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# Socio-economic inequalities in utilisation of physiotherapy and chiropractic treatment in Norway

A population based cross-sectional survey

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## Acknowledgement

Finishing this thesis mark the end of a seven-year journey. In 2014 I had my final exam and I was set out to finish this thesis in 2016, but within three years, two turned into five, and the plans were changed.

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## Abstract

**Background:** In Norway, it is widely agreed that health services should be available for all, regardless of place of residence, gender, income or socioeconomic status. It appears that the use of general practitioners is equally distributed, while the better-off are more likely to use specialist healthcare. There is limited knowledge of the equity of other aspects of health care, such as physiotherapy and chiropractic care.

**Aim:** The aim of this thesis is to investigate the socioeconomic differences in the utilisation of physiotherapy and chiropractic treatment.

**Methods and materials:** The materials used for this thesis are questionnaire data from the sixth survey of the cross-sectional Tromsø Study, conducted in 2007 -2008. The study sample consists of 12,984 participants aged 30-87 years old. A descriptive analysis employed to describe the study population. To investigate the associations between household income, education and the utilisation of physiotherapy and chiropractic treatment, hierarchical logistic regressions are conducted. The outcome variable is the probability of use of physiotherapy and chiropractic treatment during the previous 12 months. The analyses are stratified by gender and adjusted for age and a selection of need variables.

**Results:** Need factors are the most important predictors for the use of physiotherapy and chiropractic treatment. Women's probability of visiting a physiotherapist increases with increasing education (OR for trend 1.118, CI 1.018 – 1.228). For men, a high income predicts a higher probability of use of physiotherapy (OR for trend 1.258, CI 1.138 – 1.391). For both men and women, the probability of using a chiropractor increase with increasing income (OR for trend 0.860, CI 0.788 – 0.951 and 0.898, CI 0.817 – 0.987 respectively). Men with the

highest income are more than two times more likely to utilise both physiotherapy and chiropractic treatment than men with the lowest income.

**Conclusion:** This thesis reveals inequalities in the use of chiropractic treatment and physiotherapy according to income and education.

**Keywords:** Cross-sectional study, socioeconomic inequalities, healthcare utilisation, physiotherapist, chiropractor, chiropractic care, physiotherapy, Norway.

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## List of abbreviation

SES	Socioeconomic status
GP	General practitioner
OECD	Organization for Economic Co – operation and Development
HELFO	The Norwegian Health Economics Administration
OR	Odds Ratio
MCAR	Missing completely at random
MAR	Missing at random



# 1 Introduction

## 1.1 Background

After studying the healthcare situation in a coal mine valley in Wales, John Tudor Hart introduced the inverse care law in 1971: 'The availability of good medical care tends to vary inversely with the need for it in the population served.' (1). With this quote, the idea of unequal access to healthcare became known.

In Norway it is widely agreed that access to healthcare services should be ruled by the principle of equal services for equal need independent of place of residence, gender, income and socioeconomic status (2-4) Over the last decade, it has become well documented that social inequalities exist in the utilisation of healthcare. It seems that the use of general practitioners (GPs) is equally distributed, while the better off are more likely to utilise specialist healthcare(5). However, knowledge is limited regarding other aspects of healthcare. Though insufficient healthcare is not considered one of the most important determinants of social inequalities in health, it is an important challenge for the health service itself (6, 7).

As a physiotherapist, I became curious about how the goals of equity are met with respect to the utilisation of physiotherapists and chiropractors. Few studies have been conducted, but a tendency towards higher use by those with higher socio-economic status (SES) can nevertheless be seen (5). Knowledge about how the services work today is the first step in reaching the goal of equity. With access to the Tromsø Study, a large population study with a high response rate and several measurements of need, an opportunity to observe how the use of physiotherapy and chiropractic treatment is affected by socioeconomic factors was given(8). The information derived from this study contributes

knowledge to a field with limited knowledge. Knowledge about equity in utilisation of physiotherapy and chiropractic treatment should be of interest to researchers, health professionals and politicians when planning for equity in healthcare.

## **1.2 Present knowledge**

In general social inequality in healthcare does not appear to be on the agenda for the Norwegian health services or emphasised in research(7). In 2007 the 'National Strategy to Reduce Social Inequalities in Health' (9) was presented and both goals for reaching equality in healthcare included to increase the knowledge of this subject. A report from 2014 concludes, 'It is difficult to see that the research on social inequalities in health services has been particularly strengthened and that our knowledge today is significantly better than when the 'National Strategy to Reduce Social Inequalities in Health' was written.'"(my translation; (7). Below, current knowledge on social inequalities in the use of physiotherapy and chiropractic treatment is presented.

### **1.2.1 Socioeconomic differences in the use of physiotherapy and chiropractic treatment.**

Few studies have been conducted on socioeconomic differences in the utilisation of physiotherapists and chiropractors. In Norway, knowledge is limited to Statistic Norway's reports on 'Social differences in the utilisation of healthcare services' from 2009 and 2017 (4, 10). The utilisation of chiropractors was measured only in the report from 2009. This report reveals differences in the utilisation of both physiotherapy and chiropractic treatment according to education level in groups with similar needs. For both physiotherapy and chiropractic treatment, use increases with increasing education. The use of a chiropractor also increases with increasing income, especially in patients older than 67 (10). The report from 2017(4) reveals a clear social gradient in the use of physiotherapy with respect to

income in all groups and with respect to education among older users. Education seems to matter more in women's use of physiotherapy than in men's. In Ireland, a similar study examined at the utilisation of various health services, including physiotherapy (11). Subjects with low levels of education had a 30% lower chance of using physiotherapy than subjects with middle or high levels of education, for both women and men. Income was not included as a predictor for use in this study. No other studies which consider socioeconomic differences in the use of physiotherapy and chiropractic treatment in general were encountered. However, some studies which consider this in more defined groups were discovered. A large population study from Canada examined healthcare utilisation among chronic back pain patients. This study indicated increased use of both chiropractors and physiotherapists in patients with higher income and higher education(12). A study of older chiropractor users in the US found no differences in the education or income of those visiting chiropractors compared to those not visiting chiropractors (13). Freburger et al.(14) have reported that for people with back and neck pain and the same level of need, those with higher education are more likely to visit a physiotherapist than those with less education; income was not included as a predictor for use in this study. Another study considered people with spinal pain and the factors predicting the use of a medical doctor(MD) and physiotherapist compared to an MD only and the use of a chiropractor compared to use of an MD and physiotherapist. The study found that the odds of seeking care by a physiotherapist over an MD only are higher in those with more education and income. None of the socioeconomic factors were significant for people seeking care by chiropractors over physiotherapists and MDs(15). Overall, few studies have been done in this field. Even with some inconsistent results, it may seem that a social gradient is present in the use of chiropractic treatment and physiotherapy.

### **1.3 Aim of the study**

This thesis aims to extend our knowledge regarding the use of physiotherapy and chiropractic treatment, using data from the sixth survey in the Tromsø Study. The main aim is to determine whether there are differences in the utilisation of physiotherapists or chiropractors relative to the education and income of people with similar needs. In addition, the demographic characteristics of users of these services are presented.

### **1.4 Conceptual clarifications and theory**

#### **1.4.1 Equity in healthcare**

Equity in healthcare is a central objective of many healthcare systems, including that of Norway, and features several aspects (3). According to Report No. 20 to the Storting(9) healthcare services should be equal in terms of access, use and outcome. Others are also including availability and quality as aspects of equity in healthcare(5). There are different ideas of which is the most important aspect, but equity in access is the term most commonly used in government documents and policies(16-18). Access is, however, a complex concept which is difficult to measure easily. Thus, use, is what is often measured in research(17).

No common agreement on how to define equity was found, however, most definitions are based on the fact that access, use or treatment should not be related to irrelevant characteristics, and that people's use of healthcare should match their need for healthcare(16). A definition used by the Organisation for Economic Co – operation and Development (OECD) is horizontal equity: that people in equal need of care are treated equally, irrespective of characteristics such as income, place of residence, race, etc.(19). In research, equity in health care is often operationalised as equity in use according to

socioeconomic defined groups and controlled for need and other variables(7). Due to transferability to other studies, and the measures available in the sixth survey of the Tromsø Study, this is also how equity is measured in this thesis.

#### **1.4.2 Use of healthcare**

According to Andersen's behavioural model of health care use, individuals seek care based on an interaction that includes their predisposition to use healthcare, the available resources and their need for care (20). People's predisposition to use healthcare can reflect their preferences for the utilisation of healthcare and their health beliefs. Enabling resources such as income, health insurance, available health personnel and facilities increase the likelihood of use occurring(20). In addition, age and gender are factors known to influence the use of healthcare(4, 21). Other factors that may influence use are marital status, education, knowledge of health care and social support(7, 22). Differences in language and cultural background can act as barriers to the utilisation of healthcare (6).

Health personnel often impact people's choice of healthcare(17). Thus, their thoughts about people's illnesses and abilities to benefit from healthcare may affect the possibility for access and use both regarding what is suggested and even more, if a referral is required(5, 17).

#### **1.4.3 Need**

According to Andersen's behavioural model, need is the most important and obvious indicator of healthcare use (20). To compare healthcare use between groups, it is a prerequisite that the need for healthcare is as close to similar in the groups being compared as possible(10).

There is no common method of defining and measuring the need for healthcare. Most often, various measures that indicate poor health and a possible need for healthcare, have been created (4). One's state of health can be measured either through one's own judgement of health and functional state(perceived need) or through a professional's judgement about health status and need for medical care(evaluated need)(20). Culyer and Wagstaff (23) have argued that health or illness is not necessarily a factor for healthcare need. Illness is an important factor for healthcare use only if obtaining healthcare could improve the individual's health. From this point of view, one's capacity to benefit from treatment is more important than one's state of health (23). In most of the literature employed in this thesis, need is measured through different measures of self-reported morbidity. This method is also how the OECD recommends measuring need (16).

From demographic studies on the use of physiotherapy and chiropractic care, we know that people seek care through chiropractic treatment mainly for musculoskeletal problems(24, 25). Problems related to the musculoskeletal system are one of the primary reasons for seeking care from a physiotherapist as well. Other common reasons for seeking care from a physiotherapist are a diagnosis related to the brain or nervous system(stroke, multiple sclerosis, etc.), heart and circulation, and lungs and breathing(chronic obstructive pulmonary disease, etc.)(26). Based on what has previously been mentioned, and the available measures in the sixth survey of the Tromsø study, need in this thesis, is measured based on a wide range of self-reported measures of health.

