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# Gender differences in disability after sickness absence with musculoskeletal disorders: five-year prospective study of 37,942 women and 26,307 men

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## Abstract

**Background:** Gender differences in the prevalence and occupational consequences of musculoskeletal disorders (MSDs) are consistently found in epidemiological studies. The study investigated whether gender differences also exist with respect to chronicity, measured as the rate of transition from sickness absence into permanent disability pension (DP).

**Methods:** Prospective national cohort study in Norway including all cases with a spell of sickness absence > eight weeks during 1997 certified with a MSD, 37,942 women and 26,307 men. The cohort was followed-up for five years with chronicity measured as granting of DP as the endpoint. The effect of gender was estimated in the full sample adjusting for sociodemographic factors and diagnostic distribution. Gender specific analyses were performed with the same explanatory variables. Finally, the gender difference was estimated for nine diagnostic subgroups.

**Results:** The crude rate of DP was 22% for women and 18% for men. After adjusting for all sociodemographic variables, a slightly higher female risk of DP remained. However, additional adjustment for diagnostic distribution removed the gender difference completely. Having children and working full time decreased the DP risk for both genders, whereas low socioeconomic status increased the risk similarly. There was a different age effect as more women obtained a DP below the age of 50. Increased female risk of chronicity remained for myalgia/fibromyalgia, back disorders and "other/unspecified" after relevant adjustments, whereas men with neck disorders were at higher risk of chronicity.

**Conclusions:** Women with MSDs had a moderately increased risk of chronicity compared to men, when including MSDs with a traumatic background. Possible explanations are lower income, a higher proportion belonging to diagnostic subgroups with poor prognosis, and a younger age of chronicity among women. When all sociodemographic and diagnostic variables were adjusted for, no gender difference remained, except for some diagnostic subgroups.

## Background

Musculoskeletal disorders (MSDs) affect a large proportion of the working population and their quality of life and contribute to increasing healthcare costs, lost work days and higher social insurance expenditures in most welfare states. One of the most worrying aspects of this

"epidemic" is the high number of patients in working age that become permanently disabled and dependent of social insurance benefits because of MSD [1-7]. A growing literature has identified prognostic factors or causes of chronicity among patients with short-term disability caused by back pain [8-10] and other MSDs [11-15] in order to improve treatment and secondary prevention.

Indicators relevant to the epidemiology of MSD are scarce [1]. However, studies of sickness absence (SA) and permanent work-disability might outline the

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functional consequences of MSDs when cause-specific information is present [16]. Within universal social insurance systems, like in Sweden and Norway, population-based studies are feasible, since most women have paid work [7,17-20].

Gender differences are a key feature of the MSD epidemiology. A female excess in SA is found in countries with different social insurance systems and different levels of sickness absenteeism [7,17-19], even though some studies differ [21]. This corresponds to findings from epidemiological surveys of MSDs, in the general population [22,23] or in occupational samples [24,25] which have consistently found a higher prevalence among women [26]. A gender and site specific analysis of data from the Dutch cross sectional DMC3 study [22] showed a "slightly different" pattern in women and men with regard to the association of musculoskeletal pain with age, education, use of health care, disability and work-leave variables [27]. Behavioural factors and hazardous workplaces lead to more fractures and other injuries among men. Several studies on predictors of chronicity in MSD have shown that women with MSDs might have an increased risk of chronicity [13,15,17]. However, this has not been a subject for in-depth assessment.

Recently, investigators from different countries have discussed the need for gender specific studies of work related MSDs, without specifically mentioning the aspect of chronicity [28-30]. A main issue here is how statistical analyses should be performed, with adjustment or stratification for gender. Data from two large epidemiological studies from the US [29] and Canada [30] were analyzed both with adjustment for gender and separately for women and men in order to identify the full range of associations. Thus, in this study we decided to assess the gender difference with both approaches.

MSDs dominate social insurance expenditure in the Nordic countries, with respect to both short-term and permanent work disability. In the period 1994-2003, 150,374 women and 129,612 men obtained disability pension (DP) in Norway. Forty-one percent of these women and 28% of the men were certified with a MSD [31] whereas the incidence of DP caused by non-MSD was nearly similar. Thus, the higher prevalence of MSD among women has led to a "gender-gap" in the use of social insurance.

