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Abstract

Many in the working population today obtain disability pension and a significant part of the population receive sick leave compensation or other kinds of public support in shorter or longer periods of time. In our society today, one of the most frequent reasons of sick leave and disability pension is pain in neck and/or back.

This study will examine the association between musculoskeletal pain in relation to risk of disability pension, and include lifestyle factors, such as physical activity and BMI, to examine if these factors can modify the association. We ran cox regression analyses on a HUNT population including 45654 individuals to estimate RRs of disability pension with 95% CI.

The results show that musculoskeletal pain in neck/shoulder/back increases the risk of disability pension (RR 2,57, CI 2,44 – 2,72). A combined analysis including musculoskeletal pain and different levels of BMI showed that the risk of disability pension increases from normal weight (RR 2,67, CI 2,46 – 2,94) to obese (RR 4,02, CI 3,64 – 4,45) among people with musculoskeletal pain, compared to normal weight without pain. High BMI also gives an increased risk of disability pension among people without pain (RR 1,55, CI 1,37 – 1,75). Physical activity is also showing to be a contributing factor. People with pain, already have a risk of disability pension, but it can be reduced from the inactive (RR 2,54, CI 2,11 – 3,05) to the highly active (RR 1,48, CI 1,25 – 1,75), when compared to inactive people without pain. A similar preventive effect can be seen among people without pain, where the risk of disability pension descends to RR 0,55 (CI 0,47 – 0,66) with high activity, compared to the inactive without pain.

Our main findings are the relation between musculoskeletal pain in the neck, shoulders and back towards risk of disability pension. This study also found that physical activity and BMI may affect the relation between musculoskeletal pain and risk of disability pension, where increased physical activity reduce the risk of disability pension and increased BMI has the opposite effect. In conclusion, it seems that physical activity and achieving normal weight may reduce the unfortunate effects of musculoskeletal pain when it comes to risk of disability pension.

Contents

1.0 Introduction

1.1 Work disability and disability pension

The Norwegian population shows generally good health and an ascending lifespan. Still there are many in the working population who obtain disability pension and a significant part of the population receive sick leave compensation or other kinds of public support in shorter or longer periods of time. (Regjeringen, 2010) Of all Norwegians between 15 and 66 years of age as many as 15 % are work disabled through the registry of social security. (Statistisk sentralbyrå, 2014) As well as being a public health problem and economic challenge for a welfare state, disability pension has large social and economic consequences for individuals. (Karlsson et al, 2008) Karlsson et al (2008) also mention that people with disability pension often report lower levels of quality of life or psychological well-being compared to other groups of retirees. Another important effect is the heightened risk factors among people with sick leave. (Helgesson et al, 2015) Helgesson et al (2015) found that people on sick leave had an increased risk of further work absence, unemployment, death and lower future income. Further Helgesson et al (2015) says that sickness absence is in many ways similar to unemployment. Whereas return to work is unlikely in many cases of long-term sickness absence. (Helgesson et al, 2015)

1.2 Effects of musculoskeletal pain

The topic of increased sickness absence and musculoskeletal pain in our society is of outmost importance, and it does not just affect the Scandinavian countries. (Lahti et al, 2010) In Norway, the increased social security can be the result of a good welfare society, which easier gives people the opportunity to evade a standard work life. But, pain in the neck and/or back is one of the most common causes of sickness absence and disability pension in our society today. (Statistisk sentralbyrå, 2014, Regjeringen, 2010) This gets supported by the national institute of occupational health which shows statistics where musculoskeletal pain is one of the most common reasons for sick leave in Norway today. (Statens arbeidsmiljøinstitutt, undatet) Multiple other studies have found similar results. (Karlsson et al, 2008, Anderson et al, 2012, Brooks et al, 2006) Karlsson et al (2008) looked into sick leave diagnoses to determine risk factors for disability pension. They found that men have higher risk for disability pension when it is as a result of mental disorders. While women have a higher risk when it comes to

musculoskeletal diagnoses. (Karlsson et al, 2008) For statistics concerning sick leave in 2009 musculoskeletal disorders was reported as diagnose in 39 %. Mental disorders amounted 19 % of all sick leave invoked by doctors. (Regjeringen, 2010)

