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Master's in public health – Master thesis

Association between participation in organized activity and loneliness among adolescents in Tromsø municipality - A cross sectional study

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Foreword

I always enjoyed participating in various of organized activities, which is mainly because I found this topic highly interestingly to investigate on. My background as an occupational therapist made me interested to investigate the phenomenon of *participation*.

I want to gratefully thank my supervisors through this master thesis period. Thank you, Kristin Benjaminsen Borch who has been helpful through this whole period, both before but also during writing the thesis. Constructive feedback throughout, but along the line of providing me with enough confidence and motivation to get through this. Thank you, Jagrati Jani-Bølstad for being supportive and helpful regarding the research material, and for providing specific and constructive feedback during this master thesis. I also want to thank another teacher in the course, Marko Lukic, which has been of valuable help regarding statistics.

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Abstract

Background

Loneliness is a common subjective feeling. We might feel lonely, but still engage and interact in social groups, and we can be alone and live happily with this. Participation in organized activity might reduce mental health challenges through social mechanisms, with the opportunity of developing life skills and social relationships. To my knowledge, no previous studies have investigated the direct association between participation in organized activity and self-reported feelings of loneliness.

Aim

The main aim of this study is to investigate the association between participation in organized activity and self-reported feelings of loneliness among adolescents, aged 13-16 in Tromsø municipality.

Method

This is a quantitative study with a cross-sectional design based on the Norwegian Ungdata survey conducted in 2018. Ungdata is a national survey conducted in each municipality. Binary logistic regression was performed to investigate the association between organized activity and reported feelings of loneliness.

Results

The results showed higher odds (Odds Ratio (OR) 1.23, 95% CI: 0,98-1,54) in the unadjusted model of reporting feeling lonely, having participated in organized activity compared to those who currently participated. Adjusting for co-variables, the association was attenuated and resulting in an OR of 1.06 (95% CI: 0,78-1,43) of reporting feelings of loneliness having previously participated in organized activity, compared to the reference category.

Conclusion

There are no statistically significant associations between participation in organized activity and reported feelings of loneliness, among adolescents in Tromsø. Results implies that it is higher odds of feeling lonely previously participating in any organized activity. Further research should be considered, to find out and solve the root causes of why adolescents are quitting doing organized activity and invest in interventions that might act as preventive.

Shortenings

CDC - Center for disease control and prevention

CI – Confidence interval

FAS – Family affluence scale

KoRus – Kompetansesentre innen rusfeltet

NSD/SIKT - Norwegian Center of Research Data

Odds Ratio – OR

REK - Regional committee of medical and health science research ethics

SES – Socioeconomic status

SEP – Socioeconomic position

Introduction

1.1 Background

1.1.1 Mental health and loneliness

Public health challenges related to mental health is a burden worldwide (Sagatun, Sjøgaard, Bjertness, Selmer & Heyerdahl, 2007). Mental health challenges can decrease the quality of life, increase health care costs, and are also associated with lower work productivity (Twenge, Haidt, Blake, McAllister, Lemon & Le Roy, 2021). Mental health challenges are also one of the leading causes to health-related disabilities among children and adolescents (Boelens, Smit, Raat, Bramer & Jansen, 2022). Globally, there is an increase of loneliness among adolescents between 15-16 years of age (Twenge et al, 2021). Although, this trend of loneliness is not directly related to the participation in organized activity, but due to other factors (Twenge et al, 2021). Factors like implementation and use of smartphones and increasingly internet-use, these factors seemed to have a negative influence on loneliness among adolescents (Twenge et al, 2021).

Mental health is a broad term, including different symptoms and conditions. According to Hoffmann, Barnes, Tremblay & Guerrero (2022), mental health is defined as *“a state of well-being where a person realizes their own abilities, can cope with the common stresses of life, can work in a productive manner and is able to contribute to their community”* (Hoffmann et al, 2022). Loneliness is not specifically defined as a mental health problem, but it is associated with poor mental health and conditions like anxiety, depression, low self-esteem, sleep problems and increased stress (Mind, 2019). Mental health and loneliness have a strong link, as they both can have an impact on each other, a bi-directional association (Mind, 2019). Mind (2019) presented an illustration that show how loneliness negatively can impact mental health in general, and how the mental health can impact feelings of loneliness (Mind, 2019). Being lonely could cause other mental health challenges, and mental health challenges can lead to feelings of loneliness (Mind, 2019). A previous study has described loneliness as a *“modern behavioral epidemic”* influencing an individual’s both mental and physical health (Keyes, Gradidge, Gibson, Harvey, Roeloffs, Zawisza & Forwood, 2023).

Loneliness is a rather common experience and is a subjective feeling. An article from 2010 presented that 80% of adolescents under 18 years of age experienced feeling lonely at one

point (Hawkley & Cacioppo, 2010). All individuals in a society can experience lonely feeling (Hawkley & Cacioppo, 2010). Loneliness is personal and individual feelings. One common description is that loneliness occurs when demands for social contact and relationships are not met. Feeling different, misunderstood, useless or experiencing a difficult situation in life might influence feelings of loneliness (Helsedirektoratet, 2022). Although loneliness is a common subjective experience, it is difficult to define (Hawkley & Cacioppo, 2010). According to Hawkley (2022), the definition of loneliness is “*the distress that accompanies a perceived discrepancy between desired and actual social relationships*” (Hawkley, 2022). Being alone does not make you lonely immediately; one might feel lonely, but still engage and interact with peers in social groups, and one can be alone without other people and live happily with this (Mind, 2019; Hawkley, 2022). This is also supported by Hawkley & Cacioppo, which presents that one can live a quite antisocial life and still don't feel lonely, where others rely on a rich social life, still can have a feeling of loneliness (Hawkley & Cacioppo, 2010).

Consequences of loneliness can affect cognition, emotions, and behavior (Hawkley & Cacioppo, 2010). Loneliness or being social isolated, increases the risk of being vulnerable for physiological processes. Sleep quality is one example of these physiological processes that has been presented. Additionally, an increased risk of morbidity and mortality has also been associated with loneliness or social isolation (Hawkley & Cacioppo, 2010).

In addition, loneliness can diminish the capacity for self-regulation. Self-regulation is of importance to accomplish social norms and personal goals due to regulation of one's thoughts, feelings, and behaviors (Hawkley & Cacioppo, 2010). Regulation of emotions can increase the ability of behaviors, such as the level of physical activity (Hawkley & Cacioppo, 2010). Furthermore, physical activity is a well-known factor for physical health, mental health, and cognitive function. Diminished self-regulation of emotions might contribute to less engagement in health-promoting behaviors (Hawkley & Cacioppo, 2010).

A Finnish prospective follow-up study examined the simultaneously effects of social isolation and loneliness on mortality (Tanskanen & Attila, 2016). This study revealed evidence of an association between social isolation and mortality, whilst effects of loneliness on mortality was nonsignificant when studied simultaneously with social isolation (Tanskanen & Attila, 2016). Previous literature distinguishes between loneliness and social isolation (Tanskanen & Attila, 2016). According to Center for disease control and prevention (CDC) (2021),

loneliness is the subjective feeling of being alone, regardless of the amount of social contacts, while social isolation is related to the lack of social connections in an objective point of view (CDC, 2021). Social isolation is also reported by CDC as a potential risk factor for loneliness for some (CDC, 2021). This implies that it could be necessary with awareness related to social isolation's influence on people's health related to loneliness.