MSD might have different meanings and consequences for women and men and there are several explanations of the gender difference in MSD, with varying degrees of evidence [32] which may also have relevance with respect to chronicity: The exposure-theory claims that women generally have poorer working conditions, whereas the vulnerability theory claims that women are more strongly affected by pathogenic factors.

Biological factors might explain the increased vulnerability and a higher prevalence of MSDs like osteoporosis, rheumatoid arthritis and fibromyalgia in women [33,34]. Mental/physical co-morbidity [35] and the interplay between pain and depression contribute to the functional consequences of MSDs, since depression is more common in women [36] and may affect pain differently [37]. There are also differences in health beliefs and help seeking [27,38,39]. Gender differences in self rated health has been shown to vary in countries with different welfare state models, with the largest female/male difference in the Nordic countries [40]. The double-burden theory implies that the combined exposure to stressors in the family and at work might lead to musculoskeletal problems and SA [41,42] which might have different consequences depending on the extent of gender inequality [43,44]. Finally, socioeconomic variables play an important role in musculoskeletal morbidity [17,18,23,45,46] and different positions in society and workplace hierarchies might therefore also contribute to gender differences. Low socioeconomic status, education and income are both exposures and might lead to increased vulnerability. Adjusting for socioeconomic variables might reduce the gender differences significantly [17,18]. When also including workplace factors, the gender difference might "disappear" completely [21].

The aims of this national prospective cohort study were: To assess the chronicity/transition into permanent DP after sickness absence with a MSD and to investigate possible gender differences. If a gender difference is present, to investigate possible socioeconomic and medical (biological) explanations.

## Methods

### Design

Register-based, national, prospective cohort study.

### The origin of data and ethical considerations

The study was approved by the Norwegian Data Inspectorate. Explanatory variables originated from public registers merged by means of the national ID number. The data were obtained from an anonymous research database (FDtrygd) established by Statistics Norway and the National Insurance Services (NIS).

### Population at risk, inclusion criteria and participants

On January 1 1997, 1,019,216 men and 920,139 women aged 16-62 years were vocationally active and covered by the national SA benefit scheme in Norway. More than 70% of sickness certificates are issued by GPs, and the International Classification of Primary Health Care (ICPC) has been used by NIS since 1990 [47]. ICPC is organised in chapters corresponding to organ systems. Chapter L includes MSD and has a total of

53 sub-diagnoses: L01-L29 indicate symptoms like “back pain” and L70-L99 disorders or syndromes [48]. The ICPC L-chapter also includes MSDs with a traumatic background like fractures, sprains and other soft tissue injuries. All cases with a spell of SA > eight weeks, starting in 1997 with a main sick-leave diagnosis indicating a MSD were included, a total of 37,942 women and 26,307 men. This corresponds to an annual incidence of 4.1/100 for vocationally active women and 2.5/100 for men. Table 1 shows the most frequent MSD diagnoses. Sick-leave diagnoses were organised into nine groups based on localisation or pathophysiology: back disorders, neck disorders, non-traumatic disorders in the upper extremities, non-traumatic disorders in the lower extremities, fractures and other injuries, muscular pain/fibromyalgia, rheumatoid arthritis and similar disorders, osteoarthritis, and “other”. Back problems were the largest group affecting 29% of the women and 34% of the men on SA, an annual incidence of 1.2/100 and 0.9/100 respectively.

#### Follow-up and endpoint

The study cohort was followed from the start of the index spell until December 31, 2002. The maximum and

mean follow-up period was 83 and 61 months respectively. The endpoint was the date of granting a DP, obtained from the DP register, which is complete since this is the basis for payment of pensions.

#### Explanatory variables and measurements

Diagnostic group, age, gender, annual income, educational attainment (years), weekly working hours, and whether living with children, were used as explanatory variables, shown in table 2. Those with no missing variables, 28,705 women and 19,837 men, were included in the statistical analyses.

#### The Norwegian social insurance system

All vocationally active residents are covered by the *SA benefit program*. A sickness certificate is required after three days' absence. After eight weeks, the certifying physician must complete a report including a diagnosis and plans for treatment. Therefore, eight weeks are considered as the start of LTSA. All inhabitants aged 18-66, are entitled to DP in case of permanent work disability caused by disease or injury. The DP program is thus equally accessible for both genders, even though employment rate is lower among women, and 40% work part time. People without work can obtain DP, but most DPs are granted after a process starting with SA benefits.

