered quickly after the inclusion in 1985 and therefore had not been in frequent contact with health care professionals and social insurance officers, while others had had substantial disorders during parts of or the entire 11-year period. The present results are probably grounded on respondents with more, rather than less, experience of contacts, which is an advantage in relation to the current research issue.
Self-rating of health over time was of interest in the validation of the health-line. In a search of the literature, no other instrument was found that measures self-rated general health in the same way (e.g., over time and with the answer given graphically). Data on sickness absence can be studied over time, thus such information was considered to be useful for testing the validity of the health-line. Another method might be to ask subjects to fill in the health-line in immediate connection with interviews.

It was assumed that, by bringing to mind other important events in life, such as child-birth, marriage, or divorce, a subject would more easily remember how his or her overall health had been during a certain period, thus eliminating some recall bias. This method has been shown to give good agreement between recalled events and official records (149).

To be able to draw conclusions regarding the replicability of the health-line, this tool should be further evaluated after repeated ratings of several subjects. Nonetheless, Lundberg et al. (150) have found that self-rating of health was as reliable as, or even more reliable than, most of the more specific questions they asked.

The relatively low response rate (72%) for the health-line question suggests that some subjects found it difficult to use this method, or that the instructions were not clear enough. Perhaps the technique is not suitable for those with very poor health. It is also possible that difficulties arise when describing personal health in retrospect. For example, it has been reported that patients in severe pain occasionally lose their time perspective (151). The number of subjects in the present cohort was too small to permit any definite conclusions.

Both the question on perceived contacts with rehabilitation professionals and that including the health-line were designed for this pilot study, and they need to be further tested before any definite statements can be made about their usefulness.

Epidemiological and statistical methods

Due to large variations in duration of sick-leave spells and the fact that different measures can produce divergent results (66, 99, 152), a number of measures of sickness absence were used in the first study. In light of the skewed distribution of the length of sick-leave spells, both mean and median values were calculated for five of the measures. Days on disability pension are seldom included and
combined with sick-leave days. Sweden differs from other countries in that there is no limit to the length of a sick-leave spell, which means that a person can be on sick leave for several years before a disability pension is granted. Local differences between social insurance offices or variation in practice over time or with sex can influence how long it takes for a disability pension to be approved, and, to eliminate such effects in the present analyses, the days of sickness absence and disability pension were combined in two of the six absence measures. Another advantage of using this combined measure was that it was possible to include all absence for a person who, for instance, had been granted part-time disability pension and was on sick leave for the other part time could be included.

When analysing risk factors for disability pension over a period as long as eleven years, it is necessary to use a model that makes proper allowance for censored observations and makes use of the information on subjects up to the time when they are lost to follow-up. The Cox proportional hazard regression has these qualities, and it also takes into consideration the time point during the follow-up period when the disability pension is granted. Thus this method was suitable for the present research objectives and study design. Methodologically speaking, with a shorter follow-up period, the time factor would have been less important, and a logistic regression might have worked just as well. A nested case-control design is an alternative model that could have been used in the current studies, where the cohort members who were not granted a disability pension could have been used as controls. Such a design is more convenient if it is necessary to collect additional data. However, all data were already available for the present studies, so a cohort design and a Cox regression analysis was preferable.

Two Cox regression models were applied to predict disability pension, one using retrospective sick-leave data (covering the three years prior to inclusion; paper II), and one in which sick-leave data for 1985–1996 were included as a time-dependent covariate (paper III). The latter model gave a more accurate estimate of the relative risk in terms of a higher $\chi^2$ value (48.9, as compared to 24.0 for the first tested model). However, this does not signify that the present model really was a better predictor of disability pension. Although the model using retrospective data predicted disability pension over a much longer time, it could still identify differences related to sex and citizenship. The model with a time-
dependent covariate appeared to be satisfactory for analysis of sick-leave data, even though the material used here was rather limited; obviously, further testing of this model on more extensive data must be done before any definite conclusions can be drawn about applicability. Six of the longitudinal investigations of sickness absence listed in Table 1 were prospective cohort studies using disability pension as an outcome measure. The span of these six studies was 5–21 years. Four of them used the standard Cox regression model, one used logistic regression, and the sixth used individual ratios of observed to expected granting of disability pensions.

An attempt was made to apply a salutogenic approach (153, 154) in the analyses of data on the studied cohort (paper IV). Robust models such as logistic and linear regression were employed due to the limited size of the cohort, and because the incidence and duration of sickness absence varied greatly among the individuals studied. However, the central limit theorem seemed to work well, since results were the same, even when the dependent variable was not normally distributed in the linear regression.

Factor analysis and linear regression were carried out to analyse responses regarding perceived contacts with rehabilitation professionals. For the health-line question correlation coefficients between the data on self-rated health and the number of days per year on sick leave and/or disability pension were used. Both these instruments were designed for this pilot study and have not been tested elsewhere. Nevertheless, this first test of the usefulness of the instruments indicates that they are worth further development.

**Needs for future research**

More longitudinal studies on sickness absence and disability pension are needed to clarify these complex phenomena and to facilitate identification of aetiological factors. The follow-up periods in the few longitudinal studies that have been performed were rather short and seldom long enough to detect the consequences of sickness absence, many of which may have a life-long course of events.

Most longitudinal studies conducted thus far were based on a cohort in a certain occupation or workplace, or on patients. Clearly, population-based studies are also needed that include students and people who are unemployed. In addition,
more diagnosis-specific studies should be performed, since both aetiology and future sick-leave patterns may be related to diagnoses. Studies should also include data on diagnosis during a follow-up period, to ascertain how the diagnosis made for an individual can change over time.

