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The economic costs of musculoskeletal disorders

A cost-of-illness study in Sweden for 2012

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Abstract

Musculoskeletal disorders (MSDs) affect muscles, joints, tendons and other supporting tissue. They are associated with pain and reduction in the normal range of activity. MSDs are amongst the most common causes of ill health and sickness absence, giving rise to substantial costs for the society. The key aim of this study is to calculate the economic costs of musculoskeletal disorders in Sweden relating to year 2012 by performing a cost-of-illness analysis with a societal perspective and a prevalence-based approach. The results showed that total cost for musculoskeletal disorders amounted to SEK 102.3 billion of which health care accounted for SEK 37 billion (36 percent). Of total health care costs in Sweden in 2012, musculoskeletal disorders accounted for 11 percent. Indirect costs on the other hand accounted for almost two thirds of total costs for MSDs, contributing to a substantial overall burden to societal costs.

Keywords: Musculoskeletal disorders, Cost-of-illness, Direct costs, Indirect costs, Human capital.

Abbreviations

ATC	Anatomic Therapeutic Chemical Classification
AUP	Pharmacy sale price
COI	Cost-of-illness
DALY	Disability-adjusted life year
DDD	Defined daily dose
DRG	Diagnosis-related group
EU	European Union
HC	Human capital
ICD-10-SE	Swedish version of the International Classification of Diseases and Related Health Problem system, version 10
KPP	Cost per patient
MDC	Major Diagnostic Category
MSD	Musculoskeletal disorder
NBHW	The National Board of Health and Welfare
OTC	Over-the-counter
QALY	Quality-adjusted life year
SA	Sickness and activity compensation
SCB	Statistics Sweden
SKL	The Swedish Association of Local Authorities and Regions
SSIA	The Swedish Social Insurance Agency
WHO	The World Health Organization

Contents

1 Introduction

Today, Sweden among other industrialized countries are facing great challenges from demographic, environmental and lifestyle factors. One example is the dramatic increase in average life expectancy. Increased numbers and proportion of people at very old ages will have a significant impact on many sectors in the society, particularly the health care sector. Reason is the diseases generally associated with increased age, e.g. chronic diseases (Lidgren et al., 2014; Vårdanalys, 2014).

The chronic diseases that have been assessed to cause the greatest financial burden on societies and individuals are musculoskeletal disorders (MSDs). MSDs are disorders affecting bones, joints and muscles. The disorders including those resulting from trauma directly affect the mobility, autonomy and quality of life of more than 100 million people in Europe. In addition, the prevalence of MSDs is expected to grow further along with the ageing population, meaning that the financial burden from these diseases will continue to increase in coming decades (Lidgren et al., 2014; Vårdanalys, 2014).

Increased financial burden from chronic diseases have already been observed in many countries. Health care costs for chronic diseases have been assessed to account for a majority of total health care costs, both in Sweden and internationally. In Europe and the United States, health care costs of chronic diseases are estimated at 80 percent of total costs. According to a study from the National Board of Health and Welfare (NBHW) in Sweden, Swedish health care costs are expected to increase by 30 percent during the period 2010-2050 (Vårdanalys, 2014).

From an economic perspective, the increased proportion of elderly and the decreased proportion of people of working age implies a reduced tax base and hence reduced revenues to health care (Lyttkens, 2010). In order to finance forthcoming expenditures, utilizing existing resources optimally as well as creating conditions for a sustainable, efficient and equitable health care in the future is crucial (Vårdanalys, 2014).

In light of this, the key aim of this study is to calculate the economic costs of musculoskeletal disorders in Sweden relating to year 2012 by performing a cost-of-illness (COI) analysis with a societal perspective and a prevalence-based approach. Cost-of-illness studies are one of the cornerstones of the discipline of health economics and are of great interest to health economists despite the criticism (see section 3). The reason is that a cost-of-illness study enables a full economic evaluation, including both direct costs and indirect costs, of a disease. It further enables a comparison perspective of the economic burden between different diseases, e.g. between MSDs and cardiovascular disease. This is not applicable if there are no widely accepted and standardized methods to calculate costs (Ament and Evers, 1993).

An additional underlying aim of this study is to compare the result with previous Swedish cost-of-illness studies on musculoskeletal disorders to evaluate cost developments over time. As mentioned before, the financial burden from MSDs is expected to grow along with the ageing population, meaning that the cost estimates in this study should be higher than in previous studies. A comparison perspective is therefore of great interest for health economist as well as for policy makers in order to plan for future health care.

This study will include MSDs defined by ICD-10 Chapter XIII Diseases of the musculoskeletal system and connective tissue (M00-M99). Cost estimates for resource use and production loss will include statistics where any diagnosis M00-M99 is specified as the primary diagnosis. Resource use is further identified as hospital admissions that are encoded by diagnosis-related groups by NordDRG category MDC 08. Lastly, costs for pharmaceuticals will include all drugs for the Musculoskeletal system (ATC code M) and selected drugs under ATC code L (Antineoplastic and immunomodulating agents).

A number of limitations will be made in this study. First, direct costs related to pharmaceuticals will only include biologic drugs under ATC code L[1]. The selection is based on the available published data from the NBHW. Second, indirect costs for informal care and community care will not be estimated due to the lack of data on the extent of resource use in both sectors, particularly in community care. There are

[1] The biologic drugs that are included are Enbrel (L04AB01), Humira (L04AB04), Mabthera (L01XC02), Orencia (L04AA24), Remicade (L04AB02) and Roactemra (L04AC07).

therefore no basis to calculate the share of community care directly relating to musculoskeletal disorders. Third and last, the cost of lost quality-adjusted life years (QALYs) is not possible to include in the context of this study.

Due to the aforementioned limitations, the cost estimates in this cost-of-illness study will be underestimated. The total cost for musculoskeletal disorders will in other words not reflect reality accurately. Hence, it will be difficult to draw any specific conclusions, but the result is mainly intended to be used as guidelines to assess the size of the problem.

The remainder of this study will be structured as follows; section 2 contains the background introduction to the musculoskeletal disorders, the prevalence and the economic burden. Section 3 describes the methodological framework, motivates the choice of method and explains how it is applied. In section 4, the data sets used in this study is presented and depicts what alterations have been made. In section 5, the results of this study is presented, which are then discussed in section 6. Finally, section 7 presents the conclusions drawn.

2 Background

Diseases of the musculoskeletal system is a collective name for several different diseases affecting bones, joints and muscles. It also includes bone fractures and joint injuries caused by accidents. MSDs are an increasing health care issue globally, being the second leading cause of disability after mental and behavioral disorders (Socialstyrelsen, 2012a; Vos et al., 2012).

The most common diseases in the musculoskeletal system is non-specific pain, rheumatoid arthritis (RA), osteoarthritis (OA) and osteoporosis. The global prevalence of RA have been estimated at about 0.5-1.0 percent worldwide with a higher prevalence observed in northern Europe countries and the United States compared with southern Europe and developing countries (Lundkvist et al., 2008). In addition, 40 million people in the European Union (EU) are estimated to have osteoarthritis, corresponding to 0.5 percent of total gross domestic product (GDP), and in 2010, also 22 million women and 5.5 million men were estimated to have osteoporosis (Conaghan et al., 2014; Svedbom et al., 2013). These figures are just a sample of diseases within the musculoskeletal system but nevertheless demonstrates the size of the problem.

Musculoskeletal disorders also includes injuries caused by accidents. The World Health Organization (WHO) estimated that approximately 5.8 million people die worldwide each year from injury, accounting for 11 percent of global mortality. This implies that injuries have a significantly impact on the society on a physical, psychological and economical level. The total costs have been estimated at US$518 billion globally, meaning that injuries are a major cause of total health care costs in the world (Willenberg et al., 2012).

