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The association between physical activity and psychological distress among an adult Sami and non-Sami population in Norway – the SAMINOR 2 Questionnaire Survey

A cross-sectional study

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Abstract

Background: Physical activity (PA) reduces the risk of mental health problems. However, there is limited knowledge of the influence of PA on psychological distress (PD) in a Sami population.

Aim: to investigate the association between PA levels and PD among a Sami and non-Sami population in Norway, and if the association differed between gender in both ethnic groups.

Materials/methods: Data from the SAMINOR 2 Questionnaire Survey included 11,600 participants (18-69 years) from 25 municipalities in Mid- and Northern Norway (response rate: 26.8%). Logistic regression analyses assessed the association between PA (10-category PA scale) and PD (The Hopkins Symptom Checklist-10), including stratification on gender and ethnicity.

Results: PA levels were inversely associated with 43% lower odds of experiencing PD. Lower PA levels were associated with higher odds of experiencing PD and vice versa. In the adjusted models, the estimates remained statistically significant. Sami and non-Sami men had 41% lower odds, Sami women had 22% lower odds, and non-Sami women had 40% lower odds of experiencing PD.

Conclusion: There was a significant inverse association between PA and PD among the Sami and non-Sami population. There was a small to none difference in the association of PA and PD between ethnicities and gender.

Keywords: Mental health, mental health problems, psychological distress, physical activity, Sami, indigenous, non-Sami population, Norway

List of abbreviations

MH	Mental health
MHP	Mental health problems
PD	Psychological distress
HSCL	The Hopkins Symptom Checklist
PA	Physical activity
SES	Socioeconomic status
NDH	The Norwegian Directorate of Health
NOWAC	The Norwegian Women and Cancer Study
BMI	Body mass index
OR	Odds Ratio
95% CI	95% Confidence Interval
REC	The Regional Committee of Medical and Health Research Ethics
NSD	The Norwegian Data Protection Authority
CSHR	The Centre for Sami Health Research
SSB	Statistics Norway
UiT	The Arctic University of Norway

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1 Background

1.1 Mental health

The World Health Organization (WHO) (1) defines mental health (MH) as "a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively, and can make a contribution to his or her community". It is fundamental to our collective and individual ability as humans to think, interact with each other, earn a living, and enjoy life (1). Multiple biological, psychological, and social factors determine the level of MH in a person at any time. MH is a positive term, and good MH is considered to be a resource and more than the absence of mental disorders or disabilities (1, 2).

1.1.1 Definitions and clarification of concepts

It is common and important to distinguish between MH problems (MHP) and mental disorders (2, 3). MHP are described as symptoms that can cause great difficulties, but not necessarily to the extent that it is diagnosed as a mental disorder (2, 3). Psychological distress (PD) is referred to as part of MHP. PD often refers to the presence of anxiety- and depression-like symptoms which are relatively general and may often be transient. Symptoms are usually measured by checklists, for instance the Hopkins Symptom Checklist (HSCL)-10 (used to measure PD in the current study) (2, 4). The HSCL-10 has previously been used by other researchers and has proven to be a valid and reliable instrument to measure MHP, such as PD (5). Mental disorders, on the other hand, are generally characterized by a combination of abnormal thoughts, perceptions, behavior, emotions and relationships with others (6). It is defined by the dictionary of Psychology from the American Psychological Association (7) as "any condition characterized by cognitive and emotional disturbances, abnormal behaviors, impaired functioning, or any combination of these." The definition is used when the burden of symptoms are so high and of such a nature that a diagnosis can be made (3). In mental disorders, three major categories are included; schizophrenia, affective disorders (major depression and manic depressive illness) and anxiety disorders (8). Such disorders are measured by standardized diagnostic instruments, preferably clinical interviews (2). This thesis focuses on the concept MHP, and PD assessment to measure the outcome. I am aware that other authors use different terms about MHP, and when referring to other authors research, their choice of the term will be used.

1.1.2 Prevalence of mental disorders and mental health problems

Mental disorders accounts for 10% of overall disease burden, including death and disability worldwide (9). The prevalence of mental disorders among the population in Norway vary considerably, according to methods and diagnostic criteria used (10). According to Norwegian and international studies, an estimate of 15-20 percent of the population has some kind of MHP and 3% has a mental disorder (10). In Norway, limited information is available about the prevalence of mental disorders in different age groups (11). However, several international studies have shown that the prevalence of MHP are higher among younger adults than among older people (12). In the European ESEMeD-study, the 12-month prevalence of MHP was more than twice as high among individuals between 18-24 years than among individuals in age group 65 years or older (13). In Norway, there is a present concern of increasing levels of MHP among those of younger age, in particular women (12). There is an uniform agreement across studies that women display higher levels of anxiety, compared to men (14). This is also the case for depression (15), both in Europe and the United States of America (13, 16). MHP and mental disorders remains widely under-reported all over the world (17). Particularly in lower income countries where data is scarer and there is less awareness towards MH and treatment of MHP and mental disorders (17).

1.1.3 Consequences and risk factors

Since MHP and mental disorders often debut early in life and tends to be chronic or reoccur, will they in many cases cause important consequences in several areas of life (2). Such as education, salary, personal relationships, employment status and social participations. In many cases, there is a need for persistent treatment and the MHP may result in unemployment and long-term sick leave. Mental disorders rank on top of the costliest conditions in Norway in 2013 (18, 19). It is estimated to cost the Norwegian society around NOK 70 billion per year in social security expenses and treatment- and social expenses (18, 19). According to WHO, depression is the single diagnosis that causes the greatest loss of healthy life years in the population in the western world (2). The most central risk factors for MHP are most likely genetic vulnerability, conditions of upbringing and life events, socio-economic conditions, as well as health-related conditions such as somatic disease and chronic pain (2). The risk factors' importance can be amplified if they act in the absence of protective factors, together with other risk factors, or if they constitute chronic burdens. Central protection factors include conditions that strengthen the resilience of the individual (2). Mostly, individual protective

factors are identical with aspect of positive MH such as self-esteem, emotional resilience, social skills and mastery (20).

1.2 Physical activity

Caspersen et al. (21) define physical activity (PA) as any bodily movement produced by skeletal muscles that require energy expenditure. PA refers to all movement including leisure time, for transport to get to and from places, or as part of a person's work. Martinsen (22) highlights the difference between PA and physical exercise (PE) where PA includes every single bodily movement that increases the energy consumption considerably above rest level. PE is an activity that consists of structured, planned, and repetitive bodily movements that are performed to maintain or improve health and physical fitness. I.e., PE is not different from PA, but a regular or repeated form of PA. PA contributes to preventing and managing i.e., noncommunicable diseases such as cardiovascular diseases, cancer, and diabetes (23). It promotes health in all age groups and can treat more than 30 diseases (24). Physical inactivity is an independent risk factor for ill-health and together with sedentary behavior is linked to an increased risk of several diseases and early death (25). Today, we use more and more time on sedentary activities. Reducing sedentary behavior through regularly short, active periods are important, but promoting PA is even more important, especially among those who are completely inactive (25).

Both the WHO and the Norwegian Directorate of Health (NDH) (26, 27) recommend 150-300 minutes of moderate-intensity PA per week; or at least 75 minutes of vigorous-intensity PA throughout the week for substantial health benefits in adults. Objectively registered PA assessed with an accelerometer shows that 32% of Norwegian adults met the minimum recommendations of PA according to NDH (28). PA measured by activity meters shows that women have a higher level of PA than men. In the age group 20-64 years do 34% of women and 29% of men met the minimum recommendations of PA from NDH. The level of PA is stable in this age group but decreases after the age of 69 years. PA equivalent to the recommendations reduces the risk of cardiovascular diseases, type-2 diabetes, different types of cancer, high blood pressure, and stroke (25). PA has been shown to improve overall well-being and ensures healthy growth and development in young people (23). In addition, it enhances people's thinking, learning, and judgment skills. Additional health benefits are obtained by PA higher than today's recommendations (25).

The mapping from the NHD reveals social differences, especially in the education level of men (28). Of men with ≥16 years of education, almost twice as many meet the recommendation of PA compared to men with ≤ 9 years of education (approximately 40% versus 20%). For women with ≥16 years, almost 40% meet the recommendations, while approximately 25% of women with ≤ 9 years of education meet the recommendations. Levels of PA are often lower in people with chronic health conditions such as chronic pain (29). Socioeconomic status (SES) refers to socioeconomic standing in society, often measured by educational level, occupation, or income (30). People with low SES generally report a lower level of leisure-time PA and commuting to work PA, and also report a more sedentary behavior (31).

1.2.1 Measurements of physical activity and mental health

Longitudinal study results on the relationship between PA and MH seem to depend on the type of measurement of PA (32). In adults, self-report measures of PA tend to have low correlations with objective measures (33-36). The use of self-reported PA is subject to response and recall bias and is often overreported (37, 38). Measuring PA accurately using self-report tools can be difficult since individuals cannot estimate accurately the amount of PA completed in surveyed time or the intensity of PA (38, 39). In earlier studies, self-reported PA levels have been reported to differ by marital status (40, 41), however, the results are currently unclear. In those studies, results showed that married participants are more active than single participants. At the same time, other literature suggests no differences, or lower PA in married participants (42). Studies using self-reported measures should be interpreted cautiously, particularly when informing public health policy (43).

1.3 Physical activity and mental health

There has been shown an association between PA and the reduced risk of MHP and increased quality of life (44). PA also promotes mental well-being and prevents PD and mental disorders (2). A prospective analysis of an Australian National Sample found substantial and highly statistically significant associations between moderate to vigorous PA and different symptoms of PD (45). They measured PD by the well-established Kessler Psychological Distress Scale (46) captures nonspecific PD and measures depressive symptoms and anxiety (45). Such symptoms as “tired for no reason, nervous, hopeless, restless, depressed and

worthless" to mention a few. PA was measured from responses to a self-reported questionnaire. Furthermore, results showed that frequent participation in moderate to vigorous PA reduces PD and decreases the likelihood of falling into a high-risk category (45). A large nationally representative study on British adults investigated the associations between a validated (47) self-reported questionnaire-based PA, and PD measured by the valid (48) and widely utilized the General Health Questionnaire-12 (49). The results indicate a clear dose-response benefit between lower PA levels and reduced PD (49).

Another study, in a multi-ethnic Asian population from Singapore, also used the General Health Questionnaire-12 to measure PD (50). PA was measured by the validated (51) Global Physical Activity Questionnaire version 2. Results showed that higher PA levels based on a questionnaire were also associated with protection against PD (50). A cross-sectional study from Southern Norway used an online self-report questionnaire measuring PD with the validated HSCL-5 (sort-version of HSCL-25) and leisure time PA by asking three questions on frequency, duration, and intensity (52). They found an increased odds of having mental distress among men reporting low-leisure time PA and high sedentary time compared to the rest of the male population (52). For women, it was found an increased odds of mental distress among those reporting high sedentary time compared to the rest of the female population. After adjusting for possible confounders, no association was shown between low leisure-time PA and mental distress among women (52).