From a clinical perspective, it is essential to determine the type of consequences that are related to long-term sickness absence, and whether these effects can vary between patients due to the impact of factors that are known to be associated with high risk of long-term sickness absence. Furthermore, the increase in expenditures for sick pay and disability pension must be curbed, and one way to do that is prioritise cases in which rehabilitation measures can be assumed to have the greatest effect. The present analyses showed that, even if the members of the studied cohort represented a high risk group for disability pension, many of them had low levels of future sickness absence.

In Sweden and in many other Western countries, data on sickness absence are registered for administrative purposes. To be able to use such information in scientific research, the computerised registers should also contain data on aspects such as diagnoses, occupation, employer, and workplace.

In the research underlying this thesis, a Cox regression analysis with a time-dependent covariate (sickness absence during the two past years) was used to predict disability pension. This model was not found in other sickness absence studies, but it did seem to perform well. More than one time-dependent covariate can be included in such a model, which means that factors such as occupation and marital status could be updated during a follow-up period, leading to a more accurate estimate of the relative risk.

This thesis is based on a pilot study. Accordingly, before any general conclusions can be drawn about the results and the applicability of the methods used, corresponding analyses must be conducted that consider other cohorts with different characteristics, such as other diagnoses, ages, and geographical areas, as well as more recent data.
Summary and general conclusions

The 213 members of the studied population-based cohort of younger persons who had had a sick-leave spell lasting 28 days or longer with back, shoulder, or neck diagnoses in 1985 were found to be at high risk of disability pension within 11 years. Compared to people on sick leave with other diagnoses during the same period, the women, but not the men, in the cohort were at higher risk of disability pension. Moreover, the higher risk of disability pension among the women was still apparent when the sick-leave pattern over the follow-up period was taken into consideration.

A clinical implication of these findings is that it might be appropriate to recognise four weeks of sickness absence due to these very common disorders as a strong risk factor for disability pension, at least for women. Half of the men on disability pension were receiving such benefits due to a psychiatric disorder, and the men were granted full-time pension more often than women.

Various statistical and epidemiological methods and measures were used to analyse the longitudinal data on the cohort. A Cox regression model with a time-dependent covariate was tested and found to be suitable for prediction of disability pension. This model has not previously been used in this area of research, but the present results indicate that further testing of the model would be of value.

By applying a salutogenic approach, new associations were found between sickness absence, socioeconomic group, and marital status, which were not discerned by a pathogenic approach. These results imply that factors other than the risk factor for disability pension are associated with future low sickness absence. This knowledge, together with baseline data on factors associated with disability pension and/or future low sickness absence, may facilitate procedures such as making decisions about the introduction and allocation of early rehabilitation measures. For the studied cohort, it was found that the factors sex, health, and whether on disability pension were related to how the individuals perceived contacts with social insurance officers and healthcare workers. However, it is possible that the opposite is true, that is, that professionals treat clients differently depending on their sex and state of health.

The health-line seemed to be a suitable instrument for collecting data on self-rated general health over time. The present research was the first attempt to
evaluate the practicability of this method. The results suggest that the technique may be useful, and data on the health-line correlated well with the number of days per year on sick leave and disability pension.

General conclusions

- Additional research is needed to elucidate the situation of women on sick leave with low-back, neck, and shoulder diagnoses.
- Further testing and practical application of statistical and epidemiological models for analysing sickness absence and disability pension data should be carried out to ascertain the validity and usefulness of such models.
Svensk sammanfattning (Summary in Swedish)

Sjukfrånvaro är idag ett stort folkhälsoproblem i Sverige, liksom i övriga västvärlden, och problemet har ökat under de senaste åren. Sjukfrånvaro är ett komplex fenomen, inte bara relaterat till sjukdom och ohälsa, utan också till faktorer på individnivån, arbetsplatsen och på samhällsnivån.


Syftet med denna avhandling har varit att genomföra en pilotstudie för att få bättre kunskap om faktorer som har samband med sjukfrånvaro och förtidspensionering, om uppfattningar om möten med rehabiliteringspersonal, och om självskattad hälsa över tid bland personer som initialt varit sjukskrivna med rygg-, nacke- eller skulderdiagnoser.

En prospektiv kohortstudie med elva års uppföljning av alla personer som under 1985 var 25-34 år, bodde i Linköpings kommun och hade ett sjukskrivningsfall om minst 28 dagar med rygg-, nacke- eller skulderdiagnos genomfördes. Kohorten bestod av 213 personer, varav 61 procent kvinnor. Följande data om personerna i kohorten samlades in: Antal sjukfrånvarodagar och sjukfrånvarofall under åren 1982-1984, diagnos och data om ålder, kön, yrke, medborgarskap, civilstånd och inkomst vid inkluderingsfallet under 1985, data om alla sjukskrivningsperioder (datum, hel/deltid), sjukbidrag och förtidspension (datum, hel/deltid), emigration (datum) och död (datum och orsak) från 1985 t o


De övergripande slutsatser som dras är att olika statistiska och epidemiologiska modeller behöver prövas ytterligare för att kunna genomföra adekvata analyser
av data om sjukfrånvaro och förtidspension. Vidare behövs framförallt mer kunskap om situationen för kvinnor sjukskrivna med dessa diagnoser.
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