#### **1.4.4 Socioeconomic status (SES)**

Baker (27) has defined SES as a measure of one's combined economic and social status. This status is often measured as a combination of education, income and occupation. In general,



at least two of the three core indicators of SES (income, education and occupation) should be measured; most studies includes at least education and income (10). In this thesis, preliminary analyses were made with all three indicators. However, only education and income were included in the final analysis.

#### **1.4.5 Chiropractor**

In Norway, chiropractors are authorised healthcare personnel. They are a part of the first line of service and work as primary contacts at the same level as GPs for people with musculoskeletal problems. Chiropractors are entitled to refer people to specialist healthcare and radiological examinations and can prescribe sick leave. They are educated in the diagnostics and treatment of complaints regarding the nerves, muscles and skeleton(28). In 2018, there were 906 employed chiropractors in Norway and in 2007, there were 390 (29, 30). In 2019, Tromsø had six chiropractors in three clinics(31). From what I could find, in 2007, there were two to three chiropractors in one clinic. No information of the density of chiropractors in Tromsø compared to the rest of Norway were found.

#### **1.4.6 Physiotherapist**

In Norway physiotherapists are authorised health personnel. Every municipality is required to offer a minimum of physiotherapy care to its citizens, which is provided by employed physiotherapists and physiotherapists with an operating grant. Physiotherapists can also work in hospitals, nursing homes, rehabilitation facilities and private clinics. In 2018, there were 13,104 employed physiotherapists in Norway and in 2007, the number was 9,824 (29, 30). Employing a rough estimate from the available information, I assume there are just over 100 physiotherapists in Tromsø at the moment (32). Due to changes in the numbers of physiotherapists nationwide, the number of physiotherapists in Tromsø in 2007 were

probably somewhat lower than today. There is no information on the density of physiotherapists in Tromsø compared to the national average.

#### **1.4.7 Payment and reimbursement systems**

Chiropractors in Norway have a direct payment agreement with The Norwegian Health Economics Administration (HELFO). Chiropractors themselves determine the cost of their services, so the reimbursement from HELFO covers only a limited portion of the costs. The normal price for a first-time consultation ranges from 550 kr to 700 kr, and the reimbursement from HELFO was 139 kr as of 30 May 2019 (33). When visiting a physiotherapist in the municipality or in governmental institutions, one pays only a deductible for the services provided. Until 1 January 2018, a referral from a GP, chiropractor or manual therapist was required, in order to only pay this deductible. The price for an initial contact with a physiotherapist is 173 kr. A maximum for expenses per year was set at 2,085 kr in 2018 (2,500 kr in 2006), and anything above this amount is free (34, 35). Until 1 January 2017, several diagnoses gave the right to free physiotherapy. Now, only people under 16 years old and people with an approved occupational injury are entitled to free physiotherapy (36). When visiting a physiotherapist without operating grants in a private clinic, an individual must pay for the whole treatment, and the prices are similar to those of a chiropractor.

## 2 Material and methods

### 2.1. Material

The data for this master thesis is collected from the sixth survey of the Tromsø study (Tromsø 6), a cross-sectional, population-based survey which considered various health-issues, symptoms and chronic diseases. At present, data from Tromsø 7 is available. At the starting point of this thesis and when the analyses were performed, these data was not available.

#### 2.1.1 The Tromsø Study

The Tromsø study was initiated in 1974 and is a prospective cohort study run and owned by University of Tromsø. Since 1974, seven surveys have been carried out 6-7 years apart, referred to as Tromsø 1-7. The last one Tromsø 7 was conducted in 2015 – 2016.

The original purpose of the Tromsø study was to investigate the cause of the high mortality rate of cardiovascular diseases in Tromsø and to find ways for preventing this. Over the years, the study has been expanded to include a variety of other health issues, like diabetes, cancer, osteoporosis and musculoskeletal problems(8).

The study cohort consists of people who live in the municipality of Tromsø. When Tromsø 6 was carried out, there were 70,000 inhabitants. 60,000 people were living in a city-like town centre, while the rest were scattered throughout the whole municipality (2,558 square kilometres) (37). Tromsø is a centre of education, research, administration and fishing related industry. The population is growing and is dominated by Caucasians (mainly Norwegians), but it also includes a Sami minority. The population of Tromsø may be considered representative of a Northern European, white, urban population (37).

The study population varied in different cycles. Total birth cohorts and additional random samples of inhabitants of the municipality of Tromsø have been invited. Some of the participants have participated in several of the surveys. In total 45,473 people have participated in the surveys, and 18,510 have participated in three or more surveys (8).

### **2.1.2 Study population and sample size**

In this thesis, the subjects were participants from Tromsø 6. Tromsø 6 was conducted from October of 2007 to December of 2008. For Tromsø 6 the following were invited: residents aged 40–42 and 60–87, a 10% random sample of individuals aged 30–39 years, a 40% random sample of individuals aged 43–59, and a large subgroup from Tromsø 4 that attended a second visit for extended examinations. In total, 19,762 people were invited and 12,984 (65.7%) attended the survey. The participants were between 30 and 87 years old (37). Table 1 gives an overview of the invited and participants of Tromsø 6 by gender and age.

**Table 1:** Participation in Tromsø 6, 2007-08

Age	Men invited	Women invited	Men attended	Women attended	% men	% women
30-34	242	257	90	130	37.2	50.6
35-39	302	284	122	167	40.4	58.8
40-44	2,036	2,047	1,075	1,292	52.8	63.1
45-49	952	922	588	621	61.8	67.4
50-54	855	905	534	666	62.5	73.6
55-59	847	800	613	623	72.4	77.9
60-64	1,634	1,581	1,165	1,281	71.3	81.0
65-69	1,068	1054	830	827	77.7	78.5
70-74	691	745	516	549	74.7	73.7
75-79	506	711	325	439	64.2	61.7
80-84	372	604	162	261	43.5	43.2
85-87	120	227	34	74	28.3	32.6
<b>Total</b>	<b>9,625</b>	<b>10,137</b>	<b>6,054</b>	<b>6,930</b>	<b>62.9</b>	<b>68.4</b>

The data was collected through comprehensive questionnaires, sampling of biological specimens and clinical measurement. The first questionnaire was mailed together with an invitation to the study, and the second was delivered at participation (37). For this thesis, only questionnaire data was used.

Those who did not answer one of two main questions - Have you for the last 12 months visited a physiotherapist/chiropractor? (one question for each) were excluded from the analysis. This concerned 603 for physiotherapy and 817 for chiropractic treatment. Two of these responded *no* to visiting a physiotherapist, and 12 responded *no* to visiting a

chiropractor, but did, report number of times they had visited a physiotherapist or a chiropractor, respectively. These answers were accordingly changed to *yes* and included in the analysis. To avoid excluding more people than necessary analyses with different samples for physiotherapists and chiropractors were conducted. This resulted in a sample of 12,378 for the analysis of the utilisation of physiotherapy and 12,164 for the analysis of the utilisation of chiropractic treatment.

## **2.2 Variables**

### **2.2.1 Dependent variable**

#### ***Use of physiotherapist/chiropractor***

The main variable for this thesis is the probability (use/no use) of use of a physiotherapist and of chiropractor during the previous 12 months. It was measured in the questionnaire with the question:

***'Have you during the last 12 months visited a physiotherapist/chiropractor?'***

One question was asked regarding physiotherapy and one regarding chiropractic treatment. The options for responding were *yes* or *no*. Those responding *yes* were also asked to report the number of visits.

### **2.2.2 Independent variables**

The following independent variables were chosen on the basis of the existing literature on the subject, clinical knowledge and details made available through the questionnaire.

## **Demographic variables**

### ***Gender***

The scope of the socioeconomic differences in health and use of healthcare, and reasons for them, may also differ between men and women (6). To study differences between genders in the use of these services, and to prevent differences from confounding analysis, all analyses were stratified by sex.

### ***Age***

The main analysis was accordingly adjusted for age. Age is given as age in years per 31 December 2007. In the analysis we divided subjects into 10 – year groups, respectively 30-39, 40-49, 50-59, 60-69, 70-79 and 80-89. In the regression analysis age was coded as a dummy variable with the youngest age group (30–39) used as reference category.

### ***Marital status***

Regression analyses on marital status were performed; however, as they did not yield significant explanation of the use of physiotherapy or chiropractic treatment, they were not included in the final analyses. Marital status was measured by the question, What is your marital status? There were eight different categories for responding: single, married, widow/widower, divorced, separated, registered partnership, separated partnership and divorced partnership. For analysis we merged these into four categories single, married/registered partnership, widow/widower and divorced. In the regression analysis marital status was coded as dummy variables with single as reference category.

#### **2.2.4 Socioeconomic status**

Socioeconomic status is measured by three different variables: education level, household income and self-reported occupation status.

##### ***Education level***

Education level was measured by the following question: What is the highest level of education you have completed? There were five possible responses: Primary/secondary and modern secondary school, technical/vocational school and one to two years senior high school, high school diploma, college/university less than four years, college/ university four years or more. For the analysis, the variables were merged into three categories: low education (primary/secondary school), middle education (different forms of high school) and high education (college/university). This grouping is in accord with OECD standards for reporting education (10). In the regression analysis, education was coded as a dummy variable with low education as a reference category.

##### ***Household income***

Household income is considered a better indicator for social status, than an individual's own income (10). Household income was measured through the following question: What was the household's total taxable income last year? Include income from work, social benefits and similar. There were seven categories for answering: less than 125,000, 125–200,000, 201–300,000, 301–400,000, 401–550,000, 701–850,000, more than 850,000. For the analysis, we grouped these into four categories: low income (less than 125,000–200,000), low-middle income (201–400,000), high-middle income (401–700,000), high income (more than 700,000). In the regression analysis, household income was coded as a dummy variable with low income as a reference category.



