Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Medicine and Health Sciences
Department of Neuromedicine and Movement Science

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The association between chronic low back pain and changes in physical activity

Longitudinal data from the HUNT Study

Master's thesis in Human Movement Science
Supervisor: Tom Ivar Lund Nilsen

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Abstract

Background: The aim of this study is to examine the association between chronic low back pain and changes in physical activity. To see if chronic low back pain affects the duration and frequency of leisure time physical activity, and if the occurrence of chronic LBP could lead to inactivity.

Methods: The study in total used data from 20 312 men and women who participated in HUNT1, HUNT2 and HUNT3, and who reported about low back pain and physical activity. A generalized linear model and logistic regression was used to calculate mean differences and odds ratios for reduction physical activity minutes per week, reduction physical activity frequency per week and inactivity.

Results: The odds ratio for reduced leisure time minutes of physical activity per week from HUNT1 to HUNT3 was 1.11 (95 % CI 1.00-1.23) for persons who did have LBP at HUNT2. The odds ratio was 1.07 (95% CI 0.98-1.16) for reducing leisure time frequency of physical activity per week. The odds ratio of becoming inactive was 1.28 (95% CI 1.13-1.45).

Conclusion: People who experienced chronic low back pain have an increased risk of becoming inactive. The association between chronic LBP and reduced activity minutes and frequency was rather weak.

Sammendrag

Bakgrunn: Målet med studien er å finne sammenhenger mellom kroniske korsryggssmerter og endringer i fysisk aktivitet. Om kroniske korsryggssmerter påvirker tiden og frekvensen av fysisk aktivitet på fritiden, og om tilstedeværelsen av kronisk korsryggssmerte kan føre til inaktivitet.

Metode: Studien inkluderer totalt data fra 20 312 menn og kvinner som har deltatt i både HUNT1, HUNT2 og HUNT3, samt rapportert om korsryggssmerter og på de konfunderende faktorene. Generalisert lineær modell og logistisk regresjon ble brukt til å kalkulere gjennomsnittlig forskjell og odds ratio for reduksjon av aktivitetsminutter pr uke, reduksjon for aktivitetsfrekvens pr uke og inaktivitet.

Resultat: Oddsen for å redusere fysisk aktivitet på fritiden minutter pr uke på grunn av kronisk korsryggssmerte er 1.11 (95 % CI 1.00-1.23) og 1.07 (95% CI 0.98-1.16) for å redusere frekvensen av fysisk aktivitet på fritiden. Oddsen for de med kroniske korsryggssmerter å bli inaktiv er 1.28 (95% CI 1.13-1.45).

Konklusjon: De som opplever kroniske korsryggssmerter har en større risiko for å bli inaktiv. Sammenhengen mellom kroniske korsryggssmerter og reduksjon av aktivitet, både minutter og frekvens er liten og ikke signifikant.

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Introduction

Physical activity is by the Centers for Disease Control and Prevention (CDC) defined as any bodily movement which increase energy expenditure higher than the basal level, which is produced by the contraction of skeletal muscle. The same article by the CDC defined physical inactivity as the physical activity level which is less than the physical activity level required for optimal health and prevention of premature death (1). Physical inactivity and sedentary lifestyle result in an increased risk for disease and early death (2). Physical inactivity causes worldwide about 6% of the coronary heart disease, 7% of breast cancer, 10% of colon cancer, 9% of premature mortality, about 5.3 million deaths occurring worldwide in 2008. About 1 out of 4 adults in the world are inactive. Evidence have shown that physically inactive people have between 20-30% greater risk of death than physically active people (3). The economic burden on the health-care system because of inactivity, is about 53.8 billion dollars worldwide, and because of unknown confounding factors yet to be researched the cost will most likely be much greater (4).

Musculoskeletal pain is one of the most common reasons for sick leave and disability (5-9). In Norway as well as several western European countries, musculoskeletal disorders are the dominating cause of sick leave, rehabilitation and disability leave (8, 10). It is because of the loss of a large number of work days and that we receive large treatment costs (11), one of the most costly individual problems in society (5, 8, 9, 12, 13).

About 60-85% of adults in the western world, including countries like Sweden, Netherlands, United Kingdom, United States of America, Norway, and most of the western world, will experience low back pain (LBP) throughout their lives (5, 10, 11, 14), and a lot of the people with low back pain would need to seek medical help (15). About 15% of adults has low back pain at any given time (11). Despite the large numbers of people experiencing low back pain, they mostly recover rather quickly, and about 10-15 % gets chronic symptoms (15). But, it is still one of the main causes of disability globally (10, 13, 16). Among the Norwegian population, 75-80% will experience musculoskeletal pain or discomfort (10).