Andersen et al (2012) shows that musculoskeletal disorders increase the risk of sick leave and reduced work capability. They also reveal the importance of the pains location. Hence Andersen et al (2012) shows results where those with considerable pain in the knees have 80 % increased risk of long term sick leave. The same pain zone in the low back and neck/shoulders, respectively, increased risk of long term sick leave by 50 % and 40 % among health care workers. (Andersen et al, 2012) Another study investigated multiple risk factors for early retirement among nurses. (Jensen et al, 2012) They found health related factors such as chronic back pain and upper extremity disorders to be important risk factors. Chronic back pain and upper extremity disorders more than doubled the risk for early retirement. (Jensen et al, 2012) There are much pointing towards that musculoskeletal pain is an important risk factor for sick leave and disability pension. Dorner et al (2015) found that musculoskeletal pain and depression leads to sickness absence which later leads to a heightened risk of disability pension. Jansson & Alexanderson (2013) also shows musculoskeletal pain as a strong risk factor for all-cause and diagnosis specific disability pension.

1.3 Effects of physical activity and BMI

Disability pension as a result of musculoskeletal pain is an issue with many different underlying factors. Physical activity and BMI are two such underlying factors. Lahti et al (2010) found the health consequences of physical inactivity to extend to many public health problems, including sickness absence. In a prospective cohort, Van den Heuvel et al (2005) found that employees practicing sports take sick leave significantly less often than their counterparts. Their sick leave periods were also shorter once they did occur. (Van den Heuvel et al, 2005)

Promotion of regular physical exercise and prevention of obesity are initiatives assumed to reduce the incidence of musculoskeletal pain. (Brooks, 2006) For example, obesity has been associated with increased prevalence of low back pain in several cross-sectional studies. (Shiri et al, 2010) Other studies support the hi risk factors for musculoskeletal pain, such as inactivity (Nilsen et al, 2011, Deng et al, 2014, Van den Heuvel, 2005) and high BMI (Nilsen et al, 2011). These factors seem to affect the relation, whereas physical activity tend to reduce the risk of musculoskeletal pain and BMI heightens it. These relations depends on different levels of BMI and physical activity.

Apparently many of the earlier mentioned studies only takes into consideration the relation between physical activity, BMI and musculoskeletal pain. Some have included sick leave or disability pension, (Lahti et al, 2010, Van den Heuvel et al, 2005) and others does not include musculoskeletal pain as a contributing factor to risk of disability pension. (Fimland et al, 2014) It is therefore relevant to study the relation of musculoskeletal pain and disability pension, and further, look at the effects of physical activity and BMI.

1.4 Primary aim

This study will examine the association between musculoskeletal pain in relation to disability pension, and include lifestyle factors, such as physical activity and BMI, to examine if these factors can modify the association.

2.0 Methods

2.1 Study population

This study is based on data from the Norwegian Nord-Trøndelag Health Study (HUNT). The study has been conducted in three different periods of time; whereas HUNT 1 was run in 1984-86, HUNT 2 in 1995-97 and HUNT 3 in 2006-08. In this present study only data collected in HUNT 2 will be used. HUNT 2 includes everyone in Nord-Trøndelag over the age of 20 years, and is thus the largest health study ever to be done in Norway. HUNT 2 included 65.000 who replied the questionnaire, plus physiologic examinations, which results in a 70 % participation. (HUNT, undated) More information regarding the selection process, participation and questionnaires in HUNT can be found at the following site: http://www.hunt.ntnu.no.

This study only includes participants who were between the age of 20 and 65 at baseline.

2.2 Variables

2.2.1 Disability pension as follow-up

The HUNT2-data was linked to the national event database FD-Trygd for info on incident disability pension by identifying the participants through their personal identification number. Disability pension is an economic support system for people with injuries or without the ability to endure 100 percent of the work day. Many studies entail sick leave as a variable, but disability pension requires medical confirmation from doctors and a thorough process to be affirmed. These data made it possible to follow-up through to 2007. In the follow up, concerning disability pension, participants were censored due to contractual early retirement, old-age retirement, emigration and death or upon reaching the age of 67 years, whichever occurred first. These data were collected from national registries and gave the opportunity of complete follow-up.