There might be that the association between PA and symptoms of anxiety and/or depression is bidirectional (53). A study from 2012 suggests that regular PA reduces the risk of developing symptoms of anxiety and/or depression (53). On the other hand, having symptoms of anxiety and/or depression increases the probability of not meeting the recommendations of PA. Another study only found evidence for one direction in this relationship, where PA demonstrated a relationship with depression (54). While depression did not appear to have such a relationship with PA. Literature suggests that there is a need of producing a more differentiated picture of the relationship between PA and MH (55). This is because different types of PA might associate with different dimensions of MH and the association between these two might change in different populations. Researchers should clarify on which PA types increase psychological functioning (55). This would make the development easier on which forms of PA are likely to be most beneficial in different circumstances (56).

1.4 Sami population

Sápmi; the indigenous Sami people's traditional settlement area is mostly located in the central and northern parts of Norway, Sweden and Finland and Russia (57). Most of the Sami population live in Norway and are often divided into groups based on language (Northern-, Lule- and Southern Sami) and geographical location (coastal or inland) (58). Due to the lack of ethnic markers in national population records and censuses, the size of the present Sami population in the Scandinavian countries is not known (59). To this date, there is no reliable or updated demographic record on the Sami exists. In a population census in 1970, Aubert estimates that there were 40,000 Sami in Norway i.e., individuals with some Sami affiliation (60-62). The traditional Sami lifestyle and culture include involvement in occupations related to reindeer herding, hunting, farming, and fishing (63). Few Sami are still holding on to their traditional ways of life, and for decades, there has been a large migration from the north to the south of Norway and urbanization takes place both within and outside Sápmi (60, 64).

1.4.1 Discrimination and assimilation

Through centuries, the Sami were exposed to comprehensive discrimination and assimilation (65). Especially when the Norwegian national state had a Norwegianization policy from 1850 to 1960 aimed at assimilating Sami into the Norwegian culture (66). The assimilation policies affected mainly the use of Sami languages, and consequently, many Sami today do not consider themselves Sami nor speak a Sami language (60). Today, approximately 20,000-30,000 Sami speak a Sami language (67). Previous research on Sami and other indigenous people has been done with a stigmatizing, discriminating, and racist view where Sami and other indigenous people were presented as more inferior than the Norwegian majority population (68, 69). Since the 1980s, the situation has changed, and there has been an ethnic and cultural revival and the Sami people are treated generally more as equals (65). Yet, in Norway, Sami adults report experiencing ethnic discrimination more frequently in comparison to ethnic Norwegians (70, 71).

1.4.2 Previous research

There are limited available population-based studies on the prevalence of MHP among the adult Sami population (72). This is mainly due to Sami being officially registered as Norwegian citizens, which makes it difficult to produce data on Sami as a distinct population (73). A few previous published studies showed no differential MH status among adult Sami compared to their counterpart in the general population (74-76). Conversely, a cross-sectional

study conducted in 2018 found a higher prevalence of PD (measured by the HSCL-10) among the Sami population compared to the non-Sami population in both men and women (72). The study suggests the lack of differences in MHP may be due to overlooked within-groups differences in the Sami population. There are few published studies on PA levels in rural areas including the Sami population and limited knowledge on contemporary PA levels in regions with Sami population (77, 78). A study regarding PA levels in an adult population in Finnmark County in 2018, found that Sami individuals had a higher sedentary proportion compared to non-Sami (78). They measured PA by the self-reportedly and validated Saltin-Grimby questionnaire (78-80).

Hermansen et al. (77) investigated PA measured by interviews according to ethnic origin in Finnmark County from a population-based survey performed in 1987-1988. They found that Sami men and women were more physically active at work and had higher total PA scores (77). A study published in 2021, including 10 municipalities in Northern Norway investigated PA levels in Sami and non-Sami populations (81). The study revealed that almost 60% reported a PA level >5 using a 10-category scale as a measure for PA levels. Results showed no statistically significant differences in mean self-reported PA levels in Sami and non-Sami men overall (81). However, stratifying for geographical areas, Sami men reported statistically significant higher PA levels compared to their counterparts in the same area. Sami women reported lower mean PA levels compared to non-Sami women, driven by the results in the Sami dominant municipalities of Kautokeino and Karasjok (81). After adjustments, the only statically significant ethnic difference in PA level was observed in women, when all regions (coastal versus inland) were combined.

It is important to gain more knowledge on health and life in the Sami population (82). Identifying possible differences between ethnic populations may be important in the matter of planning for future public health interventions. Whereas the associations between PA and PD have previously been shown, to my knowledge, there are no previously published studies that examine this relationship in an adult Sami population compared to a non-Sami population. My hypothesis is that higher levels of PA are associated with lower PD in both ethnic groups. Despite the hypothesis that there is no ethnic difference in the association between PA and PD, is it relevant to investigate this in a population that includes both Sami and non-Sami. It is important to know if there are ethnic differences in these associations to be able to offer a culturally adapted health service.

1.5 Purpose of the study

The overall aim of this present study is to investigate the association between PA levels and PD status among Sami and non-Sami populations in Norway. Furthermore, to investigate whether the association differs between the two ethnic groups. Additionally, to investigate if the association differ between gender in both Sami and non-Sami women and men. This study focuses on the following question: *"Is there an association between physical activity level and psychological distress status among adults in Sami and non-Sami population in Norway?"*

2 Material and Methods

2.1 Study design

This cross-sectional study used already collected data from the second survey of the Population-based Study on Health and Living Conditions in Regions with Sami and Norwegian Populations – The SAMINOR 2 Survey (83). The SAMINOR 2 Survey consists of two separate surveys; the SAMINOR 2 Questionnaire Survey conducted in 2012, and the SAMINOR 2 Clinical Survey conducted from 2012-2014 (84). The Population-based Study on Health and Living Conditions in Regions with Sami and Norwegian Populations – The SAMINOR Study is conducted by the Centre for Sami Health Research (CSHR) UiT The Arctic University of Norway (UiT).

2.2 Study population

The first survey of the Population-based Study on Health and Living Conditions in Regions with Sami and Norwegian Populations – The SAMINOR 1 Survey was conducted from 2003-2004 (58). This present study used data collected from the SAMINOR 2 Questionnaire Survey (83). Data from the invited population in 25 selected municipalities in Mid- and Northern Norway were included (in some cases, only some districts in the municipalities were included, indicated in brackets): Finnmark, Troms, Nordland, and South- and North-Trøndelag (figure 1). Municipalities included are as following: Karasjok, Kautokeino, Porsanger, Tana, Nesseby, Lebesby, Alta, Loppa and Kvalsund, Sør-Varanger, Kåfjord, Kvænangen, Storjord, Lyngen, Skånland, Lavangen, Tysfjord, Evenes, Hattfjelldal (Hattfjelldal), Grane (Majavatn), Narvik (Vassdalen), Røyrvik, Namsskogan (Trones and

Furuly), Snåsa (Vinje), and parts of Røros (Brekken) (83). The target population of the survey was all inhabitants aged 18-69 registered in the Norwegian National Population Register by December 1st, 2011 (83). They were selected from the same areas as the SAMINOR 1 Survey, in addition to Sør-Varanger (58, 83).

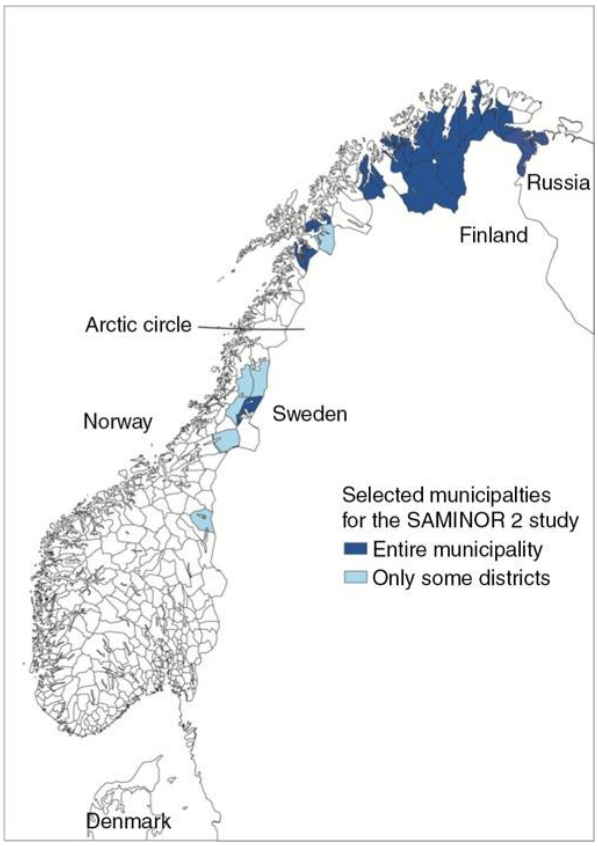


Figure 1 - Investigation areas of the SAMINOR 2 Questionnaire Survey (83).

2.3 Data collection

Data in the SAMINOR 2 Questionnaire Survey were collected either by a paper-questionnaire format returned by post or by a web-based questionnaire submitted online (83) and assigned with a unique ID to each participant. The questionnaires and instruction material were written in Norwegian and translated into three Sami languages; Lule, Northern and Southern Sami. Questionnaires were sent out from 9-12 January 2012 and reminders were sent to non-responders after 6 weeks and after 4 months (83).

2.4 Study Sample

Altogether, 44,669 women and men were invited to participate in the SAMINOR 2 Questionnaire Survey (83). Among these, 1,424 letters were returned to the sender, due to either wrong address or the recipient had moved. These were not considered to have been invited and the total number of invitations resulted in 43,245 people. In total, 11,600 gave informed consent and were included in the study, with an overall response rate of 26.8% (83). For the present study, participants were excluded if they had missing information regarding self-reported PA, PD, and ethnicity. In total, 324 individuals were excluded due to missing information on PA and 523 individuals had missing information on PD. This resulted in a total of 10,753 people in the study sample we received from the CSHR. All missing values to the variables of interest were excluded after receiving the data set. Hence, the final analytical sample for this study was 8947 people (figure 2).