In a study from 2005, a uniform method calculating medical costs of injury was developed and applied in 10 European countries. This method allowed for calculations of medical costs of injury by age, sex, external cause and type of injury at country level and EU level. The result showed quite similar patterns of costs by age, sex, injury type, and external cause between the countries. For all countries, costs per capita increased

exponentially in ages 65 years and older, due to the combined effect of high incidence and high costs per patient. The elderly females accounted for almost tripled costs compared with same age males, but also young children and male adolescents were categorized as high-cost groups. Home and leisure injuries (including sport injuries) combined with occupational injuries accounted for 86 percent of total hospital costs of injury (Polinder et al., 2005).

In Sweden, musculoskeletal disorders are the most common causes of pain and consequently also the leading causes of impairment of work abilities, long term sicknesses, and sickness and activity compensations. The consequences are substantial costs for both the people affected and the society as a whole (Socialstyrelsen, 2012a). In 2003, Linköping University estimated that the total economic costs of rheumatic diseases and osteoporosis for year 2001 amounted to SEK 36 billion. The largest expense was indirect costs (productivity costs) which accounted for 86 percent of total costs while direct costs (health care and pharmaceuticals) represented the remaining 14 percent. The study also showed that two-thirds of both direct costs and indirect costs was attributable to women, indicating that women are overrepresented when it comes to MSDs (Schmidt et al., 2003).

The impact of musculoskeletal disorders is in other words extensive, not only in terms of costs. From the individual perspective, it is rather the impact on the quality of life that is central. MSDs are in general characterized with poor quality of life, such as pain and loss of mobility, but also an increased risk of premature death in cardiovascular disease (Socialstyrelsen, 2012a; Ajeganova et al., 2013).

The incidence of MSDs is highest among older people. More than half of all chronic conditions in people over age 65 are connected to bones, joints and muscles (Socialstyrelsen, 2012a). There is, however, a tendency for non-specific symptoms such as chronic widespread pain to decrease at the retirement age of 65. A possible explanation could be that the body is no longer exposed to adverse physical and psychological factors at work (Bergman, 2007).

Besides age-related incidence, people with lower socioeconomic status tend also to be overrepresented among MSDs. People suffering from chronic pain might have a lower socioeconomic status because of the problems caused by pain, or that low socioeconomic status increases the risk of developing chronic pain (Jöud, 2013).

3 Method

3.1 Cost-of-illness studies

Cost-of-illness studies are descriptive studies that value in economic terms the costs of a particular health problem, which enables the economic burden of the problem to be estimated. It hence provides a holistic view of the overall burden of a particular disease on society, given current treatment alternatives. Cost-of-illness studies also identify how costs are allocated between for example the health care sector, the individual, the family and others, and their relative sizes. This information can highlight areas where costs can be saved or inefficiencies reduced and is practical information to guide funding decisions and policy-making (Ament and Evers, 1993).

An additional advantage with cost-of-illness studies is that it can act as a building block in a subsequent economic evaluation. This means that in an evaluation, the change in direct costs and indirect costs of an intervention or a program would be weighted against the change in health effects (Ekman et al., 2005).

As mentioned in the beginning, cost-of-illness studies are one of the cornerstones of the discipline of health economics. However, they have raised much criticism on both methodological grounds and for being doubtful value for policy-making purposes. The reason is that cost-of-illness studies are not considered full economic evaluations because they do not assess actions to address the problem. Another criticism is that they are ineffective use of resources because they do not provide enough information to identify inefficiency or waste since no comparisons between different treatments are being applied. From a policy-making perspective, economic evaluations would be more valuable since it asses both costs and health effects of single medical interventions or healthcare programs (Ament and Evers, 1993; Ekman et al., 2005).

3.2 Types of costs

In cost-of-illness studies a distinction is made between direct, indirect and intangible costs. Intangible costs are the value of improved health *per se*, or the pain and suffering associated with treatment. As these consequences are difficult to measure and value, cost-of-illness studies are usually defined to quantify the costs that are monetarily measurable. Therefore, only direct costs and indirect costs will be estimated in this study (Drummond et al., 2005).

There are however reasons to believe that intangible costs are of great importance when it comes to musculoskeletal disorders. MSDs are chronic diseases, meaning that patients are suffering from pain for long periods, usually during the remaining time of life. Consequently, intangible costs would be high. At the same time, successful biologic drugs for rheumatoid arthritis have been documented to increase patients' quality of life (Kobelt et al., 2004). This would on the other hand lead to lower intangible costs.

Direct costs are defined as the actual money expenditures related to an illness or disorder. These costs include resource use in the health care sector and other sectors such as community care. They also include consumption of pharmaceuticals and patient's out-of-pocket expenses (Drummond et al., 2005).

In contrast, indirect costs include costs related to lost output caused by illness, disability or injury (Drummond et al., 2005). In this cost-of-illness study, productivity costs due to both sickness and premature death will be included. Since MSDs are characterized with pain and loss of mobility, indirect costs are expected to be a major expenditure sector.

3.3 Human capital approach

A generally accepted method to calculate productivity costs in health economics is the human capital (HC) approach. The HC approach is based on the assumption that earnings reflect productivity. Productivity costs are therefore quantified in terms of forgone earnings. In practice, however, neither salary nor working hours at the

individual level can be observed. Instead, an average level of wages and other costs, such as pension fees, are included in order to value the loss of production (Drummond et al., 2005).

There are many reasons to questioning the human capital approach. First of all, the human capital approach values a life with respect to the individual's lost earnings potential. This approach ignores that people are worth more than just what they produce. Secondly, the approach is based on the assumption that earnings reflect productivity. Since men on average get paid more than women, this approach assumes that men are more productive than women. Lastly, based on the assumptions in this approach, indirect costs are zero when retirees die. Consequently, from a societal perspective, it is more favorable when older people die compared to younger as it would result in lower costs.

3.4 Prevalence versus incidence

In cost-of-illness studies, two approaches can be used to estimate costs, prevalence-based and incidence-based. The underlying rationale of the prevalence-based approach is that it estimates the economic burden of a condition over a specified period, usually a year. For example, direct costs and indirect costs resulting from musculoskeletal disorders are assigned to the year in which they occur (Ament and Evers, 1993).

The incidence-based approach on the other hand estimates the lifetime costs of a condition from its onset until its disappearance, usually by cure or death. This means that all costs are discounted to their present value and assigned to the year in which the disease first appears. In order to apply an incidence-based approach, it assumes data at the individual level where well-defined disease progression can be followed over time and where the onset of illness is known, as for example stroke (Ament and Evers, 1993).

Musculoskeletal disorders are often characterized by slow onset of symptoms with joint swelling, joint or muscle tenderness, movement pain followed by rest pain, functional impairment, reduced muscle strength and fatigue, which may last for a longer period before diagnosis is determined. In other words, the onset of the disorders is ambiguous, meaning that it is difficult to assign which year the disease first

appeared. This is the main reason why a prevalence-based approach is more practicable in this cost-of-illness study.

Direct costs and indirect costs due to sickness will be estimated by using a prevalence based approach. In addition, the prevalence-based data will be using a top-down approach meaning that e.g. productivity costs will be calculated using average level of income instead of individual salaries[2]. The advantages of using a top-down approach are that no extrapolation is needed, and that it avoids the risk of double-counting. The disadvantages on the other hand are that diagnoses may be underreported or misreported, and that important cost items are missing from national illness registers. For example, costs for social services or unpaid home help are not included if a pure top-down approach is being used[3] (Ekman et al., 2005).

Indirect costs due to premature death will however be estimated using an incidence-based approach. Costs will be calculated from the year death occurs and then discounted by three percent until reached retirement age.