### ***Self-reported occupation status***

In Tromsø 6, this was measured through the following question: I consider my occupation to have the following social status in the society: (if you are not currently employed, think about your latest occupation). There were five response categories: very high social status, fairly high social status, neither high nor low social status, fairly low social status and very low social status. For the analysis, we merged these into three categories low (fairly low and very low social status), middle (neither high nor low social status), high (very high and fairly high social status). In the regression analysis, self-reported occupation status was coded as a dummy variable with low as a reference category. This variable was included in the initial analysis. It did not contribute significantly to predicting the utilisation of physiotherapy or chiropractic treatment. More than 10% (approximately 1,500 responders) of the sample, were missing in this variable. To avoid losing too much power, this variable was thus removed from the final analysis.

### **2.2.5 Need**

In this thesis need is operationalized through various self – reported health measures. The variables were chosen based on what is known, both in the literature and from clinical knowledge, to affect the use of physiotherapy and chiropractic treatment. Though there may be differences in variables affecting the use of physiotherapy and chiropractic treatment, preliminary analysis using the same variables for both were made. In Table 2 an overview of the need variables including in the initial analysis.

**Table 2** Need variables included in the initial analysis.

Description	Question	Creating variables	
		Options	
<b>General health</b>	How do you in general consider your own health to be?	Very bad Bad Neither good nor bad Good Excellent	Merging bad and very bad due to low numbers.
<b>Chronic pain</b>	Do you have persistent or constantly recurring pain that has lasted for 3 months or more?	No = 0 Yes = 1	
<b>Heart attack</b> <b>Stroke/brain haemorrhage</b> <b>Asthma</b> <b>Bronchitis/emphysema/COPD</b>	Do you have or have you had a .....?	No = 0 Yes = 1	
<b>Psychological problems</b>	Have you ever had, or do you have psychological problems for which you sought help?	No = 0 Yes = 1	
<b>EQ-5D score</b>	EQ-5D is a standardized instrument for use as a measure of health outcome(38).	Each dimension has 5 levels:	
<b>Neck</b> <b>Arm</b>	Have you during the last year suffered from pain and/or	No complaint = 1	

<b>Upper back</b>	stiffness in muscles or joints	Little	
<b>Lumbar</b>	in your ..... lasting for at least	complaint =2	
<b>Hip or leg</b>	3 consecutive months?	Severe	
<b>Other</b>		complaint = 3	

All the variables were run through a logistic regression at the same time. Appendix 1 shows the validation of the need variables for the use of both physiotherapy and chiropractic treatment, stratified by gender. In the final analysis only those significant ( $p < 0.05$ ) for use of physiotherapy or chiropractic treatment were included, respectively. These variables differ between genders, but all health variables significant for one or both genders in the final analysis were included. For use of physiotherapy following variables were included: heart attack, stroke, chronic pain, eq – 5d score, neck pain, upper back pain, lumbar pain, hip and leg pain and general health. For use of chiropractic care following variables were included: neck pain, upper back pain, lumbar pain, and other pain.

### 2.3 Missing data

Not everyone answered all the questions in the questionnaire, which led to different numbers for the independent variables. This shows in some of the tables as differences in n. Those who did not respond to the main question regarding visiting a physiotherapist or chiropractor were excluded from the analysis. A separate exclusion for physiotherapy and chiropractic treatment were made, in order to avoid losing too many in the analysis. Thus, the numbers on the total population in the analysis regarding use of physiotherapy and chiropractic treatment are different.

There were no missing responders for the variables sex, age and marital status. For the other variables, there was a large variation in the amount missing for each variable, from 0.2% up to 28%. When running the need variables in a logistic regression analysis with listwise exclusion, the amount of missing was 36.1% for use of physiotherapy (40.4% women, 31.3% men) and 35.6% for use of chiropractor treatment (39.8% women, 31.0% men). Due to the number and nature of those missing, in variables with more than 10% missing the missing data were replaced to avoid losing power. Different forms of multiple imputation are among the recommended ways of replacing missing values (39). This is not a part of the curriculum in this master program and is therefore not an option for this thesis. Thus, for all variables with more than 10% missing, the “replace by series mean” command in Statistical package for the Social Sciences (SPSS) was used. This applied to the need-variables: neck pain, arm pain, upper back pain, lumbar pain, hip or leg pain and other pain. For variables with less than 10% missing, a listwise deletion was made in the regression analysis. A listwise deletion was made for the main variables education and income and for the need variables; heart attack, stroke, bronchitis, asthma, psychological problems and chronic pain. The variable EQ-5D was just above in use of physiotherapy (10.1%) and slightly below in use of chiropractor (9.9%). To get the sample size most similar, I replaced the missing in the EQ-5D variable for both use of physiotherapist and chiropractor.

## **2.4 Statistical analysis**

All analyses were performed using IBM SPSS (Statistical package for the Social Sciences) version 25.0 for Windows. The tables were produced in Microsoft Word. The statistical tests were all two-sided and the significance level was set to 0.05. We used a 95% confidence interval in the logistic regression. All analyses were made separately for sex. As mentioned above, for variables with more than 10% missing, mean imputation in SPSS were used.

To present the characteristics of the sample, descriptive statistics were used, and the results are given in percent (tables 3 and 4). To explore the difference between age groups and gender in the utilisation of physiotherapy and chiropractic treatment, cross tables and chi-square tests were used (Table 5). When conducting chi-square tests by using cross tables, there were no cells with expected counts lower than five. Hierarchical logistic regression was run to determine how the demographic and socio-economic variables were associated with use of physiotherapy and chiropractic, adjusted for need variables (tables 6-9). The regression analysis was performed with two models to obtain a better idea regarding how the different variables affect the use of physiotherapy and chiropractic treatment. In each of the models, all the independent variables were included in one block and analysed at the same time. Model 1 includes variables for socioeconomic status and is adjusted for age. In addition to the variables included in Model 1, Model 2 also included need variables that were significant in one of the genders in the initial analysis on utilisation of chiropractic treatment and physiotherapy. The final model is the one most relevant according to the aim of this thesis.

For all included variables we obtained odds ratios (ORs) for trend. To identify any lack of linearity in the trend analysis, we also performed a dummy analysis to obtain ORs for each category. To determine whether the independent variables included in the model contribute significantly, we used the deviance statistic, often referred to as -2LL because of the way it is calculated:  $\text{Deviance} = -2 \times \log - \text{likelihood}$ . Since the deviance has a chi-square distribution it is easy to calculate the significance of the value, thus it is convenient to use this rather than the log-likelihood. As for other model tests, this test assesses the “goodness of fit” of the two competing statistical models. If it decreases when more variables are included in the model, this means that it is better fitted with the data. If the change in the -2LL value is

significant, we can assume that at least one of the included variables partly explains the variance of the dependent variable (40). In addition to the -2LL, we report the Nagelkerke  $R^2$ . Though it is often compared to the  $R^2$  in linear regression, one should be careful to interpret it as percent explained. It can however, say something about the improvement of the model when more independent variables are included(40).

The independent variables were tested for correlation. No correlation larger than 0.7 was found. Also tests for multicollinearity were made, but no values indicated that multicollinearity was a problem.

## **2.5 Ethics**

The Tromsø Study was approved by the Norwegian Data Inspectorate and recommended by the Regional Committee of Research Ethics (REK). In Tromsø 6 each participant signed a written informed consent. For this thesis no further approval was needed.

### 3 Results

#### 3.1 Characteristics of the study sample

Table 3 provides an overview of the distribution of the participants included in the final sample stratified by background characteristics and utilisation of a physiotherapist.

**Table 3:** Characteristics of the participants (%) stratified by gender and utilisation of a physiotherapist.

	Women		Men	
	Total sample n = 6,555	Physiotherapist n = 1,721	Total sample n = 5,823	Physiotherapist n = 1,057
<b>Age</b>				
30-39	4.4	3.5	3.6	2.0
40-49	28.4	24.1	28.1	25.7
50-59	19.0	20.4	19.0	20.1
60-69	30.2	30.6	32.9	34.3
70-79	13.7	16.1	13.5	14.2
80-89	4.3	5.3	2.9	3.7
<b>Marital status</b>	<b>n = 6,555</b>	<b>n = 1,721</b>	<b>n = 5,823</b>	<b>n = 1,057</b>
Single	16.9	14.8	19.3	17.2
Married	54.4	53.6	64.9	67.9
Widow	12.7	14.9	3.1	2.9
Divorced	16.1	16.7	12.6	11.9
<b>Household income</b>	<b>n = 5,922</b>	<b>n = 1,536</b>	<b>n = 5,591</b>	<b>n = 1,011</b>
Low	15.3	17.1	7.7	6.2
Low middle	28.8	30.4	24.0	27.0
High middle	32.3	33.1	39.0	39.5
High	23.5	19.5	29.2	27.3
<b>Education</b>	<b>n = 6,472</b>	<b>n = 1,700</b>	<b>n = 5,757</b>	<b>n = 1,047</b>
Low	30.8	32.0	24.4	27.6
Middle	32.0	34.8	35.4	35.7
High	37.2	33.2	40.1	36.7
<b>Self – rated occupation status</b>	<b>n = 5,688</b>	<b>n = 1,447</b>	<b>n = 5,304</b>	<b>n = 953</b>
Low	9.7	9.1	5.6	6.5
Middle	59.1	62.4	52.0	52.8
High	31.1	28.5	42.4	40.7

The age group which most often uses physiotherapy is 60–69 years for both men and women. The mean age for women and men using physiotherapy is 58.6(SD 12.7) and 58.5(SD 12.0) respectively (not displayed in the tables). Though there are some differences, the total study group is similar to the group using physiotherapy, for both men and women.



Table 4 presents an overview of the distribution of the participants included in the final sample stratified by background characteristics and utilisation of chiropractic treatment.