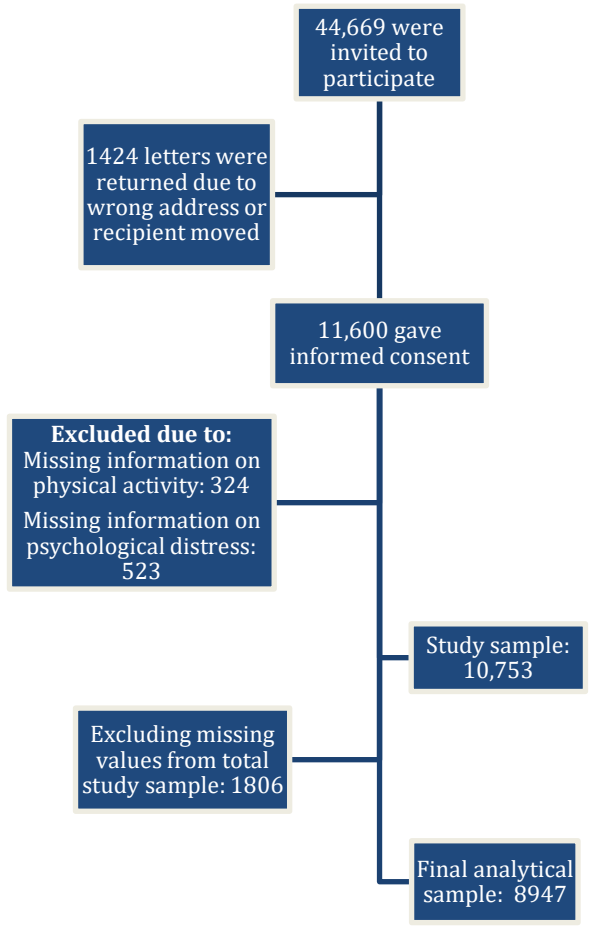


Figure 2 - Flowchart for the analytical study sample from the SAMINOR 2 Questionnaire Survey (83).

2.5 Variables

2.5.1 Measurement of exposure variable - physical activity

PA level were assessed with a 10-category scale (figure 3) after reading the following explanation: *We will now ask you to state your physical activity level on a scale from very low to very high. The scale below runs from 1 to 10. Physical activity includes both housework and activity at work, as well as exercise and other physical activities such as walking, etc. Mark the number that best matches your level of activity* (85). The scale reflects the amount of PA across different domains, including recreational, occupational, transportation and household PA, and combines them into one global assessment of the PA levels (86). PA levels were recoded into five groups: 1-2, 3-4, 5-6, 7-8, 9-10. This 10-category scale has previously been used in the Norwegian Women and Cancer Study (NOWAC) and has appeared to be a valid self-report instrument suitable to differentiate general PA levels among adult women in Norway (86, 87). However, the scale has not been validated for men nor people of Sami ethnicity. Also, the scale cannot differentiate between the intensity, duration, and frequency of PA (81). Nor the differences in perception of the scale or identify the type of PA.

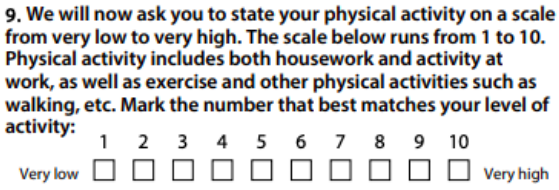


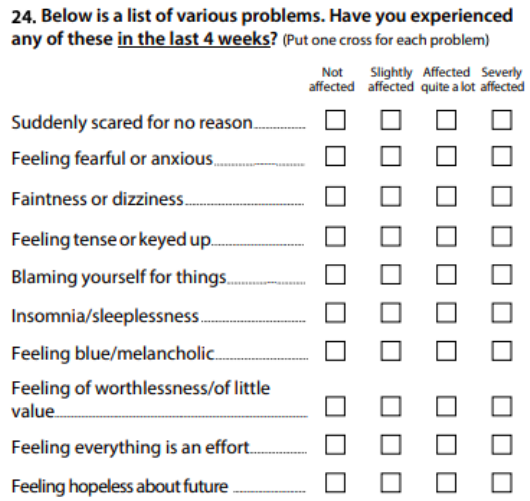
Figure 3 - Question 9 in the SAMINOR 2 Questionnaire Survey (85)

2.5.2 Measurement of outcome variable – psychological distress

PD was measured by the HSCL-10 (figure 4), a short version of the HSCL-25 which also have a HSCL-5 version (5). This checklist rates the presence of symptoms during the last four weeks associated to depression with 6 items; *blaming yourself for things, insomnia/sleeplessness, feeling blue/melancholic, feeling of worthlessness/of little value, feeling everything is an effort, feeling hopeless about future.* For anxiety it is 4 items; *suddenly scared for no reason, feeling fearful or anxious, faintness or dizziness, feeling tense or keyed up* (4, 85). It uses a 4-point scale (From 1: not at all, to 4: very much) where higher mean scores indicate more mental distress ranging 1-4. In a validation study on SAMINOR 2 Questionnaire Survey respondents, there appeared no significant measurement invariance

between the ethnic groups included (88). This is an indication that HSCL-10 response scale was interpreted in a similar way by the ethnic groups. In addition, validation of the HSCL-10 has previously been performed by other researchers and has proven to be a valid and reliable instrument to measure PD. They showed a correlation that ranged from 0.91 to 0.97 between the different HSCL-instruments (5).

Prior to receiving the data set, the HSCL-10 score was computed into a dichotomous variable where the participants who scored above the cut-off point of mean ≥1.85 classifies as experiencing PD. Previous studies have used the same cut-off point to classify PD (72, 88). The cut-off criteria of 1.85 is indicative of PD based on Norwegian data, equals a score of 1.89, 1.94 and 1.92 in the Sami core, Sami affiliation and Sami background groups, respectively (88). Thus, the cut-off criterion 1.85 may be safely used in across groups. Before we received the data set, participants with missing values on three or more questions were excluded. Participants with missing values on one or two questions was replaced with the sample mean value before the calculation of the total score.



24. Below is a list of various problems. Have you experienced any of these in the last 4 weeks? (Put one cross for each problem)

	Not affected	Slightly affected	Affected quite a lot	Severly affected
Suddenly scared for no reason	☐	☐	☐	☐
Feeling fearful or anxious	☐	☐	☐	☐
Faintness or dizziness	☐	☐	☐	☐
Feeling tense or keyed up	☐	☐	☐	☐
Blaming yourself for things	☐	☐	☐	☐
Insomnia/sleeplessness	☐	☐	☐	☐
Feeling blue/melancholic	☐	☐	☐	☐
Feeling of worthlessness/of little value	☐	☐	☐	☐
Feeling everything is an effort	☐	☐	☐	☐
Feeling hopeless about future	☐	☐	☐	☐

Figure 4 - Question 24 in the SAMINOR 2 Questionnaire Survey (85)

2.6 Demographic and health characteristics

Ethnicity, education, income, smoking status, alcohol consumption, chronic somatic diseases, and body mass index (BMI) were self-reported and used to describe the demographic and health characteristics of the participants in this study. Information on age and gender was obtained from Statistics Norway (SN). Age is defined as the participant's age at the enrolment into the study (01.01.2012) (83). It was categorized into groups of 30-39 years (including

those under the age of 30 because of few participants), 40-49 years, 50-59 years, and 60-69 years. All variables used in the statistical analyses based on the questionnaire used in the SAMINOR 2 Questionnaire Survey (85) are described in table 1.

2.6.1 Ethnicity

Ethnicity is most commonly used as an entirely social construct, referring to e.g., sharing of a common culture, shared language, attitude, religion, and cultural traditions (89). Sami ethnicity was measured by the following question: *"What do you consider yourself to be?"* with the options "Norwegian", "Sami", "Kven", and "Other" (85). It was possible to report multiple ethnicities to the question. Participants who answered "Sami" was considered Sami regardless of whether they had reported other ethnicities in addition to Sami. Participants who answered "Norwegian" were considered as "non-Sami". Those who did not answer "Sami" or "Norwegian", only "Kven" or "Other" were excluded (set to missing). Other studies have used several criteria to categorize Sami ethnicity (72, 81, 90). Such as self-perceived Sami ethnicity, Sami linguistic affiliation and ethnic background. These first two criteria are also used by the Sami Parliament to electoral roll (72). However, self-identification seems to have become ethically preferable to base ethnicity data on (57, 91). For example, the United Nations explicitly recommends self-identification when ethnicity is recorded in a national census (92). This also includes the possibility of multi-ethnic identification.

Table 1 - Description of variables used in the statistical analyses based on the questionnaire used in the SAMINOR 2 Questionnaire Survey (85)

Variables	**SAMINOR 2**		**Coded/grouped into**
	Question	**Answer options**	**Categories**
Physical activity	We will now ask you to state your physical activity level on a scale from very low to very high. The scale below runs from 1 to 10. Physical activity includes both housework and activity at work, as well as exercise and other physical activities such as walking, etc. Mark the number that best matches your level of activity	1 2 3 4 5 6 7 8 9 10	1-2 3-4 5-6 7-8 9-10
Psychological distress	Below is a list of various problems. Have you experienced any of these in the last four weeks? *(Put one cross for each problem):*	**Not affected - Slightly affected - Affected quite a lot - Severely affected** Suddenly scared for no reason Feeling fearful or anxious Faintness or dizziness Feeling tense or keyed up Blaming yourself for things Insomnia/sleeplessness Feeling blue/melancholic Feeling of worthlessness/of little value Feeling everything is an effort Feeling hopeless about future	*Computed into a dichotomous variable* Yes (score ≥ 1.85 experience PD) No (score < 1.85 do not experience PD)
Ethnicity	What do you consider yourself to be?	Norwegian Sami Kven Other	Non-Sami (Norwegian) Sami (reporting Sami alone or together with other ethnicities) *(Answering only "Kven" or "Other" were excluded)*
Education	How many years of school have you completed? *(Consider every year you have attended school or been a student)*	Years	Primary school ≤ 9 years Secondary school (10-12 years) College and university ≤ 4 years (13-15 years) Higher college or university education > 4 years (16 years and more)
Income	What is the family/household's gross income per year?	<150,000 NOK 150,000-300,000 NOK 301,000-450,000 NOK 451,000-600,000 NOK 601,000-750,000 NOK 751,000-900,000 NOK	Low (<150,000-300,000 NOK) Medium (301,000-600,000 NOK)

		>900,000 NOK	High (601,000-900,000 NOK)
Smoking status	Do you smoke, or have you previously smoked?	Yes, daily Yes, previously Yes, sometimes No, never	Yes, daily Former, sometimes No, never
Alcohol consumption	Approximately how often have you been drinking alcohol during the last year? *(Light beer and non-alcoholic beer are not included)*	Never Not last year About 1 time per year 2-3 times per month About 1 time per week 2-3 times per week 4-7 times a week	Less than monthly (never, not the past year, sometimes during the last year) Monthly (once a month, 2-3 times a month) Weekly (once a week, 2-3 times a week, 4-7 times a week)
Chronic pain	Have you during the past year been bothered by pain and/or stiffness in muscles and joints which has lasted for at least 3 consecutive months?	Yes No	Yes No
BMI	Calculated by self-reported weight in kg (question 7) divided by the square of height in meters (question 8)	Question 7: How much do you weigh? (in kg) Question 8: What is your height? (in cm)	Underweight/normal weight (< 25 kg/m^2) Overweight (25-29.9 kg/m^2) Obese (≥30 kg/m^2)
Chronic somatic diseases	Do you, or have you ever had?	Diabetes High blood pressure Angina pectoris Myocardial infarction Chronic bronchitis, emphysema, COPD Asthma Eczema Psoriasis Multiple sclerosis Bechterews disease	*Merges into a common variable that is grouped into:* None (0 diseases) One or more diseases.