According to a study by Cacioppo, Hawkley, Ernst, Burleson, Berntson, Nouriani & Spiegel (2006), loneliness is closely connected to depression – but these are separate concepts and constructs (Cacioppo et al, 2006). This study reveals that those young adults who are feeling lonely, also have lower levels of optimism, social skills, support, mood, and emotional stability (Cacioppo et al, 2006). In addition, loneliness can be understood with different perspectives; social and emotional loneliness (Baumeister & Leary, 1995). Feelings of social loneliness occurs when a person has insufficient amount of social interactions, while emotional loneliness happens when there is a lack of meaningful and intimate relatedness (Baumeister & Leary, 1995).

The literature reports several factors which possibly can contribute to loneliness. Living alone, having fewer social contacts and restricted opportunities to establish and develop social relationships is some of them (De Araújo Pinto, Asante, Dos Santos Puga Barbosa, Nahas, Dias, & Pelegrini, 2021). Loneliness is a predictor for a decrease in several activities, while for instance physical activity is considered a protective factor for peoples' mental health (Hawkley, Preacher and Cacioppo, 2007). Lonely individuals may have a reduced motivation of engagement in activities (Hawkley et al, 2007).

1.1.2 Organized activity and mental health

Physical activity and mental well-being are both essential for a healthy development in adolescence, which impacts the quality of life later in life (Guddal, Stensland, Småstuen, Johnsen, Zwart, & Storheim, 2019). Maintenance of physical activity for adolescents and through adolescence is important to reduce occurrence of mental health challenges (Guddal et al, 2019). It is of importance both for the individual self, related to both physiological and psychological aspects, but also in a public health perspective (Guddal et al, 2019). Previous research reports that physical maintenance is related to mental health; as poor mental health in adolescence tends to continue into adulthood (Guddal et al, 2019). In addition to physical

activity, organized activity is reported to act as a preventive factor for mental health challenges for adolescents (Boelens et al, 2022).

Being an active individual, being a part of sports and other variations of organized activity offers a great possibility of engaging in a venue which could increase social well-being (Keyes et al, 2023). This might possibly have an influence on adolescents' mental health, and thus, reduce feelings of loneliness in the line of improved mental health (Keyes et al, 2023).

Participation in organized activities can provide benefits both for the individual and the community (Khasnabic, Heinicke Motsch & Achu, 2010). For instance, sports activities provide an enjoyable way to improve well-being, which includes stress relief and improvement of both physical and mental health (Khasnabic et al, 2010). Development of both physical and social skills is often related to being a part of organized activity (Khasnabic et al, 2010). Organized activities and sports are also a place for people to increase the social inclusion, bringing several of people with different abilities together – a place where one can use a set of physical and social skills which can be further developed through participation in organized activities (Khasnabic et al, 2010).

In principle, organized youth sports are sporting program led by adults which involves engagement from children, adolescents, and young adults (Vella, Swann, Allen, Schweickle & Magee, 2016). In organized sports, individuals attend organized training, workouts, and competitive fixtures under the formal guidance from an adult leader. Participants are typically arranged into teams to participate in both leagues and competitions where this is suitable. Organized sports arrangements usually occur outside the school context (Vella et al, 2016).

Around the globe, the popularity regarding organized sport remains high. Approximately 2/3 of all children and adolescents participates in organized sports (Vella et al, 2016). This was presented in a cohort follow-up study among Australian children, with a mean age of 12,4 years (Vella et al, 2016). As mentioned above, engagement in organized sports is a suitable and attractive venue for the development of social skills and the prevention of mental health challenges for children and adolescents (Vella et al, 2016).

A systematic review found, through 30 eligible studies that there is a consensus that participation in sports for adolescents is related to improved health (Eime, Young, Harvey, Charity & Payne, 2013). This is compared with other types of leisure-time physical activities.

This systematic review highlights that most of those studies included were cross-sectional studies, which cannot conclude with any causality (Eime et al, 2013).

Engagement in sports and organized activity seems to have a positive effect on children and adolescence's mental health (Murray, Sabiston, Doré, Bélanger, & O'Loughlin, 2021). For instance, organized sports and activity increases physical activity levels, which contributes to feelings of social identity through interactions with peers (Murray et al, 2021). The social support gained from interactions with others, is related to better mental health overall. Sport improves both confidence and self-esteem. Additionally, improvement of psychological mechanisms; like changes in neurotransmitters associated with emotions such as dopamine and serotonin (Murray et al, 2021). Taking part in organized sports may reduce the risk of depression, which have been presented as a risk factor for loneliness (Hutten, Jongen, & Hajema, 2021). The association between engagement in sport and mental health appears to be stronger in a team, compared to individual physical activity and mental health (Murray, et al, 2021).

Results from Murray et al (2021) is also supported by Hoffmann et al (2022), presenting that team sport participation is an effective protection against the development of mental health challenges, because of the possibility of social interactions (Hoffmann et al, 2022). This study presents results that those adolescents who are engaging in individual sports had higher levels of mental health outcomes (i.e., anxiety, depression and and social problems) compared to participation in team sports (Hoffmann et al, 2022).

A prospective longitudinal study from Canada found bi-directional associations between participation in sports and social anxiety and loneliness. Sport participation predicted lower social anxiety and loneliness for adolescents from 13-16 years of age (Brière, Yale-Soulière, Gonzalez-Sicilia, Harbec, Marizot, Janosz & Pagani 2018). A cross-sectional study conducted in Norway investigated if social competence mediated a relationship between loneliness and participation in organized sports (Haugen, Säfvenbom & Ommundsen, 2013). This was done using adolescents with a mean age of 15,3 years in 38 schools in Norway (Haugen et al, 2013). Results showed that higher sports participation was associated with lower levels of loneliness. This association was evident after controlling for other variables like age, sex, and non-organized physical activity (Haugen et al, 2013).

Experiences with peers are believed to decrease the risk of symptoms related to psychological distress; social anxiety, sadness, and isolation (Brière et al, 2018). According to Brière et al (2018) sport participation might have an influence on these experiences. Sport participation might reduce distress through social mechanisms, with individuals in sports actualize their strengths and potential through the opportunity of developing life skills and relationship with others, both peers and adults (Brière, et al, 2018). Additionally, participation in team sports produces greater psychological gains compared to individual sports, mainly because of the opportunity to practice social skills and enhancing relationships (Brière, et al, 2018).

Touching into various of types of activity above, a study conducted in United Kingdom examined the possible association between attending live sporting events, engaging as passive member, and loneliness (Keyes, et al, 2023) Being exposed for the opportunity of social interactions, and belonging to a social group, there are reasons to believe that this could influence the occurrence of loneliness (Keyes et al 2023).

On the other hand, it is not only positive or improved psychological outcomes reported in previous literature. A study reported that participation in organized sports also has been associated with increased occurrence of difficulties such as stress, burnout, and immoral behavior (Vella et al, 2016). Interestingly, there is a question of which direction the results are pointed towards, is it so – that loneliness could decrease due to the participation in organized sports, or is it that the nature of organized sports could increases loneliness? The direction of many of the reported associations remains unclear, as most studies are cross-sectional studies (Vella et al, 2016).

1.2 Aim

1.2.1 Rationale for the study

Previous research indicates that there are reasons to believe that increased participation in activities could decrease mental health challenges. Several of these studies examines the broader perspective of mental health and include a variety of other factors like self-esteem, life satisfaction, peer problems, depression, and anxiety (Guddal et al, 2019; Sagatun et al, 2007; Murray et al, 2021). Additionally, studies do connect mental health to organized sports, but also the relationship between mental health and general physical activity.