**Table 4:** Characteristics of the participants (%) stratified by gender and utilisation of chiropractor.

	Women		Men	
	Total sample	Chiropractor	Total sample	Chiropractor
<b>Age</b>	<b>n = 6,395</b>	<b>n = 447</b>	<b>n = 5,769</b>	<b>n = 451</b>
30-39	4.5	5.6	3.6	4.0
40-49	28.7	35.6	28.3	32.4
50-59	18.9	23.7	19	19.1
60-69	30.3	23.7	32.7	34.1
70-79	13.5	9.6	13.5	8.4
80-89	4.2	1.8	2.9	2.0
<b>Marital status</b>	<b>n = 6,395</b>	<b>n = 447</b>	<b>n = 5,769</b>	<b>N = 451</b>
Single	17.1	18.6	19.5	19.1
Married	54.5	55.7	64.7	67.2
Widow	12.4	8.5	3.1	2.9
Divorced	16.0	17.2	12.6	10.9
<b>Household income</b>	<b>n = 5,787</b>	<b>n = 408</b>	<b>n = 5,544</b>	<b>N = 430</b>
Low	15.2	12.0	7.7	4.2
Low middle	28.8	24.3	23.8	21.9
High middle	32.4	37.0	39.1	40.5
High	23.6	26.7	29.5	33.5
<b>Education</b>	<b>n = 6,315</b>	<b>n = 443</b>	<b>n = 5,707</b>	<b>N = 448</b>
Low	30.6	24.4	24.4	23.4
Middle	32.0	36.6	35.4	38.4
High	37.4	39.1	40.2	38.2
<b>Self – rated occupation status</b>	<b>n = 5,558</b>	<b>n = 400</b>	<b>n = 263</b>	<b>N = 417</b>
Low	9.9	8.0	5.5	6.0
Middle	59.0	61.3	52.0	53.7
High	31.1	30.8	42.4	40.3

As for use of physiotherapy, the total study group seems similar to the group using chiropractic treatment for both men and women. Chiropractors are used the most by the age group 40–49 for women and by the age group 60–69 for men. The average age for men and women who visit a chiropractor is 55.7(SD 11.8) and 53.7(SD 12.0), respectively (not displayed in the tables).

### 3.2 Distribution of visits to physiotherapists and chiropractors in the study sample

In total, 2,778 people (22.4%) visited a physiotherapist, and 898 people (7.4%) visited a chiropractor the previous year (not displayed in the tables).

Table 5 demonstrates the distribution of the participants who visited physiotherapist and chiropractor at least once during the last 12 months by age, stratified by gender. The table also presents the proportion of participants who visited a physiotherapist or chiropractor at least once during the last 12 months by gender.

**Table 5:** Proportion of participants visiting physiotherapy or chiropractor at least once during the last 12 months by age and gender.

	Physiotherapy				Chiropractor			
	Male n = 5,823 n (%)	Female n = 6,555 n (%)	p-value <sup>a</sup>		Male n = 5,769 n (%)	Female n = 6,395 n (%)	p-value <sup>a</sup>	
<b>Total</b>	<b>1,057 (18.2)</b>	<b>1,721(26.3)</b>	< 0.001		<b>451 (7.8)</b>	<b>447 (7.0)</b>	0.081	
<b>Age</b>	<b>p-value<sup>a</sup></b>		<b>p-value<sup>a</sup></b>		<b>p-value<sup>a</sup></b>		<b>p-value<sup>a</sup></b>	
30-39	21 (10.1)	60 (20.9)	=0.007	< 0.001	18 (8.7)	25 (8.7)	= 0.014	< 0.001
40-49	272 (16.6)	415 (22.3)			146 (9.0)	159 (8.7)		
50-59	212 (19.1)	351 (28.2)			86 (7.8)	106 (8.8)		
60-69	363 (19.0)	527 (26.6)			154 (8.2)	106 (5.5)		
70-79	150 (19.1)	277 (30.8)			38 (4.9)	43 (5.0)		
80-89	39 (22.9)	91 (32.2)			9 (2.0)	8(1.8)		

<sup>a</sup> Tested by Chi – square

More women than men visited a physiotherapist, and the difference is significant. There were no significant differences in visiting rates for chiropractors between genders. The likelihood of visiting a physiotherapist increased with age. For chiropractors, the likelihood of visiting decrease with age. The differences are significant and are present in both men and women.

### **3.3 Utilisation of physiotherapy**

Tables 6 and 7 illustrate how the probability of utilizing physiotherapy at least once during the previous 12 months, for both women and men, is influenced by demographic, socioeconomic and need variables. In the hierarchical regression, SES (household income and education) and age were introduced in Model 1 and need variables were introduced in Model 2.

**Table 6: Women's probability of physiotherapy utilisation at least once during the previous 12 months. The effect of education and income on the utilisation of physiotherapy before (Model 1) and after adjusting for need variables (Model 2).**

	Model 1 <sup>a</sup>		Model 2 <sup>b</sup>	
	OR (95 % CI)	OR for trend (95% CI)	OR (95 % CI)	OR for trend (95 % CI)
	n = 5,702	n = 5,702	n = 5,702	n = 5,702
<b>Household income</b>				
Low (ref)	1	0.958(0.890-1.032)	1	1.075(0.991-1.165)
Low middle	1.003 (0.822-1.224)		1.194 (0.964-1.479)	
High middle	1.035 (0.837-1.279)		1.230 (0.978-1.546)	
High	0.845 (0.661-1.080)		1.296 (0.993-1.690)	
<b>Education</b>				
Low (ref)	1	0.971(0.890-1.058)	1	<b>1.118(1.018-1.228)</b>
Middle	1.136(0.966-1.335)		1.183 (0.994-1.407)	
High	0.964 (0.809-1.149)		<b>1.249(1.034-1.509)</b>	
<b>Age</b>				
30-39 (ref)	1	<b>1.097(1.037-1.161)</b>	1	<b>1.121(1.053-1.193)</b>
40-49	1.157(0.839-1.596)		1.005(0.713-1.417)	
50-59	<b>1.531(1.102-2.128)</b>		1.275(0.897-1.812)	
60-69	<b>1.411(1.020-1.953)</b>		1.267(0.895-1.794)	
70-79	<b>1.632(1.140-2.336)</b>		<b>1.540(1.047-2.265)</b>	
80-89	<b>1.642(1.040-2.592)</b>		<b>1.642(1.004-2.684)</b>	
<b>Improvement</b>				
Nagelkerke $R^2$	0.011		0.182	
-2LL	6465.643		5756.101	
Change -2LL (p-value)	43.164 (< 0.001)		709.541 (< 0.001)	

<sup>a</sup>Model 1: Utilisation of physiotherapy according to education, income and age, unadjusted for need variables.

<sup>b</sup>Model 2: Utilisation of physiotherapy according to education, income and age, adjusted for need variables.

**Table 7: Men’s probability of physiotherapy utilisation at least once during the previous 12 months. The effect of education and income on the utilisation of physiotherapy before(Model 1) and after adjusting for need variables (Model 2).**

	Model 1 <sup>a</sup>		Model 2 <sup>b</sup>	
	OR (95 % CI) n = 5,407	OR for trend (95% CI) n = 5,407	OR (95 % CI) n = 5,407	OR for trend (95 % CI) n = 5,407
<b>Household income</b>				
Low (ref)	1	1.075(0.980-1.178)	1	<b>1.258(1.138-1.391)</b>
Low middle	<b>1.542(1.123-2.117)</b>		<b>1.669(1.190-2.342)</b>	
High middle	<b>1.513(1.09-2.089)</b>		<b>1.940(1.374-2.741)</b>	
High	<b>1.494(1.054-2.118)</b>		<b>2.317(1.629-3.451)</b>	
<b>Education</b>				
Low (ref)	1	<b>0.882(0.800-0.972)</b>	1	1.023(0.921-1.136)
Middle	0.866(0.720-1.042)		0.962 (0.789-1.173)	
High	<b>0.784(0.645-0.953)</b>		1.039 (0.842-1.282)	
<b>Age</b>				
30-39	1	<b>1.103(1.034-1.176)</b>	1	<b>1.117(1.039 -1.200)</b>
40-49	<b>1.682(1.050-2.696)</b>		1.507(0.918-2.474)	
50-59	<b>1.973(1.223-3.183)</b>		1.594(0.962-2.638)	
60-69	<b>1.949(1.219-3.117)</b>		<b>1.720(1.048-2.823)</b>	
70-79	<b>2.100(1.275-3.460)</b>		<b>2.010(1.183-3.414)</b>	
80-89	<b>2.398(1.278-4.496)</b>		<b>2.443(1.252-4.768)</b>	
<b>Improvement</b>				
Nagelkerke $R^2$	0.008		0.171	
-2LL	5075.558		4506.194	
Change in -2LL (p-value)	27.364 (= 0.002)		569.364 (< 0.001)	

<sup>a</sup>Model 1: Utilisation of physiotherapy according to education, income and age, unadjusted for need variables.

<sup>b</sup>Model 2: Utilisation of physiotherapy according to education, income and age, adjusted for need variables.

### **3.3.1 Model 1: Unadjusted for need variables**

A trend towards an increased use of physiotherapy with increasing age was observed in women and men (OR for trend 1.097, CI 1.037–1.161 and 1.103, CI 1.034–1.176, respectively). The probability of visiting a physiotherapist did not vary according to education or household income for women (Table 6, Model 1). A trend towards a decreased use of physiotherapy with higher education was observed for men (OR for trend 0.882, CI 0.800–0.972). The probability of visiting a physiotherapist increased with increasing income for men (Table 7, Model 1).

### **3.3.2 Model 2: Adjusted for need variables.**

When need variables are included in the regression, the Nagelkerke  $R^2$  almost doubles in size for both genders (Tables 6 and 7, Model 2). This result indicates that the need variables, as expected, are the strongest predictors of the use of physiotherapy. Between Model 1 and Model 2 the change in  $-2LL$  was significant ( $p < 0.001$ ) for both women and men.

A trend towards an increased use of physiotherapy with increasing education is observed for women (OR for trend 1.118, CI 1.018–1.228). Those with a high level of education are almost 1.3 times more likely to visit a physiotherapist than those with a low level. Age remain a significant predictor for utilisation of physiotherapy for women in Model 2 (OR for trend 1.121, CI 1.053–1.193), but only the two eldest age groups exhibit a significantly higher probability for use than the reference group. Household income is not significant for predicting visits to a physiotherapist by women (Table 6, Model 2).

A trend towards an increased use of physiotherapy with increased income is observed for men (OR for trend 1.258, CI 1.138–1.391). Men belonging to a high-income household are 2.3 times more likely to visit a physiotherapist than men in a low-income

household. Education is not a significant predictor for the utilisation of physiotherapy by men. The trend for age also remains significant in Model 2 (OR for trend 1.117, CI 1.039–1.200). The two lowest age groups deviate from the trend of not being significantly different from the reference group (Table 7, Model 2).