2.7 Statistical analyses

Statistical analyses were performed using Stata version 17 on Mac with permission and license from UiT. In the total sample there was less than 6% missing values and I decided to do a complete case analysis and exclude the missing values from the analytical sample. The

characteristics of the study participants are presented descriptively by PA categories under the results chapter. They are presented in a table of the total sample and two tables separated for men and women. Statistical analyses included univariate and multivariable logistic regression and were performed using the variables PD (HSCL-10), PA (10-category scale), gender and ethnicity. I did a backward selection procedure to investigate statistically possible confounders in the association between PA and PD. In the selection of models, variables that did not contribute significantly into the model were removed; the result of this indicated that alcohol consumption could be excluded from further analysis and was therefore not treated as a confounder (p-value=0.123). Confounding occurs when a factor is associated with both the exposure and the outcome, and is not part of the causal pathway from exposure to outcome (93).

Univariate logistic regression was performed to assess the association between PA and PD. To verify the association between PD and all other variables except PA, I ran a univariate logistic regression that also gave an indication of which variables to adjust for. Multivariable logistic regression was used to adjust for possible confounders that included age, education, income, smoking status, chronic pain, chronic somatic disease, and BMI. I checked for gender in the model, and this did not change the estimates (data not shown). The analyses were stratified according to gender and ethnicity and are shown in separate tables. Spearman's rank correlation test was performed to check multicollinearity and there was no violation of this assumption. The estimates are presented as Odds Ratios (OR) with 95% confidence intervals (95% Cl) with a p-value set to 5%. The unadjusted and adjusted results for the logistic regression analysis are presented in tables for the logistic regression outputs. PA level 5-6 was used as the level of reference since it represents one the categories with the largest number of participants.

2.8 Ethical aspects

All participants gave written informed consent to participate in the SAMINOR 2 Questionnaire Survey (83). The SAMINOR 2 Questionnaire Survey has been assessed and approved by the Regional Committee for Medical and Health Research Ethics (REC North) and the Norwegian Data Protection Authority (NSD). For this project, we sent an application to REC North, to ensure that the project did not need to get an ethical approval from REC. We received an answer from REC 08.11.2021, where they concluded that this project was not

obligated to be applied for according to the Health Research Act § 2. Nor did we have to apply this project to NSD, which also complies with the guidelines of UiT The Arctic University of Norway, and to the SAMINOR guidelines (94). In addition, we applied for Sami collective consent from the Sámi Health Research committee, and they approved the project on 17.01.2022. There are ethical guidelines for Sámi health research based on international conventions (UN Convention on Civil and Political Rights, ILO Convention No. 169 on Indigenous and Tribal People in Independent States and the UN Declaration on the Rights of Indigenous People) (95). These guidelines are to ensure that Sami health research is rooted in indigenous people´s right to self-determination (96). As well as to consider and respect the diversity and uniqueness that characterizes Sami culture and communities. As mentioned earlier, previous discriminating ways of research have been done on Sami and other indigenous people (68, 69). The result of this made a massive impact on many and created distrust among Sami people toward researchers (95). Ethnicity is sensitive information and something researchers must be aware of regarding Sami health research.

2.9 Access to data: The SAMINOR 2 Questionnaire Survey

I did, together with my supervisors, send an application to the SAMINOR project board, presenting the project together with a list of necessary variables to answer the objective of the study. The SAMINOR project board accepted the project on 10.11.2021. All variables in the requested dataset were anonymous and cannot be tracked back to individuals. When this study got approved by the collective consent, we sent the approval to the SAMINOR project board. This was the requirement to receive and sign the contract before we got access to the SAMINOR 2 Questionnaire Survey data material.

3 Results

3.1 Results of the study sample characteristics

After excluding all missing values from the data set, the total study sample resulted in 8947 participants (table 2). The characteristics including missing values is to be found in appendix 1. Table 2 describes the characteristics of the total analytical study sample by PA categories. The study sample consisted of 45.2% men and 54.8% women. Few participants reported both very low (1-2) and very high (9-10) PA levels (3.1% and 7.0%, respectively).

3.1.1 Demographical characteristics

Most age groups reported PA levels 7-8, except age group 60-69 where the most (40.6%) reported PA levels was 5-6. Within the age groups reporting PA levels 7-8, there was a descending trend by age, with highest proportion in group 18-39 years (41.1%) and lowest (33.3%) in group 60-69 years. In PA levels 5-6, an opposite trend was shown, with highest (40.6%) in the oldest age group and lowest (30.7%) in the youngest age group. Generally, in all income groups the percentage was largest in those reporting 5-6 and 7-8 PA levels. In participants with income ≤300 000 NOK and 301-600 000 NOK per year, the proportion was found to be highest in PA levels 5-6. For participants reporting >600 000 NOK per year, the largest proportion had PA levels 7-8. Through the level of education, the largest proportion of the two groups with primary and secondary school reported lower PA levels (<5-6) then those groups with college and university or higher education (7-8).

3.1.2 Lifestyle behaviors and health characteristics

In smoking status, the largest proportion of those who smoked daily reported PA levels 5-6. Most of those who previously or occasionally smoked, or had never smoked, reported a higher PA level (7-8). The monthly and weekly alcohol consumption groups had a similar distribution of PA. The results indicate that most participants who reported monthly and weekly consumption of alcohol reported a higher PA level (7-8) than those who consumed alcohol less than monthly (5-6). Most participants who reported chronic pain had a lower PA level (5-6) than those who reported no chronic pain (PA level 7-8). In general, most of the participants in the different BMI groups reported a PA level between 5-6 and 7-8. Those who were normal and underweight (BMI <25 kg/m^2) and those who were categorized as overweight (25-29.9 kg/m^2) reported a higher PA level (7-8) than most who were obese (BMI ≥30 kg/m^2) (PA level 5-6). There was a difference in the highest PA level between those who were under- and normal weight and obese (10.7% versus 1.9%, respectively). The distribution of PA in somatic diseases was similar to chronic pain; most with no somatic diseases reported PA level 7-8 while most of none or more disease reported a PA level of 5-6.

3.2 Characteristics of psychological distress, ethnicity, and gender

In total, 971 (10.9%) participants reported PD, leaving 7976 (89.1%) participants reporting no PD. The proportion of no PD was largest (39.4%) in PA level of 7-8 most (33.4%) participants with PD reported PA level 5-6. There was a higher proportion of participants with PD in the lowest (1-2) PA level versus the highest (9-10) PA level (9.1% versus 3.2%). The

opposite was shown in no PD where more participants reporting highest (9-10) PA level than lowest (PA level 1-2) (7.4% versus 2.4%). There was a difference in the proportion of the participants by ethnicity, where a total of 1903 (21.3%) reported Sami, and 7044 (78.7%) reported non-Sami. The distribution of PA was similar in Sami and non-Sami participants and the largest proportion of the ethnic groups reported PA level 7-8 (38.1% Sami versus 37.8% non-Sami). Tables 3 and 4 present the results stratified to gender. The tables demonstrate similar distribution between men and women, and a similar distribution compared to the total sample. The majority of both men and women reported PA level 7-8 (36.7% and 38.8%, respectively). There were small differences in gender, e.g., men reporting having PD, reported a lower PA level (3-4) than women with PD (PA level 5-6). Within income group 301-600 000 NOK, most women (37.7%) reported PA level 5-6, while most men reported PA level 7-8 (35.5%). Most women who reported they had previously or occasionally smoked, reported a higher PA level (7-8) than men (PA level 5-6) in the same category.

Table 2 – Characteristics of the total study sample by PA categories from the SAMINOR 2 Questionnaire Survey (83)

Characteristics for the study sample[1] (N = 8947) by physical activity categories. The SAMINOR 2 Questionnaire Survey (83)

	1-2 (n=276/3.1 %)		3-4 (n=1567/17.5%)		5-6 (n=3097/34.6%)		7-8 (n=3385/37.8%)		9-10 (n=622/7.0%)		Total (n=8947)
	n	%	n	%	n	%	n	%	n	%	n
Age groups (years) (N= 8947)											
18-39	75	3.0	391	15.5	776	30.7	1038	41.1	246	9.7	2526
40-49	63	2.9	379	17.4	722	33.1	864	39.6	156	7.1	2184
50-59	82	3.6	427	18.8	803	35.3	829	36.5	133	5.9	2274
60-69	56	2.9	370	18.9	796	40.6	654	33.3	87	4.4	1963
Psychological distress (N= 8947)											
No	188	2.4	1280	16.1	2773	34.8	3144	39.4	591	7.4	7976
Yes	88	9.1	287	29.6	324	33.4	241	24.8	31	3.2	971
Gender (N= 8947)											
Men	151	3.7	738	18.3	1371	33.9	1484	36.7	300	7.4	4044
Women	125	2.6	829	16.9	1726	35.2	1901	38.8	322	6.6	4903
Ethnicity (N= 8947)											
Non-Sami	206	2.9	1247	17.7	2448	34.8	2660	37.8	483	6.9	7044
Sami	70	3.7	320	16.8	649	34.1	725	38.1	139	7.3	1903
Family gross income (NOK) (N= 8947)											
Low ≤300 000	75	6.6	250	22.0	400	35.2	338	29.8	72	6.3	1135
Medium 301-600 000	103	3.0	594	17.7	1225	36.5	1224	36.5	209	6.2	3355
High >600 000	98	2.2	723	16.2	1472	33.0	1823	40.9	341	7.7	4457
Level of education (years) (N= 8947)											
Primary school (0-9)	64	5.4	231	19.5	444	37.5	372	31.4	74	6.2	1185
Secondary school (10-12)	85	3.5	431	17.9	924	38.3	817	33.9	154	6.4	2411
College and university ≤4years (13-15)	65	2.7	429	17.9	780	32.5	939	39.1	189	7.9	2402