Musculoskeletal pain is in literature often dived into acute, subacute and chronic pain (11). Chronic musculoskeletal pain is often defined as pain and/or stiffness in muscles and joints lasting over 3 months during the past year (7, 11), or muscular pain that occurs episodically within a 6 month period (11). Pain in general is categorized into specific pain (with known

specific pathology e.g. infection, tumor, osteoporosis, fracture etc.) and non-specific pain (with no specific known pathology) (15). Back pain could be divided into more specific areas on the back, in Helseundersøkelsen i Nord-Trøndelag (HUNT), back pain is divided into low back pain, upper back pain, neck pain and shoulder pain (17). The definition on low back pain according to Krismer and van Tulder (11) is "pain located between the 12th rib and the inferior gluteal folds, with or without pain in one or both legs." In total, 51% of the population in the Norwegian HUNT study reported having chronic musculoskeletal disorders. In the Norwegian Helseundersøkelsen i Hordaland (HUSK) they found that 38% of men and 48% of women in the age of 40-49 years, and 41% of men and 57% of women in the age of 70-74 years reported chronic musculoskeletal pain and stiffness (10). Low back pain being one of the most common musculoskeletal disorders in Norway, as well as in other western countries (6). The presence of non-specific low back pain, can cause the loss of health status, loss of function, limitations of activities, both daily living and leisure time, and restricted participation e.g. temporary or permanent work disability (11).

All over the world there is national recommendations on how much daily activity we should be doing, the previous recommendations said we should do at least 30 minutes of physical activity in a moderate intensity (18). The World Health Organization and the Norwegian Directory of Health changed the guidelines in 2016 into 150 minutes of moderate physical activity per week or 75 minutes of high intensity physical activity per week (19). When looking at how much activity people is doing, there is only about 30% of adults that actually fulfil the physical activity recommendations (20). Physical inactivity and a sedentary lifestyle are risk factors for several chronic diagnosis. Metabolic syndrome, obesity, insulin resistance, type 2 diabetes, cardiovascular diseases, depression and musculoskeletal pain is among the diagnosis with increased risk (1). Physical activity is on the other hand proven to prevent or have a positive effect on the diseases mentioned above (1, 2).

There are a lot of research on the effect on how physical activity or lack of, effect LBP (1, 21). However, research on the effect of chronic LBP on physical activity is sparse, and just a few studies have examined this association. The findings also showed a great variety. From positive results where they found a significant decrease of physical activity after onset of back pain (22), a lower physical activity level and altered physical activity pattern because of chronic low back pain (23). Other studies found no association between chronic LBP and physical activity (24, 25). In other words, the studies cannot come to any clear conclusion whether there's any association between chronic LBP and leisure time physical activity (26).

Aim

The aim of this master thesis is to determine if chronic low back pain is associated with changes in leisure time physical activity, and the risk of becoming inactive, using longitudinal data from the HUNT Study, Norway.

Methods

Study population

The Nord-Trøndelag Health Study (HUNT) is a large cohort study based on the population of Nord-Trøndelag, 1 of 19 counties in Norway. The population of Nord-Trøndelag is fairly representative for the Norwegian population. The only thing differing Nord-Trøndelag from Norway in general, is that there is no large city's (27). There have been 4 data collections, the first one in 1984-86 (HUNT1), the second in 1995-97 (HUNT2), HUNT3 in 2006-08 and HUNT4 2017-19. The current study is based on data from HUNT1, HUNT2 and HUNT3. In HUNT1, 74 599 people above 20 years old participated, which was an 88.1% response rate. In HUNT2, 93 898 people were invited to participate and 69.5% (65 237 people) of the invited accepted the invitation. In HUNT3, 54.1% (50 839 people) of the 93 860 people who were invited participated in the study. In total more than 150 000 people have participated (17). We selected the 27 992 who had participated in HUNT1, HUNT2 and HUNT3 (28). A total of 20 312 people answered the question on low back pain in HUNT2 and on the relevant confounding variables. Different numbers of people were included in the analyses depending on the variable of physical activity that was used. The number of participants included in each analysis is shown in figure 1.