### **3.4 Utilisation of chiropractic treatment**

Tables 8 and 9 demonstrate how the probability of using a chiropractor at least once during the previous 12 months, for both women and men, is influenced by demographic, socioeconomic and need variables. The hierarchical regression analysis was performed in the same way as it was for the utilisation of physiotherapy.

**Table 8: Women’s probability of chiropractor utilisation at least once during the previous 12 months. The effect of education and income on the utilisation of a chiropractor before (Model 1) and after adjusting for need variables(Model 2).**

	Model 1 <sup>a</sup>		Model 2 <sup>b</sup>	
	OR (95 % CI) n = 5,739	OR for trend (95% CI) n = 5,739	OR (95 % CI) n = 5,739	OR for trend (95 % CI) n = 5,739
<b>Household income</b>				
Low (ref)	1	1.082(0.954-1.227)	1	<b>1.159(1.018-1.318)</b>
Low middle	0.922(0.630-1.350)		1.006 (0.684-1.479)	
High middle	1.139(0.773-1.678)		1.232 (0.831-1.824)	
High	1.100(0.716-1.690)		1.408(0.909-2.180)	
<b>Education</b>				
Low (ref)	1	0.963(0.830-1.118)	1	1.076(0.925-1.253)
Middle	1.147(0.858-1.533)		1.173 (0.875-1.573)	
High	0.975(0.716-1.328)		1.187 (0.869-1.622)	
<b>Age</b>				
30-39	1	<b>0.850(0.771-0.938)</b>	1	<b>0.860(0.778-0.951)</b>
40-49	1.014(0.635-1.620)		0.909(0.564-1.465)	
50-59	1.102(0.679-1.778)		0.960(0.586-1.572)	
60-69	0.678(0.414-1.110)		0.624(0.378-1.031)	
70-79	0.676(0.378-1.209)		0.646(0.357-1.167)	
80-89	0.405(0.156-1.047)		0.415(0.159-1.085)	
<b>Improvement</b>				
Nagelkerke $R^2$	0.013		0.074	
-2LL	2898.226		2756.574	
Change -2LL (p-value)	29.930 (= 0.001)		141.652 (< 0.001)	

<sup>a</sup>Model 1: Utilisation of a chiropractor according to education, income and age, unadjusted for need variables.

<sup>b</sup>Model 2: Utilisation of a chiropractor according to education, income, age and adjusted for need variables.



**Table 9: Men’s probability of chiropractor utilisation at least once during the previous 12 months. The effect of education and income on utilisation of a chiropractor before(Model 1) and after adjusting for need variables(Model 2).**

	<b>Model 1<sup>a</sup></b>		<b>Model 2<sup>b</sup></b>	
	<i>OR (95 % CI)</i> n = 5,499	<i>OR for trend (95% CI)</i> n = 5,499	<i>OR (95 % CI)</i> n = 5,499	<i>OR for trend (95 % CI)</i> n = 5,499
<b>Household income</b>				
Low (ref)	1	<b>1.179(1.032-1.346)</b>	1	<b>1.264(1.103-1.448)</b>
Low middle	1.610(0.950-2.729)		1.607 (0.943-2.739)	
High middle	<b>1.751(1.034-2.966)</b>		<b>1.877(1.102-3.199)</b>	
High	<b>1.987(1.143-3.456)</b>		<b>2.395(1.368-4.193)</b>	
<b>Education</b>				
Low (ref)	1	0.888(0.773-1.020)	1	0.967(0.840-1.114)
Middle	1.004(0.768-1.314)		1.054 (0.803-1.384)	
High	0.807(0.607-1.073)		0.943 (0.706-1.259)	
<b>Age</b>				
30-39	1	<b>0.912(0.832-0.999)</b>	1	<b>0.898(0.817-0.987)</b>
40-49	0.990(0.592-1.657)		0.937(0.555-1.585)	
50-59	0.860(0.504-1.468)		0.725(0.402-1.253)	
60-69	0.894(0.533-1.500)		0.806(0.475-1.366)	
70-79	0.608(0.331-1.117)		0.558(0.301-1.034)	
80-89	0.745(0.308-1.804)		0.734(0.299-1.803)	
<b>Improvement</b>				
Nagelkerke $R^2$	0.009		0.065	
-2LL	2990.857		2860.321	
Change -2LL (p-value)	21.410 (= 0.014)		130.536 (< 0.001)	

<sup>a</sup>Model 1: Utilisation of a chiropractor according to education, income and age, unadjusted for need variables.

<sup>b</sup>Model 2: Utilisation of a chiropractor according to education, income and age, adjusted for need variables.

### 3.4.1 Model 1: Unadjusted for need variables.

In women and men, there is a trend towards a decreased use of chiropractic treatment with increasing age (OR for trend 0.850, CI 0.771–0.938 and 1.179, CI 1.032–1.346, respectively).

Education and household income are not significant predictors of the utilisation of chiropractic treatment by women (Table 8, Model 1). A trend towards increased use of a chiropractor treatment with increased household income in men is observed (OR 1.179, CI

1.032–1.346). Education is not a significant predictor of the utilisation of chiropractic treatment in men (Table 9, Model 1).

### **3.4.2 Model 2: Adjusted for need variables**

When need variables are included in the regression, the Nagelkerke  $R^2$  increases more than sixfold for both genders. This increase indicates that the need variables are also the strongest predictor of chiropractic treatment. Between Model 1 and Model 2, the changes in  $-2LL$  were significant ( $p < 0.001$ ) for both women and men.

The trend according to age remains constant for both woman and men (OR for trend 0.860, CI 0.788 – 0.951 and OR for trend 0.898, CI 0.817 – 0.987). A trend towards an increased use of chiropractic treatment with increased household income is observed for both women and men (OR for trend 1.159, CI 1.018 – 1.318 and OR for trend 1.264, CI 1.103 – 1.448) (Tables 8 and 9, Model 2). Men with the highest income are almost 2.4 times more likely than the reference group to visit a chiropractor (Table 9, Model 2).

## 4 Discussion

### 4.1 Summary of findings

This thesis reveals that there are socioeconomic differences in the utilisation of physiotherapy and chiropractic treatment by people with the same needs. These differences are seen in both women and men. The probability of using physiotherapy increases with higher education for women and with increasing household income for men. The probability of using a chiropractor increases with increasing household income, for both men and women. The ORs for trend are small for both women and men. However, for men in a high-income household, the odds of visiting a chiropractor or a physiotherapist are more than double those of men in a low-income household. This difference is considerable. Need characteristics explain most of the variation in the utilisation of both chiropractic treatment and physiotherapy.

No significant difference between genders is observed in those visiting chiropractors, but 8% more women than men visited a physiotherapist, but no significant difference between genders can be seen in those visiting chiropractors. As expected, the utilisation of physiotherapy increases with increasing age. The age relation is the opposite for visiting chiropractors. Fewer of the need variables tested are significant for users of chiropractors than for users of physiotherapy, suggesting that a narrower patient group visits chiropractor than physiotherapist.

### 4.2 Socioeconomic differences in the utilisation of physiotherapy

This thesis demonstrates a trend towards an increased use of physiotherapy with increasing household income in men. The OR for trend (OR=1.25) is similar to what was reported by a Canadian study (OR=1.32) which considered the use of physiotherapy by back pain patients.

In this study, the researchers did not stratify for gender. (12). A report from Statistics Norway in 2016 (4) also indicated that the use of physiotherapy increases with household income for both men and women. The difference within the groups studied varies by 3–12 percentage points. In this report, the largest socioeconomic differences are found among the oldest and in those with poor health. This result has been confirmed by others(10). In this thesis, no analysis on whether the social gradient varies in age groups and in people with different health status were made. Due to the differences in how studies control for need and in study populations, the results are difficult to compare.

The most obvious explanation for the fact that income is a predictor of use is that people with a lower income cannot afford physiotherapy (12). Norway offers a reimbursement system for physiotherapy, to ensure that the service is affordable to most people (4). However, those with the lowest income (and poorest health) reports more unmet needs for health care than any other groups(4). Even with a reimbursement such as Norway's, costs may act as a barrier to contacting healthcare services, especially for those with the poorest health. In addition, this group is often in need of several forms of healthcare, and even if some of their costs are reimbursed, the total of their healthcare expenses may be too high (41). Even if people can afford physiotherapy, the ability to pay is relative, and people with a lower income must use a larger portion of their income for treatment than those who enjoy a higher income. When deciding whether to seek care, the cost for each person can modify his or hers perception of the need to seek care (7, 42). It is likely that the greater the proportion of their income people spend on treatment, the more important their thoughts about the benefits of the treatment will be. Furthermore people's ability to take time from work or home to seek care may differ systematically and most likely have the greatest effects on those in low-income household (7, 15). Additionally, the waiting

lists in public physiotherapy are often long. People who can afford the care, can choose to visit a private physiotherapist and thus avoid the waiting lists. The wait could possibly contribute to the differences in use that are evident according to income.

In women, we found a small increase in the use of physiotherapy with increasing education. Those with a high level of education had a 25% higher chance of using physiotherapy than those with the lowest level of education. This result is similar to what was reported in an Irish study which found that people with middle and high levels of education have a 30% higher chance of using physiotherapy than those with a low level of education (11). That study did not stratify by gender. The studies in Norway, which are most comparable to this thesis, are surveys of living conditions from Statistics Norway. A report from 2009 has indicated differences in the use of physiotherapy according to education in women for all the defined need groups(10). The differences varied from 10 to 66 percentage points between those with the highest and lowest levels of education. The highest difference was found in the oldest women with poor health. This report has also indicated differences according to education in men but to a lesser extent than for women. Similar to the result in this thesis, this result may suggest that education is a more important predictor for use of physiotherapy for women than for men, a finding also stated in a Statistics Norway report from 2017 (4). Studies from Canada and the UK on the use of physiotherapy for people with back pain, reported an increased probability of use of 50% and 10% in those with a higher level of education, respectively. They did not stratify their analyses by gender. Neither of these studies measured need in the same way as in this thesis, and the study population differed, which makes these studies difficult to compare.

Education may affect the use of health services in several ways. People with different education levels may view the benefits of health services differently (17, 23). In addition, knowledge of health and health problems and how to deal with these may affect people's choices of healthcare, and may vary systematically between different population groups and according to education (5, 17). My results may be a consequence of the fact that women with a higher level of education find physiotherapy more useful than those with a lower level of education or that they have more knowledge of which symptoms and health problems may benefit from physiotherapy.