Studies have been conducted worldwide, both in Norway and other countries. Other countries like for instance Canada, Brazil and United States have published studies who investigate the link between mental health and organized activity (Murray et al, 2021; Pinto et al, 2019; Hoffmann et al, 2022). To my knowledge, none of these studies have examined the direct association between organized activities and loneliness.

Further, no studies have presented this particular focus in the local community and municipality of Tromsø. There has been a couple of studies done in Norway during the last 5-6 years, which has examined different aspects related to the association between physical activity or organized activity and psychological concepts. Carlsen (2021) found that increased physical activity reduced loneliness among students above 18 during the COVID pandemic, whereas Guidon (2017) found that being included in organized activity resulted in stronger psychological resiliens, connection and motivation (Carlsen, 2021; Guidon, 2017).

According to a previous report from Ungdata in 2018, 11% of the adolescent population between 13-16 years of age in Tromsø are feeling very lonely, while 12% reported moderate feelings of loneliness (NOVA, 2018). Both numbers are higher compared to the national Ungdata numbers, of 9 and 11%, respectively (NOVA, 2018). Numbers from Tromsø in 2021 showed that those who felt very lonely was 12%, and those who felt moderate feelings of loneliness was 16% - both numbers from 2021 is also higher than the national numbers (NOVA, 2021).

Mental health conditions are estimated to be one of the leading global burdens of disease for adolescents, and organized youth sports is to reportedly one of the most popular activities in the world (Vella, 2019). Most research related to this topic are focusing into the association between either physical activity in general and loneliness, or mental health in general in relation to sports engagement.

1.2.2 Main aim of the study

The main aim of this study is to investigate if there is an association between loneliness and the participation of organized physical activity among adolescents, aged 13-16 in Tromsø, using Ungdata from 2018. This is a rather small study among Ungdata's surveys, with students from 8th-10th grade of a lower secondary school, in Tromsø. This survey has also been conducted in 2014, which making it a possibility of compare results over the years. In general, we do not have enough knowledge of the consequences constructed by the global COVID-19 pandemic. One of the reasons behind choosing the survey from Ungdata conducted in 2018, is because of the disruptions caused by the pandemic. The pandemic, which occurred in the early start of 2020, may had a strong influence on adolescents life, both on social, mental, and physical dimensions. The main reason related to this is that the opportunity of participating in organized activity was disrupted because of this pandemic, which makes it difficult to investigate the association between participation in organized activity and reported feelings of loneliness at that point in time. By examining the association between participation in organized activity and reported feelings of loneliness in the Ungdata survey from 2018, we could contribute to an increase in knowledge of loneliness among adolescents in a pre-pandemic setting.

1.3 Research question

Is there an association between participation in organized activity and self-reported feelings of loneliness among adolescents in Tromsø municipality?

2 Materials and methods

2.1 Study design

This is a quantitative study with a cross-sectional design. Cross-sectional studies are studies where observations are undertaken at a single point in time (Thelle, 2015). In general, they are used both descriptively and analytically. This study is analytical. In this study design, the individuals are not being followed over time, but only measured at one specific moment of time (Alexander, Lopes, Ricchetti-Masterson & Yeatts, n.d). This thesis is based on a survey from Ungdata conducted in 2018, this is further described in the next section.

2.2 UNGDATA 2018

Ungdata is a qualified and secure system through the implementation of local surveys among students in primary and secondary high schools in Norway (Frøyland, 2017). Through thorough mapping of the local situation for adolescents, Ungdata surveys is well established to be applied in community-based work, related to public health and preventive actions the community (Frøyland, 2017).

The Ungdata survey from 2018 contains 23 different topics and provides an illustration of the usual habits for adolescents. The research institute “*Velferdsforskningsinstituttet NOVA*” and seven different regional competence centers within the addiction field “*Kompetansesentre innen rusfeltet*” (KoRus) are responsible for the Ungdata survey. It is done in collaboration with municipalities in Norway (NOVA, 2018). Ungdata’s intention is to examine the most central fields of adolescents daily lives and behavior (NOVA(a), n.d). The survey contains questions regarding quality of life, friends, activities, health and relationships with both peers and family (NOVA(a), n.d). This survey is carried out for elementary school, lower secondary school, and upper secondary school. Ungdata maps different daily habits adolescents have both at school, but also outside the school setting. The items in the questionnaire contain questions regarding alcohol, smoking status, physical activity levels, and other types of leisure activities. Students are questioned about their family’s wealth and economic position, and how their homes are established. Other topics that the Ungdata survey includes are related to family, friendships, school and local environments, health, bullying, and rule breaking (NOVA, 2018). In general, there is established a basic module, which each municipality needs to implement, with having the possibility to carry out extra and more thorough modules if necessary. Results from the Ungdata survey could be used design interventions for the

municipality, to improve the health in the young population taking local differences into account when implementing changes in the future (NOVA, 2018).

2.2.1 Participants

In 2018 all students in lower secondary school were invited to answer the Ungdata survey in Tromsø. In total, 1908 adolescents between 13-16 years of age answered the self-administered questionnaire. These 1908 adolescents resulted in a response rate of 82% in total, in Tromsø (NOVA, 2018). The survey is electronically, takes place anonymously at school, with supervision of a teacher present in the classroom. It has a duration of 30-45 minutes in total. It is anonymous and it is voluntarily, and all are invited to join. Parents are informed beforehand, and they are informed by the school if they do not consent that their child cannot participate (NOVA, 2018).

2.2.2 Inclusion/exclusion

Inclusion criteria of this study is adolescents living in Tromsø in the age between 13-16 years of age, attending 8th-10th grade in the lower secondary school in 2018, in Tromsø. Elementary school children, children from the age of 10-13 years of age and adolescents in upper secondary school are excluded from this study. Among the 1908 adolescents who answered the survey, students which systematically have answered with nonsense answer were removed (figure 1). Furthermore, respondents are excluded the more co-variables that are included. In the flow chart (figure 1) an overview of the sample is presented that were included in the final analyses in this thesis. Missing observations are presented in descriptive tables in the appendix.