Higher college and university >4years (≥16)	62	2.1	476	16.1	949	32.2	1257	42.6	205	7.0	2949
Smoking status (N= 8947)											
Yes, daily	91	5.6	393	24.2	592	36.4	486	29.9	65	4.0	1627
Yes, previously or occasionally	102	3.0	622	18.2	1238	36.2	1274	37.2	187	5.5	3423
No, never	83	2.1	552	14.2	1267	32.5	1625	41.7	370	9.5	3897
Alcohol consumption past year (N= 8947)											
Less than monthly	119	4.2	565	20.0	989	35.0	956	33.8	197	7.0	2826
Monthly	75	2.3	510	15.4	1148	34.7	1315	39.7	265	8.0	3313
Weekly	82	2.9	492	17.5	960	34.2	1114	39.7	160	5.7	2808
Chronic pain (N= 8947)											
Yes	167	4.3	832	21.5	1445	37.4	1270	32.8	153	4.0	3867
No	109	2.2	735	14.5	1652	32.5	2115	41.6	469	9.2	5080
BMI (kg/m^2) (N= 8947)											
Underweight/normal weight <25	76	2.1	432	11.8	1122	30.6	1652	45.0	391	10.7	3673
Overweight 25-29.9	91	2.6	634	17.8	1305	36.7	1330	37.4	198	5.6	3558
Obese ≥30	109	6.4	501	29.2	670	39.0	403	23.5	33	1.9	1716
Somatic disease (N= 8947)											
None	104	2.3	657	14.5	1475	32.4	1909	42.0	402	8.8	4547
One or more	172	3.9	910	20.7	1622	36.9	1476	33.6	220	5.0	4400

[1] – Study sample excluding missing values
Psychological distress - HSCL-10 score >=1.85
Ethnicity – "I consider myself Sami/Norwegian"
Chronic pain – pain and/or stiffness that has lasted for 3 months
BMI – body mass index
Somatic disease – current or former somatic diseases

Table 3 – Characteristics for men by PA categories from the SAMINOR 2 Questionnaire Survey (83)

Sample characteristics for men[1] (N=4044) by level of physical activity categories. The SAMINOR 2 Questionnaire Survey (83)

	1-2 (n=151/3.7%)		3-4 (n=738/18.3%)		5-6 (n=1371/33.9%)		7-8 (n=1484/36.7%)		9-10 (n=300/7.4%)		Total (n=4044)
	n	%	n	%	n	%	n	%	n	%	n
Age group (years) (N= 4044)											
18-39	35	3.6	143	14.7	278	28.5	398	40.8	122	12.5	976
40-49	32	3.5	167	18.0	304	32.8	362	39.0	63	6.8	928
50-59	51	4.8	218	20.6	362	34.1	367	34.6	63	5.9	1061
60-69	33	3.1	210	19.5	427	39.6	357	33.1	52	4.8	1079
Psychological distress (N= 4044)											
No	110	3.0	629	16.9	1268	34.2	1412	38.0	294	7.9	3713
Yes	41	12.4	109	32.9	103	31.1	72	21.8	6	1.8	331
Ethnicity (N= 4044)											
Non-Sami	110	3.4	595	18.6	1088	34.1	1168	36.6	234	7.3	3195
Sami	41	4.8	143	16.8	283	33.3	316	37.2	66	7.8	849
Family gross income (NOK) (N= 4044)											
Low ≤300 000	47	9.3	116	22.9	175	34.5	141	27.8	28	5.5	507
Medium 301-600 000	55	3.8	278	19.0	511	35.0	518	35.5	98	6.7	1460
High >600 000	49	2.4	344	16.6	685	33.0	825	39.7	174	8.4	2077
Level of education (years) (N= 4044)											
Primary school (0-9)	44	6.5	137	20.3	245	36.4	207	30.7	41	6.1	674
Secondary school (10-12)	46	3.7	233	18.5	468	37.2	425	33.8	86	6.8	1258
College and university ≤4 years (13-15)	38	3.6	190	18.0	340	32.2	405	38.3	84	8.0	1057
Higher college and university >4 years (≥16)	23	2.2	178	16.9	318	30.1	447	42.4	89	8.4	1055
Smoking status (N= 4044)											
Yes, daily	46	6.6	185	26.5	258	36.9	195	27.9	15	2.2	699
Yes, previously or occasionally	61	3.8	321	19.9	588	36.5	560	34.7	83	5.2	1613
No, never	44	2.5	232	13.4	525	30.3	729	42.1	202	11.7	1732

Alcohol consumption past year (N= 4044)											
Less than monthly	55	5.3	207	19.9	346	33.3	339	32.7	91	8.8	1038
Monthly	37	2.5	239	15.9	526	34.9	578	38.4	126	8.4	1506
Weekly	59	3.9	292	19.5	499	33.3	567	37.8	83	5.5	1500
Chronic pain (N= 4044)											
Yes	86	5.5	362	23.3	587	37.7	461	29.6	61	3.9	1557
No	65	2.6	376	15.1	784	31.5	1023	41.1	239	9.6	2487
BMI (kg/m^2) (N= 4044)											
Underweight/normal weight <25	42	3.2	157	12.1	378	29.1	552	42.5	170	13.1	1299
Overweight 25-29.9	47	2.4	348	18.0	684	35.4	740	38.3	113	5.6	1932
Obese ≥30	62	7.6	233	28.7	309	38.0	192	23.6	17	2.1	813
Somatic disease (N= 4044)											
None	59	2.8	300	14.4	658	31.7	860	41.4	202	9.7	2079
One or more	92	4.7	438	22.3	713	36.3	624	31.8	98	5.0	1965

[1] – Sample of men excluding missing values
Psychological distress - HSCL-10 score >=1.85
Ethnicity – "I consider myself Sami/Norwegian"
Chronic pain – pain and/or stiffness that has lasted for 3 months
BMI – body mass index
Somatic disease – current or former somatic diseases

Table 4 – Characteristics for women by PA categories from the SAMINOR 2 Questionnaire Survey (83)

Sample characteristics for women[1] (N=4903) by level of physical activity categories. The SAMINOR 2 Questionnaire Survey (83)

	1-2 (n=125/2.6%)		3-4 (n=829/16.9%)		5-6 (n=1726/35.2%)		7-8 (n=1901/38.8%)		9-10 (n=322/6.6%)		Total (n=4903)
	n	%	n	%	n	%	n	%	n	%	n
Age group (years) (N= 4903)											
18-39	40	2.6	248	16.0	498	32.1	640	41.3	124	8.0	1550
40-49	31	2.5	212	16.9	418	33.3	502	40.0	93	7.4	1256
50-59	31	2.6	209	17.2	441	36.4	462	38.1	70	5.8	1213
60-69	23	2.6	160	18.1	369	41.7	297	33.6	35	4.0	884
Psychological distress (N= 4903)											
No	78	1.8	651	15.3	1505	35.3	1732	40.6	297	7.0	4263
Yes	47	7.3	178	27.8	221	34.5	169	26.4	25	3.9	640
Ethnicity (N= 4903)											
Non-Sami	96	2.5	652	16.9	1360	35.3	1492	38.8	249	6.5	3849
Sami	29	2.8	177	16.8	366	34.7	409	38.8	73	6.9	1054
Family gross income (NOK) (N= 4903)											
Low ≤300 000	28	4.7	134	21.3	225	35.8	197	31.4	44	7.0	628
Medium 301-600 000	48	2.5	316	16.7	714	37.7	706	37.3	111	5.9	1895
High >600 000	49	2.1	379	15.9	787	33.1	998	41.9	167	7.0	2380
Level of education (years) (N= 4903)											
Primary school (0-9)	20	3.9	94	18.4	199	38.9	165	32.3	33	6.5	511
Secondary school (10-12)	39	3.4	198	17.2	456	39.6	392	34.0	68	5.9	1153
College and university ≤4 years (13-15)	27	2.0	239	17.8	440	32.7	534	39.7	105	7.8	1345
Higher college and university >4 years (≥16)	39	2.1	298	15.7	631	33.3	810	42.8	116	6.1	1894
Smoking status (N= 4903)											
Yes, daily	45	4.9	208	22.4	334	36.0	291	31.4	50	5.4	928
Yes, previously or occasionally	41	2.3	301	16.6	650	35.9	714	39.5	104	5.8	1810
No, never	39	1.8	320	14.8	742	34.3	896	41.4	168	7.8	2165

Alcohol consumption past year (N= 4903)											
Less than monthly	64	3.6	358	20.0	643	36.0	617	34.5	106	5.9	1788
Monthly	38	2.1	271	15.0	622	34.4	737	40.8	139	7.7	1807
Weekly	23	1.8	200	15.3	461	35.2	547	41.8	77	5.9	1308
Chronic pain (N= 4903)											
Yes	81	3.5	470	20.4	858	37.1	809	35.0	92	4.0	2310
No	44	1.7	359	13.8	868	33.5	1092	42.1	230	8.9	2593
BMI (kg/m^2) (N= 4903)											
Underweight/normal weight <25	34	1.4	275	11.6	744	31.3	1100	46.3	221	9.3	2374
Overweight 25-29.9	44	2.7	286	17.6	621	38.2	590	36.3	85	5.2	1626
Obese ≥30	47	5.2	268	29.7	361	40.0	211	23.4	16	1.8	903
Somatic disease (N= 4903)											
None	45	1.8	357	14.5	817	33.1	1049	42.5	200	8.1	2468
One or more	80	3.3	472	19.4	909	37.3	852	35.0	122	5.0	2435

[1] – Sample of women excluding missing values
Psychological distress - HSCL-10 score >=1.85
Ethnicity – "I consider myself Sami/Norwegian"
Chronic pain – pain and/or stiffness that has lasted for 3 months
BMI – body mass index
Somatic disease – current or former somatic diseases

3.3 The association between physical activity and psychological distress

Univariate and multivariable logistic regression analyses were performed to examine the crude and adjusted ORs of the PA levels (categorized into five groups) and PD (dichotomized). Table 5 showed almost no difference in OR after adjusting for confounding variables.

3.3.1 The crude model

In the analysis without adjustments (crude), each additional increase of PA was significantly associated with 43% (OR:0.57, p=0.000) less likely odds of having PD. Investigating the different PA levels, the participants reporting PA levels <5-6 were more likely to experience PD. Participants that reported PA level 1-2 had almost three times higher odds (OR:2.99, p=0.000) for having PD compared to those who reported PA level 5-6. Those reporting PA level 3-4 had 77% (OR:1.77, p=0.000) higher odds for experiencing PD compared to PA level 5-6. For participants reporting PA level 7-8 and 9-10, the results indicate 30% and 50% (OR:0.70 and 0.50, p-values of 0.000 and 0.001, respectively) reduced odds of experiencing PD compared to PA level 5-6. All associations between PA and PD were statistically significant at a 5% level.