Until 1 January 2018, patients needed a physiotherapy referral if they were to obtain reimbursement for their costs, and GPs most commonly provided this referral. Thus, the initial contact with the GP is relevant to understanding the pattern of use. Vikum et al. (43) have suggested that since GP visits are not affected to the extent of the inequities seen, some of the differences actually arises from inequities in meeting the GP. Though referral to physiotherapy is highly related to need, other factors, including the level of education, can affect whether people obtain a referral or not (14, 15, 44). One reason suggested for the differences in referral rates, is that higher-educated groups present their health problems in a way that more often matches professional conception and may lead to easier referrals(5, 45). Higher-educated people often spend more time with the doctor, which may also influence the odds of receiving a referral or not(17). No information was present in the dataset on whether people visited a physiotherapist after a referral or not. Thus, how this affected the result in this thesis is unknown. No other studies researching this were found.

The descriptive analysis demonstrates that more women than men visited a physiotherapist, and that the utilisation of physiotherapy increases with increasing age. These results are consistent with several other studies (4, 10, 15). One reason for greater use

by women and older people, may be that these groups report poorer health than men and younger people (15, 21). Gender differences caused by reproductive complaints, which were not controlled for, may also contribute to these differences (46). Men and women view health and the use of healthcare differently (15). If women regard physiotherapy to be more useful than men, this could explain the observed differences. Another possible explanation is that women are referred to special-care services and physiotherapy more often than men (14, 21).

In this thesis need is the most important factor for predicting use of physiotherapy. This finding is supported by others, regarding both physiotherapy and the use of other healthcare services (4, 10, 44, 47).

#### **4.3 Socioeconomic differences in the utilisation of chiropractic treatment**

The regression analysis reveals that the odds of visiting a chiropractor increases with increasing household income for both men and women (OR for trend = 1.264 and 1.159, respectively). The only Norwegian study comparable to mine is a report from Statistics Norway, which indicates an increased use of chiropractic treatment by those with a higher level of education and household income(10). The differences according to household income are mainly found in those over 67 years old with a difference of seven percentage points between those with a low and high-middle income. This tendency is evident in younger people as well. These findings contradicted one U.S. study on older chiropractor users, which reported no differences in use according to socioeconomic factors (13). A Canadian study considering back pain also reports differences in the use of chiropractic treatment according to income and education. Those with the highest income were nearly 1.5 times more likely to visit a chiropractor than those with the lowest income, for both men

and women(12). In this thesis, the odds of visiting a chiropractor were nearly 2.4 times higher for men belonging to the highest household income group compared to those in the lowest household income group. None of the studies measured need the same way as in this thesis and the study population differed. Furthermore, chiropractic care is organised differently in different countries, which may be a reason for the divergent results and the difficulty in comparing the studies.

In Norway, the reimbursement for chiropractor services is low. For other services with little or no reimbursement of costs, such as dental care, income is a more important predictor than for services with little or no self-payment (4). Thus, people not being able to afford chiropractic treatment is an even clearer explanation here, than for the use of physiotherapy. My results do not support this assumption, as income did not seem to be a more important predictor in the use of chiropractic care than physiotherapy. A study which considered visiting a chiropractor compared to visiting a physiotherapist and MD did not find any differences according to income, thus supporting the finding in this thesis(15). The size of the social gradient has been reported by some as more present among those who are older and in poorer health(4, 10). In this thesis, no analysis comparing those visiting a chiropractor and physiotherapist were made, but from the descriptive analysis, it seems that users of chiropractic care are younger and have fewer comorbidities than users of physiotherapy. This may explain the lack of differences, but also makes our results difficult to compare. In addition, people with a higher SES are more likely to select complimentary treatment, so the same people who visit physiotherapists might also visit chiropractors, which may influence the difference between users of chiropractor care and physiotherapy.(12).



In men, the trend was not linear; only the two highest-income groups differed from the reference group. This result may suggest that there is a threshold for household income at which people conclude that they can afford chiropractic treatment, which has been observed in studies of the use of physiotherapy (4).

As for the utilisation of other health services, the use of chiropractic treatment is closely related to the health beliefs of patients and the values and attitudes they hold about health and the use of health services (5, 24, 42). Two studies of patient attitudes indicated that people with higher incomes, who are insured and in better health prefer chiropractic treatment over other healthcare treatments(48, 49). For many of the conditions for which people seek care from physiotherapists or chiropractors, there is a lack of evidence regarding which treatment is more beneficial. Thus, the patient's preferences and judgements of the healthcare practices are of even greater importance (50). If the variations in the use of chiropractic care (and physiotherapy) found in this thesis are primarily a result of the patient's preferences for care, this is not necessarily a threat to the goal of equity as long as these preferences are not related to systematic differences in what people can afford, knowledge of treatment options or referrals(5, 17). Whitehead and Dahlgren(6) argue that even systematic differences in health beliefs are probably promoted by structural differences and are thereby unwarranted. In this thesis health beliefs and patient preferences were not measured, as none of those measured in Tromsø 6 was considered relevant for the aim of this thesis.

No gender differences in the use of chiropractic treatment were identified in this thesis. In contrast to what is discovered in this thesis regarding physiotherapy use, the visit rates for chiropractors decrease with increasing age. A Canadian study has reported similar

findings(51). Other studies, both Norwegian and from other countries, have reported divergent results (21, 25, 49, 52). Differences in the populations studied and the organisation of care may explain the divergent results.

As for use of physiotherapy, need is the most important factor predicting the use of chiropractic treatment. Fewer of the need variables tested were significant for visiting chiropractor, which suggests that a narrower (and maybe healthier) patient group visits chiropractors than physiotherapists. As mentioned, women and older people often report poorer health than men and younger(15, 21). The findings in this thesis that there are no differences in gender and fewer old people visiting chiropractors may also suggest that there are differences in the health of patient groups visiting chiropractors compared to physiotherapists.

#### **4.4 Comments on findings**

Though this thesis indicates that there are differences in the use of physiotherapy and chiropractic treatment according to socioeconomic factors for people with similar needs, there is little knowledge on the health effects of the observed differences and whether there is too little use by those not using, or too much use in those using. Finding the right level of use is not straightforward. The national average could be a goal for equal services, but it might not always reflect the optimal level. In addition, current knowledge regarding the optimal level of treatment (the effects of too much or too little treatment) must be considered (50). Limited evidence of the best treatment for many of the conditions treated by physiotherapists and chiropractors complicates the process of finding the ideal level of use(14). Over the last decade, there has been increasing focus on how more treatment, or treatment at all, is not always better(53). From a perspective of health-policy, deciding on

the optimal level of treatment is important, as overtreatment leads to unnecessary health costs and may have an adverse effect on people's health in the same way as too little treatment(14). For the future it would be important to determine the appropriate use of services, what differences are acceptable and what the effect of the differences cause.

Over the last 2 years, structural changes have been made to the physiotherapy service, regarding both referrals and reimbursements. As far as I have found, no evaluation of these changes has been made, though such changes are bound to affect use. International studies have concluded that the demand for services is affected by the levels of deductibles, and that these deductibles affect those in lower social level the most(7). There is a lack of knowledge on the user fees affect use of healthcare in Norway. In the 'National Strategy to Reduce Social Inequalities in Health' from 2007, an assessment of the self-payment scheme was requested, but this has still not been completed(7). It has been emphasised that follow-ups on the distributional effects should be central when such changes are carried out(54). Without following up on how these changes affect use, there is a risk increasing of the use of undocumented services or decreasing the use of what actually has a documented effect on people's health. Additionally, there is a risk for increasing the socioeconomic differences in the use of health care.

## **4.5 Methodological considerations**

### **4.5.1 Strengths**

The strengths of this thesis are the large sample size and the wide range of need variables available, which allowed me to study both physiotherapy and chiropractic care users and gender separately. The large sample size also reduced the influence of random errors. The

wide range of need variables made it possible to validate them against each other and may to some extent have compensated for recall bias and underreporting.

The study population was validated. The education level among those who attended is somewhat higher than the general Norwegian and Tromsø populations. In addition, the external validity is considered to be sufficient, and the study population is valid for an urban, white population (37). In addition, because the study is limited to one municipality, geographical confounders are unimportant.

#### **4.5.2 Limitations**

There are several limitations of this study. The limitation with the greatest possibility to threaten the findings is the large amount of missing data and how this was handled. To avoid losing complete sets and power, I chose to replace missing values with the series mean for those need variables missing with more than 10%. There were more missing data for women, those with a low level of education, younger individuals (under 50) and those in poorer health. This findings suggests that the data is not missing completely at random (MCAR). They are more likely missing at random (MAR), meaning that the reason for a value being absent can be related to some of the observed data, but not the missing value itself(55). With the missing values not being MCAR, especially in the presence of a great inequality in the number of missing values for the different variables, the mean substitution may lead to an inconsistent bias and thereby affect the internal validity(39). Due to the scope of the curriculum, the alternative to mean imputation was complete case analysis. I performed both complete case analysis and analysis with mean imputation. In the complete case analysis, income became a significant predictor for both men and women with respect to their utilisation of physiotherapy. For use of chiropractic treatment, no predictors besides

need became significant. The trend was, however, the same, so it is likely to assume that these differences were related to reduced power. With a large group of non-responders and missing data that are not MCAR and since it is of interest to make inferences about the entire study population rather than about the portion of the study population that provides answers to all the relevant variables in the analysis, a complete case analysis is not recommended (39). Replacing missing values with the series mean results in no new information; it only increases the sample size and leads to an underestimation of the errors (56). Even if mean imputation is not an optimal way to handle this, it was preferred to maintain the power of the study than do nothing.

Another limitation is that this thesis is based on data that are more than 10 years old. There have been changes in how services are organised and in people's patterns of use, so these findings may not be transferable to current use and may thus affect the external validity of the results.

In this thesis it is assumed that the need measured from the questionnaire is what caused the use of physiotherapy and chiropractic care. It is known that use of healthcare may alter the way people view their own health, and treatment may also influence people's health directly(5). Due to the cross-sectional design, these variables were measured at the same time and it is uncertain whether the assumptions of that the need measured is what caused use of health care, hold true. It is possible that the need measured is a result of the health care used and not vice versa.