2.2.3 Flow chart

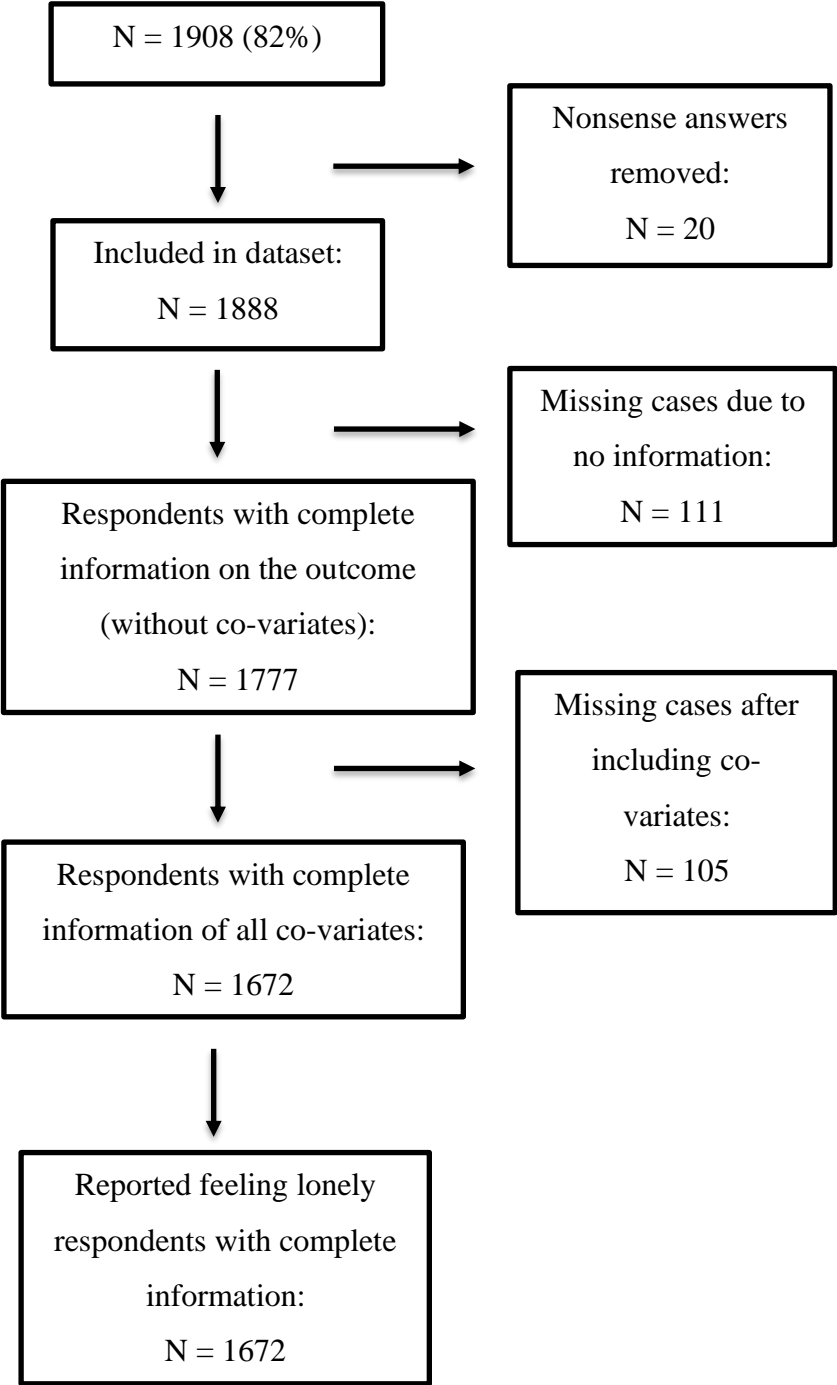


Figure 1: Flow chart of respondents included in analyses, Ungdata 2018, Tromsø municipality

2.2.4 Variables

The questionnaire contains several items covering different topics. In this thesis topics, it is a more narrow and direct focus; the focus lies within factors which are related to participation in organized activity and the association with reported feelings of loneliness.

2.2.4.1 Main outcome variable

The outcome variable in this thesis is reported feelings of loneliness. It is questioned as *“during the previous week, have you ever felt lonely?”* (Ungdata, 2018). The question of loneliness is answered by *“not at all”*, *“a little bit”*, *“moderate feelings of loneliness”* and *“feeling very lonely”* (Ungdata, 2018).

2.2.4.2 Main exposure variable

The exposure variable is formulated with the following question: *“Are you, or have you ever been, in an organization, clubs, teams or organizations after the age of 10?”* (Ungdata, 2018). The question of participation in organized activity is answered by *“Yes, I am participating now”*, *“No, but I used to participate”* and *“No, never”* (Ungdata, 2018). This implies that organized activity is not specified, but varies between organizations, teams, and clubs.

2.2.4.3 Co-variates

The questionnaire in the Ungdata survey contains other variables that potentially influence the association between participation in organized activity and feelings of loneliness. Co-variates will be controlled and adjusted for in the analyses. Variables of interests is related to socioeconomic status (SES), smoking habits, alcohol intake, bullying, feelings of depression, anxiety and stress and other activities during leisure time. These factors are confirmed through previous research (Hoffmann et al, 2022; Guddal et al, 2019; Murray et al, 2021; Sagatun et al, 2007). Co-variates are described below.

Feelings of sadness, unhappiness, or depression

This question is a part of the section of mental health issues in the Ungdata survey. The question is formulated “*during the previous week, have you ever felt sad, unhappy or depressed?*”. Measurements are answered with “*not at all*”, “*a little bit*”, “*a lot*” and “*very much*”, the same as the main outcome in this thesis.

Bullying

The questionnaire contains three different questions to measure bullying; “*Does it occur that you are a part of bullying, threats or ostracism of peers at school or in leisure-time?*”, “*Are you bothered being bullied, threatened or do you experience ostracism in school or in leisure-time?*” and “*Are you being bullied, threatened or excluded online?*”. Measurements are answered with “*yes, several times a week*”, “*yes, once a week*”, “*yes, every other week*”, “*yes, once a month*”, “*seldom*” and “*never*”. In this thesis “*are you bothered being bullied, threatened or do you experience ostracism in school or in leisure-time?*” will be used.

Smoking and intake of alcohol

Smoking status was asked “*Do you smoke?*” and is answered by: “*Never*”, “*used to, but I quit*”, “*weekly, but not every day*” and “*daily smoking*”.

Alcohol consumption question had the following answer categories; “*never*”, “*only tasted a few times*”, “*Now and then, but not monthly*”, “*1-3 times a month*” and “*weekly*”.

Exercise

Participants are asked to think about which types of activities they have done during the previous week, in leisure time. One of these questions is formed as “*Do you exercise on your own?*”. It’s frequency is answered with “*none*”, “*once*”, “*2-5 times*” and “*6 times or more*”.

Socioeconomic position (SEP)

In the Ungdata survey, one of these variables, participants are asked “*During the previous 2 years, have your parents had good or bad economy?*”. Options of answers is “*very good*”, “*good*”, “*neither*”, “*quite low*” and “*very low*”.

Additionally, measurements of participants’ SEP is measured in a combined status regarding parental resources (Bakken, Frøyland & Sletten, 2016). SEP combines the level of education, number of books and the family’s wealth; a module named “*Family Affluence Scale*” (FAS) (Bakken et al, 2016). In analyses all answers are coded from 0-3, and it is calculated a mean

score of all three parts. For instance, both parents with higher education gives a score of 3, if only one of them has higher education the score is 1,5 and if none of them has higher education the score is 0 (Bakken et al, 2016). FAS includes four different questions which all have scores from 0-3; all of these are calculated into one score of FAS. Questions which are included is “*Does your family has a car?*”, “*Do you have your own bedroom?*”, “*How many times have you travelled on vacation during the previous year?*” and “*How many computers does your family has?*” (Bakken et al, 2016).

2.3 Analysis

IBM SPSS Statistics version 28.0 was used for statistical analyses. Confidence interval (CI) is 95%, making threshold level at 0,05 for statistically significance. Descriptive tables with the demographic characteristics regarding the participants are presented with numbers and percentages in table 1. Characteristics related to co-variates are presented in descriptive tables (table 2). There has been done adjustments by using other co-variates in various analyses, which potentially could influence the results of interest.

The variables “*bullying*” and “*exercise*” was recoded from 6 to 4 options of answers. For “*bullying*” the regular answers of 2 and 3 were recoded into “2”, which indicates “*occasionally*”, previously being “2 = *Weekly*” and “3 = *Every two weeks*”. Previous answer of “4 = *Once a month*” and “5 = *Almost never*”, are recoded into “3 = *Seldom*”.