3.5 Perspectives of cost-of-illness studies

Cost-of-illness studies can be conducted from different perspectives. Impacts and costs can be assessed from the perspective of the health system, the individual, or the society. A societal perspective is including both direct costs and indirect costs meaning that costs will be included no matter if it is the health system or the individual who incurs them. In general, a broader societal perspective is preferred since the impact of a condition is not solely on the individuals or organizations directly involved. An advantage with a societal perspective is that it can detect costs shifting between sectors and account for alternative resource use outside the health sector (Byford and Raftery, 1998).

[2] In the bottom-up approach, data are collected directly from a sample of patients during or after medical visits, and then the figures from the sample are extrapolated to represent the whole population by using national prevalence figures. This approach can be used either as an alternative or as a complement to the top-down approach.

[3] Despite that a top-down approach is being used, costs for social services and unpaid home help will not be included due to lack of data, as mentioned in the introduction.

4 Data

4.1 Prevalence

According to a survey on living conditions (ULF) from Statistics Sweden (SCB), 957 000 persons aged 16 and older were living with musculoskeletal disorders in 2012. The survey also showed that the prevalence was higher among women than men of which women accounted for over two-thirds (67 percent). The majority of those living with MSDs (76 percent for men and 80 percent for women) was over 45 years (SCB 2012a). High prevalence among women and elderly is in line with previous studies (see e.g. Socialstyrelsen, 2012a).

The survey from SCB also estimated that 1.5 million people aged 16 and older had severe pain in their body (SCB, 2012a). This is consistent with the result in a dissertation from Lund University on back and neck pain, where 10-14 percent of the population suffered from low back pain at any given time (point prevalence) (Jöud, 2013).

4.2 Resource use in health care

Following sections will give a detailed description of the data that have been used to estimate the costs for outpatient care, inpatient care and pharmaceuticals. In general, data for musculoskeletal disorders are presented in national administrative records such as the NBHWs patient, death, operation, and pharmaceutical records. There are, however, no current national data on resource use in outpatient care.

Outpatient care In the absence of nationally collective data from outpatient care, costs for resource utilization have been estimated based on statistics from Region Skåne together with published data from the Swedish Association of Local Authorities

and Regions (SKL). The number of physician contacts (both physical and other forms of communication as for example over the phone) in Region Skåne in 2012 amounted to more than 3 million in primary care and 2.5 million in specialist care (Region Skåne, 2012). On national level, this would correspond to 23.2 million physician contacts in primary care and 19.4 million physician contacts in specialist care.

Data on the number of physician contacts was complemented by data on the number of visits to other health care providers than physicians, particularly nurses, physiotherapists and occupational therapists. According to SKL, the number of visits to other health care providers amounted to 25.9 million in primary care and 7.3 million in specialist care (SKL, 2013). In addition, the NBHW estimated that 20-30 percent of the visits in primary care are caused by people with musculoskeletal disorders (Socialstyrelsen, 2012a). Based on these numbers, the total number of contacts caused by MSDs was estimated to 17.1 million.

Inpatient care Estimates on direct costs for musculoskeletal disorders in inpatient care was based on published statistics from the NBHW and the Cost-Per-Patient (KPP) database from SKL (Socialstyrelsen, 2012b; SKL 2012). The KPP-database is divided into DRGs, grouped into Major Diagnostic Categories (MDCs). This study is based on MDC 08, Musculoskeletal System and Connective Tissue (Socialstyrelsen, 2014a). DRGs under MDC 08 is presented in **Table 2** in Appendix.

The KPP-database includes the number of admissions, hospital-bed days and inpatient costs. To calculate the costs for inpatient care, data from the NBHW was combined with cost estimates from the KPP-database. The latest available data was from the data collection in 2012. The results are presented in **Table 3 – Table 4** in Appendix.

Pharmaceuticals Costs for pharmaceuticals for treatment of the musculoskeletal system is based on published data from the NBHW's report on pharmaceutical costs for 2012. The report presents defined daily doses (DDD) and costs (AUP) for prescription drugs, drugs in inpatient care and over-the-counter (OTC) drugs. The report further presents DDD for all major groups, which in this case is ATC code M. As only some drugs under ATC code L can be attributed to musculoskeletal disorders, an inclusion of the entire group would lead to an overestimation of the costs. Therefore, only selected drugs under L was included (Socialstyrelsen, 2013).

4.3 Productivity costs

Under indirect costs, available information on productivity costs due to reduced work capacity and premature death is compiled. As mentioned before, productivity costs have been calculated according to the human capital approach.

Reduced work capacity In Sweden, MSDs are the leading cause to sick leave and sickness and activity compensation (SA). There are primarily two different forms of compensation available for employed individuals who become sick or injured. The first one is sickness benefit which is given to people who are unable to work due to illness. The other one is SA which is given to people who probably never will be able to work full time due to illness, injury or disability[4] (Lidwall, 2011).

Studies on sick leave from Sweden are often based on data from the Swedish Social Insurance Agency (SSIA). One problem with this data is that sick leave shorter than 14 days is not registered. The reason is that the employer is financially responsible for the first 14 days in a period of absence due to illness. Information on leaves of absence shorter than 14 days is therefore not available from the SSIA (Lidwall, 2011). The implication of the legal structure of the labor market in Sweden is consequently that indirect costs might tend to be underestimated. Another implication is that diseases with shorter course of disease, e.g. fever and cold will have small or zero indirect costs as they are not registered by the SSIA. This is an important aspect when both performing a cost-of-illness study and comparing different diseases. In addition, diseases such as fever and cold might rather result in sickness at work, meaning less productivity and hence hidden productivity costs.

In order not to underestimate the indirect costs for musculoskeletal disorders, each period of absence that is registered by the SSIA have been added 14 days. This does however mean that periods of absence shorter than 14 days (i.e. periods not registered by the SSIA) have not been possible to include in the cost estimates. There are therefore reasons to believe that the indirect costs in this study are underestimated, but as MSDs are generally associated with longer sick periods, this might not be a problem.

[4] Sickness and activity compensation was previously called disability pension. An important difference is that SA is always time limited, unlike disability pension.

Premature death The premise is that premature death have costs to society in terms of productivity costs up to the retirement age of 65. In order to calculate premature death caused by MSDs, this study have been based on mortality data and a lifetime table for 2012. The value of lost working years where calculated using data from the Labor Force Survey (AKU) from SCB which indicated average employment rate by gender and age group (Socialstyrelsen, 2012c; SCB, 2012b).

To calculate productivity cost, the number of deaths in each age group was multiplied with expected working activity in each age group, the employment rate and the average monthly salary. Future productivity costs was then discounted by 3 percent. There was however no assumptions about productivity growth over time.

4.4 Unit costs

The economic costs of musculoskeletal disorders have been estimated for the year of 2012 which was the last full calendar year with available data. Because of that, 2012 prices have been used in various types of resource use. All unit prices are presented in **Table 1**.

Costs for outpatient care was based on the price list of Region Skåne[5]. The cost for a physician contact in primary was SEK 1359 while a visit with another health care provider was SEK 554. In specialist care, the cost for a physical doctor visit, other physician contact, and a visit to other health care providers was SEK 2316, SEK 295, and SEK 1039, respectively (Södra regionvårdsnämnden, 2011).

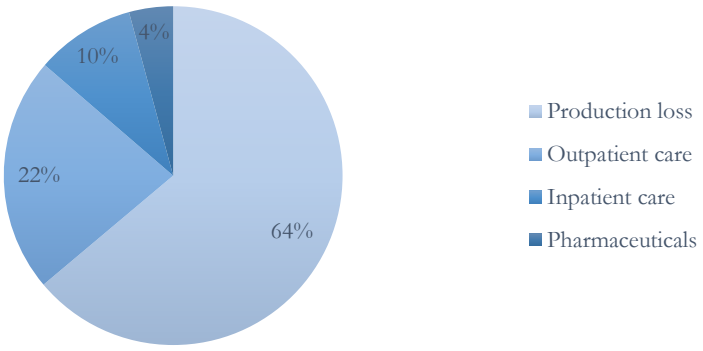
Indirect costs related to productivity losses were valued based on wage data from SCB. The average monthly salary for men was SEK 32,100 and SEK 27,600 for women (SCB, 2012b). The calculations also included social security contributions (31.42%) and an average cost of collective wage agreement (10.38%) for men and women in Sweden in 2012[6] (Ekonomifakta, 2012).