2.2.2 Pain

The participants are asked through the questionnaire: ”During the last year, have you had pain and/or stiffness in your muscles and limbs that has lasted for at least 3 consecutive months?”. If “yes” they are further asked where and how long the pain has been present. Additionally they are asked if the pain have reduced their work capability (no/insignificant, to some extent, considerably, I don’t know), if they have taken sick leave as a result of the pain and if the pain have led to reduced leisure time physical activity. For the different analyses, there have been created different pain variables. The first variable includes all reported pain whilst other variables additionally include only location specific pain. All reported pain have been used in the descriptive statistics and the variable used in all other analyses entail all who have reported pain but only those who additionally have pain in the neck, shoulders, upper back and/or low back. In the tables the variable is shown as “Pain neck/shoulders/back”. One analysis includes this pain variable as well as other similar variables. These variables also include everyone who has reported pain, but only those who report pain in neck/shoulders, and one variable for only low back pain.

2.2.3 Physical activity

The participants are asked about their average physical activity during leisure time the former year. Choice options are vigorous (sweating/out of breath) or light (not sweating/not out of breath) physical activity. And how often the physical activity has been performed weekly the former year. By recoding the variable, physical activity has been split into four different levels of activity. Those who replied no physical activity any times weekly in either light or hard activity were coded as inactive. The ones who replied <1 time weekly or 1-2 times weekly by light activity only were coded “low activity”. Further on, those who replied <1 time weekly by hard activity or 3+ times by light activity were coded as “medium activity”. Lastly those who replied 1-2 or 3+ times weekly by hard activity only were coded as “high activity”.

2.2.4 Body Mass Index

Through the physical examination, weight and height were registered by HUNTs qualified and trained personnel. This was later calculated into BMI and recoded into three different levels of BMI. Those categorized as underweight and normal weight were combined into one group of everyone under 25 kg/m^2. Participants between 25 – 30 kg/m^2 are categorized overweight and those over 30 kg/m^2 categorized obese. (WHO, 2009)

2.3 Statistic analyses

All analyses are run in the statistics program SPSS Statistics 20. The first analysis with descriptive statistics, is a regular combination of descriptive and frequency analysis. It is stratified by overall reported pain and shows the characteristics at baseline. The other analyses are cox regression, which calculates relative risks (RRs) and 95% confidence intervals (CI). The cox regression was run multiple times for each location of pain. Another cox regression was run where we looked at the combined effect of musculoskeletal pain and body mass index on risk of disability pension. The same analysis was run on the combined effect of musculoskeletal pain and physical activity on risk of disability pension. Additionally it has been run analyses to test statistical interaction by including a product term in the model. It has been adjusted for a standard set of variables in each analysis in an attempt to avoid confounding. These variables are smoking, recoded as 1 (never), 2 (prior) and 3 (present). Education was recoded into 1 (junior/high school), 2 (college) and 3 (university). It has also been included age as a continuous variable and gender coded as 1 (male) and 2 (female).

2.4 Ethics

The study was approved by the Regional Committee for Ethics in Medical Research and carried out according to the Declaration of Helsinki. All participants in the HUNT study signed a written informed consent upon participation.

3.0 Results

In this prospective study of 45470 persons, 6499 (14,3 %) received disability pension during 10 years of follow-up.

Table 1) Descriptive statistics

Descriptive Statistics at baseline			
		Pain	No Pain
Number of individuals		19024	26446
Gender %	Men	8635 (45,4)	13346 (50,5)
	Women	10389 (54,6)	13100 (49,5)
Mean Age (SD)		44,6 (11,2)	40,0 (12,2)
Education %	Junior/High	5664 (29,8)	5496 (20,8)
	College	9241 (48,6)	13326 (51,2)
	University	3797 (20,0)	7220 (27,7)
Disability pension %		4423 (23,2)	2076 (7,8)
BMI %	Normal weight	7705 (40,5)	12300 (46,5)
	Overweight	8275 (43,5)	10843 (41,0)
	Obese	3017 (15,9)	3258 (12,3)
Physical activity %	None	1210 (6,4)	1360 (5,1)
	Low	5928 (31,2)	6766 (25,6)
	Medium	6124 (32,2)	8477 (32,1)
	High	4879 (24,6)	8860 (33,5)

Table 1 shows the characteristics of all included at baseline, separated in groups of pain or no pain. The participants age differs some between the two groups, and it is shown that more females than men report pain or stiffness in muscles and limbs. When it comes to education, the group with pain is slightly less educated. People with pain have a higher percentage of disability pension than their counterparts without pain. BMI also differ to some extent between the groups, where the people with pain tends to be slightly more overweight and obese. Physical activity seems to differ between the groups as well, where the group with pain has less high forms of activity than the group without pain.

Table 2) Risk of disability pension among individuals with reported pain or stiffness in muscles and/or limbs.