For “*exercise*”, answer option “2 = *Seldom*” and “3 = *1-2 times a month*” were recoded into “2 = *Seldom*”. Additionally, recoding 5 and 6 into “4 = *Often*”, being “5 = *3-4 times a week*” and “6 = *More than 5 times a week*” initially.

2.3.1 Logistic regression

Binary logistic regression analysis was conducted to investigate the association between participation of organized activity and reported feelings of loneliness. A binary logistic regression approach was used because of recoding loneliness into two different variables. The outcome variable was recoded in two ways to make it possible to do binary logistic regression with a dichotomous outcome variable (Pallant, 2016). The outcome variable, feelings of loneliness was categorized into a dichotomy variable (yes/no) as “*not bothered at all*” in one category, whereas “*a little bit*”, “*moderate feelings of loneliness*” and “*feeling very lonely*” collapsed into one category.

“*Yes, I am participating*” was chosen as the reference category in the analysis, regarding the exposure variable; participation in organized activity. The first recoding was used in the analyses for the main results. Results is presented in two different models; these models are described below.

The second recoding is presented in appendix. Loneliness was categorized as «*not bothered at all*” and “*a little bit*” in one category, whereas “*moderate feelings of loneliness*” and “*feeling very lonely*” was put into the second category. Both analyses are compared and further assessed in the section of results in the thesis. Further assessment is done after the results including all co-variates in the equation.

1st recoding	2nd recoding
1 = “Not bothered at all”	1 = “Not bothered at all” and “a little bit”
2 = “A little bit”, “moderate feelings of loneliness” and “feeling very lonely”	2 = “Moderate feelings of loneliness” and “feeling very lonely”

2.3.1.1 Model 1

In model 1 all the included co-variates were adjusted for in the binary logistic regression analysis. These co-variates were feelings of sadness, unhappiness or depression, smoking status, and alcohol intake, bullying, exercise, and socioeconomic status.

2.3.1.2 Model 2

Model 2 only included those co-variates which contributes statistically significance to explain the model 1, and these co-variates was included in model 2 of the binary logistic regression analysis.

2.4 Ethics

It is voluntary to participate in the Ungdata survey (NOVA(b), n.d.). Students are free to choose if they want to complete it or skip certain parts of the survey (NOVA(b), n.d.). At lower secondary school, collected data is anonymous, which makes it impossible to identify any of those individuals who completes the survey. Parents of individuals under the age of 18 have the right to decline the participation of the survey (NOVA(b), n.d.). To use already

collected data, there is no need for an approved application for appraisal. In this case, there was no need for an application to the “*Regional committee of medical and health science research ethics*” (REK). In addition, as the data is anonymous and aggregated data, “*Norwegian Center of Research Data*” (NSD/SIKT) approval was not applied for.

2.4.1 Data storage

This data is stored in a personal computer, with a two-step authentication process with personal password with no access for others, after a signed application for the necessary data. Before the data was applied for, a protocol of this project was developed and approved by the master program at UiT Arctic University of Norway. Collected data is retrieved from NSD/SIKT, and the agreement of having the data until 2024 has been signed. Data will be deleted after the period of agreement.

3 Results

3.1 Descriptive statistics

In this section, various tables of descriptive characteristics and figures of characteristics of the population in the Ungdata survey are presented with numbers and percentages. In table 1, results are presented for adolescents’ feelings of loneliness, containing demographic description of gender and grade, where grade represents age.

Girls reported more lonely feelings than boys in general (table 1). 49% of the respondents who answered the survey was boys, 51% were girls. Among boys, 5,6% reported feeling very lonely and 11,7% reported moderate feelings of loneliness. 65,6% reported not being bothered with loneliness at all. Girls who reported feeling very lonely was 16,4% and 15,1% reported having moderate feelings of loneliness. 41,1% among girls reported not being bothered with loneliness at all.

Table 1: Demographic characteristics of the study population, Ungdata 2018, Tromsø municipality, related to feelings of loneliness

During the previous week, have you ever felt lonely?

	Total N (%)	Not bothered at all (1)	A little bit (2)	Moderate feelings of loneliness (3)	Feeling very lonely (4)
Total N (%)	1672 (100%)	888 (53,1%)	402 (24%)	195 (11,7%)	187 (11,2%)
Gender					
Boys	819 (49%)	537 (65,6%)	169 (20,6%)	66 (8,1%)	47 (5,6%)
Girls	853 (51%)	351 (41,1%)	233 (27,3%)	129 (15,1%)	140 (16,4%)
Grade (age)					
8 th (13-14 years old)	561 (33,6%)	330 (58,8%)	114 (20,3%)	63 (11,2%)	54 (9,6%)
9 th (14-15 years old)	559 (33,4%)	293 (52,4%)	134 (24%)	71 (12,7%)	61 (10,9%)
10 th (15-16 years old)	552 (33%)	265 (48%)	154 (27,9%)	61 (11,1%)	72 (13%)

Girls who reported feeling very lonely, resulted in 16,4%, which is 10-11% higher than boys. Results are displayed in a histogram visualizing the distribution of gender (figure 2). In general, we can observe that girls answered that they felt lonelier compared to boys at all levels included.

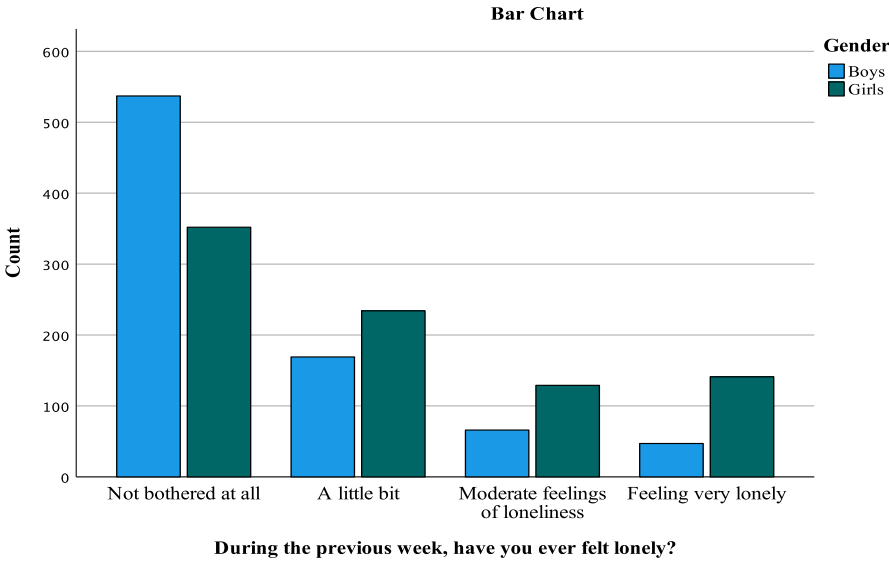


Figure 2: Percentages of gender and feelings of loneliness, Ungdata 2018, Tromsø municipality

Figure 3 presents the proportion of those who are participating in organized activity or not, by gender. Boys reported a higher degree of participation in organized activities compared to girls in Tromsø municipality from the Ungdata survey. In total, 1/3 of the participants reported that currently participating in organized activity (30-35%) and 10% used to participate.