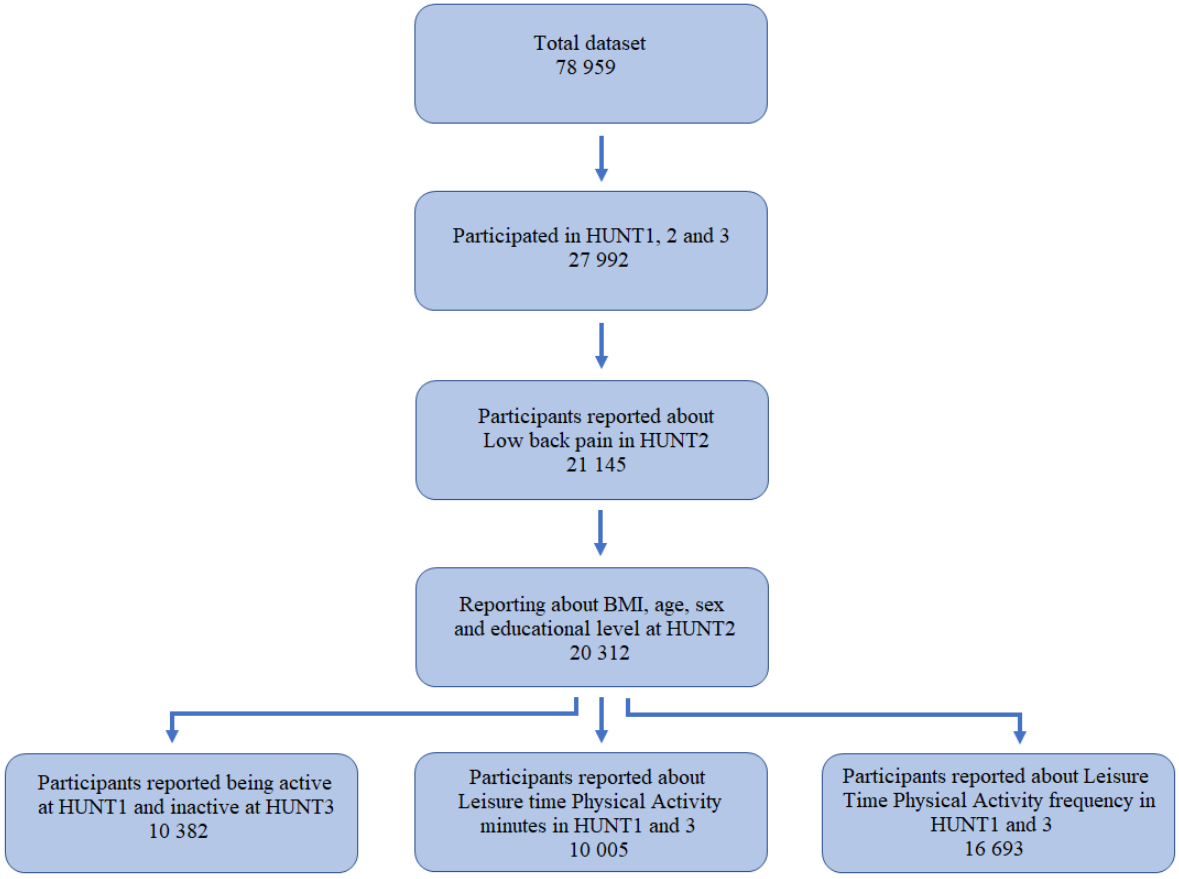

Figure 1: Flowchart of exclusion of participants in the study.

Study variables

The data used in this study is collected by self-administered questionnaires sent in the mail to each inhabitant in Nord Trøndelag. And by clinical examinations administered by HUNT (17).

Chronic musculoskeletal pain

In the HUNT2 questionnaire the participants answered the question “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 NO, go on to the next section. If YES, answer the following questions:” Further questions defined in which area the pain occurs (“Where did you have pain and/or stiffness? Neck Shoulders Elbows Wrists, hands Chest/stomach Upper part of

back Lumbar region Hips Knees Ankles, feet (If you had complaints in several areas for at least 3 months in the last year, put a circle around the yes-X for the complaint that lasted longest.)"). For the sake of the analysis the information was recoded into a categorical variable, low back pain, yes=1, no=0.

Leisure time physical activity

At baseline, HUNT1, and at follow-up in HUNT3 the participants answered questions about their leisure time physical activity. "How much of your leisure time have you been physically active during the last year? (Think of a weekly average for the year. Your commute to work counts as leisure time.) Low physical activity (no sweating/not out of breath) Vigorous physical activity (sweating/out of breath)" and "How often do you exercise? (on the average) Never, Less than once a week, Once a week, 2-3 times a week, Nearly every day." Was then recoded into a durability variable min/week defining 1=10, 2=22.5, 3=45, 4=75 and into a frequency variable frequency/week defining 1=0, 2=0.5, 3=1, 4=2.5, 5=5.

By recoding the exercise frequency HUNT1 (ExeF@NT1BLQ2) and defining "Never" and "less than one time a week" as inactive = 1, and "once a week", "2-3 times a week" and "about every day" = 0 we created a new variable "inactive_h1". "inactive_h3" was then created by repeating the procedure from "inactive_h1" on the variable exercise frequency HUNT3 (Exe@NT3BLQ1).