	No. of persons	No. of cases	Un-adjusted	Age-adjusted[a]	Multi-adjusted[b]	95%CI[b]
No reported pain	45470	2076	1.00	1.00	1.00	Reference
All reported pain	45470	4423	3,35	2,64	2,49	2,36 – 2,62
Neck/shoulder/back	45470	3972	3,52	2,75	2,57	2,44 – 2,72
Neck/shoulder	45470	3400	3,71	2,84	2,60	2,46 – 2,74
Low Back	45470	2649	3,63	2,94	2,75	2,61 – 2,91

a) Adjusted for age
b) Multiadjusted for age, gender, smoking (never, prior, present) and education (junior/high school, college, university)

This table shows the risk of disability pension among individuals who have reported pain or stiffness in muscles and/or limbs. This effect is reduced by adjusting for age, and later followed by age, gender, smoking and education. In addition to all reported pain, several location specific pain variables are included. The variable containing pain in neck/shoulder/back shows a stronger association (RR 2,57, CI 2,44 – 2,72) than the variable including all reported pain (RR 2,49, CI 2,36 – 2,62). In the pain specific variables, pain in stomach, chest, hips, knees, ankles, elbows, and wrists, have been excluded. For pain in only the neck/shoulders, the effect is slightly higher (RR 2,60, CI 2,46 – 2,74). The variable containing only pain in low back shows the highest association with risk of disability pension by 2,75 (CI 2,61 – 2,91).

Table 3) Risk of disability pension after 10 years of follow-up as a combined effect of pain in neck/shoulder/back and body mass index at baseline.

	No Pain					Pain			
BMI	No. of persons	No. of cases	RR[a]	95%CI[a]		No. of persons	No. of cases	RR[a]	95%CI[a]
Normal weight	12704	777	1,00	Reference		6517	1386	2,67	2,46 – 2,94
Over-weight	11249	982	1,18	1,08 – 1,30		6984	1720	2,89	2,65 – 3,15
Obese	3416	427	1,55	1,37 – 1,75		2544	860	4,02	3,64 – 4,45

a) Multiadjusted for age, gender, smoking (never, prior, present) and education (junior/high school, college, university)

This table shows the combined effect of musculoskeletal pain and different categories of BMI on the risk of disability pension. Persons classified as normal weight are those under 25 kg/m^2. The combined analysis including musculoskeletal pain and different levels of BMI showed that the risk of disability pension increases from normal weight (RR 2,67, CI 2,46 – 2,94) to obese (RR 4,02, CI 3,64 – 4,45) among people with musculoskeletal pain, compared to normal weight without pain. High BMI also gives an increased risk of disability pension among people without pain (RR 1,55, CI 1,37 – 1,75). Overweight appears to be important in both the group with and without pain. For those overweight the risk differs from 1,18 (CI 1,08 – 1,30) among people without pain to 2,89 (CI 2,65 – 3,15) among people with pain. Those with pain are more at risk of disability pension and people of normal weight have over two and a half times the risk compared to those of normal weight without pain. As for the obese, the risk of disability pension is almost four times the risk when comparing those without pain to those with pain. It is a significant interaction between musculoskeletal pain and BMI of 0,002.

Table 4) Risk of disability pension after 10 years of follow-up as a combined effect of pain in neck/shoulder/back and physical activity at baseline.

	No Pain					Pain			
Physical activity	No. of persons	No. of cases	RR[a]	95%CI[a]		No. of persons	No. of cases	RR[a]	95%CI[a]
Inactive	1437	182	1,00	Reference		988	328	2,54	2,11 – 3,05
Low activity	7013	715	0,75	0,64 – 0,89		5102	1456	1,93	1,65 – 2,26
Medium activity	8784	681	0,70	0,59 – 0,83		5205	1209	1,72	1,47 – 2,02
High activity	9156	444	0,55	0,47 – 0,66		4035	693	1,48	1,25 – 1,75

a) Multiadjusted for age, gender, smoking (never, prior, present) and education (junior/high school, college, university)