[5] After a review of price lists in different regions in Sweden, no significant difference was found.
[6] According to ekonomifakta.se indicated, average cost of social security contributions in 2012 were 37.4% for blue-collar workers and 46.2% for white-collar workers. Therefore, an average of 37.4% and 46.2% was used, namely 41.8%.

5 Results

Total costs and allocations of costs for musculoskeletal disorders are presented in **Table 1**. Total costs amounted to SEK 102.3 billion in 2012. Translated into cost per person based on the population in Sweden in 2012 corresponds to about SEK 11 000. Of total costs, health care accounted for 36 percent, or the equivalent of SEK 37 billion while non-health care accounted for 64 percent, or the equivalent of SEK 65.4 billion. The allocation of costs for musculoskeletal disorders in percent is further presented in **Figure 1**.

Figure 1: The allocation of costs for musculoskeletal disorders in percent.



Non-health care costs included costs for lost productivity caused by premature death, sick leave, and sickness and activity compensation. Figures on productivity costs were calculated separately for men and women. The results and underlying calculations are reported in more detail in **Table 5 – Table 9** in Appendix.

The Tables shows that women had higher productivity costs than men as women's share of total costs were 62 percent. This despite that men on average worked in occupations with higher wages (and hence should result in higher productivity costs). The only explanation to this result is that women is overrepresented among MSDs. They therefore represents a larger share of total costs, despite lower wages. This is in line with previous studies (see e.g. Schmidt et al., 2003).

From the Tables on productivity costs, it can also be inferred that costs of lost production due to premature death was a small expenditure item compared to sick leave and sickness- and activity compensation. The most obvious explanation to this result is that musculoskeletal disorders are primarily characterized with pain and loss of mobility, leading to reduced capacity to work and large productivity costs. However, there are reasons to believe that the result is misleading. The number of deaths related to musculoskeletal disorders might be underestimated in the data. When people with MSDs dies from any cause of death, it will most likely not be attributed to the musculoskeletal system although the underlying cause was musculoskeletal related. The number of deaths related to MSDs are therefore probably underestimated, leading to hidden productivity costs. This is of course a problem, but it would also be problematic if the cause of death would be attributed to both musculoskeletal disorders and e.g. cardiovascular disease. This could lead to double-counting and consequently overestimate the costs when performing a cost-of-illness study on more than one disease.

In the NBHWs patient record and the KPP-database, costs for inpatient care are divided by primary diagnosis within the group of MSDs. As can been seen in **Table 3**, three diagnostic groups accounted for about 60 percent of total resource utilization. Osteoarthritis, spondylopathies (disorders of the spine) and other dorsopathies together accounted for 60 percent of both hospital-bed days, admissions and the number of patients treated with a primary diagnosis in the group of MSDs. In total, the NBHWs patient records registered over 450 000 bed days for about 78 500 patients in the group of MSDs in 2012. The number of patients (78 498) represents almost 10 percent of total number of patients for all diseases in the NBHWs record for 2012 (Socialstyrelsen, 2012d).

To estimate the hospital costs for musculoskeletal disorders, data from the NBHWs patient record was combined with information from the KPP-database. The estimated costs based on hospital admissions and bed days for a sample of code groups in MDC 08 are reported in **Table 4**. The largest cost was replacements of joints in the hip, knee or foot (29 percent), followed by surgery on the hip and femur as well as back and neck procedures which respectively constituted for 12 percent (Socialstyrelsen, 2012b; SKL, 2012).

Resource use and costs in outpatient care are represented in **Table 1**. Primary care and specialized care accounted for over SEK 23 billion together, representing 62 percent of total costs for health care. As the estimates are based on data from Region Skåne (scaled up to national level), these figures might not represent the actual resource use in Sweden accurately. The reason is that in per-capita calculations, there are several factors that could contribute to misleading results. Morbidity, health care consumption and productivity costs may differ between the national average and regional levels. However, as Region Skåne represents about 13 percent of the total population in Sweden, this region can be considered representative of the national average. An additional argument in favor of Skåne as a representative region is that the distribution of costs between outpatient care and inpatient care for musculoskeletal disorders are in line with previous results (see e.g. Schmidt et al., 2003).

Table 1: Total costs and allocations of costs for musculoskeletal disorders.

Type of resource use	Number of units	Average unit cost, SEK	Total cost, SEK millions
Health care costs			
Outpatient care			
Primary care			
Physician contact	5 793 217	1 359	7 873
Other health care contact	6 475 000	554	3 587
Specialist care			
Physician contact (physical)	4 052 338	2 316	9 385
Physician contact (other)	803 938	295	237
Other health care contact	1 815 250	1 039	1 886
Inpatient care			
Hospital admissions	169 724		9 706
Drugs			
Pharmaceutical benefit			2000
Inpatient drug			1788
Individual expenditure			
Non-prescription drugs (ATC code M)	85 300 000		511
Total health care costs			**36 973**
Non-health care costs			
Productivity costs			
Mortality			
Lost working years	M: 293	M: 546 214	M: 26
	F: 477	F: 469 642	F: 31
	M+F: 770		M+F: 57
Total premature death			*57*
Reduced work capacity			
Sick leave (number of days)	12 650 781	M: 2 324	M: 11 469
		F: 1 998	F: 15 421
			M+F: 26 890
Sickness and activity compensation (number of persons)	100 585	M: 546 214	M: 13 110
		F: 469 642	F: 25 311
			M+F: 38 421
Total work disability			*65 311*
Total productivity costs			*65 368*
Total non-health care costs			**65 368**
Total economic burden			**102 341**

6 Discussion

The total economic burden of musculoskeletal disorders was estimated to SEK 102.3 billion in 2012. The study included costs such as costs for outpatient care, inpatient care, pharmaceuticals and productivity costs due to morbidity and premature death. Costs for lost productivity accounted for the largest expenditure item as musculoskeletal disorders are primarily related to reduced capacity to work. Productivity costs due to premature death was thus a comparatively small part of the costs.

6.1 Limitations

As mentioned earlier in this study, there are reasons to believe that the numbers of deaths related to musculoskeletal disorders are underestimated. A previous study from 2011 examined whether sick leave in musculoskeletal disorders increased the risk of sickness and activity compensation or premature death. The results showed that sick leave in MSDs had health consequences for both women and men in terms of a greatly increased risk of sickness and activity compensation, and an increased risk of premature death from any cause of death (Jansson and Alexanderson, 2011). This result implies that premature death in MSDs is more common than what data shows. It further implies that the productivity costs due to premature death in this cost-of-illness study might be significantly underestimated.

There are additional reasons to believe that total costs are significantly underestimated in this cost-of-illness study. As mentioned in the introduction, a number of limitations have been made for various reasons despite that some of them are assumed to be central for MSDs. First and foremost is the cost of lost QALYs. The implications of the disorders are reduced quality of life and disability, leading to large costs for lost QALYs for the individual. To illustrate this, osteoporosis was estimated to cause 36.000 lost QALYs, at a cost of approximately SEK 24.6 billion in Sweden in 2010

(Svedbom et al., 2013). As this was only one disorder within musculoskeletal disorders, the total cost for lost QALYs are expected to be high.