We then proceeded with calculating the product of physical activity duration and frequency, to find the total minutes per week of physical activity. These operations created the variables exercise minutes per week HUNT1 (exe_min_week_tot_H1) and exercise minutes per week HUNT3 (exe_min_week_tot_H3).

Using the new total minutes per week of physical activity variables (exe_min_week_tot_h1-exe_min_week_tot_h3=exe_min_diff_H1_H3) to find the difference in activity from HUNT1 to HUNT3. To create a similar variable for frequency, exe_freq_diff_H1_H3, the same procedure was repeated "exe_freq_week_tot_h1-exe_freq_week_tot_h3=exe_freq_diff_H1_H3".

Confounding variables

The assumed confounding variables age, sex, body mass index (BMI) and educational level were measured at HUNT2. Height was measured to the nearest 1.0 cm, and weigh to the nearest 0.5 kg, wearing light clothes. BMI was calculated by dividing weight (kg) on height (m) squared, BMI=kg/m². The BMI variable was categorized into groups 1=under 18.5, 2=18.5-24.9, 3=25-29.9 and 4=30 and above.

Statistical analysis

Simple descriptive analyses were used to check for normal distribution.
Linear regression was used to estimate mean differences and confidence intervals in changes of leisure time physical activity minutes and frequency between HUNT1 and HUNT3, associated with LBP at HUNT2. We used logistic regression to calculate odds ratio (OR) for inactivity at HUNT3, and for reduced frequency and duration between HUNT1 and HUNT3, associated with LBP status at HUNT2. Only the participants who reported being physically active at HUNT1, was used in the logistic regression to calculate OR for becoming inactive. All analyses were first adjusted for age, and then for all confounding variables (sex, BMI and educational level). The precision of the estimated OR was assessed using a 95% confidence interval (CI). The software used for the statistical analyses was IBM SPSS Statistics 26.

Ethics

The study was approved by Regional Committee for medical research ethics (REK midt: 9468). All participants signed a written consent for participation in the HUNT study.

Results

Table 1 present the characteristics of the study population according to low back pain (LBP) at HUNT2. The mean age of people without LBP was 50.00 years, the mean age of people with LBP was 52.37 years. Mean BMI within the group without LBP was 26.13 kg/m^2, and mean BMI within the group with LBP was 26.73 kg/m^2. The BMI distribution in table 2 shows that 13% of those without LBP has a BMI above 30 kg/m^2 and is categorized as overweight, while 18% of those with LBP was categorized as overweight.

Table 1: Baseline characteristics of the study population according to sex, BMI, age at examination and highest education. Divided on pain.

Characteristic	N	No LBP at HUNT2	LBP at HUNT2
Body Mass Index[a] (mean, SD)	16963	26.13 (3.57)	26.78 (3.96)
Age at HUNT2 (mean, SD)	16963	50.00 (11.01)	52.37 (10.37)
Sex (n, %)	16963		
Female	9070	5533 (61.00)	3537 (39.00)
Male	7893	5374 (68.09)	2519 (31.91)
Body Mass Index[a] (n, %)	16963		
1 Under 18.5	63	38 (0.3)	25 (0.4)
2 18.5-24.9	6421	4306 (39.5)	2115 (34.9)
3 25-29.9	7965	5141 (47.1)	2824 (46.6)
4 30 and above	2094	1422 (13.0)	1092 (18.0)
Highest education (n, %)	16963		
1 Primary school 7-10 years	6159	3535 (32.40)	2624 (43.30)
2 High school 1-2 years	6361	4133 (37.90)	2228 (36.80)
3 University qualifying level/ Junior college	1060	773 (7.10)	287 (4.70)
4 University, less than 4 years	2033	1457 (13.40)	576 (9.50)
5 University/college, 4 years or more	1350	1009 (9.30)	341 (5.60)

Abbreviation: SD, standard deviation

[a]Weight(kg) / height(m)^2 at HUNT2

Figure 2 and 3 shows great variation in change of physical activity both minutes and frequency per week.