Use of health care patterns are complex and influenced by several factors (44). There were no information available of the capacity of the physiotherapy and chiropractic care in Tromsø and no measures of health beliefs(7, 17) There is also a possibility of unmeasured

confounders of the associations between the SES and utilisation of physiotherapy and chiropractic care. Though Tromsø 6 has been validated, the attendees were older, had a higher proportion of married/cohabitant and female participants, and the level of education was higher, so generalisations must be made with caution. The potential for recall bias, underreporting and wrong reporting should also be considered.

#### **4.6 Contributions from the study**

This thesis contributes knowledge to a field in which little research has been done and in which more knowledge is seen as an important aspect of reaching the goal of equity in healthcare(7, 57). This thesis confirms what most other studies have found: people with a higher level of education and household income utilise physiotherapy and chiropractic care the most. In addition, this thesis contributes knowledge about the demographic descriptions of users of chiropractic treatment and physiotherapy, and the results suggest that there are important differences between the users of these services. The differences found is of importance when planning how to make services equal for equal needs, and this study might draw the attention of both the providers and planners of health services in planning for the allocation of resources and in agreeing on the appropriate use of these services.

This thesis found that income is the most important socioeconomic predictor for the use of healthcare, which is supported by Lunde et al. (4). Though the reasons for how income affects use are unclear, it may be worthwhile to consider whether the reimbursement system could be targeted, so that those who need reimbursement the most also obtain it the most. An assessment of the reimbursement system is highly recommended by others as well (7, 57).

#### 4.7 Further studies

Because little previous work has been done in this field, there are several proposals for further studies, and the results from this thesis can be used as a starting point for deriving hypotheses. With the seventh round of the Tromsø Study completed, longitudinal studies are possible. Few studies have been done, which describes changes over time (17). Studies focusing on equity in outcome are also of interest, since this is an area where research is nearly absent(7).

Given changes in referral requirements and the removal of free physiotherapy from many patient groups, studies which investigate how these changes affect the use of physiotherapy, and thereby the goal of equity in healthcare use, are of interest. Such a study could be done using the available data from population studies or surveys. Over the past years, however, there has been a steady increase in available registry data. Even though there are still some obstacles in obtaining these data and connecting different registries, this provides possibilities for research on several issues(17). For the purpose of studying the use of physiotherapy and chiropractic treatment, data from the 'patient- and user registry for the municipality'(my translation; KPR) and a database called 'control and payment of health reimbursement'(my translation; KUHR) could be obtained and further connect these with each other, different registries for income and education and other relevant databases(17, 58, 59) . Doing this would provide the opportunity to examine the differences in care-seeking behaviour between different payment systems and different diagnoses in addition to what have already been studied. Unfortunately, none of these registries contain information about those visiting a fully private physiotherapist because they are not reporting to HELFO. Data about these visits must be collected otherwise.

#### **4.8 Conclusion**

The aim of this thesis was to investigate whether there are socioeconomic differences in the utilisation of chiropractic treatment and physiotherapy. The main conclusion is that a higher SES measured by income and education, leads to an increased use of these services. For the utilisation of physiotherapy, education is a significant predictor for women, and household income is a significant predictor for men. Regarding the utilisation of chiropractic treatment, household income is a significant predictor for both men and women. Need is the main factor for predicting the utilisation of both chiropractic treatment and physiotherapy.

In addition, this thesis demonstrates that more women than men use physiotherapy and that older people visit physiotherapists more often than younger people do. For chiropractic treatment, the age factor is reversed, and there are no significant differences between men and women.

These results reveal that the goal of equity in the use of physiotherapy and chiropractic treatment has not been fulfilled.



## Reference list

1. Hart JT. The inverse care law. *The Lancet*. 1971;297(7696):405-12.
2. Sosial- og helsedirektoratet. Sosial- og helsedirektoratets handlingsplan mot sosiale ulikheter i helse: Gradientutfordringen. Oslo: Norwegian directorate of health and social affairs; 2005. Report No.: IS-1229.
3. van Doorslaer E, Masseria C. OECD Health Working Paper NO. 14: Income-Related Inequality in the Use of Medical Care in 21 OECD Countries. Paris: Directorate for Employment, Labour and Social Affairs; 2005.
4. Lunde ES, Otnes B, Ramm J. Sosial ulikhet i bruk av helsetjenester: En kartlegging Oslo: Statistics Norway; 2017.
5. Finnvold JE. Likt for alle? Sosiale skilnader i bruk av helsetenester. Oslo: Norwegian Directorate of Health; 2009. Report No.: IS-1738.
6. Whitehead M, Dahlgren G. Begreper og prinsipper for å utjevne sosiale ulikheter i helse. Utjevning av helseforskjeller del 1. Oslo: Norwegian Directorate of Health; 2009. Report No.: IS-1665.
7. Dahl E, Bergsli H, van der Weel KA. Sosial ulikhet i helse: En norsk kunnskapsoversikt. Oslo: Høgskolen i Oslo og Akershus, Fakultet for samfunnsfag/Sosialforsk; 2014.
8. UiT Norges Arktiske Universitet. Om Tromsundersøkelsen [Internet]. 2019 [cited 2019 19.08]. Available from: [https://uit.no/forskning/forskningsgrupper/sub?p\\_document\\_id=367276&sub\\_id=377965](https://uit.no/forskning/forskningsgrupper/sub?p_document_id=367276&sub_id=377965).
9. Report No. 20. National Strategy to Reduce Social Inequalities in Health. Oslo: Norwegian Ministry of health and care services; 2006-2007.
10. Jensen A. Sosiale ulikheter i bruk av helsetjenester En analyse av data fra Statistisk sentralbyrås levekårsundersøkelse om helse, omsorg og sosial kontakt Oslo: Statistics Norway; 2009.
11. McNamara A, Normand C, Whelan B. Patterns and determinants of health care utilisation in Ireland. Dublin: The Irish Longitudinal Study on Ageing; 2013.
12. Lim K-L, Jacobs P, Klarenbach S. A Population-Based Analysis of Healthcare Utilization of Persons With Back Disorders. Results From the Canadian Community Health Survey 2000–2001. *SPINE*. 2006;31(2):212-8.
13. Weigel P, Hockenberry JM, Bentler SE, Obrizan M, Kaskie B, Jones MP, et al. A longitudinal study of chiropractic use among older adults in the United States. *Chiropractic & Osteopathy* [Internet]. 2010 [cited 2019 12.09]; 18(34):[1-14 pp.]. Available from: <https://chiromt.biomedcentral.com/articles/10.1186/1746-1340-18-34>.
14. Freburger JK, Carey TS, Holmes GM. Management of Back and Neck Pain: Who Seeks Care From Physical Therapists? *Physical Therapy*. 2005;85(9):872-86.
15. Chevan J, Riddle DL. Factors Associated With Care Seeking From Physicians, Physical Therapists, or Chiropractors by Persons With Spinal Pain: A Population-Based Study. *Journal of Orthopaedic & Sports Physical Therapy*. 2011;41(7):467-76.
16. Goddard M, Smith P. Equity of access to health care services: Theory and evidence from the UK. *Social Science & Medicine*. 2001;53(9):1149-62.
17. Godager G, Iversen T. Empirisk litteratur om sosial ulikhet i bruk av helsetjenester i Norge. Underlagsrapport til Sosial ulikhet i helse: En norsk kunnskapsoversikt. Oslo: Universitet i Oslo, Institutt for helse og samfunn; 2013.
18. Powell M, Exworthy M. Equal Access to Health Care and the British National Health Service. *Policy Studies*. 2003;24(1):51-64.
19. van Doorslaer E, Masseria C, Koolman X. Inequalities in access to medical care by income in developed countries. *CMAJ*. 2006;174(2):177-83.
20. Andersen RM. Revisiting the Behavioral Model and Access to Medical Care: Does it Matter? *1995*;36(1):1-10.
21. Sandnes T. Helse og bruk av helsetjenester - forskjeller mellom kvinner og menn. Oslo: Statistisk Sentralbyrå; 2007. Report No.: 37/2007.