**Table 1 The most frequent musculoskeletal diagnoses in sick leave >8 weeks in Norway in 1997, according to The International Classification of Primary Health Care (ICPC): N and percent of musculoskeletal cases, and percent obtaining a disability pension (DP)**

| ICPC Code | Diagnosis                        | Men  |      |      | Women |      |      |
|-----------|----------------------------------|------|------|------|-------|------|------|
|           |                                  | N    | %    | % DP | N     | %    | %DP  |
| L84       | Back syndrome without radiation  | 3579 | 13.6 | 17.2 | 5165  | 13.6 | 19.1 |
| L86       | Back syndrome with radiation     | 3979 | 15.1 | 18.4 | 3607  | 9.5  | 23.0 |
| L83       | Neck syndrome                    | 2005 | 7.6  | 25.0 | 4340  | 11.4 | 23.9 |
| L92       | Shoulder syndrom                 | 2179 | 8.3  | 19.6 | 3781  | 10.0 | 22.7 |
| L99       | Musculoskeletal disorder NUD     | 913  | 3.5  | 19.2 | 4780  | 12.6 | 12.4 |
| L93       | Epicondylitis/tendinitis forearm | 1699 | 6.5  | 14.7 | 2652  | 7.0  | 20.2 |
| L02       | Back symptoms                    | 1042 | 4.0  | 17.5 | 1857  | 4.9  | 17.2 |
| L88       | Rheumatoid arthritis             | 777  | 3.0  | 39.4 | 1220  | 3.2  | 50.3 |
| L76       | Other fractures                  | 1009 | 3.8  | 13.3 | 613   | 1.6  | 17.8 |
| L73       | Fracture ankle/leg               | 803  | 3.1  | 4.7  | 630   | 1.7  | 11.4 |
| L18       | Widespread muscular pain         | 144  | 0.5  | 28.5 | 957   | 2.5  | 49.0 |
| L01       | Neck symptoms                    | 330  | 1.3  | 21.8 | 676   | 1.8  | 23.1 |
| L96       | Acute inner injury of knee       | 632  | 2.4  | 8.2  | 333   | 0.9  | 14.1 |
| L72       | Fracture forearm                 | 349  | 1.3  | 6.9  | 536   | 1.4  | 15.7 |
| L08       | Shoulder symptoms                | 332  | 1.3  | 19.3 | 406   | 1.1  | 19.2 |
| L89       | Osteoarthritis of the hip        | 250  | 1.0  | 41.6 | 406   | 1.1  | 48.3 |

#### Statistical analysis

Survival analysis was carried out. Diagnoses and socio-demographic factors were treated as categorical, and tested as predictors for obtaining a DP, by means of Cox proportional hazards analysis.

The hazards ratio (HR) with 95% confidence intervals (95% CI) was first estimated in the full sample with gender, age, education and income as explanatory variables. Then weekly working hours and family status (children <18 years) were included as covariates and finally diagnostic subgroup was included in a full model (table 3).

In order to explore the gender difference further, HRs with 95%CI were estimated separately for men and women, shown in table 4, corresponding to the last model of table 3.

Table 5 shows the gender indicator estimated in stratified models for each diagnostic subgroup, adjusted for all socioeconomic factors, corresponding to model 2 in table 3.

#### Results

The mean age was nearly similar in the male and female samples, 40.4 versus 40.9 years. The mean educational level was slightly higher for the women 11.7 versus 11.3 years. However, mean annual income was 215,000 NOK for men versus 162,000 for women. (EUR 1 approximately

**Table 2 Frequencies of explanatory variables N (%), and the proportions N (%) obtaining disability pension (DP) during 5 years follow-up according to musculoskeletal groups and sociodemographic variables**