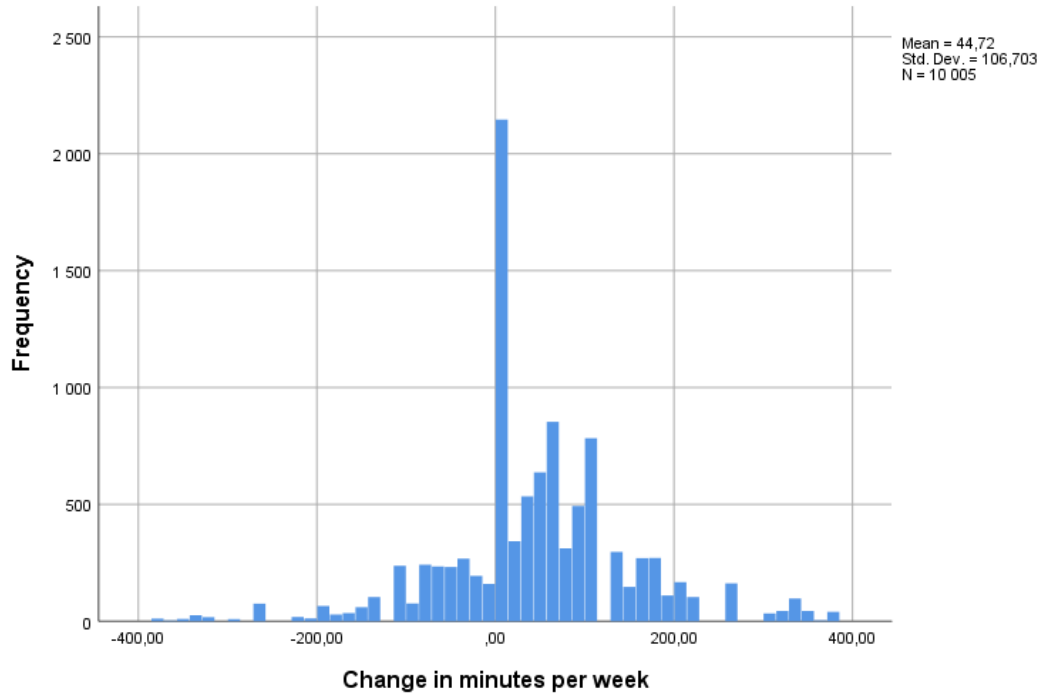

Figure 2: Change in minutes per week from HUNT1 to HUNT3.

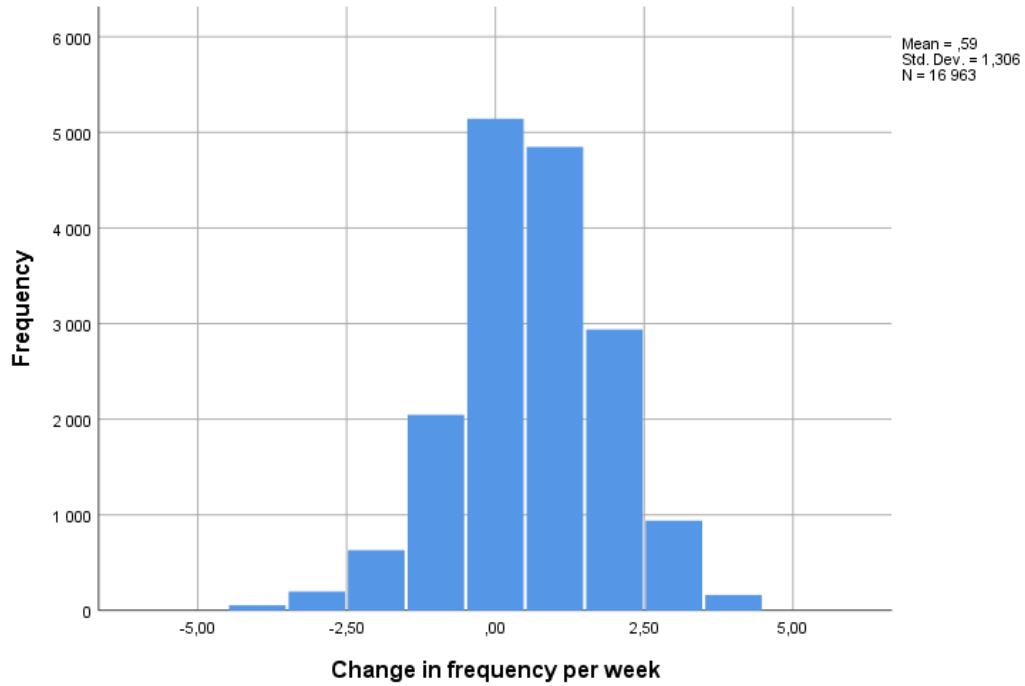

Figure 3: Change in frequency per week from HUNT1 to HUNT3.

Table 2 present the mean difference in change in physical activity from HUNT1 to HUNT3 between people who reported they had chronic LBP at HUNT2 and those that did not.

Overall, there was a change in physical activity minutes of 45.69 in those without LBP and 42.82 in those with LBP at HUNT2. This corresponds to an adjusted mean difference of -3.33 minutes per week (95% CI -7.79 to 1,13). The analysis of change in leisure time physical activity frequency per week showed a mean difference if 0.03 times (CI -0.04 to 0.04).