Secondly are the costs for informal care, and community care such as home care or assisted living facilities. As patients with musculoskeletal disorders are struggling with a reduction in the normal range of activity, additional help with e.g. household tasks are central for these patients. A study from the Netherlands estimated the magnitude of the burden of informal care of rheumatoid arthritis patients. In general, the study showed that informal care can be burdensome in the context of RA. The caregivers had on average been providing informal care for more than 11 years. Total time invested in caregiving was 27.4 hours per week. Most of the informal care provided was related to household tasks such as house cleaning and the preparation of food and drinks. More than 80 percent of the caregivers indicated that their time spent on household activities had increased compared with the period before the patient was ill and 6.1 percent had to quit their paid job to free time to care for the patient. A total of 43.5 percent of the caregivers had experienced additional costs as a result of caregiving while 18.9 percent reduced their leisure time (Brouwer et al., 2004).

The study from Netherlands illustrates the importance of informal care for patients with musculoskeletal disorders. As shown in the study, caregivers quit their jobs in order to free time to care for the patient. This leads to lost income for the caregiver and high productivity costs for the society. Hence there are reasons to assume that costs for informal care would be large for both the individual and the society.

Although above mentioned costs are central for musculoskeletal disorders, there was no possibility in the context of this study to include them. In addition, including the costs is not entirely unproblematic. For example, when it comes to community care, it is difficult to distinguish between care only related to MSDs and care granted on other grounds such as reduced ability to fend for himself because of dementia. Costs for community care are therefore difficult to assign to a specific disease and could have led to an overestimation.

6.2 Cost comparison

Estimated costs for musculoskeletal disorders in this cost-of-illness study significantly underestimates the total costs for the society. Despite underestimation, the result indicates that MSDs have a major impact on the society.

As an underlying aim of this study was to compare the result with previous Swedish cost-of-illness studies on MSDs, it might suggest whether my results are reasonable or not. The reason for the comparative perspective was primarily to evaluate cost developments over time, which is of great interest for policy makers in orders to plan for future health care. Since the financial burden from MSDs is expected to grow along with the ageing population, costs estimates in this study are expected to be higher compared to earlier studies.

In 2008, Linköping University estimated the economic costs for different disease groups in Östergötland, Sweden. According to the study, total costs for musculoskeletal disorders amounted to SEK 4.7 billion in 2006, representing 23 percent of total costs (SEK 20.2 billion) for all diseases (Schmidt and Andersson, 2008). The population of Östergötland represents 4.6 percent of the population in Sweden. To compare the costs in Östergötland with the costs in this cost-of-illness study (i.e. total costs in Sweden), costs had to be scaled up to national level. In order to compare them with the costs from 2012, they also had to be adjusted to the price level in 2012. According to the consumer price index, costs amounted to over SEK 102.2 billion for musculoskeletal disorders. In other words, the costs for 2006 are well in line with the result in this study (SEK 102.3 billion).

There are yet one difference between the two cost-of-illness studies. The study by Schmidt and Andersson (2008) had not included productivity costs due to premature death. As this cost represented only a small part of total costs in this study, it does not contribute to any significant difference in outcome (i.e. SEK 0.1 billion).

In contrast, as the costs for musculoskeletal disorders are expected to increase over time, it is very interesting that costs for 2012 are in line with costs for 2006. This result suggests that costs for MSDs are constant over time, or at least for this time of period. It could be the case that the time period is too short to evaluate whether or not the

costs increases over time. In addition, costs are expected to increase along with the ageing population, and the average life expectancy is most likely the same now as in 2006.

Due to the limitations in this study, there are several reasons to assume that the results do not reflect reality accurately. Besides the limitations, some assumptions that have been made in this study might have affected the results. For example, the assumption that resource use in outpatient care in Region Skåne is representative for Sweden could have contributed to misleading results. On the whole, the results in this study are not sufficiently reliable in order to draw conclusion regarding cost developments over time.

6.3 Future challenges

Between 1990 and 2010, total disability-adjusted life years (DALYs) due to musculoskeletal disorders increased with 4.7 percent and accounted for 6.8 percent in 2010 (Murray et al., 2012). This illustrates that the prevalence of MSDs have not reached its peak yet, and will continue to increase as the average life expectancy is continuing to increase. It further illustrates that if this trend continues, it will give rise to more substantial costs for the society and burden future health care systems even more than today.

In order to finance forthcoming expenditures it is therefore crucial to utilize existing resources optimally. It is also essential to prevent and alleviate the disease course. For example, biologic drugs for rheumatoid arthritis are documented to increase the patients' quality of life. Even though the costs for biologic drugs are significant, increased use of biologic drugs could alleviate the disease course and hence lead to lower outpatient care as well as inpatient care. Lower direct costs could then compensate for the increased costs for pharmaceuticals (Kobelt et al., 2004).

Lastly, an important aspect is unrelated medical costs in life-years gained. This important cost category is normally ignored in economic evaluations (Rappange et al., 2008). The point is that if patients do not die in this disease, they will die in any other.

7 Conclusion

The key aim of this study has been to calculate the economic costs for musculoskeletal disorders in Sweden relating to year 2012. The total costs amounted to SEK 102.3 billion of which health care amounted to over SEK 37 billion. According to the NBHW, total health care spending amounted to approximately SEK 327 billion in 2012 (Socialstyrelsen, 2014b), meaning that musculoskeletal disorders accounted for about 11 percent. Indirect costs on the other hand accounted for almost two thirds of total costs for MSDs, contributing to a substantial overall burden to social costs.

Although estimates of the societal costs have tried to be as comprehensive as possible, some limitations have been necessary in the context of the study. The limitations are mainly related to different health care interventions. The total societal costs are therefore significantly underestimated, meaning that the result do not reflect the reality accurately.

In addition, many studies have been emphasizing that costs related to MSDs are increasing steadily along with the ageing population. This development is however not reflected in this cost-of-illness study as the results are in line with previous studies, suggesting that costs are constant over time. On the other hand, as the results from this study are not sufficiently reliably, it is not possible to draw any conclusions regarding cost developments over time.

This study rather outlined the substantial financial burden from MSDs on both individuals and the society, regardless underestimated costs. Given the epidemiological pattern, the financial burden is expected to become even more substantial in the coming decades. In order to meet future demand in the health care sector, it is essential to prioritize research into the most cost-effective strategies for prevention and treatment (Murray et al., 2012). To alleviate and inhibit the disease course it is also important with early diagnosis, early treatment and rehabilitation (Socialstyrelsen, 2012a).

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References

Ahlberg, I. (2014). Kostnader för rörelseorganens sjukdomar i Sverige år 2012. *IHE-Rapport 2014:4*.

Ajeganova, S., Andersson, ML., Frostegård, J., & Hafström, I. (2013). Disease factors in early rheumatoid arthritis are associated with differential risks for cardiovascular events and mortality depending on age at onset: a 10-year observational cohort study. *J Rheumatol, 40(12)*, 1958-66. doi: 10.3899/jrheum.

Ament, A., & Evers, S. (1993). Cost of illness studies in health care: a comparison of two cases. *Health Policy, 26(1)*, 29-42.

Bergman, S. (2007). Public health perspective – how to improve the musculoskeletal health of the population. *Best Pract Res Clin Rheumatol, 21(1)*, 191-204.

Brouwer, WB., van Exel, NJ., van de Berg, B., Dinant, HJ., Koopmanscharp, MA., & van den Bos, GA. (2004). Burden of caregiving: evidence of objective burden, subjective burden, and quality of life impacts on informal caregivers of patients with rheumatoid arthritis. *Arthritis Rheum, 51(4)*, 570-7.

Byford, S. & Raftery, J. (1998). Perspectives in economic evaluation. *British Medical Journal, 316(7143)*, 1529-30.

Conaghan, PG., Kloppenburg, M., Schett, G., Bijlsma, JW., & EULAR osteoarthritis ad hoc committee, (2014). Osteoarthritis research priorities: a report from a EULAR ad hoc expert committee. *Ann Rheum Dis, 73(8)*, 1442-5. doi: 10.1136/annrheumdis-2013-204660.