3.3.2 The adjusted model

After adjusting for potential confounders, the effect estimates remained similar and statistically significant shown in table 5. The adjusted model indicate that each additional increase of PA was associated with 37% (OR:0.63, p=0.000) less likely odds of having PD. Participants who reported PA level 1-2 and 3-4 had close to three (OR:2.98, p=0.000) and 1.76 (p=0.000) times higher odds of experiencing PD compared to PA level 5-6. Those reporting PA level 7-8, had 29% (OR:0.71, p=0.000) reduced odds of experiencing PD. Within the highest PA level (9-10), participants had 50% (OR:0.50, p=0.001) reduced odds of experiencing PD compared to PA level 5-6.

Table 5 - Full model of the association between PA and PD in the total sample from the SAMINOR 2 Questionnaire Survey (83)

Crude model[a]	**n**	**OR (95%CI)**	**p-value**
Physical activity level			
1-2	276	2.99 (2.21-4.10)	0.000
3-4	1567	1.77 (1.47-2.12)	0.000
5-6	3097	1.0	
7-8	3385	0.70 (0.59-0.85)	0.000
9-10	622	0.50 (0.33-0.75)	0.001
Cont.	8947	0.57 (0.53-0.61)	0.000
Adjusted model[b]	**n**	**OR (95%CI)**	**p-value**
Physical activity level			
1-2	276	2.98 (2.20-4.05)	0.000
3-4	1567	1.76 (1.47-2.12)	0.000
5-6	3097	1.0	
7-8	3385	0.71 (0.59-0.85)	0.000
9-10	622	0.50 (0.34-0.74)	0.001
Cont.	8947	0.63 (0.58-0.68)	0.000

Notes: PA categorized into five groups and as a continuous variable (1-10 on the scale). PA level 5-6 is used as the value of reference (1.0). [a]Crude OR. [b]Adjusted for age, income, education, smoking, chronic pain, BMI, and somatic diseases. Values for OR and 95% CI are rounded up to nearest decimal

3.4 The association stratified according to gender and ethnicity

Table 6 presents the adjusted analysis for the association between PA and PD stratified according to gender and ethnicity. The OR for continuous PA between both ethnicities in men were identical (OR:0.59, p=0.000). In non-Sami women, OR for continuous PA was similar to men (OR:0.60 p=0.000), and in Sami women, the OR for continuous PA was 0.78 (p=0.015). Each additional increase of PA was associated with 41% lower odds for having PD in both Sami and non-Sami men (p=0.000). In women, each additional increase of PA was associated with 40% reduced odds for experiencing PD in non-Sami women (p=0.000). Sami women had for each additional increase of PA 22% lower odds for having PD (p=0.015). In the analysis of the different PA level categories, there was a similar trend as the results for the total study sample presented in table 5. In both genders and ethnicities, the OR decreased as the PA level increased. The results of PA level 1-2 and 3-4 showed higher odds for PD, while PA level 7-8 and 9-10 indicated lower odds for PD in all groups compared to the reference group. However, not all results were statistically significant, especially in Sami men and women. None of the OR in Sami women were statistically significant. For Sami men, only PA level 1-2 were statistically significant (OR:3.33, p=0.005). In non-Sami women, PA level 9-10 were statistically non-significant (OR:0.63, p=0.083). For non-Sami men, PA level 7-8 were statistically non-significant (OR:0.72, p=0.093).

Table 6 - Full model of the association between PA and PD, stratified for ethnicity and gender from the SAMINOR 2 Questionnaire Survey (83)

	Men						Women					
	Sami			Non-Sami			Sami			Non-Sami		
Physical activity	**n**	**OR[a] (95%CI)**	**p-value**	**n**	**OR[a] (95%CI)**	**p-value**	**n**	**OR[a] (95%CI)**	**p-value**	**n**	**OR[a] (95%CI)**	**p-value**
1-2	41	3.33 (1.45-7.65)	0.005	110	2.91 (1.70-4.99)	0.000	29	1.73 (0.66-4.60)	0.265	96	3.90 (2.39-6.22)	0.000
3-4	143	1.60 (0.84-3.07)	0.153	595	2.05 (1.45-2.90)	0.000	177	1.43 (0.86-2.36)	0.166	652	1.82 (1.40-2.38)	0.000
5-6	283	1.0		1088	1.0		366	1.0		1360	1.0	
7-8	316	0.63 (0.33-1.20)	0.164	1168	0.72 (0.49-1.06)	0.093	409	0.87 (0.56-1.37)	0.553	1492	0.64 (0.50-0.84)	0.001
9-10	66	0.24 (0.05-1.13)	0.072	234	0.29 (0.10-0.83)	0.021	73	0.59 (0.23-1.50)	0.269	249	0.63 (0.38-1.06)	0.083
Cont.	849	0.59 (0.46-0.75)	0.000	3195	0.59 (0.51-0.66)	0.000	1054	0.78 (0.64-0.95)	0.015	3849	0.60 (0.53-0.67)	0.000

Notes: PA categorized into five groups and as a continuous variable (1-10 on the scale). PA level 5-6 is used as the value of reference (1.0). [a]Adjusted for age, income, education, smoking, chronic pain, BMI, and somatic diseases. Values for OR and 95%CI are rounded up to nearest decimal

4 Discussion

The purpose of this present study was to investigate the association between PA levels and PD among Sami and non-Sami population in Norway. Furthermore, there was an additional aim to investigate whether the association differed between the two ethnic groups and gender in both Sami and non-Sami men and women.

4.1 Summary of findings

The results in this study showed that most of those who had lower level of PA level (<5-6) experienced PD. Participants with higher level of PA (>5-6) reported no experience of PD. The result of logistic regression analysis demonstrated a significant inverse association between higher level of PA and odds of having PD in the total sample. And the association was similar in Sami and non-Sami men and women. Through the different PA levels, PA level <5-6 showed higher odds for PD, while PA levels >5-6 showed reduced odds for having PD in the total sample. There was a small to none difference in the adjusted model, which suggest that there was no interference of the confounding factors (income, education, smoking, chronic pain, BMI, and somatic diseases). The adjusted stratified model showed a similar OR between Sami men (OR: 0.59) and non-Sami men and women (OR:0.59 & 0.60, respectively). Sami women had a somewhat higher OR than the other three groups (OR: 0.78). Both ethnicities and gender reached the level of significance for continuous PA. The results from the different PA levels showed the same estimates as in the total sample, however, several of the effect estimates were statistically non-significant in gender and ethnicities.

4.2 The association between physical activity and psychological distress

PA has shown to promote mental well-being and be effective in preventing PD (2). The current study discovered a clear statistically significant inverse association between PA and PD, and that higher levels of PA is protective of PD. The results demonstrated that for each additional increase of PA, participants had lower odds of experiencing PD in the crude model. These effect estimates, interestingly, remained similar and statistically significant after adjusting for potential confounders. These results build on the existing literature that PA has

shown to reduce the risk of MHP (44). An Australian study found a statistically significant association between moderate to vigorous PA and reduction of PD (45). PA was measured by a self-reported questionnaire on duration, frequency and intensity, whereas PD was measured by the Kessler Psychological Distress scale (46) on depression and anxiety symptoms (45). Furthermore, a Singapore study from 2013 demonstrated that a higher PA level (measured by the validated (51) Global Physical Activity Questionnaire version 2) was associated with protection against PD (measured by the validated (48) General Health Questionnaire) (50). In the current study, reporting higher PA levels (>5-6) indicated that participants experienced lower odds of having PD compared to PA level 5-6. As the estimates of the Australian and Singapore studies support the findings from the current study, will the different instruments to measure PA and PD, make it challenging to compare them.

One study from Britain in 2017 found an association between low PA level (assessed by a validated (47) self-reported questionnaire) and reduced PD (measured by the validated (48) General Health Questionnaire-12) (49). The results from the current study were not similar. In the different PA levels, participants in the lowest PA level (1-2) had almost three times higher odds of experiencing PD. And those with PA level 3-4 had almost doubled their odds for having PD compared to the reference group with PA level 5-6. Then again, the different instruments used for measure of PA and PD, make it difficult to compare that study to the current one. Results from longitudinal studies on the relationship between PA and MH seem to depend on the PA measurement type (32). However, because of the results from the British study, one may discuss that PA in general, no matter level, can be beneficial for reduced PD. Literature suggests that there is a need of producing a more differentiated picture of the PA and MH relationship (55). This due to the association between these two might change in different populations. In addition to different types of PA might associate with different dimensions of MH.

Although not proven, the association between PA and symptoms of anxiety and/or depression is likely to be bidirectional (53). The presence of anxiety- and depression-like symptoms is often referred to as PD (2). To my knowledge, the research is scarce on this topic, and it is not possible to be certain if the association goes in two directions. However, one study on this topic found that there is a bidirectional association between PA and symptoms of anxiety and/or depression (53). PA on a regular basis, reduces the risk of developing symptoms of anxiety and/or depression. On the other hand, having symptoms of anxiety and/or depression

increases the probability of not meeting the recommendations of PA. Another study only found evidence for one direction in this relationship, where PA demonstrated a relationship with depression, but not vice versa (54). In the current study, the hypothesis is that higher PA is associated with less PD, however, in a cross-sectional study design is it not possible to eliminate the possibility that the association can also be the other way around. Future experimental studies to investigate the explanation of possible causalities between PA and PD can be suggested.

In the light of these findings, the effect estimates in the current study seem to be similar with previously published studies described above (45, 50, 52). One can argue on the fact of the different instruments used to measure both PA and PD are not comparable with each other. However, the findings in the different studies might indicate that no matter how one measure PA and PD, the association will still appear. In addition, the different measure instruments may cause different results in the association. For instance, the results from the current study revealed a strong association between lower PA levels and the increased odds of PD. On the other hand, literature also indicate an association between lower PA level and reduced PD (49). All the PA measurements in these studies, including the current one, were self-reported. The use of self-reported PA is often overreported and must be interpreted with caution (37, 38).

4.2.1 Stratified according to gender and ethnicity

To my knowledge, no available studies among Sami and Non-Sami populations regarding the association between PA and PD are available to this date. In the results of the current study investigating gender and ethnicity, the adjusted OR in men regardless of ethnicity and non-Sami women were similar. In Sami women, the result showed a slightly higher OR. Nevertheless, there were found reduced odds of experiencing PD for each additional increase of continuous PA in all four groups. This indicate that the association did not differ between the two ethnicities in men. And overall, the analysis showed a relatively small to none difference in the association of PA and PD between gender and ethnicities. These findings support the hypothesis of this study that there is an association between PA and PD, regardless of ethnic background. Since there is lack of knowledge on this association and it may not be a reason to believe that there are any differences on how PA affects PD. It can rather be that there are different causes to PD in the Sami versus non-Sami populations. This, however, is beyond the aim of the current study to investigate.