Table 4 shows the combined effect of musculoskeletal pain and different amounts of physical activity in relation to disability pension. The results show that physical activity has an effect on risk of disability pension among people with and without pain. Firstly, it can be seen in the group with pain where there's a significant inverse effect. This inverse effect follows the increased amount of physical activity. The effect descends from 2,54 (CI 2,11 – 3,05) to 1,93 (CI 1,65 – 2,26), onwards 1,72 (CI 1,47 – 2,02) and for the highly active 1,48 (CI 1,25 – 1,75) when compared to inactive people without pain. A similar inverse effect can be seen in the group without pain, where the effects progresses from the inactive of 1,00 (reference) to low activity of 0,75 (CI 0,64 – 0,89), medium activity 0,70 (CI 0,59 – 0,83) and lastly 0,55 (CI 0,47 – 0,66) among the highly active. This means that those highly active are almost half as likely to receive disability pension compared to those who are inactive among people without pain. Again, those with pain are significantly more at risk than those without pain. But both groups can gain a preventive effect of physical activity where increased physical activity results in reduced risk of disability pension. This is also shown by a significant interaction between physical activity and musculoskeletal pain of 0,049.

4.0 Discussion

This study aims to examine the risk of disability pension among people with musculoskeletal pain, and to what extent lifestyle factors, such as leisure time physical activity and BMI, can modify this association. The study follow a large population over a 10 year period regarding disability pension and musculoskeletal pain, with physical activity and BMI as modifying factors. The main results show that musculoskeletal pain in neck, shoulders and back gives an increased risk of disability pension. Furthermore high BMI seems to be a very central modifying factor where people with and without musculoskeletal pain have increased risk of disability pension. The participants with musculoskeletal pain have much higher risk for disability pension than their counterparts without any pain, especially when BMI is included as a modifying factor. Additionally, physical activity appears to be important for reducing the risk for disability pension, among individuals with and without pain. Both the groups can gain a significant preventive effect by increasing physical activity.

4.1 Disability pension and Pain

Overall pain is a risk factor for disability pension. No matter where the pain has origin we found around two and a half times increased risk of disability pension than among people without pain. Andersen et al (2012) found some similar results, yet smaller effects, in their study concerning pain zones as a risk factor for sick leave. Nurses with pain in low back had a 40 % increased risk of long-term sick leave. In the same pain zone the risk of long-term sick leave, as a result of shoulder and neck pain, where 50 %. (Andersen et al, 2012) A prospective cohort study from Finland by Haukka et al (2013) studied the odds ratio of sickness absence as a result of different numbers of pain sites. They combined 18 different sites into 4 main sites in their analyses. The odds ratio for the different sites varied from twice the odds to four times the odds of sickness absence compared to no pain depending on the number of pain sites. (Haukka et al, 2013) This study supports our findings in a better way than Andersen et al (2012).

4.2 The combined effect of musculoskeletal pain and BMI on risk of disability pension

BMI is another important risk factor in relation with disability pension. High BMI gives an increased risk of disability pension for both people with and without pain. Especially among people with pain, risk of disability pension was almost doubled in the group containing obese compared to the group of normal weight. The same progression, but considerably lower risk of disability pension, can be found among people without pain, where obese have over 50 % increased risk compared to normal weight. It should also be mentioned that the people classified as overweight are also at risk in both groups, with or without pain. Rather few have studied the relation between BMI and disability pension, but those who have, found similar effects. (Roos et al, 2013) Roos et al (2013) found that obesity was a risk factor for disability pension, where severely obese had an increased risk of almost four times than their normal weight counterparts. Additionally, they found the importance of BMI in relation to risk of musculoskeletal disorders where hazard ratios doubled from obese to severely obese. (Roos et al, 2013) Evanoff et al (2014) also studied the relation between BMI and risk of musculoskeletal pain. This was a study among men to look at occupational exposures which could result in shoulder or knee pain. They found increased odds of shoulder pain as a result of heightened BMI (obesity). Similar effects was studied by Puroila et al (2015) who found that obesity among men gave almost twice the odds as a predictor of musculoskeletal pain compared to those of normal weight.

4.3 The combined effect of musculoskeletal pain and physical activity on risk of disability pension

The last of the main factors applied in the analyses is physical activity. Our study shows the combined effects of physical activity on risk of disability pension among people with and without pain/stiffness in muscles and limbs. Among people without pain, physical activity gives a 25 – 45 % preventive effect based on the amount of completed physical activity. For people with pain, increased physical activity can more than halve the risk of disability pension from the inactive to the highly active. It should also be said that even the people who complete only a low amount of physical activity gains a significant reduction in risk of disability pension. Many different studies have found effects of physical activity as a preventive option (Fimland et al, 2014, Jørgensen et al, 2011) though many whom have tried different work place treatment programs have turned up empty handed (Aas et al, 2011, Schaafsma et al, 2013) These workplace studies mostly entailed physical conditioning programs, including workplace related

exercises for strengthening back and flexibility, as well as adding a set date for return to work. (Schaafsma et al, 2013) Even if many studies have found significant effects of physical activity on reducing musculoskeletal pain, (Nilsen et al, 2011, Deng et al, 2014, Van den Heuvel, 2005) they may not have included sickness absence or disability pension. This particular study has findings that imply that the effects physical activity has on musculoskeletal pain can be carried on in relation to disability pension to some extent.