Table 2: Mean difference in change of leisure time physical activity

	No. of non-cases	No. of cases	Mean (SD)	Age adj mean difference	Multi adj* mean difference	95% CI
Change in min per week						
Pain						
No	5 271	1 355	45.69 (105.82)	0.00	0.00	Ref.
Yes	2 618	761	42.82 (108.40)	-3.16	-3.33	(-7.79 – 1.13)
Change in frequency per week						
Pain						
No	9 081	1 826	0.60 (1.28)	0.00	0.00	Ref.
Yes	4 951	1 105	0.59 (1.36)	0.05	0.03	(-0.04 – 0.04)

*Adjusted for Age at test point [year, HUNTAg], Sex, BMI [kg/m²], Highest achieved education [HUNTBL].

Table 3 shows the odds ratio of becoming inactive or reducing activity frequency and time at the presence of LBP. At follow-up HUNT3 26.17% with LBP did not reduce their exercise minutes per week, while 7.61% did reduce the number of minutes they spent every week on leisure time physical activity. While 29.19% of the participants with LBP did not reduce their activity frequency, 6.51% did reduce how many times a week they were physically active. Among those who reported they had LBP at HUNT2 and that were physically active at HUNT1, 28.78% did not become inactive at HUNT3, 5.05% did become inactive. The analysis show that there are 1.11 times greater odds of reducing physical activity minutes per week (95% CI 1.00-1.23), when comparing the group of participants with LBP to the group without LBP at HUNT2. The risk of reducing frequency of leisure time physical activity per

week is 1.07 (95% CI 0.98-1.16) when comparing those with, to those without LBP. The risk of becoming inactive at the presence of LBP at HUNT2 is 1.28 times higher than those without pain (95% CI 1.13-1.45).

Table 3: Odds ratio for inactivity and reduction in physical activity time and frequency

	No. of non-cases (%)	No. of cases (%)	Age adj OR	Multi adj* OR	95% CI
Reduction minutes per week					
Pain					
No	5271 (52.68)	1355 (13.54)	1.00	1.00	(Ref.)
Yes	2618 (26.17)	761 (7.61)	1.11	1.11	(1.00-1.23)
Reduction frequency per week					
Pain					
No	9081 (53.53)	1826 (10.76)	1.00	1.00	(Ref.)
Yes	4951 (29.19)	1105 (6.51)	1.09	1.07	(0.98-1.16)
Inactive					
Pain					
No	6 092 (58.68)	778 (7.49)	1.00	1.00	(Ref.)
Yes	2 988 (28.78)	524 (5.05)	1.35	1.28	(1.13-1.45)

*Adjusted for Age at test point [year, HUNTAg], Sex, BMI [kg/m^2], Highest achieved education [HUNTBL].

Discussion

Main results

The main results in this large-scale population-based study shows that the individuals who were physically active at HUNT1 and that reported they had LBP at HUNT2, has an significantly increased chance of becoming inactive at HUNT3. The risk of reducing the number of minutes spent on leisure time physical activity per week and the frequency of physical activity is rather small. Analyses of mean differences in physical activity minutes and frequency per week showed weak and negligible associations.

Comparison with previous findings

There is little research done on whether or not chronic low back pain is affecting physical activity. The previous findings were either based on case-control studies with a small number of participants in comparison to this study. The previous studies did not measure physical activity in participants before the onset of LBP and the studies was small cohort or case-control studies (23, 24, 29), or smaller scaled longitudinal studies (22, 25), in comparison to this study who used long-term longitudinal data (HUNT). The HUNT data also registered people's physical activity level before and after onset of LBP which makes it possible to measure changes in physical activity.

A study by Huijnen et.al. found no evidence of LBP causing decrease in physical activity level (25). A study by Bousema et.al. found a tendency of chronic pain leading to decrease in physical activity in a subgroup during their study, but the results were not significant (22). One case-control study observed that the group with chronic low back pain spent fewer hours on activity than the healthy controls (23). Verbunt et.al. found no significant results when they studied time of physical activity in chronic low back pain patients and healthy controls (24). Like the previously mentioned studies, this study was not able to find conclusive results either when it comes to change in activity level, minutes used for leisure time physical activity or frequency of physical activity per week.