Drummond, MF., Sculpher, MJ., Torrance, GW., O'Brien, BJ., & Stoddart, GL. (2005). *Methods for the Economic Evaluation of Health Care Programmes* (3. uppl.). New York: Oxford University Press.

Ekman, M., Johnell, O., & Lidgren, L. (2005). The economic cost of low back pain in Sweden in 2001. *Acta Orthop, 76(2)*, 275-84.

Ekonomifakta, (2012). *Statistikdatabasen*. Available at: http://www.ekonomifakta.se/sv/Fakta/Skatter/Skatt-pa-arbete/Sociala-avgifter/ [Accessed at: 2014-05-20].

Försäkringskassan, (2012). *Statistikdatabasen*. Available at: http://www.forsakringskassan.se/statistik [Accessed at: 2014-05-20].

Jansson, C., & Alexanderson, K. (2011). Innebär sjukskrivning i muskuloskeletala diagnoser en ökad risk för sjuk- och aktivitetsersättning eller förtida död bland kvinnor och män? En rikstäckande prospektiv kohortstudie. *Delrapport 6 i projekt om kvinnors och mäns sjukfrånvaro.* Karolinska Institutet, Institutionen för klinisk neurovetenskap.

Jöud, A., (2013). *Back and neck pain: Patterns in healthcare consultations*. Doktorsavhandling, Lunds universitet, Medicinska Fakulteten.

Kobelt, G., Eberhardt, K., & Geborek, P. (2004). TNF inhibitors in the treatment of rheumatoid arthritis in clinical practice: costs and outcomes in a follow up study of patients with RA treated with etanercept or infliximab in southern Sweden. *Ann Rheum Dis, 63(1)*, 4-10.

Lidgren, L., Gomez-Barrena, E., N Duda, G., Puhl, W., & Carr, A. (2014). European musculoskeletal health and mobility in Horizon 2020: Setting priorities for musculoskeletal research and innovation. *Bone Joint Res, 3(3)*, 48-50. doi: 10.1302/2046-3758.33.2000296.

Lidwall, U. (2011). Vad kostar olika sjukdomar i sjukförsäkringen? *Socialförsäkringsrapport 2011:4*. Stockholm: Försäkringskassan. Available at: http://www.forsakringskassan.se/statistik/publikationer/socialforsakringsrapporter [Accessed at: 2014-08-30].

Lundkvist, J., Kastäng, F., & Kobelt, G. (2008). The burden of rheumatoid arthritis and access to treatment: health burden and costs. *Eur J Health Econ, 8(2)*, 49-60.

Lyttkens, CH. (2010). Sjukvårdens långsiktiga finansiering. *Vårdens utmaningar*. Ed. Anell, A. & Gerdtham, UG. SNS förlag.

Murray, CJ., Vos, T., Lozano, R., Naghavi, M., Flaxman, AD., Michaud, D., et al. (2012). Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet, 380(9859)*, 2197-223. doi: 10.1016/S0140-6736(12)61689-4.

Polinder, S., Meerding, WJ., van Baar, ME., Toet, H., Mulder, S., van Beeck, EF., et al. (2005). Cost estimation of injury-related hospital admissions in 10 European countries. *J Trauma, 59(6)*, 1283-90.

Rappange, DR., van Baal, PH., van Exel, NJ., Feenstra, TL., Rutten, FF., & Brouwer, WB. (2008). Unrelated medical costs in life-years gained: should they be included in economic evaluations of healthcare interventions? *Pharmaceuticals, 26(10)*, 815-30.

Region Skåne, (2012). *Statistikdatabasen 2012*.

SCB, (2012a). *Undersökningar om levnadsförhållanden*. Available at: http://www.scb.se/ulf/ [Accessed at: 2014-04-20].

SCB, (2012b). *Statistikdatabasen*. Available at: http://www.scb.se/sv_/Hitta-statistik/ [Accessed at: 2014-04-20].

Schmidt, A., & Andersson, A. (2008). Östgötars samhällskostnader för ohälsa fördelat på sjukdomsgrupper – 2006. *CMT Rapport 2008:2*. Available at: http://liu.diva-portal.org/smash/record.jsf?pid=diva2:265359 [Accessed at: 2014-04-15].

Schmidt, A., Husberg, M., & Bernfort, L. (2003). Samhällsekonomiska kostnader för reumatiska sjukdomar. CMT Rapport 2003:5.

SKL, (2013). *Statistik om hälso- och sjukvård samt regional utveckling 2012*. Available at: http://webbutik.skl.se/sv/artiklar/statistik-om-halso-och-sjukvard-samt-regional-utveckling-2012.html [Accessed at: 2014-08-15].

SKL, (2012). *KPP-databasen*. Available at: https://stat.skl.se/kpp/index.htm [Accessed at: 2014-04-25].

Socialstyrelsen, (2014a). *Vägledning till NordDRG. Svensk-CC version 2014*. Available at: http://www.socialstyrelsen.se/Lists/Artikelkatalog/Attachments/19299/2013-12-24.pdf [Accessed at: 2014-08-30].

Socialstyrelsen, (2014b). Tillståndet och utvecklingen inom hälso- och sjukvård och socialtjänst. Lägesrapport 2014. Available at: http://www.socialstyrelsen.se/publikationer2014/2014-2-3 [Accessed at: 2014-08-30].

Socialstyrelsen, (2013). *Läkemedel - statistik för år 2012*. Available at: http://www.socialstyrelsen.se/publikationer2013/2013-3-21 [Accessed at: 2014-08-30].

Socialstyrelsen, (2012a). Nationella riktlinjer för rörelseorganens sjukdomar 2012: Osteoporos, artros, inflammatorisk ryggsjukdom och ankyloserande spondylit, psoriasisartrit och reumatoid artrit. Västerås: Edita Västra Aros. Available at: http://www.socialstyrelsen.se/publikationer2012/2012-5-1 [Accessed at: 2014-08-30].

Socialstyrelsen, (2012b). *Sociastyrelsens statistikdatabas. DRG i slutenvård.* Available at: http://www.socialstyrelsen.se/statistik/statistikdatabas/drgislutenvard [Accessed at: 2014-04-20].

Socialstyrelsen, (2012c). *Dödsorsaksregistret.* Available at: http://www.socialstyrelsen.se/statistik/statistikdatabas/dodsorsaker [Accessed at: 2014-04-25].

Socialstyrelsen, (2012d). *Socialstyrelsens statistikdatabas. Diagnoser i slutenvård.* Available at: http://www.socialstyrelsen.se/statistik/statistikdatabas/diagnoserislutenvard [Accessed at: 2014-04-20].

Svedbom, A., Hernlund, E., Ivergård, M., Compston, J., Cooper, C., Stenmark, J., et al. (2013). Osteoporosis in the European Union: a compendium of country-specific reports. *Arch Osteoporos, 8(1-2)*, 137. doi: 10.1007/s11657-013-0137-0.

Södra regionvårdsnämnden, (2011). *Regionala priser och ersättningar för Södra sjukvårdsregionen 2012*. Available at: http://www.skane.se/sv/Webbplatser/Sodra-regionvardsnamnden/PriserAvtal/ [Accessed at: 2014-08-30].

Vos, T., Flaxman, AD., Naghavi, M., Lozano, R., Michaud, C., Ezzati, M., et al. (2012). Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet, 380(9859),* 2163-96. doi:10.1016/S0140-6736(12)61729-2.

Vårdanalys, (2014). VIP i vården? – Om utmaningar i vården av personer med kronisk sjukdom. *Rapport 2014:2*. Stockholm.