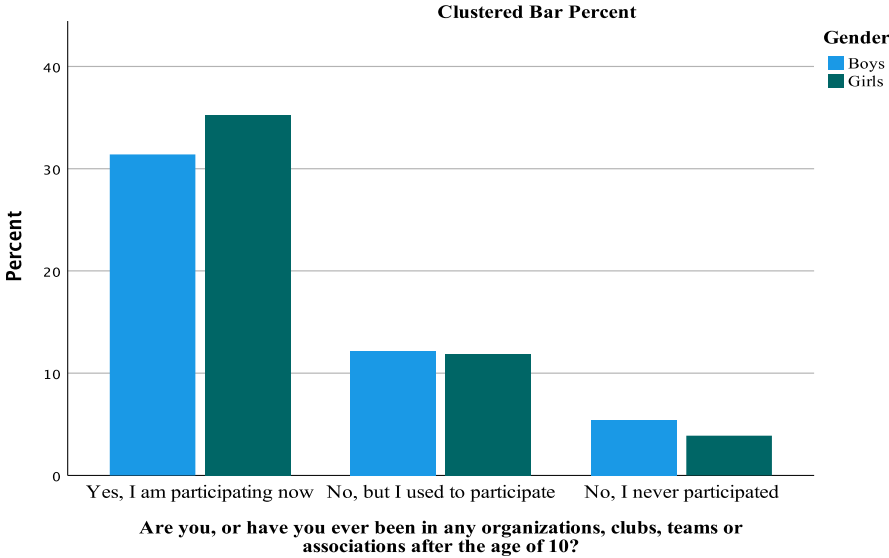


Figure 3: Percentages of participation in organized activities by gender, Ungdata 2018, Tromsø municipality

3.2 Co-variates

Characteristics of co-variates and potential confounders is presented in table 2 by feeling of loneliness. Missing observations, due to non-response are excluded from all analyses and not reported in table 2. Feeling sad, unhappy, or depressed, smoking status, alcohol intake, bullying, exercise, and socioeconomic status are included and presented in table 3, which is displayed below.

84,4% of those who never are feeling sad, unhappy, or depressed reported not bothered at all with feelings of loneliness. On the other hand, 63,4% of those who report that they are feeling very lonely, reported more feelings of sadness, unhappiness, or depression.

10% of those who were never smokers reported feeling very lonely, and non-smokers who do not reported with loneliness accounts for 54,1%. For daily smokers, 45,5% reported not being bothered with feelings of loneliness, whereas 27,3% reported feelings of loneliness.

Regarding alcohol intake, 10,1% of adolescents who never drink alcohol reported feeling very

lonely, 20% of those who have weekly intake of alcohol are feeling very lonely. 59,3% never drinks alcohol and reported not being bothered with loneliness.

Often bullied adolescents who reported feeling very lonely, counts for 42,6% of the adolescent respondents in the Ungdata survey in Tromsø municipality. Of those who are often bullied, an increase in reported lonely feelings is present. Adolescents who reported not being bothered at all with loneliness was 5,2%, a little bit was 15,9%, and those who reports moderate feelings of loneliness counted for 19,8%. Most of the adolescents in Tromsø are not being bullied (54,1%), whereas 69,3% of these are not bothered with any feelings of loneliness at all.

58% reported that they are not bothered with loneliness at all, 22,6% reported that they felt a little bit lonely, 10,7% reported moderate of lonely feelings, whereas 8,7% are feeling very lonely. At the other end, of those who never does exercise in leisure time, 19,3% reported feeling very lonely.

Regarding the socioeconomic status in families, 45,5% report a “*very good*” economic position and wealth during the previous 2 years. 61,5% of these are not bothered with loneliness. Regarding those who are feeling very lonely, the highest numbers are for those who have reported “*very low*” in the self-questionnaire, are 33,3%.

Table 2: Characteristics of co-variates, Ungdata 2018, Tromsø municipality

		<i>During the previous week, have you ever felt lonely?</i>			
		Not bothered at all (1)	A little bit (3)	Moderate feelings of loneliness (3)	Feeling very lonely (4)
Sad, unhappy, depressed? N = 1672					
Never	718	620 (84,4%)	84 (11,7%)	10 (1,4%)	4 (0,6%)
A little	494	214 (43,3%)	210 (42,5%)	57 (11,5%)	13 (2,6%)
Often	277	42 (15,2%)	87 (31,4%)	94 (33,9%)	54 (19,5%)
Very much	183	4 (6,6%)	13 (11,5%)	54 (18,6%)	116 (63,4%)
Do you smoke? N = 1672					
Never	1485	803 (54,1%)	364 (24,5%)	168 (11,3%)	150 (10,1%)
Did it before	119	56 (47,1%)	24 (20,2%)	15 (7,7%)	24 (20,2%)
Seldom	43	19 (44,2%)	9 (20,9%)	7 (16,3%)	8 (18,6%)
Weekly	16	5 (35,7%)	4 (28,6%)	3 (21,4%)	2 (14,3%)
Daily	11	5 (45,5%)	1 (9,1%)	2 (18,2%)	3 (27,3%)
Intake of alcohol? N = 1672					
Never	980	581 (59,3%)	211 (21,5%)	96 (9,8%)	92 (9,4%)
Seldom	433	202 (46,7%)	119 (27,5%)	60 (13,9%)	52 (12%)
Sometimes	188	71 (37,8%)	57 (30,3%)	32 (17%)	28 (14,9%)
1-3 times a month	56	24 (42,9%)	15 (25,8%)	5 (8,9%)	12 (21,4%)
Weekly	15	10 (66,7%)	0 (0%)	2 (13,3%)	3 (20%)

Are you being bullied?		N = 1672				
Never	906	628 (69,3%)	179 (19,8%)	52 (5,7%)	47 (5,2%)	
Seldom	621	232 (37,4%)	186 (30%)	104 (16,7%)	99 (15,9%)	
Occasionally	91	19 (20,9%)	25 (27,5%)	29 (31,9%)	18 (9,6%)	
Often	54	9 (5,2%)	12 (15,9%)	10 (19,8%)	23 (42,6%)	

Exercise		N = 1672				
Never	243	127 (52,3%)	47 (19,3%)	22 (9,1%)	47 (19,3%)	
Seldom	631	321 (50,9%)	160 (25,4%)	81 (12,8%)	69 (10,9%)	
Occasionally	453	240 (53%)	117 (25,8%)	55 (12,1%)	41 (9,1%)	
Often	345	200 (58%)	78 (22,6%)	37 (10,7%)	30 (8,7%)	

Family's economy during the previous 2 years		N = 1672				
Very low	15	6 (40%)	2 (13,3%)	2 (13,3%)	5 (33,3%)	
Low	76	21 (27,6%)	19 (25%)	14 (18,4%)	22 (28,9%)	
Neither	273	97 (35,5%)	85 (31,1%)	44 (16,1%)	47 (17,2%)	
Quite good	547	296 (54,1%)	130 (23,8%)	61 (11,2%)	60 (11%)	
Very good	761	468 (61,5%)	166 (21,8%)	74 (9,7%)	53 (7%)	

Table 3: Descriptive information of "Socioeconomic position"

SEP	Range	Maximum	Mean	Std. deviation
N = 1672	2,8	3,0	2,154	0,4936

3.3 Main findings

Binary logistic regression was performed to investigate the impact of various of variables on certain two levels (yes/no) of loneliness. The main exposure is regarding participation in any type of organized activity. In the Ungdata questionnaire, organized activity is referred to as participating in any organizations, teams or clubs, thus not defined as a specific term.