Studies that did find an association between pain and reducing physical activity, is studies looking at fear of pain and physical activity in addition to pain itself. A systematic review found that there were many sociodemographic and health factors with coherence to why people developed sedentary behavior (30). Fear of injury being one of the psychological factors proven to have a strong association with decreasing physical activity when experiencing chronic low back pain (31). A study on avoidance behavior in chronic pain patients found that the patients suffering from chronic pain, spent much time trying to control their pain levels. This often by controlling and limiting their behavior and avoiding pain escalating activity or stimulation (32). A study looking at sub-acute low back pain and physical activity, found that the physical activity after onset of pain did have significant negative associations with disability and fear of movement/(re)injury (33). Which could be one of the factors explaining the significant results of people with chronic low back pain having a higher risk of becoming inactive. Low back pain patients waiting for lumbar fusion surgery found that 28% of the patients in the study were inactive, and 55% were active but did not meet the physical activity recommendations from WHO. Lotzke et.al. found an increased risk of becoming inactive when suffering from chronic low back pain. The study also found a negative effect of fear of injury/pain on chronic pain and physical activity, fear of injury/pain being a cause of inactivity in this group of people. Fear of movement, pain and/or injury is one of the greatest causes for people sinking into a calm and sedentary lifestyle, and disability (34).

A study about pain in osteoarthritis patients showed that those who suffer chronic pain in muscles or bone, and have what's categorized as a high pain level, have shown to have a lower physical activity level than those with a lower pain level (35). The effect of pain on osteoarthritis patient's behavior, showed that when experiencing a high enough pain level, they start to think catastrophizing thoughts and that this led to a more sedentary behavior. When these levels of pain appeared in the morning, it led to less activity during the same day and more time in sedentary behavior. The study also found significant results that daily pain was associated with more time active steps taken and less time spent in sedentary behavior, if they were non-white females with higher education (35). Huijnen on the other hand did not find any association at all between daily life activity levels and pain intensity in chronic low back pain patients (25).

A study on osteoarthritis patients found that only a small to moderate number of participants with knee and hip osteoarthritis met the recommended guidelines for physical activity (36).

The World Health Organization (WHO) recommendations for physical activity, divided people in age groups; children 5-17 years old, adults 18-64 years old and 65 years old and above. For the groups 18-64 years old and above 65 years old, the recommendations from WHO is; at least 150 minutes of moderate intensity physical activity throughout the week. Recommendations many countries have adopted, like Norway, United States of America and Germany among others (37-39). The importance of physical activity in our everyday life is not just to be in great physical shape, but also reducing risk of disease (1, 37). Obesity, cardiovascular diseases, depression and anxiety, osteoarthritis, cancer and musculoskeletal pain e.g. chronic low back pain are some of the diseases or medical conditions which has negative association with inactivity (1). The studied population in this study shows that the increased risk of becoming inactive because of chronic low back pain, not only could affect their movement pattern, but also could lead to serious diseases (1) and in worst case death (40). A systematic review found that there is a mildly increased risk of death in people with chronic pain. And that the risk of death because of chronic pain, increase when multiple pain sites are present, and if the pain is widespread (40).

There is great importance of researching if chronic pain affect physical activity. We fear the consequences of having chronic pain, the impact chronic pain has on a person's health and his or hers quality of life.

Strengths and limitations to the study

The strengths of this study are the prospective design, a large cohort study including the larger part of the population in a large county in Norway including both rural and urban environments. Among those who were invited to participate in the HUNT study, 89,4% (77 212 people) participated in HUNT1, 69,5% (65 237 people) in HUNT2 and 54,1% (50 807 people) participated in HUNT3 (17, 28). This is a relatively high participation rate compared to other longitudinal studies as HUSK (Helseundersøkelsen i Hordaland (41)) and the Helsinki Health Study (42). In total 27 991 people participated in HUNT1, 2 and 3, this large sample size of participants strengthens the study and the reliability of the study is high.

Using a questionnaire in the data collection, compared to physical collection of data by a scientist, could lead to information bias. Information bias could occur because the participants answers the questionnaire, over- and underreporting physical activity (43), one study found

that the participants is overreporting their physical activity intensity and underreporting their sedentary time (44). The usage of questionnaire to examine large populations is more cost and time effective than measurements by a scientist (43). Even if the usage of questionnaires could lead to a less exact reporting of physical activity, we still use questionnaires to a large extent. The clear advantages of the usage of questionnaires is the ability to collect data from large populations in short amounts of time and by using the same questionnaire we can repeat the data collection and be able to compare the results directly. Questionnaires has the possibility to include static activities (45). In the case of the HUNT1 and 3-study the same questionnaire has been used to collect data on physical activity, the data is therefore directly comparable and the test-retest reliability is high. The usage of the same questionnaire in two different surveys on the same individuals, enable to do analyses on change, like in this study on physical activity. The information on low back pain was collected in HUNT2, which makes it less likely the reporting of physical activity is directly related to the current episode of LBP.

In this study we took both leisure time physical activity frequency and leisure time physical activity time in minutes into consideration, but not intensity. The World Health Organization recommendations for physical activity during the week, include, time, frequency and intensity (37). The lack of the physical activity intensity variable in this study is therefore a limitation to the study.