| Explanatory variables            | Men          |              |             |             | Women        |              |             |             |
|----------------------------------|--------------|--------------|-------------|-------------|--------------|--------------|-------------|-------------|
|                                  | N            | %            | DP          | DP%         | N            | %            | DP          | DP%         |
| Rheumatoid arthritis             | 777          | 3.0          | 306         | 39.4        | 1220         | 3.2          | 614         | 50.3        |
| Osteoarthritis                   | 644          | 2.4          | 269         | 41.8        | 880          | 2.3          | 452         | 51.4        |
| Myalgia/fibromyalgia             | 523          | 2.0          | 145         | 27.7        | 1836         | 4.8          | 757         | 41.2        |
| Neck problems                    | 2335         | 8.9          | 574         | 24.6        | 5016         | 13.2         | 1194        | 23.8        |
| Back problems                    | 8979         | 34.1         | 1598        | 17.8        | 11164        | 29.4         | 2246        | 20.1        |
| Other                            | 1829         | 7.0          | 288         | 15.7        | 5838         | 15.4         | 812         | 13.9        |
| Upper extremities, non traumatic | 4625         | 17.6         | 792         | 17.1        | 7300         | 19.2         | 1565        | 21.4        |
| Lower extremities, non traumatic | 874          | 3.3          | 120         | 13.7        | 1053         | 2.8          | 218         | 20.7        |
| Fractures and injuries           | 5721         | 21.7         | 510         | 8.9         | 3635         | 9.6          | 551         | 15.2        |
| <b>All</b>                       | <b>26307</b> | <b>100.0</b> | <b>4602</b> | <b>17.5</b> | <b>37942</b> | <b>100.0</b> | <b>8409</b> | <b>22.2</b> |
| <b>Age</b>                       |              |              |             |             |              |              |             |             |
| 16-29                            | 5122         | 19.5         | 98          | 1.9         | 7448         | 19.6         | 163         | 2.2         |
| 30-39                            | 7698         | 29.3         | 516         | 6.7         | 9992         | 26.3         | 886         | 8.9         |
| 40-49                            | 6989         | 26.6         | 1162        | 16.6        | 10183        | 26.8         | 2418        | 23.7        |
| 50-59                            | 5622         | 21.4         | 2312        | 41.1        | 9122         | 24.0         | 4229        | 46.4        |
| 60-62                            | 876          | 3.3          | 514         | 58.7        | 1197         | 3.2          | 713         | 59.6        |
| <b>Education (years)</b>         |              |              |             |             |              |              |             |             |
| Basic 7-9                        | 3134         | 11.9         | 1311        | 41.8        | 4538         | 12.0         | 2238        | 49.3        |
| Lower middle 10-12               | 9579         | 36.4         | 1534        | 16.0        | 14876        | 39.2         | 3625        | 24.4        |
| Higher middle 13-15              | 10866        | 41.3         | 1393        | 12.8        | 12760        | 33.6         | 1764        | 13.8        |
| Academic > 15                    | 1479         | 5.6          | 182         | 12.3        | 4646         | 12.2         | 584         | 12.6        |
| Missing                          | 1249         | 4.7          | 182         | 14.6        | 1122         | 3.0          | 198         | 17.6        |
| <b>Annual income NOK*</b>        |              |              |             |             |              |              |             |             |
| < 125,000                        | 3163         | 12.0         | 479         | 15.1        | 9530         | 25.1         | 2131        | 22.4        |
| 125,000-199,999                  | 7083         | 26.9         | 1303        | 18.4        | 18615        | 49.1         | 4271        | 22.9        |
| 200,000-274,999                  | 11954        | 45.4         | 2240        | 18.7        | 8640         | 22.8         | 1831        | 21.2        |
| > 275,000                        | 4048         | 15.4         | 580         | 14.3        | 1126         | 3.0          | 176         | 15.6        |
| <b>Weekly working hours</b>      |              |              |             |             |              |              |             |             |
| 0-19                             | 835          | 3.2          | 220         | 26.3        | 5580         | 14.7         | 1535        | 27.5        |
| 20-29                            | 565          | 2.1          | 101         | 17.9        | 6278         | 16.5         | 1389        | 22.1        |
| 30+                              | 19328        | 73.5         | 2712        | 14.0        | 17648        | 46.5         | 3188        | 18.1        |
| Missing                          | 5579         | 21.2         | 1569        | 28.1        | 8436         | 22.2         | 2297        | 27.2        |

N = 26,307 men and 37,942 women sickness absent > 8 weeks.

8 NOK). During follow-up 22% of the women and 18% of the men obtained a DP. Crude DP rates increased with age, lower education and low income for both genders. Twelve percent of both the female and male sample had only basic education (7-9 years). Of these, 49% of the women and 42% of the men obtained a DP. The crude risk of DP was higher for women in all diagnostic groups, except for neck problems and "other". DP rates for the diagnostic subgroups varied from 14% (other) to 51% (osteoarthritis) among women and from 9% (fractures and injuries) to 41% (osteoarthritis) among men (table 2).