4.4 Physiological mechanisms

The association between disability pension and musculoskeletal pain may entail many underlying factors. Mainly, the musculoskeletal pain limits the individual in the work environment, where the pain is too great to complete regular work tasks. Musculoskeletal pain has also shown to reduce both physiological and psychological well-being, as well as a general perception of quality of life. (Fimland et al, 2014) Mental factors seems to have a role in the relation to disability pension (Lahti et al, 2013), but Øverland et al (2012) found higher effects of disability pension when as a result of musculoskeletal disorders. To better understand the relation of disability pension and musculoskeletal disorders, the physiological mechanisms of BMI and physical activity on musculoskeletal pain should be highlighted.

The exact physiologic mechanisms concerning excess body mass and physical exercise on risk of musculoskeletal pain are unclear. One theory concerning musculoskeletal pain is where obesity induces chronic low-grade systemic inflammation, while exercise has an opposite effect by reducing inflammatory factors (Nilsen, 2011). A review by Das (2001) compared several cross-sectional studies that have shown a positive association between obesity and serum levels of pro-inflammatory cytokines such as interleukin-6 and tumor necrosis factor α. Recent evidence indicates that interleukin-6 and tumor necrosis factor α may be involved in the progression of chronic pain (Dina et al, 2008, Darnall et al, 2010) and that the serum level of these cytokines predicts pain intensity in chronic pain patients (Koch et al, 2007). However, further studies are needed.

4.5 Strengths and limitations

The strengths of the current study are the large and unselected population, the prospective design, the standardized measurement of height and weight, the possibility of adjusting for several potentially confounding factors, and the link to national registries giving the opportunity of complete follow-up. The questions on chronic musculoskeletal pain used in HUNT 2 have acceptable reliability and validity (Palmer et al, 1999). The questionnaire on physical activity has also proven acceptable repeatability and validity, especially for the "hard/vigorous" activity. (Kurtze et al, 2007) The "light" activity achieved lower repeatability and Kurtze et al (2007) mentions the relation should be studied further.

A limitation of the study is that information on exercise, BMI and musculoskeletal pain was obtained only at baseline, and changes occurring during the follow-up period could not be taken into account. The HUNT questionnaire is also much self-reported data, which is a recurrent problem with questionnaires in general. Although self-reported information on musculoskeletal pain, leisure time physical activity, smoking, and education could be a source to misclassification, it is not likely that such misclassification is differential between people with different status on disability pension or musculoskeletal pain. Another limitation is the topic of who replies these questionnaires versus who does not reply. The questionnaire have 70 % attendance and a study by Langhammer et al (2012) shows that nonparticipants had lower socioeconomic status, higher mortality and showed higher prevalence of several chronic deceases, though except common problems such as musculoskeletal pain. The study by Langhammer et al (2012) concerns the HUNT 3 study, but the same findings was studied in HUNT 2 by Holmen et al (2003). It is not surprising that the same characteristics was found since many of the attendants contributed in both studies. When it comes to confounding we have adjusted for a standardized set of variables. There will always be some potential residual confounding due to unmeasured or unknown factors. We did not adjust for mental factors, mostly because of its role as a mediator on the relation between musculoskeletal pain and disability pension.

4.6 Conclusion

The findings in this study can help to clarify the effects of musculoskeletal pain, BMI and physical activity on the risk of disability pension. Our main findings are the relation between musculoskeletal pain in the neck, shoulders and back towards risk of disability pension. This study also found that physical activity and BMI may affect the relation between musculoskeletal pain and risk of disability pension, where increased physical activity reduce the risk of disability pension and increased BMI has the opposite effect. Our findings show these effects among people with and without pain. In conclusion, it seems that physical activity and achieving normal weight may reduce the unfortunate effects of musculoskeletal pain when it comes to risk of disability pension.

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