Conclusion

The risk of decreasing minutes and frequency per week because of chronic low back pain, is small and not significant. The study however showed a significant association between having chronic low back pain and the risk of becoming inactive.

Further research

Further research could potentially focus on the maintenance of physical activity despite pain, and the mechanisms behind. This because of the importance on treating chronic low back pain and to be able to reduce the risk of other diseases like coronary heart disease, diabetes type 2,

hypertension and stroke among others. But also reducing risk of acute pain becoming chronical by reducing fear of movement among persons with acute and sub-acute low back pain. According to this study's limitations, The World Health Organizations physical activity recommendations also include intensity of physical activity. Further studies on association between chronic low back pain and leisure time physical activity, should therefore include intensity in addition to frequency and time of physical activity.

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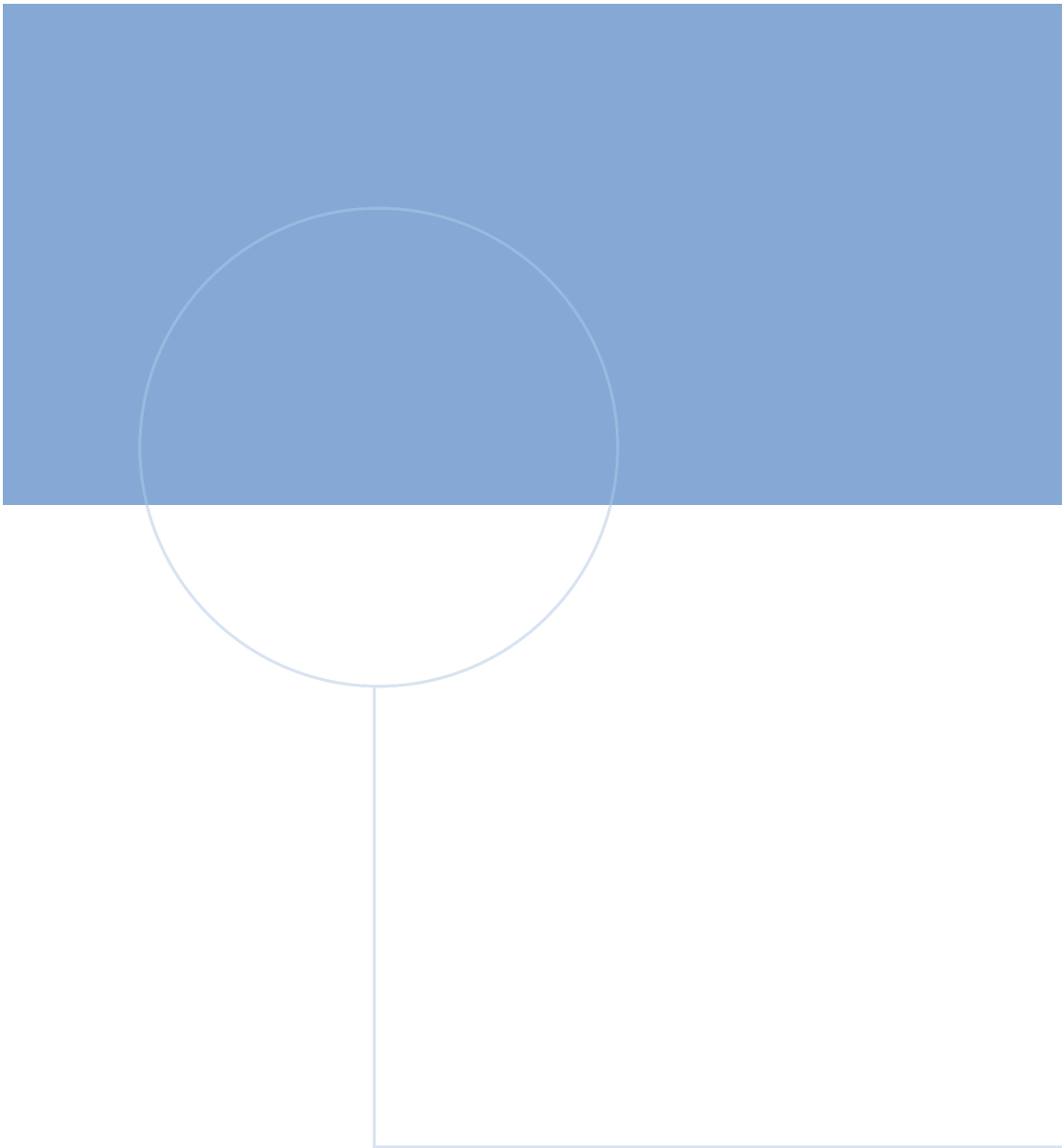

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