The binary logistic analysis models were adjusted for co-variables that included gender, socioeconomic status, smoking habits, alcohol intake, bullying and respondents exercising on their own. Table 5 presents numbers of participants in the binary logistic regression analysis implemented.

Table 4: Numbers of participants in the binary logistic regression analysis of loneliness and participation in organized activity. Unadjusted and adjusted. Ungdata 2018, Tromsø municipality

	Total N (%)
Included in analysis	N = 1672
1 = “Not bothered at all”	N = 888 (53,1%)
2 = “A little bit”, “Moderate feelings of loneliness”, “feeling very lonely”	N = 784 (46,9%)

3.3.1 Binary logistic regression

Table 7 presents results of the first model of a binary logistic regression analysis. In this table, both unadjusted and adjusted (model 1) results are presented. In table 8, the second model (model 2) display a model with less co-variables in the adjustments done, due to removal of co-variables from model 1 that did not contribute to explain the variations in the estimates in the first model.

Presented below, in table 7, the reference category is “Yes, I am participating now”, where the second category accounts for those participants who participated in organized activity

before but not anymore. The third category does account for those who never have participated in any organized activity. It is 1.23 higher odds (OR 1.23, 95% CI: 0,98-1,54) of feeling lonely having participated in organized activity before but not anymore, compared to those who actively participate in an organization, a team, a club, or an association. There are no statistically significant results in the unadjusted analysis (OR 1.23, 95% CI: 0,98-1,54) or the adjusted analysis (OR 1.10, 95% CI: 0,81-1,50). The results reflects that there are higher odds of feeling lonely if adolescents drop out from any sort of organized activity compared to currently participate in organized activity. No statistically significant results of the association between loneliness and any organized activity were found.

Table 5: Model 1. Binary logistic regression of loneliness and participation in organized activity. Unadjusted and adjusted, Ungdata 2018, Tromsø municipality

	Unadjusted			Adjusted		
	OR	P-value	95% CI	OR	P-value	95% CI
1 Yes, I am participating	Reference			Reference		
2 No, but I used to	1.23	0,08	(0,98-1,54)	1.10	0,54	(0,81-1,50)
3 No, never	1.11	0,53	(0,80-1,56)	0.96	0,85	(0,60-1,52)

**Adjustment variables: Gender, family's economy during the previous 2 years, socioeconomic status, smoking, alcohol intake, feeling of sadness, unhappiness, and depression, exercise, bullying*

After the first adjustments including all co-variates, the strongest predictor of feeling lonely was the co-variate which questions the feelings of sadness, unhappiness, or depression. Here, it was 4.7 higher odds of feeling lonely after controlling for all other factors in the model. Other co-variates which came out with a statistically significant result were gender (p-value: <0,001), the family's economy during the previous 2 years (p-value: 0,008) and bullying (p-value: <0,001).

Table 6: Model 2. Further adjustments of the association between loneliness and participation in organized activity, Ungdata 2018, Tromsø municipality

	Adjusted		
	OR	P-value	95% CI
1 Yes, I am participating	Reference		
2 No, but I used to	1.06	0,72	(0,78-1,43)
3 No, never	0.92	0,74	(0,53-1,47)

*Adjustments variables: "Gender", "family's economy during the previous 2 years", "feelings of sadness, unhappiness, and depression", "bullying"

For the second model of the binary logistic regression analyses, adjustments were done including all co-variates, ending up with no statistically significant results in the final model. The highest influence was observed in the second category; "No, but I used to" with an OR of 1.06 (95% CI: 0,89-1,85), interpreted that it is 1.06 higher odds of feeling lonely having participated in organized activity before, but not anymore, compared to those who currently participates in any organized activity.

4 Discussion

4.1 Summary of findings

The aim of this study was to investigate the association between loneliness and participation in organized activity among adolescents in Tromsø municipality analyzing the Ungdata survey from 2018. All models included in the final analysis were statistically non-significant. The only statistically significant results found, was present in an unadjusted model, which is included in the appendix section.

4.2 Results compared with previous research

4.2.1 Participation in organized activity

Participation in organized activity was not specifically defined or differentiated between different types in the Ungdata survey. Therefore, it could include various of activities like organizations, culture activities and sports activities that adolescents are doing in their leisure-time. Nevertheless, participation in activity with other people has benefits like health promotion, skills development, reduction of stigma, social inclusion, and empowerment (Khasnabic et al, 2010).

Previous studies mostly investigate the association between sports or physical activity and loneliness or mental health challenges (Murray et al, 2020; Pinto et al, 2019; Guddal et al, 2019; Suetani et al, 2017; Sagatun et al, 2017). Boelens et al (2022) found indications that participation in organized team sports, organized community sports and non-sports activities had a positive impact on mental challenges like anxiety, depression, self-esteem, and self-worth (Boelens et al, 2022). This was an umbrella review including six systematic reviews, with the aim of providing an overview of a variation of organized activities and a variation of mental health challenges among children and adolescents (Boelens et al, 2022).

A study conducted in Norway by Guddal et al (2019), investigated the association between physical activity and sport participation and various mental health outcomes, among adolescents between 13-19 years of age (Guddal et al, 2019). A cross-sectional study design was used, conducted in the Young-HUNT study, from the west county of Norway. They investigated self-esteem, life satisfaction and psychological distress as the main mental health outcomes (Guddal et al, 2019). Results discovered that participating in team sports reduced psychological distress compared to not being a part of team sports for boys, with an OR of 0,60 (95% CI: 0,31-1,15), but an OR of 1,02 (95% CI: 0,66-1,56) for girls, which indicates an increased odds of perceiving psychological distress being a part of team sports for girls. However, these results were not statistically significant (Guddal et al, 2019).

In this thesis, unadjusted analysis discovered that there were 1,23 (95% CI: 0,98-1,54) higher odds of feeling lonely if an adolescent did not participate in any sort of organized activity, however this result was not statistically significant after adjusting the analysis.

Participation in team sports has been found to be positively associated with reduced anxiety, depression, and social difficulties (Hoffmann et al, 2022). The purpose of this study was to investigate the association between organized sports participation and mental health difficulties. Mental health difficulties that were examined was anxiety, depression, social problems, attention problems and somatic complaints (Hoffmann et al, 2022). It does not cover the term loneliness, but many of those factors included could be related to feelings of loneliness. A limitation in Hoffmann’s study is that the measure is a parent-rated measure, which would not be sufficient to relate it to loneliness in the adolescent, as loneliness is a subjective feeling (CDC, 2021; Hawkley, 2022; Hoffmann et al, 2022). However, the findings in this thesis cannot be compared directly because it did not cover loneliness.

Dropouts in organized sports between 8 and 10 years of age is reported to be associated with an increase of mental health difficulties within the following 3 years. Children who are participating through childhood into adolescence, are also associated with a reduced risk of experiencing mental health challenges later in life (Vella, Cliff, Magee & Okely, 2015). In relation to this thesis’ results, previously participating in organized activity but not anymore could be related to dropouts in childhood as Vella et al (2015) presents in their study.

4.2.2 Loneliness

According to previous research, loneliness has a variation of definitions (Hawkley, 2022; Hoffmann et al, 2022). Hawkley (2022) defines loneliness as *“the distress that accompanies a perceived discrepancy between desired and actual social relationships”*, while Hoffmann et al (2022) states it as *“a state of well-being where a person realizes their own abilities, can cope with the common stresses of life, can work in a productive manner and is able to contribute to their community”* (Hawkley, 2022; Hoffmann et al, 2022).