When the full sample was analyzed together the risk or HR for obtaining DP related to female gender was 1.34 (95% CI 1.28-1.40) when adjusted only for age. When income and education were included, the HR

decreased to 1.21 (1.15-1.27), and significantly more when adjusted for part-time work and family obligations 1.09 (1.03-1.14). However, only after including the diagnostic distribution the gender difference was completely "removed". In this final model the risk of DP according to diagnostic subgroups is also presented after adjustment for all socio-demographic variables (table 3).

The gender-stratified analysis showed that age above 50 and very low income, were more strongly linked to the risk of DP among the men, when adjusted for all other variables. Higher education had a similar protective effect for both genders. In both genders, those working part time and those without children had an increased risk of DP. Among women, the prevalence of myalgia/fibromyalgia was 2.5 times higher than among

**Table 3 Risk\* of disability pension according to female gender, adjusted for sociodemographic and diagnostic variables**

| Variables                                 | Model 1 |        |       | Model 2 |        |       | Model 3 |        |       |
|---|---------|--------|-------|---------|--------|-------|---------|--------|-------|
|   | HR      | 95% CI | CI    | HR      | 95% CI | CI    | HR      | 95% CI | CI    |
| <b>Female gender</b> , ref men            | 1.21    | 1.15   | 1.27  | 1.09    | 1.03   | 1.14  | 1.03    | 0.98   | 1.09  |
| <b>Age</b> ref <40 years                  |         |        |       |         |        |       |         |        |       |
| 40-49                                     | 4.04    | 3.74   | 4.35  | 3.97    | 3.68   | 4.29  | 3.87    | 3.59   | 4.18  |
| 50-59                                     | 9.33    | 8.67   | 10.03 | 8.38    | 7.77   | 9.05  | 8.21    | 7.60   | 8.86  |
| 60-62                                     | 13.02   | 11.79  | 14.38 | 11.21   | 10.12  | 12.42 | 10.91   | 9.84   | 12.10 |
| <b>Education</b> ref >15 years            |         |        |       |         |        |       |         |        |       |
| < = 9 years                               | 1.67    | 1.52   | 1.84  | 1.63    | 1.48   | 1.79  | 1.65    | 1.51   | 1.82  |
| 10-12 years                               | 1.41    | 1.29   | 1.54  | 1.38    | 1.27   | 1.51  | 1.42    | 1.30   | 1.55  |
| 12-15 years                               | 1.22    | 1.12   | 1.34  | 1.19    | 1.09   | 1.30  | 1.21    | 1.10   | 1.32  |
| <b>Annual income</b> Ref >275 000 NOK     |         |        |       |         |        |       |         |        |       |
| < 124 999                                 | 1.61    | 1.45   | 1.78  | 1.18    | 1.06   | 1.32  | 1.24    | 1.11   | 1.38  |
| 125 000-199 999                           | 1.75    | 1.60   | 1.92  | 1.63    | 1.49   | 1.79  | 1.63    | 1.49   | 1.79  |
| 200 000-274 999                           | 1.51    | 1.38   | 1.65  | 1.51    | 1.38   | 1.64  | 1.49    | 1.36   | 1.62  |
| <b>Weekly working hours</b> ref full time |         |        |       |         |        |       |         |        |       |
| 1-19                                      |         |        |       | 2.00    | 1.88   | 2.14  | 1.94    | 1.82   | 2.07  |
| 20-30                                     |         |        |       | 1.20    | 1.13   | 1.28  | 1.20    | 1.13   | 1.28  |
| <b>Caring for children</b>                |         |        |       |         |        |       |         |        |       |
| No children                               |         |        |       | 1.24    | 1.18   | 1.31  | 1.26    | 1.19   | 1.33  |
| <b>Diagnosis</b> Ref back disorders       |         |        |       |         |        |       |         |        |       |
| Rheumatic disease                         |         |        |       |         |        |       | 2.14    | 1.96   | 2.33  |
| Osteoarthritis                            |         |        |       |         |        |       | 1.40    | 1.26   | 1.54  |
| Myalgia/fibromyalgia                      |         |        |       |         |        |       | 1.73    | 1.58   | 1.89  |
| Neck problems                             |         |        |       |         |        |       | 1.09    | 1.02   | 1.17  |
| Other                                     |         |        |       |         |        |       | 0.89    | 0.82   | 0.96  |
| Extremities                               |         |        |       |         |        |       | 0.77    | 0.72   | 0.81  |
| Fractures/injuries                        |         |        |       |         |        |       | 0.50    | 0.46   | 0.54  |

N = 26,307 men and 37,942 women sickness absent > 8 weeks with musculoskeletal, followed up for 5 years.