The results from the different PA levels between genders showed that both male groups had an increased odds for experiencing PD when reporting lower PA level (<5-6) compared to PA level 5-6. Though, the association in PA level 3-4 among Sami men was not significant. In the two female groups, the effect estimates were similar. However, none of the results reached the level of significance among Sami women. Statistically testing is prone to number of participants (97) and therefore, the non-significant findings might be due to small number of participants in the given PA level when stratified for gender and ethnicity. Similar results were found in a cross-sectional study from Southern Norway (52). They found an increased odds of having mental distress among men reporting low-leisure time PA compared to the rest of the male population (52). In women, no association was found after controlling for possible confounders. In the online study (52), mental distress was measured by the HSCL-5, which has shown to have a high correlation (0.91) with HSCL-10 used in the current study (5, 52). This indicate that the two versions of the HSCL seem equally good to measure PD and may make PD more comparable in these two studies. Moreover, PA was measured by questions reflecting frequency, duration and intensity (52). The instrument used in the online study, and in particular measure of PA, differ from the current study. Therefore, making comparisons between the studies are more challenging.

Several different levels of PA were statistically non-significant associated with PD, especially in Sami men and women. Even though the results in the stratified model showed statistically non-significant results, does it not imply that there is no association between PA and PD in this study sample. For instance, the analyses using PA as a continuous variable clearly showed a statistically significant association between PA and PD in both ethnicities and gender. It is important to address that the observed effect cannot provide an inferential statement about the association (97). However, a possible reason for the non-significant results may be the relatively big difference in participants who were Sami and non-Sami. Also, there was few participants who reported very high and very low PA level. When considering non-significant results, sample size is particularly important for subgroups analyses, which have smaller numbers than the overall study (97). The non-significance results found for one, or both subgroups may only be due to smaller available numbers for the analyses of the subgroups. And in the current study, the subgroups would be gender and ethnicity.

4.2.2 Confounding

Confounding occurs when a factor is associated with both the exposure and the outcome, and is not part of the causal pathway from exposure to outcome (93). Potential factors related to PA and PD in the current study were income, education, age, chronic pain, chronic somatic diseases, smoking status, and BMI. According to literature, levels of PA are often lower in people with chronic health conditions such as chronic pain (29). In addition, chronic pain and somatic diseases are central risk factor for MHP (2). People with low SES report a lower level of leisure-time PA and more sedentary behavior and SES also seems to be a big risk factor for MHP (2, 31). Furthermore, earlier international studies suggest that prevalence of MHP are higher among younger adults than among older people (12). The European ESEMeD-study showed that the 12-month prevalence of MHP was more than twice as high among individuals between 18-24 years compared to individuals in age group 65 years or older (13). From the PA recommendations from the NDH, the level of PA is stable in age group 20-64 years, but decreases after 69 years (28). These factors are likely to be associated with PA and PD, and therefore been adjusted for. Regardless of adjusting for possible confounders or not, a strong association were found between PA and PD in the total sample and in continuous PA among gender and ethnicity.

4.3 Methodological considerations

4.3.1 Information bias

This type of bias, also known as misclassification, is one of the most common sources of bias that affects the health research validity (98). It arises when there is error in measurement of exposure, outcome and other factors (99). In adults, self-report measures of PA tend to have low correlations compared with objective measurements (33-36). Measurements of PA and PD were assessed though a self-reporting questionnaire in the SAMINOR 2 Questionnaire Survey (83). The self-reported PA questions the reliability in this study. Measure PA by self-reported is a subject to response, self-reporting and recall bias (37, 98). Self-reported PA is often overreported (38) and may be overestimated by the participants in this study. In this study, PA was measured using a 10-category scale. The scale has found the be valid as a self-report instrument suitable to differentiate general PA levels among adult women in Norway (86, 87). However, it has not yet been validated among men or populations with Sami ethnicity. In addition, the scale cannot differentiate between intensity, duration, and frequency

of PA (81). Nor the differences in perception of the scale or identify the type of PA. In earlier studies, self-reported PA levels have been reported to differ by marital status (40, 41). Although, these results are currently unclear. As we were not able to obtain data from the SAMINOR 2 Questionnaire Survey (83) on marital status it was not possible to interpret if this factor would have had an impact in this study. Studies using self-reported measures should be interpreted cautiously, particularly when informing public health policy (43).

4.3.2 Selection bias

Selection bias occurs when there are errors in the selection procedure of study participants, and from factors influencing study participation (100). This kind of bias implies that the relationship between exposure and outcome may differ in those who do, and do not participate in the study. The SAMINOR 2 Questionnaire Survey assessed any potential selection bias by analyzing a sub-sample of whom participated in the SAMINOR 1 Survey (58) and who were invited to the SAMINOR 2 Questionnaire Survey but did not participate (83). They compared key characteristics to participants in the SAMINOR 2 Clinical Survey with the answers to non-participants given at the SAMINOR 1 Survey (58). They found that a selection bias by age, gender, education, and income was possible. Even though ethnicity seemed to not affect the participation, they observed that those who considered themselves to be Sami participated to a somewhat greater extent. Because of the lack of ethnic registry data for the total source population, the observation of no evident selection bias by ethnic group must be interpreted with caution (83).

Subgroups analyses have smaller number than the overall study and consequently, subgroups are frequently underpowered (97, 101). This result in a greater probability of false-negative results. Therefore, the subgroup analyses on gender and ethnicity in the current study may question the reliability of the effect estimates. A complete case analysis was done to exclude all missing values (less than 6%) from the data set. Using complete case analysis reduces the statistical power due to reduced sample size and the results may be biased (102, 103). Furthermore, alcohol consumption was excluded by backward selection because it did not contribute statistical significantly into the model. This was done to determine all of the variables that are related to the outcome, to make the model accurate, since each irrelevant regressor decreases the precision of the estimated coefficients and predicted values (104, 105). Although it is not advised to select confounders based solely on statistical significance

testing (106-109), backward selection helps to determine which variables are important early on (105).

4.3.3 Effect modification

The analyses were stratified according to gender and ethnicity; hence they were not treated as confounders. Ethnicity is most commonly used as an entirely social construct, referring to e.g., sharing of a common culture, shared language, attitude, religion, and cultural traditions (89). Ethnicity and gender are not suitable in themselves as confounding factors in this association. Instead, the effect of the exposure in different groups are assessed by effect modification (110). Effect modification is where the association between PA and PD may be different depending on a third variable, for instance gender or ethnicity. Gender was checked for in the model and it did not change the estimates (data not shown).

4.4 Strengths and limitations

A strength of the current study is that PD was measured using HSCL-10 (4) and have previously been shown to be a valid and reliable measurement (5). In addition, in a validation study on the SAMINOR 2 Questionnaire Survey respondents, there appeared no significant variance in the measurement using the HSCL-10 response scale between the ethnic groups included (88). Hence it was used in the same way between the ethnic groups. Furthermore, a strength in this study is that after adjusting for possible confounding factors, the effect estimates remained similar statistically significant. An additional strength is the possibility to investigate ethnic differences within the same geographic regions of Sami and non-Sami municipalities. A limitation in this study is that The SAMINOR 2 Questionnaire Survey (83) had low-response rate of 26.8%, especially in younger men, which raises the question of external validity. Therefore, results must be interpreted with caution and may not be generalizable. The survey suggests that the trends of low response rate and age pattern are line with other population-based studies in Norway (111). In recent years, the willingness to participate in questionnaire-based studies have declined both in Norway and internationally (112). Suspected confounding factors such as age, BMI, education, income, smoking status chronic pain, and chronic somatic disease are adjusted for in this study. However, it is possible that other factors remain not identified and residual confounding may have an impact on the association between PA and PD. Another limitation is that it is a cross-sectional study,

and the data for each individual was collected during the same time period with no follow-up. Therefore, drawing conclusions about causal relationships will not be possible.

5 Conclusion

The current study revealed a statistically significant association between PA and PD among adults in a Sami and Non-Sami population. Participants with lower levels of PA were associated with increased odds of experiencing PD. Reversely, higher levels of PA were associated with reduced odds of experiencing PD. The effect estimates remained similar and statistically significant after adjusting for possible confounders. Between gender and ethnicities, there was small to none difference in the association of PA and PD. The association between continuous PA and PD were significant in these two groups. However, not all effect estimates reached the level of significance in the different PA levels in gender and ethnicities, particularly in Sami men and women. Due to the 10-category scale for PA not being validated among men and in a Sami population, for further research, it would be reasonable to explore the association between PA and PD using other study designs with follow-up data. It is also important to look further into this association for improved public health promotion in the Sami and non-Sami population.

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Appendix 1: Characteristics for the study sample including missing values

Characteristics for the study sample N = 10,753 by physical activity categories. The SAMINOR 2 Questionnaire Survey.

	1-2 (n=342)		3-4 (n=1882)		5-6 (n=3720)		7-8 (n=4030)		9-10 (n=779)		Total (n=10,753)	
	n	%	n	%	n	%	n	%	n	%	n	%
Age groups (years) (N= 10,753)												
18-39	91	3.0	460	15.3	921	30.6	1230	40.9	308	10.2	3010	
40-49	76	3.0	437	17.3	840	33.2	981	38.8	197	7.8	2531	
50-59	99	3.6	511	18.6	972	35.5	1000	36.5	159	5.8	2741	
60-69	76	3.1	474	19.2	987	39.9	819	33.1	115	4.7	2471	
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Psychological distress (N= 10,753)												
No	220	2.3	1542	16.2	3304	34.6	3738	39.2	741	7.8	9545	
Yes	122	10.1	340	28.1	416	34.4	292	24.2	38	3.1	1208	
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Gender (N= 10,753)												
Men	179	3.7	881	18.3	1641	34.1	1745	36.2	372	7.7	4818	
Women	163	2.8	1001	16.9	2079	35.0	2285	38.5	407	6.7	5935	
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Ethnicity (N= 10,172)												
Non-Sami	239	3.0	1412	17.7	2768	34.7	3016	37.8	551	6.9	7986	
Sami	84	3.8	363	16.6	758	34.7	814	37.2	167	7.6	2186	
Missing	19		107		194		200		61		581	5.4
Family gross income (NOK) (N= 10,484)												
Low ≤300 000	90	6.3	308	21.5	512	35.8	422	29.5	100	7.0	1432	
Medium 301-600 000	132	3.3	703	17.7	1435	36.2	1435	36.2	258	6.5	3963	
High >600 000	111	2.2	832	16.3	1679	33.0	2074	40.8	393	7.7	5089	
Missing	9		39		94		99		28		269	2.5
Level of education (years) (N= 10,664)												