22. Joung IMA, van Der Meer JBW, Mackenbach JP. Marital Status and Health Care Utilization. *International Journal of Epidemiology*. 1995;24(3):569-75.
23. Culyer AJ, Wagstaff A. Equity and equality in health and health care. *Journal of Health Economics*. 1993(12):431 - 57.
24. Coulter ID, Hurwitz EL, Adams AH, Genovese BJ, Hays R, Shekelle PG. Patients Using Chiropractors in North America. Who are they, and Why Are They in Chiropractic Care? *Spine*. 2002;27(3):291-8.
25. Brown BT, Bonello R, Fernandez-Caamano R, Eaton S, Graham PL, Green H. Consumer characteristics and perceptions of chiropractic and chiropractic services in Australia: Results from a cross - sectional survey. *Journal of Manipulative and Physiological Therapeutics*. 2014;37(4):219-29.
26. National Health Service. Overview: Physiotherapy [Internet]. 2018 [updated 26.11.2018; cited 2019 10.09]. Available from: <https://www.nhs.uk/conditions/physiotherapy/>.
27. Baker EH. Socioeconomic status, Definition [Internet]. Wiley online library; 2014 [updated 21.02.2014; cited 2019 27.08]. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1002/9781118410868.wbehibs395>.
28. Norsk kiropraktorforening. Om kiropraktikk [Internet]. 2019 [cited 2019 17.08]. Available from: <https://www.kiropraktikk.no/Om-kiropraktikk>.
29. Statistisk sentralbyrå. Helse- og sosialpersonell: sysselsatte i alderen 16-66 år med helse- og sosialfaglig utdanning etter fagutdanning, sysselsetting og avtalte årsverk. [Internet]. 2007 [cited 2019 04.04]. Available from: <https://www.ssb.no/a/kortnavn/hesospers/arkiv/tab-2008-06-19-03.html>.
30. Statistisk sentralbyrå. Helse- og sosialpersonell: Tabell 1: Alder og arbeidsstyrkestatus for personer med helse- og sosialfaglig utdanning (4.kvartal). [Internet]. 2018 [cited 2019 17.08.]. Available from: <https://www.ssb.no/arbeid-og-lonn/statistikker/hesospers>.
31. Norsk kiropraktorforening. Finn en kiropraktor: Tromsø [Internet]. 2019 [cited 2019 17.08]. Available from: <https://www.kiropraktikk.no/Finn-en-Kiropraktor?search=Troms%C3%B8>.
32. Norsk fysioterapeutforbund. Finn en fysioterapeut: Tromsø [Internet]. 2019 [cited 2019 19.08]. Available from: [https://fysio.no/finn/fysioterapeut/list/?form%5Bname%5D=&form%5Bcounty%5D=TROMS&form%5Bmunicipality%5D=Troms%C3%B8&form%5Bdiscipline%5D=&form%5Bsend%5D=&form%5Bexform\\_token%5D=2d0bATHfIH0zoLvn9QoTgAT75VSjt4ZTwHfcxoEkkBQ&page=2](https://fysio.no/finn/fysioterapeut/list/?form%5Bname%5D=&form%5Bcounty%5D=TROMS&form%5Bmunicipality%5D=Troms%C3%B8&form%5Bdiscipline%5D=&form%5Bsend%5D=&form%5Bexform_token%5D=2d0bATHfIH0zoLvn9QoTgAT75VSjt4ZTwHfcxoEkkBQ&page=2).
33. Norsk kiropraktorforening. Trygderefusjon [Internet]. 2016 [updated 03.01.2017; cited 2019 15.08]. Available from: <https://www.kiropraktikk.no/om-kiropraktikk/Trygderefusjon>.
34. helsenorge.no. Egenandel hos fysioterapeut [Internet]. 2019 [updated 01.01.2019; cited 2019 12.09]. Available from: <https://helsenorge.no/betaling-for-helsetjenester/betaling-hos-fysioterapeut>.
35. Ramm Jorun. Inntektsforholdene til storbrukere av helsetjenester. Oslo: Statistics Norway; 2008. Report No.: 13:2008.
36. Norsk fysioterapeutforbund. Flere må betale egenandeler. [Internet]. 2016 [updated 13.01.2017; cited 2019 19.08]. Available from: <https://fysio.no/Hva-mener-NFF/Fag-helse-og-arbeidslivspolitik/Flere-maa-betale-egenandeler>.
37. Eggen AE, Mathiesen EB, Wilsgaard T, Jacobsen BK, Njølstad I. The sixth survey of the Tromsø Study (Tromsø 6) in 2007-2008: Collaborative research in the interface between clinical medicine and epidemiology: Study objectives, design, data collection procedures, and attendance in a multipurpose population-based health survey *Scandinavian Journal of Public Health*. 2013;41(1):65-80.
38. EQ-5D. EQ-5D-5L: About [Internet]. 2017 [updated 18.04.2017; cited 2019 11.09]. Available from: <https://euroqol.org/eq-5d-instruments/eq-5d-5l-about/>.
39. Little R, Rubin D. Statistical analysis with missing data [Internet]. Published online: Wiley; 2019 [cited 2019 12.09]. Available from: <https://onlinelibrary.wiley.com/doi/pdf/10.1002/9781119482260.ch5>.

40. Field A. Discovering statistics using IBM SPSS statistics: And sex and Drugs and Rock'n Roll. 4th ed. Los Angeles: SAGE; 2013.
41. Janbu T. Pasientbetaling for helsetjenester. Tidsskrift for den Norske Legeforening. 2005;19(125):2679.
42. Ferreira ML, Machado G, Latimer J, Maher C, Ferreira PH, Smeets RJ. Factors defining care - seeking in low back pain - A meta - analysis of population based surveys. European Journal of Pain. 2010;14(747):747.e1-.e7.
43. Vikum E, Krokstad S, Westin S. Socioeconomic inequalities in health care utilisation in Norway: the population - based HUNT3 survey. International Journal for Equity in Health 2012;11(48):1-9.
44. Hansen AH, Halvorsen PA, Ringberg U, Førde OH. Socio-economic inequalities in health care utilisation in Norway: a population based cross - sectional survey. BMC Health Services Research. 2012;12(336):1-10.
45. Kristenson M, Lundberg J, Garvin P. Socioeconomic differences in outpatient healthcare utilisation are mainly seen for musculoskeletal problems in groups with poor self-rated health. Scandinavian Journal of Public Health. 2011;39(8):805-12.
46. Mustard CA, Kaufert P, Kozyrskyj A, Mayer T. Sex differences in the use of health care services. The New England Journal of Medicine. 1998;338(23):1678-83.
47. Mortimer M, Ahlberg G. To seek or not to seek? Care-seeking behaviour among people with low-back pain. Scandinavian Journal of Public Health. 2003;31:194-203.
48. Sharma R, Haas M, Stano M. Patient Attitudes, Insurance, and Other Determinants of Self-Referral to Medical and Chiropractic Physicians. American Journal of Public Health. 2003;93(12):2111-7.
49. Ong C-K, Doll H, Bodeker G, Stewart-Brown S. Use of osteopathic or chiropractic services among people with back pain: a UK population survey. Health and Social Care in the Community. 2004;12(3):265 - 73.
50. Balteskard L, Otterdal P, Steindal AH, Bakken T, Førde OH, Olsen F, et al. Eldrehelseatlas for Norge. Tromsø: SKDE; 2017. Report No.: SKDE-report 2/2012.
51. Côte P, Cassidy JDD, Carrol L. The Treatment of Neck and Low Back Pain: Who Seeks Care? Who Goes Where? MEDICAL CARE. 2001;39(9):956-67.
52. Shekelle PG, Markovich M, Louie R. Factors Associated with Choosing a Chiropractor for Episodes of Back Pain Care. MEDICAL CARE. 1995;33(8):842-50.
53. Legeforeningen. Gjør kloke valg [Internet]. 2019 [cited 2019 13.09]. Available from: <https://beta.legeforeningen.no/kloke-valg/>.
54. Giæver Ø. Nasjonal strategi for å utjevne sosiale helseforskjeller - i teori og praksis. Underlagsrapport til Sosial ulikhet i helse: En norsk kunnskapsoversikt. Oslo: Høgskolen i Oslo og Akershus; 2013.
55. Campbell MJ. Statistics at square two: understanding modern statistical applications in medicine. 2nd ed. Malden, Mass: BMJ/Blackwell Publishing; 2006.
56. Kang H. The prevention and handling of the missing data. Korean Journal of Anesthesiology. 2013;64(5):402-6.
57. Arntzen A, Bøe T, Dahl E, Drange N, Eikemo TA, Elstad JI, et al. Anbefalte tiltak mot sosial ulikhet i helse: Fagrådet for sosial ulikhet i helse. Oslo: Helsedirektoratet 2016. Report No.: IS-2749.
58. Helsedirektoratet. Kommunalt pasient- og brukerregister(KPR) [Internet]. 2019 [cited 2019 11.09]. Available from: <https://www.helsedirektoratet.no/tema/statistikk-registre-og-rapporter/helsedata-og-helseregistre/kommunalt-pasient-og-brukerregister-kpr>.
59. Helsedirektoratet. KUHR-databasen [Internet]. 2019 [updated 08.04.2019; cited 2019 11.09]. Available from: <https://www.helsedirektoratet.no/tema/statistikk-registre-og-rapporter/helsedata-og-helseregistre/kuhr>.

## Appendix

**Appendix 1: Validation of need variables for use of chiropractor and physiotherapy.**

	Chiropractor		Physiotherapy	
	Female OR (95 % CI) n = 6029	Male OR (95 % CI) n = 5527	Female OR (95 % CI) n = 6174	Male OR (95 % CI) n = 5568
<b>Self – rated health</b>	1.035 (0.883 – 1.212)	1.096 (0.937 – 1.282)	<b>0.887 (0.807 – 0.975)</b>	1.025 (0.915 – 1.149)
<b>Chronic pain</b>	1.239 (0.962 – 1.596)	1.202 (0.932 – 1.551)	<b>1.715 (1.482 – 1.986)</b>	<b>1.655 (1.386 – 1.976)</b>
<b>Heart attack</b>	1.046 (0.553 – 1.979)	0.821 (0.542 – 1.244)	<b>0.652 (0.435 – 0.977)</b>	0.892 (0.675 – 1.179)
<b>Stroke</b>	0.513 (0.185 – 1.423)	0.609 (0.305 – 1.214)	1.468 (0.975 – 2.209)	<b>1.544 (1.076 – 2.218)</b>
<b>Asthma</b>	0.728 (0.763 – 1.474)	1.099 (0.769 – 1.572)	1.112 (0.911 – 1.358)	0.912 (0.694 – 1.198)
<b>Bronchitis/emphyse ma</b>	1.013 (0.617 – 1.665)	0.819 (0.480 – 1.400)	0.930 (0.689 – 1.256)	1.022 (0.713 – 1.467)
<b>Psychological problems</b>	1.191 (0.891 – 1.591)	1.091 (0.758 – 1.572)	1.112 (0.930 – 1.329)	1.017 (0.780 – 1.327)
<b>EQ-5D score(mean)</b>	1.391 (0.715 – 2.708)	0.757 (0.373 – 1.537)	0.815 (0.545 – 1.219)	<b>0.323 (0.192 – 0.542)</b>
<b>Neck Pain</b>	<b>1.727 (1.396 – 2.138)</b>	<b>1.409 (1.149 – 1.729)</b>	<b>1.667 (1.464 – 2.899)</b>	<b>1.886 (1.627 – 2.186)</b>
<b>Arm pain</b>	0.958 (0.774 – 1.184)	1.181 (0.948 – 1.473)	1.003 (0.880 – 1.142)	1.143 (0.977 – 1.338)
<b>Upper back pain</b>	<b>1.316 (1.062 – 1.630)</b>	0.981 (0.766 – 1.257)	<b>1.267 (1.104 – 1.454)</b>	1.082 (0.903 – 1.297)
<b>Lumbar pain</b>	<b>1.547 (1.264 – 1.892)</b>	<b>1.903 (1.570 – 2.307)</b>	<b>1.249 (1.103 – 1.414)</b>	<b>1.304 (1.128 – 1.508)</b>
<b>Hip and leg pain</b>	0.814 (0.663 – 1.000)	0.892 (0.726 – 1.095)	<b>1.297 (1.148 – 1.466)</b>	1.168 (1.011 – 1.351)
<b>Other pain</b>	<b>0.627 (0.453 – 0.869)</b>	0.741 (0.505 – 1.087)	0.893 (0.747 – 1.067)	0.976 (0.756 – 1.262)