\*Hazards ratio [HR] with 95% confidence intervals [95% CI].

Model 1: Gender variable adjusted for age.

Model 2: Do + adjusted for education, income, weekly working hours, caring for children.

Model 3: Do + adjusted for diagnosis distribution.

men and the risk of DP for women with this diagnosis was even higher than among those with osteoarthritis. Among men, neck problems carried a higher DP risk than back problems. Cases with fractures or other injuries, 22% of the male and 10% of the female sample had a significantly lower risk than all other groups for both genders (table 4).

In the diagnosis-specific analyses (table 5), women had a higher risk of DP in all diagnostic groups, except for lower limb and neck problems when adjusted only for age. In the fully adjusted model women with back problems, myalgia/fibromyalgia and "other" had significantly higher risks of DP than men with similar diagnoses. Men with neck problems had still an increased risk of DP, compared to women. No gender difference was present among cases with inflammatory rheumatism, osteoarthritis and problems in upper and lower extremities.

## Discussion

### Main findings

The distribution of diagnoses according to gender and localisations found in this study corresponds to previous studies of MSDs [15,23-26]. Back pain and non-traumatic disorders in the upper extremities represented nearly half of the cases. Contrary to most previous studies fractures/injuries, OA and inflammatory rheumatism were also included as specific categories.

The starting point of the study was a 60% greater incidence of SA with MSD among women compared to men (37,942 women and 26,307 men). The rate of chronicity measured as DP during follow-up was also slightly higher among the female sample, 22.2% versus 17.5% among the men. This combined effect explains that DP with MSD was twice as frequent among women compared to men during 1997-2002 [31].

**Table 4 Risk\* of disability pension according to sociodemographic and diagnostic predictors separately for men and women**

| Variables                                  | Men   |        |        | Women |        |        |
|--|-------|--------|--------|-------|--------|--------|
|  | HR    | 95% CI | 95% CI | HR    | 95% CI | 95% CI |
| <b>Age ref &lt; 40 years</b>               |       |        |        |       |        |        |
| 40-49                                      | 4.15  | 3.64   | 4.73   | 3.76  | 3.42   | 4.13   |
| 50-59                                      | 10.35 | 9.11   | 11.75  | 7.34  | 6.65   | 8.09   |
| 60-62                                      | 15.29 | 12.91  | 18.10  | 9.14  | 8.00   | 10.43  |
| <b>Education ref: &gt; 15 years</b>        |       |        |        |       |        |        |
| < = 9 years                                | 1.82  | 1.51   | 2.20   | 1.67  | 1.49   | 1.87   |
| 10-12 years                                | 1.59  | 1.33   | 1.92   | 1.42  | 1.28   | 1.57   |
| 12-15 years                                | 1.36  | 1.13   | 1.63   | 1.20  | 1.08   | 1.33   |
| <b>Annual income (NOK) Ref &gt;275 000</b> |       |        |        |       |        |        |
| < 124 999                                  | 1.39  | 1.15   | 1.69   | 1.12  | 0.94   | 1.33   |
| 125 000-199 999                            | 1.73  | 1.53   | 1.94   | 1.45  | 1.23   | 1.70   |
| 200 000-274 999                            | 1.52  | 1.36   | 1.68   | 1.34  | 1.14   | 1.58   |
| <b>Weekly working hrs, ref full time</b>   |       |        |        |       |        |        |
| 1-19                                       | 2.86  | 2.47   | 3.31   | 1.82  | 1.69   | 1.95   |
| 20-30                                      | 1.80  | 1.46   | 2.22   | 1.15  | 1.08   | 1.24   |
| <b>Caring for children</b>                 |       |        |        |       |        |        |
| No children                                | 1.20  | 1.10   | 1.31   | 1.30  | 1.21   | 1.39   |
| <b>Diagnosis, ref back disorders</b>       |       |        |        |       |        |        |
| Rheumatic disease                          | 2.08  | 1.78   | 2.43   | 2.16  | 1.94   | 2.40   |
| Osteoarthritis                             | 1.45  | 1.23   | 1.71   | 1.36  | 1.20   | 1.54   |
| Myalgia/fibromyalgia                       | 1.29  | 1.03   | 1.61   | 1.78  | 1.61   | 1.97   |
| Neck problems                              | 1.29  | 1.14   | 1.45   | 1.01  | 0.93   | 1.10   |
| Other                                      | 0.88  | 0.75   | 1.03   | 0.88  | 0.80   | 0.96   |
| Extremities                                | 0.82  | 0.74   | 0.90   | 0.74  | 0.69   | 0.80   |
| Fractures/injuries                         | 0.55  | 0.49   | 0.62   | 0.47  | 0.42   | 0.53   |