Primary school (0-9)	81	5.4	288	19.1	584	38.8	458	30.4	96	6.4	1507	
Secondary school (10-12)	98	3.4	518	18.0	1084	37.7	984	34.2	190	6.6	2874	
College and university ≤4 years (13-15)	81	2.9	502	17.8	916	32.5	1093	38.8	224	8.0	2816	
Higher college and university >4 years (≥16)	79	2.3	556	16.0	1106	31.9	1468	42.3	258	7.4	3467	
Missing	3		18		30		27		11		89	0.8
Smoking status (N= 10,539)												
Yes, daily	109	5.6	463	23.8	713	36.6	578	29.7	84	4.3	1947	
Yes, previously or occasionally	120	3.0	722	18.0	1442	36.0	1489	37.2	231	5.8	4004	
No, never	103	2.2	654	14.3	1500	32.7	1882	41.0	449	9.8	4588	
Missing	10		43		65		81		15		214	2.0
Alcohol consumption past year (N= 10,631)												
Less than monthly	144	4.2	686	19.9	1210	35.1	1144	33.2	259	7.5	3443	
Monthly	91	2.3	614	15.7	1345	34.4	1546	39.5	313	8.0	3909	
Weekly	101	3.1	567	17.3	1121	34.2	1292	39.4	198	6.0	3279	
Missing	6		15		44		48		9		122	1.1
Chronic pain (N= 10,249)												
Yes	194	4.4	949	21.5	1643	37.2	1437	32.5	195	4.4	4418	
No	127	2.2	842	14.4	1893	32.5	2417	41.5	552	9.5	5831	
Missing	21		91		184		176		32		504	4.7
BMI (kg/m^2) (N= 10,601)												
Underweight/normal weight <25	96	2.2	525	12.0	1329	30.4	1945	44.5	474	10.8	4369	
Overweight 25-29.9	109	2.6	753	17.9	1555	36.9	1558	36.9	242	5.7	4217	
Obese ≥30	132	6.6	577	28.6	787	39.1	472	23.4	47	2.3	2015	
Missing	5		27		49		55		16		152	1.4
Somatic disease (N= 10,579)												
None	129	2.4	772	14.4	1724	32.1	2237	41.7	502	9.4	5364	
One or more	207	4.0	1084	20.7	1942	37.1	1732	33.1	268	5.1	5233	
Missing	6		26		54		61		9		156	1.5

Psychological distress - Psychological distress, HSCL-10 score >=1.85
Ethnicity – "I consider myself Sami/Norwegian"

Chronic pain – pain and/or stiffness that has lasted for 3 months
BMI – body mass index
Somatic disease – current or former somatic disease

Sample characteristics for men (N=4818) by level of physical activity categories. The SAMINOR 2 Questionnaire Survey.

	1-2 (n=179)		3-4 (n=881)		5-6 (n=1641)		7-8 (n=1745)		9-10 (n=372)		Total (n=4814)	
	n	%	n	%	n	%	n	%	n	%	n	%
Age group (years) (N= 4818)												
18-39	44	3.8	163	14.1	329	28.6	462	40.1	154	13.4	1152	
40-49	35	3.3	194	18.3	354	33.3	403	37.9	77	7.2	1063	
50-59	58	4.6	257	20.3	437	34.5	439	34.6	76	6.0	1267	
60-69	42	3.1	267	20.0	521	39.0	441	33.0	65	4.9	1336	
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Psychological distress (N= 4818)												
No	123	2.8	750	17.0	1505	34.2	1666	37.8	363	8.2	4407	
Yes	56	13.6	131	31.9	136	33.1	79	19.2	9	2.2	411	
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Ethnicity (N= 4586)												
Non-Sami	126	3.5	675	18.7	1235	34.2	1313	36.3	266	7.4	3615	
Sami	49	5.0	163	16.8	326	33.6	354	36.5	79	8.1	971	
Missing	4		43		80		78		27		232	4.8
Family gross income (NOK) (N= 4714)												
Low ≤300 000	53	8.2	139	21.6	228	35.5	180	28.0	43	6.7	643	
Medium 301-600 000	68	4.0	329	19.2	594	34.6	605	35.2	121	7.0	1717	
High >600 000	53	2.3	395	16.8	781	33.2	928	39.4	197	8.4	2354	
Missing	5		18		38		32		11		104	2.2
Level of education (years) (N= 4776)												
Primary school (0-9)	51	6.0	170	20.1	316	37.4	250	29.6	58	6.9	845	
Secondary school (10-12)	52	3.6	272	18.6	537	36.7	498	34.0	104	7.1	1463	
College and university ≤4 years (13-15)	45	3.6	226	18.2	400	32.2	473	38.1	98	7.9	1242	

Higher college and university >4years (≥16)	30	2.4	203	16.6	375	30.6	511	41.7	107	8.7	1226	
Missing	1		10		13		13		5		42	0.9
Smoking status (N= 4714)												
Yes, daily	55	6.6	217	26.1	310	37.3	228	27.4	21	2.5	831	
Yes, previously or occasionally	70	3.7	368	19.5	687	36.5	656	34.8	102	5.4	1883	
No, never	49	2.5	274	13.7	613	30.7	822	41.1	242	12.1	2000	
Missing	5		22		31		39		7		104	2.2
Alcohol consumption past year (N= 4755)												
Less than monthly	61	4.9	258	20.6	415	33.2	403	32.2	114	9.1	1251	
Monthly	45	2.5	284	16.1	626	35.4	667	37.7	146	8.3	1768	
Weekly	71	4.1	329	19.0	583	33.6	649	37.4	104	6.0	1736	
Missing	2		10		17		26		8		63	1.3
Chronic pain (N= 4588)												
Yes	95	5.4	414	23.6	661	37.6	515	29.3	71	4.0	1756	
No	71	2.5	422	14.9	892	31.5	1159	40.9	288	10.2	2832	
Missing	13		45		88		71		13		230	4.8
BMI (kg/m^2) (N= 4758)												
Underweight/normal weight <25	49	3.2	192	12.7	436	28.9	631	41.8	203	13.4	1511	
Overweight 25-29.9	58	2.5	415	18.1	818	35.6	864	37.6	142	6.2	2297	
Obese ≥30	69	7.3	268	28.2	371	39.1	221	23.3	21	2.2	950	
Missing	3		6		16		29		6		60	1.2
Somatic disease (N= 4763)												
None	70	2.9	353	14.5	766	31.5	992	40.8	251	10.3	2432	
One or more	108	4.6	517	22.2	855	36.7	734	31.5	117	5.0	2331	
Missing	1		11		20		19		4		55	1.1

Psychological distress - Psychological distress, HSCL-10 score >=1.85
Ethnicity – "I consider myself Sami/Norwegian"
Chronic pain – pain and/or stiffness that has lasted for 3 months
BMI – body mass index
Somatic disease – current or former somatic disease

Sample characteristics for women (N=5935) by level of physical activity categories. The SAMINOR 2 Questionnaire Survey.

	1-2 (n=163)		3-4 (n=1001)		5-6 (n=2079)		7-8 (n=2285)		9-10 (n=407)		Total (n=5935)	
	n	%	n	%	n	%	n	%	n	%	n	%
Age group (years) (N= 5935)												
18-39	47	2.5	297	16.0	592	31.9	768	41.3	154	8.3	1858	
40-49	41	2.8	243	16.6	486	33.1	578	39.4	120	8.2	1468	
50-59	41	2.8	254	17.2	535	36.3	561	38.1	83	5.6	1474	
60-69	34	3.0	207	18.2	466	41.1	378	33.3	50	4.4	1135	
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Psychological distress (N= 5935)												
No	97	1.9	792	15.4	1799	35.0	2072	40.3	378	7.4	5138	
Yes	66	8.3	209	26.2	280	35.1	213	26.7	29	3.6	797	
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Ethnicity (N= 5586)												
Non-Sami	113	2.6	737	16.9	1533	35.1	1703	39.0	285	6.5	4371	
Sami	35	2.9	200	16.5	432	35.6	460	37.9	88	7.2	1215	
Missing	15		64		114		122		34		349	5.9
Family gross income (NOK) (N= 5770)												
Low ≤300 000	37	4.7	169	21.4	284	36.0	242	30.7	57	7.2	789	
Medium 301-600 000	64	2.8	374	16.7	841	37.4	830	37.0	137	6.1	2246	
High >600 000	58	2.1	437	16.0	898	32.8	1146	41.9	196	7.2	2735	
Missing	4		21		56		67		17		165	2.8
Level of education (years) (N= 5888)												
Primary school (0-9)	30	4.5	118	17.8	268	40.5	208	31.4	38	5.7	662	
Secondary school (10-12)	46	3.3	246	17.4	547	38.8	486	34.4	86	6.1	1411	
College and university ≤4 years (13-15)	36	2.3	276	17.5	516	32.8	620	39.4	126	8.0	1574	
Higher college and university >4 years (≥16)	49	2.2	353	15.8	731	32.6	957	42.7	151	6.7	2241	
Missing	2		8		17		14		6		47	0.8
Smoking status (N= 5825)												
Yes, daily	54	4.8	246	22.0	403	36.1	350	31.4	63	5.6	1116	

Yes, previously or occasionally	50	2.4	354	16.7	755	35.6	833	39.3	129	6.1	2121	
No, never	54	2.1	380	14.7	887	34.3	1060	41.0	207	8.0	2588	
Missing	5		21		34		42		8		110	1.9
Alcohol consumption past year (N= 5876)												
Less than monthly	83	3.8	428	19.5	795	36.3	741	33.8	145	6.6	2192	
Monthly	46	2.1	330	15.4	719	33.6	879	41.1	167	7.8	2141	
Weekly	30	1.9	238	15.4	538	34.9	643	41.7	94	6.1	1543	
Missing	4		5		27		22		1		59	1.0
Chronic pain (N= 5661)												
Yes	99	3.7	535	20.1	982	36.9	922	34.6	124	4.7	2662	
No	56	1.9	420	14.0	1001	33.4	1258	41.9	264	8.8	2999	
Missing	8		46		96		105		19		274	4.6
BMI (kg/m^2) (N= 5843)												
Underweight/normal weight <25	47	1.6	333	11.7	893	31.2	1314	46.0	271	9.5	2858	
Overweight 25-29.9	51	2.7	338	17.6	737	38.4	694	36.1	100	5.2	1920	
Obese ≥30	63	5.9	309	29.0	416	39.1	251	23.6	26	2.4	1065	
Missing	2		21		33		26		10		92	1.6
Somatic disease (N= 5834)												
None	59	2.0	419	14.3	958	32.7	1245	42.5	251	8.6	2932	
One or more	99	3.4	567	19.5	1087	37.5	998	34.4	151	5.2	2902	
Missing	5		15		34		42		5		101	1.7

Psychological distress - Psychological distress, HSCL-10 score >=1.85
Ethnicity – "I consider myself Sami/Norwegian"
Chronic pain – pain and/or stiffness that has lasted for 3 months
BMI – body mass index
Somatic disease – current or former somatic disease