Willenberg, L., Curtis, K., Taylor, C., Jan, S., Glass, P., & Myburgh, J. (2012). The variation of acute treatment costs of trauma in high-income countries. *BMC Health Serv Res, 12*, 267. doi: 10.1186/1472-6963-12-267.

Appendix

List of tables for Appendix:

A DRGs in MDC 08

Table 2: DRGs in MDC 08 (Socialstyrelsen, 2014a).

DRG	Text
209C	Bilateral joint replacement of hip and reattachment of lower extremity
209D	Major joint replacement in hip, complicated
209E	Major joint replacement of hip, not complicated
209F	Bilateral joint replacement of knee or foot
209G	Major joint replacement of knee or foot
209O	Joint replacement of lower extremity, outpatient
210	Hip & femur procedures except major joint, > 17 year, complicated
211	Hip & femur procedures except major joint, > 17 year, not complicated
212	Hip & femur procedures except major joint, 0-17 year
212O	Hip & femur procedures except major joint, outpatient
213	Amputation for musculoskeletal system & connective tissue
213O	Amputation for musculoskeletal system & connective tissue, outpatient
214A	Spinal fusion
214B	Other spinal fusion, complicated
214C	Other back & neck procedures, complicated
215B	Other spinal fusion, not complicated
215C	Other back & neck procedures, not complicated
215O	Back & neck procedures, outpatient
216	Biopsies of musculoskeletal system & connective tissue
216O	Biopsies of musculoskeletal system & connective tissue, outpatient
217	Wound debridement and skin graft except hand, for musculo-conn tiss dis
217O	Wound debridement and skin graft except hand, for musculo-conn tiss dis
218	Foot, lower leg or upper arm procedures, >17 year, complicated
219	Foot, lower leg or upper arm procedures, >17 year, not complicated
220	Foot, lower leg or upper arm procedures, 0-17 year
220O	Foot, lower leg or upper arm procedures, outpatient
221	Knee procedures except arthroscopy, complicated
222	Knee procedures except arthroscopy, not complicated
222O	Other knee procedures, outpatient
222P	Major knee procedures, outpatient
223	Major shoulder, elbow or arm procedures
223O	Major shoulder or elbow joint procedures, outpatient
224	Other arm procedures, not complicated
224O	Other arm procedures, outpatient
225	Foot procedures
225O	Foot procedures, outpatient
226	Connective tissue procedures, complicated
227	Connective tissue procedures, not complicated
227O	Connective tissue procedures, outpatient
228	Major thumb or joint procedures/other hand or wrist procedures

Table 2: DRGs in MDC 08 (continuation).

DRG	Text
228O	Major thumb & joint procedures, outpatient
229	Hand or wrist procedures, except major joint procedures, not complicated
229O	Hand or wrist procedures, except major joint procedures, outpatient
231O	Local excision & removal int fix devices except hip & femur, outpatient
232	Arthroscopy
232O	Arthroscopy, outpatient
233	Other musculoskeletal system & connective tissue procedures, complicated
234	Other musculoskeletal system & connective tissue procedures, not complicated
234O	Other musculoskeletal system & connective tissue procedures, outpatient
235	Fractures of femur
236	Fractures of hip & pelvis
237	Sprains, strains & dislocations of hip, pelvis & thigh
238	Osteomyelitis
239	Musculoskeletal malignancy & pathol fracture
240N	Connective tissue disorders & vasculitis, complicated
241N	Connective tissue disorders & vasculitis, not complicated
242A	Infectious arthritis and bursitis
242B	Inflammatory arthropathies, complicated
242C	Inflammatory arthropathies, not complicated
242D	Other arthritis
242E	Arthroses, complicated
242F	Arthroses, not complicated
243	Medical back problems
244	Other bone diseases, complicated
245	Other bone diseases, not complicated
247	Symptoms of musculoskeletal system & connective tissue disorders
248	Bursitis, tendonitis & myositis
249	Aftercare, musculoskeletal system & connective tissue
250	Fracture/sprain/dislocation in forearm/hand/foot, >17 year, complicated
251	Fracture/sprain/dislocation in forearm/hand/foot, >17 year, not complicated
252	Fracture/sprain/dislocation in forearm/hand/foot, 0-17 year
253	Fracture/sprain/dislocation in upper arm/lower leg except foot, >17 year, complicated
254	Fracture/sprain/dislocation in upper arm/lower leg except foot, >17 year, not complicated
255	Fracture/sprain/dislocation in upper arm/lower leg except foot, 0-17 year
256	Other musculoskeletal system & connective tissue diagnoses

B Resource use in health care

Table 3: Number (percent) of hospital-bed days, admissions and patients receiving inpatient care in hospitals in 2012 (Socialstyrelsen, 2012d).

ICD-10-SE	Hospital-bed days	Hospital admissions	Patients
M00-M99 Diseases of the musculoskeletal system and connective tissue	449 699	96 020	78 498
M00-M03 Infectious arthropathies	19259 (4 %)	2229 (2 %)	1848 (2 %)
M05-M14 Inflammatory polyarthropathies	30013 (7 %)	5160 (5 %)	4335 (6 %)
M15-M19 Arthrosis	135769 (30 %)	32354 (34 %)	29006 (37 %)
M20-M25 Other joint disorders	15397 (3 %)	6442 (7 %)	5473 (7 %)
M30-M36 Systemic connective tissue disorders	26552 (6 %)	4029 (4 %)	2646 (3 %)
M40-M43 Deforming dorsopathies	8516 (2 %)	1334 (1 %)	1131 (1 %)
M45-M49 Spondylopathies	74394 (17 %)	11942 (12 %)	9209 (12 %)
M50-M54 Other dorsopathies	57798 (13 %)	13859 (14 %)	11402 (15 %)
M60-M63 Disorders of muscles	2873 (1 %)	517 (1 %)	471 (1 %)
M65-M68 Disorders of synovium and tendon	2936 (1 %)	1055 (1 %)	971 (1 %)
M70-M79 Other soft tissue disorders	30819 (7 %)	9614 (10 %)	8901 (11 %)
M80-M85 Disorders of bone density and structure	17370 (4 %)	2782 (3 %)	2473 (3 %)
M86-M90 Other osteopathies	16383 (4 %)	2167 (2 %)	1756 (2 %)
M91-M94 Chondropathies	1309 (0,3 %)	568 (1 %)	532 (1 %)
M95-M99 Other disorders of the musculoskeletal system and connective tissue	10311 (2 %)	1968 (2 %)	1381 (2 %)

Table 4: Total health care costs in 2012 for musculoskeletal disorders defined by DRG groups in MDC 08 (Socialstyrelsen, 2012b; SKL, 2012).

MDC	Hospital admissions	Average cost per hospital-bed day, SEK	Total health care cost, SEK thousands	
			Based on admissions	Based on hospital-bed days
MDC 08 (all)	*169724*	*708654*	*9705997*	*8865759*
209 Join replacement of hip, knee and foot	35536	67908	2824706	2527115
210-212 Hip and femur procedures	15093	35349	1092326	1024663
214-215 Back and neck procedures	13255	88461	1185652	1003917
217 Wound debridement and skin graft	463	12124	74973	85568
218-220 Foot, lower leg or upper arm procedures	11427	45681	728335	669855
221-222 Knee procedures	3422	25917	194968	149914
223-224 Arm procedures	9294	52633	508240	439694
225 Foot procedures	1136	15052	51161	44629
226-227 Connective tissue procedures	3466	27124	171375	157830
228-229 Hand and wrist procedures	5770	38460	224682	210728
230-231 Excision and removal int fix device	1466	26755	54164	53363
233-234 Other musculoskeletal system and connective tissue procedures	2002	34751	157751	139064
235-237 Fractures of hip, pelvis and thigh	5782	21152	264063	205722
239 Musculoskeletal malignancy	3022	7743	161381	151609
240-241 Connective tissue disorders and vasculitis	4024	16245	213607	207120
242 Arthritis and arthroses	6803	40224	279373	272338
243 Medical back problems	14434	7236	464039	436103
244-245 Other bone diseases	2394	11861	101140	91375
247 Symptoms of musculoskeletal system and connective tissue disorders	5682	7488	127947	122116
2448 Bursitis, tendonitis and myositis	1674	9573	75397	67679
249 Aftercare, musculoskeletal system and connective tissue	2907	6507	124341	112207
250-255 Fracture, sprain or dislocation in arm, hand or foot	17803	63588	468118	547517

C Productivity costs

Table 5: Productivity costs due to reduced ability to work (Försäkringskassan, 2012).