N = 26,307 men and 37,942 women sickness absent > 8 weeks with musculoskeletal followed up for 5 years.

\* Hazards ratio [HR] with 95% confidence interval [95%CI].

**Table 5 Risk\* of disability pension according to female gender in musculoskeletal subgroups, adjusted for sociodemographic variables**

| Diagnostic group     | Model 1 |        |        |      | Model 2 |        |        |      |
|----------------------|---------|--------|--------|------|---------|--------|--------|------|
|                      | HR      | 95% CI | 95% CI | P    | HR      | 95% CI | 95% CI | P    |
| Full sample          | 1.34    | 1.28   | 1.40   | 0.00 | 1.09    | 1.03   | 1.14   | 0.01 |
| Upper limb           | 1.17    | 1.07   | 1.23   | 0.01 | 1.05    | 0.95   | 1.16   | 0.23 |
| Lower limb           | 1.23    | 0.99   | 1.54   | 0.07 | 1.23    | 0.94   | 1.59   | 0.13 |
| Other,unspecified    | 1.41    | 1.19   | 1.67   | 0.00 | 1.21    | 1.00   | 1.47   | 0.05 |
| Back problems        | 1.40    | 1.29   | 1.52   | 0.00 | 1.10    | 1.00   | 1.21   | 0.05 |
| Neck problems        | 1.05    | 0.93   | 1.19   | 0.44 | 0.83    | 0.72   | 0.96   | 0.01 |
| Myalgia/fibromyalgia | 1.76    | 1.40   | 2.22   | 0.00 | 1.44    | 1.12   | 1.85   | 0.00 |
| Osteoarthritis       | 1.28    | 1.06   | 1.54   | 0.01 | 0.89    | 0.71   | 1.11   | 0.29 |
| Rheumatoid arthritis | 1.48    | 1.24   | 1.76   | 0.00 | 1.13    | 0.92   | 1.38   | 0.26 |

N = 26,307 men and 37,942 women sickness absent > 8 weeks followed up for 5 years.

\* Hazards ratio [HR] with 95% confidence interval [95% CI].

Model 1: female gender, adjusted for age.

Model 2: female gender adjusted for age, education, income, weekly working hours, caring for children.

The income difference was substantial when comparing the male and female samples, and adjustment for income removed approximately one-third of the crude difference in chronicity. Another third was removed by adjustment for working hours and family status. Among women, a higher proportion had disorders with poor prognosis, whereas disorders with favourable prognoses, especially fractures/injuries were more frequent among men. When adjusting also for this difference, no gender effect remained.

In some important subgroups, especially back disorders, a higher female risk of DP was still present after adjusting for all variables.

When analysing men and women separately some differences in the effects of covariates were present: Among women, myalgia/fibromyalgia had a poorer prognosis than OA. The age effect was also different. Both men and women caring for children below 18 years had a lower risk of DP than comparable persons

without children. Working part time increased the risk of DP. These findings seem to refute the “double burden theory”.

### Strengths of the study

This is a population-based study of musculoskeletal impairments in the working population using medically verified diagnoses, with data on 37,942 women and 26,307. Contrary to most previous studies which have targeted regional disorders, most frequently back and upper extremities, the present study includes all MSDs. Self-reported data seldom include more than the localisation of a MSD or musculoskeletal pain, irrespective of causal or biomedical aspects. When included after eight weeks on SA, patients normally have seen their GP several times and usually additional information from radiological examinations and laboratory tests is present and sometimes even assessment by specialists. Objective sociodemographic information was available for nearly all cases. The follow-up period was considerable and there were no dropouts, since all cases of DP, death or emigration were recorded by the authorities, and linked to the research database. Compared to previous epidemiological studies, based on self-reported pain, the present design might represent a better diagnostic validity.