Type of productivity cost	**Units**	**Value[7], SEK million**
Sickness benefit (number of cases)		
Male total	196 178	
Caused by MSDs (28 %)	54 340	
Female total	331 157	
Caused by MSDs (24 %)	78 403	
Sickness benefit (total number of days)		
Male (net)	4 173 727	
Female (net)	6 618 652	
Summed number of days with sickness benefit[8]		
Male	4 934 487	11 469
Female	7 716 294	15 421
Total male and female	*12 650 781*	*26 890*
Sickness and activity compensation (number of persons)		
Male total	157 029	
Caused by MSDs (19 %)	29 887	
With full scope (61.9 %)	18 507	10 109
Weighting other compensation levels (n=11380)[9]		3 001
Summed productivity cost male		13 110
Female total	220 836	
Caused by MSDs (32 %)	70 698	
With full scope (60.2 %)	39 926	18 751
Weighting other compensation levels (n=30772)		6 560
Summed productivity cost female		25 311
Total men and female (unweigthed)	100 585	
Total male and female (weighted corresponding to full year compensation)	*77 895*	*38 421*
Total productivity cost due to reduced ability to work		**65 311**

[7] The HC approach has been used to evaluate productivity cost as the average monthly salary for men (SEK 32,100) and women (SEK 27,600) for the year 2012 including social security contributions (31.42 %) and collective wage agreement (10.38 %). One year comprises working hours equivalent to 47 work weeks comprising 5 business days, which gives a total of 235 working days.

[8] Includes registered cases with sickness benefit that exceeded 14 days and the first 14 days which the employer pays sick pay. Absences that are less than 15 days are not included in the calculation.

[9] Weighting made for productivity costs for different benefit levels (1/1, 1/2, 1/4 and 2/3).

Table 6: Productivity costs due to premature death in MSD M00-M99 in 2012. Males (Socialstyrelsen, 2012c; SCB, 2012b).

Age	M00-M99	Lost years (median values in the interval)	Number of lost working years (in ages 20-65)	Estimated life expectancy of median value Year	Expected activity given unemployment and hours worked in the age group according to AKU %	Employed %
0-4	0	78.11	0	80.11	0	
5-9	1	73.15	45	80.15	0	
10-14	0	68.19	0	80.19	0	
15-19	1	63.23	45	80.23	37.9	16
20-24	0	58.36	0	80.36	69.6	58.5
25-29	0	53.56	0	80.56	89.8	84
30-34	0	48.73	0	80.73	89.8	84
35-39	0	43.88	0	80.88	97.3	91
40-44	2	39.07	46	81.07	97.3	91
45-49	2	34.30	36	81.30	98.2	88.2
50-54	5	29.66	65	81.66	98.2	88.2
55-59	4	25.20	32	82.20	93.6	76.4
60-64	8	20.89	24	82.89	93.6	76.4
65-69	11	16.84		83.84	66.3	18.9
70-74	13	13.04		85.04	66.3	18.9
75-79	25	9.68		86.68	0	
80-84	20	6.83		88.83	0	
85+	53	4.61		91.61	0	
Total	**145**		**293**			

Table 7: Productivity costs and the discounted value of lost production due to premature death in MSD M00-M99 in 2012. Males.

		The value of lost production for each age interval (discounted 3 %)							
Age	**ICD M00-M99 Number of deaths Year 2012**	**15-19**	**20-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-74**	**Sum**
0-4	0	0	0	0	0	0	0	0	0
5-9	1	79 026	457 707	1 532 175	1 338 242	974 066	598 419	78 026	5 057 660
10-14	0	0	0	0	0	0	0	0	0
15-19	1	38 345	457 707	1 532 175	1 338 242	974 066	598 419	78 026	5 016 979
20-24	0		0	0	0	0	0	0	0
25-29	0			0	0	0	0	0	0
30-34	0			0	0	0	0	0	0
35-39	0				0	0	0	0	0
40-44	2				534 817	1 948 131	1 196 837	156 052	3 835 838
45-49	2					1 469 370	1 196 837	156 052	2 822 259
50-54	5					973 193	2 992 093	390 130	4 355 416
55-59	4						1 805 419	312 104	2 117 523
60-64	8						956 612	624 208	1 580 819
65-69	11							647 358	647 358
70-74	13							202 686	202 686
75-79	25								
80-84	20								
85+	53								
Total	**145**								**25 636 537**

Table 8: Productivity costs due to premature death in MSD M00-M99 in 2012. Females (Socialstyrelsen, 2012c; SCB, 2012b).

Age	M00-M99	Lost years (median values in the interval)	Number of lost working years (in ages 20-65)	Estimated life expectancy of median value Year	Expected activity given unemployment and hours worked in the age group according to AKU %	Employed %
0-4	1	81.74	45	83.74	0	
5-9	0	76.77	0	83.77	0	
10-14	2	71.80	90	83.80	0	
15-19	1	66.85	45	83.85	30.1	23.2
20-24	0	61.91	0	83.91	61.8	57.4
25-29	0	56.97	0	83.97	82.8	77.3
30-34	1	52.04	33	84.04	82.8	77.3
35-39	1	47.14	28	84.14	87.1	85.2
40-44	1	42.27	23	84.27	87.1	85.2
45-49	4	37.46	72	84.46	88.9	84.7
50-54	5	32.73	65	84.73	88.9	84.7
55-59	5	28.12	40	85.12	84.9	69.8
60-64	12	23.63	36	85.63	84.9	69.8
65-69	18	19.35		86.35	51.8	10.9
70-74	27	15.29		87.29	51.8	10.9
75-79	43	11.54		88.54	0	
80-84	46	8.22		90.22	0	
85+	143	5.53		92.53	0	
Total	**310**		**477**			

Table 9: Productivity costs and the discounted value of lost production due to premature death in MSD M00-M99 in 2012. Females.

		The value of lost production for each age interval (discounted 3 %)							
Age	**ICD M00-M99 Number of deaths Year 2012**	**15-19**	**20-24**	**25-34**	**35-44**	**45-54**	**55-64**	**65-74**	**Sum**
0-4	1	78 247	342 868	1 117 806	964 367	728 111	426 386	30 229	3 688 014
5-9	0	0	0	0	0	0	0	0	0
10-14	2	156 494	685 736	2 235 613	1 928 734	1 456 222	852 772	60 458	7 376 028
15-19	1	37 967	342 868	1 117 806	964 367	728 111	426 386	30 229	3 647 735
20-24	0		0	0	0	0	0	0	0
25-29	0			0	0	0	0	0	0
30-34	1			223 361	964 367	728 111	426 386	30 229	2 372 454
35-39	1				727 370	728 111	426 386	30 229	1 912 096
40-44	1				192 700	728 111	426 386	30 229	1 377 427
45-49	4					2 196 698	1 705 545	120 916	4 023 159
50-54	5					727 458	2 131 931	151 145	3 010 534
55-59	5						1 608 000	151 145	1 759 145
60-64	12						1 022 410	362 748	1 385 158
65-69	18							410 402	410 402
70-74	27							163 090	163 090
75-79	43								
80-84	46								
85+	143								
Total	**310**								**31 125 241**