### Limitations

There are several weaknesses of register-based studies with data from sickness certifications. Compared to clinical studies, with relatively few participants, there is a complete lack of health data other than a “main diagnosis” on the certificate. This means that the importance of co-morbidity and multi-site MSD cannot be examined. The importance of mental distress or depression among patients with MSD has been increasingly ascertained [35], and might also influence the gender differences

In the present study also data on workplace factors, family income and occupations were missing. There was some missing data with respect to weekly working hours, which is important for adjustment for part-time work, because of low quality of the Norwegian employment register. However more than 70% of the cases had no missing data and was included in the statistical analyses. Analyses performed with all participants gave similar results.

Annual rates of SA vary in Norway. During recessions, SA tends to be low, explained by different attitudes and changing composition of the workforce [49]. SA reached a low level in 1993, subsequently increasing until 2000. The inclusion year (1997) was thus a year with intermediate rates of SA in Norway [31].

The validity of the ICPC diagnoses might be questioned. The ICPC was developed as a tool for research

in primary health care [48], and Norwegian GPs have used this classification for more than 15 years [47]. However, no scientific investigation has compared the ICPC diagnoses with a gold standard. We believe that few Norwegian GPs use osteoarthritis as a diagnosis without radiological findings, or RA without previous assessment by a rheumatologist. In the present study, the ICPC codes were collapsed into broad categories, which might improve the validity. The diagnostic groups used in this study are quite similar to the groups used in a recent study of sickness absentees in Madrid [15]. Only one diagnosis was available for each case.

Our outcome measure was the granting of a DP during 5 years follow-up. We know however, that a number of patients who are not able to work because of their MSD, with or without co-morbidity, will not have obtained a DP five years after the onset of the disease. In stead they have long-term unemployment benefits or social assistance. Whether this is more common among men or women is not known, but could influence the results of the study.

Finally, in our statistical models, all covariates were restricted to have the same effect for men and women. Models without interactions might conceal gender differences in the effects of individual predictors of transition to DP. Both medical and sociodemographic factors (like age) might have different impacts on the musculoskeletal health of women and men.

### Comparisons with previous research findings

Gender differences in musculoskeletal morbidity and sickness absence have been explained with partly contradictory theories [18,21,32-34]. The present study confirmed that socioeconomic variables [17,18,21,23,45,46] also explain the slightly higher risk of chronicity in women. The “double-burden” theory [17,27,41-44] was refuted since no adverse effect of living in a family with children was observed. The DP risk related to working part time [17] was confirmed. Since shorter working hours will hardly increase the risk of DP, this finding is probably a result of selection effects; persons with health problems often decide to work part time only. Since diagnostic information was available, possible biological explanations were also assessed. A higher incidence of MSDs with poorer prognosis, like myalgia/fibromyalgia, and lower incidence of injuries increases the rate of chronicity among women.

### Conclusions

A higher prevalence of musculoskeletal morbidity, impairments and rates of sickness absence among women has been consistently found previously. This was also the starting point of this study, with nearly 60% more women in the study cohort. The same gender

difference, however very moderate, was found with respect to chronicity, measured as the rate of transition into a permanent DP status, before any adjustments. The study showed, however, that this difference is present only in a few MSD-subgroups and is largely explained by socioeconomic variables. In the full sample no gender difference in chronicity remained after adjustment for all included confounders.

There is now considerable research activity into risk factors of permanent disability among individuals with MSDs [8-15,17]. Gender aspects should be included in this research. A future strategy to reduce the incidence and consequences of MSDs should include better protection of female workers and probably their general position in society. Rehabilitation programs for work-disabled workers should probably also have a gender specific design, even though gender differences in chronicity are small.

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#### Authors' contributions

SG, EB and JGM all participated in the conception and planning of the study, acquisition of data, data analysis and drafting of the manuscript which was finally accepted by all authors. SG was the main researcher in this project.

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#### Competing interests

The authors declare that they have no competing interests.

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