This imply that one can live a happy life being alone, and another one can experience to feel lonely in the present of peers. Furthermore, the next question is what causes loneliness among adolescents. We can ask whether it is not being part of a social group, or if it is the nature of the organized activity that brings loneliness into account that is the question. Organized activity can be an engaging vehicle for promoting mental health for adolescents, but participation potentially brings several risks for the mental health, in a descending way (Vella, 2019). Adolescents are a vulnerable group of being exposed to maltreatment, bullying, harassment, and abuse (Vella, 2019). This could rise the numbers of young people who choose to quit in organized activity. Additionally, participation in organized youth sports is

increasing biological markers of stress and seems to be responsible for the development of anxiety for adolescents (Vella, 2019). Burnout is reported to be a result of the consequence of being exposed to ongoing stress over time, both physical and emotional fatigue (Vella, 2019). A collapse like this could result in decline in participation in organized activities (Vella, 2019).

The main findings in this study indicates that previously being a part of organized activity, but eventually experience to drop out increase the odds of feeling lonely. These results are similar to findings in another study made by Tubić, Modrić, Sekulić, Bianco, Radjo, & Drid (2023). Tubić et al (2023) examined if sports can protect children against loneliness, with a comparison between active and no active school-age children (Tubić et al, 2023). They concluded that sport participation can protect against loneliness, and that sports-active children are feeling less lonely compared to non-active children. It does not occur to be any major differences between team sports or individual sports participation (Tubić et al, 2023). The comparison between team-sports and individual sport participation, lays within that boys are more likely to enter team sports, while girls are more likely to be protected against loneliness through individual sports (Tubić et al, 2023).

A cross-sectional study conducted by Pinto et al (2019) aimed at investigate the association between loneliness and physical activity, and the participation in physical education for adolescents (Pinto et al, 2019). Results has shown that there were 2.07 (95% CI: 1,28-4,16) higher odds of feeling lonely being physical inactive. It is difficult to compare these results of physical activity to this thesis, as this thesis focusing on any organized activity, without a specific description.

4.2.3 Gender

In this thesis, there was higher numbers of reported loneliness for girls compared to boys. Hoffmann et al (2022) investigated the association between participation in organized youth sports and various mental health issues (Hoffmann et al, 2022). Aggressive behavior, anxiety, and depression were the most reported issues and overall, boys reported more mental health difficulties compared to girls among those who participated in organized activity (Hoffmann et al, 2022).

Twenge et al (2021) examined school loneliness worldwide for adolescents, and found an increase in general in loneliness, with that the increase were higher for girls compared to boys

(Twenge et al, 2021). The increase was observed through examination through several years, from 2012 until 2018 (Twenge et al, 2021). Results from should be taken into consideration. as it does not cover the association between participation in organized activity and feelings of loneliness, which makes it difficult to compare directly to this thesis' results.

A study by Pinto et al (2019) investigated the association between physical activity and loneliness among adolescents between 14-19 years of age in Brazil. They found that there was 1.32 (95% CI: 1,03-1,70) higher odds of feeling lonely for girls compared to boys (Pinto et al, 2019).

The association between psychological factors like distress, self-esteem, and life satisfaction and both physical activity and sports activities was evaluated by Guddal et al (2019). Findings showed that the percentages were higher among girls compared to boys in psychological distress, low self-esteem, and life satisfaction (Guddal et al, 2019). Regarding life satisfaction for instance, 31,4% of girls reported low life satisfaction whereas boys only reported 16,1% (Guddal et al, 2019). According to previous research, life satisfaction and self-esteem has been negatively associated with loneliness (Szcześniak, Bielecka, Madej, Pieńkowska & Rodzeń, 2020; Padmanabhanunni & Pretorius, 2021).

4.3 Methodological considerations

4.3.1 Recoding

Because of how the questions is formulated in the survey with 4 answering categories, I have chosen to recode these into two categories. This was mainly done to do a binary logistic regression analysis. Recoding of loneliness was done in two different ways. Both ways of recoding were analyzed and compared to observe if there were any differences in the results. I chose to use the first way of recoding (see 2.3.1). This made "yes" and "no" answers of feeling lonely, where equal numbers in both categories were present. Results of the second way of recoding, is presented in the appendix section.

One limitation of recoding these categories, is that the different levels of loneliness is difficult to separate, for instance; "*a little bit*" of lonely feelings and "*feeling very lonely*" when they are collapsed into one category. What is challenging about this, that it might vary how respondents are thinking about how much "*a little bit*" is, compared to "*moderate feelings of loneliness*" or "*feeling very lonely*". Another limitation is that loneliness as a term usually is

not a “yes/no” question to answer, as it is feelings and a process that might change during a period in life, also, it is difficult to directly compare other results with loneliness as it is personal feelings. One strength of doing this recoding is that it is easier to interpret the results from the binary logistic regression analysis.

4.3.2 Strengths and limitations

This survey represents the adolescent population in Tromsø, a high proportion of respondents (82%), with additionally smaller amount of nonsense answers. A high response rate makes the results representative to the adolescents population in Tromsø. Everyone was invited to join and complete this Ungdata survey from 2018, which provided everyone in the targeted population the possibility to join (Statista, n.d.). The Ungdata survey contains thorough questions of several parts in relation to adolescents’ habits in daily life. Having access to a variety of information makes it possible to control for several potential confounders.

In this thesis a cross-sectional design was used. A cross-sectional study design is often used to make inferences regarding possible associations or to gather preliminary data to support experiments or research further on. A cross-sectional design is relatively quick to conduct and is rather cheap compared to other study designs (Wang & Cheng, 2020). Cross-sectional studies can be used to measure the prevalence of conditions, as well lifestyle behaviors for instance (Wang & Cheng, 2020). It can increase knowledge of a specific population and generate new research question to future studies to explore conditions in depth (Cherry, 2022).

The cross-sectional study design is one of the main limitations to this thesis. One weakness in this study design is that it is difficult to make a causal inference because the survey is done at one specific point in time (Wang & Cheng, 2022). Another limitation is that the questions of the survey are assessed through self-reported answers. There are several potential biases to self-reported questions. Information bias might be present. In self-questionnaires, participants might provide answers which results in recall bias. This occurs when the response is dependent of the ability to recall a past event, and often occurs in relation to daily habits like smoking and drinking alcohol (Althubaiti, 2016). Smoking status and alcohol intake is included in this thesis; thus, we need to aware of the risk due to recall bias. If recall bias is present, we also might have a problem of potential over- or underestimation of the results. The questions included contains information that is relevant now, but also has questions related to the past of when the survey was conducted.

Social desirability bias might be present; respondents might provide answers of what they think is appropriated and social accepted for their age (Nikolopoulou, 2023). The Ungdata survey contains questions with sensitive topics as smoking status, alcohol intake and mental feelings, these types of questions often have a tendency of being answered in a social accepted way, or that the results are underestimated from the exact truth (Nikolopoulou, 2023; Althubaiti, 2016). This thesis includes factors related to smoking habits and alcohol intake, and therefore we need to be aware of this type of bias might be present.

4.4 Future research

Gender

Regarding gender, future research should be considered. This indicates that going deeper and investigate gender in longitudinal or qualitative studies would be of interest, what is it that makes girls report more feelings of loneliness than boys? In their youths, girls quits earlier than boys in organized sports, in this case; football (Persson, 2022). A doctoral thesis conducted in Oslo investigated why (Persson, 2022). The study found results that indicated that resources is utilized differently between gender, boys receive additional training times and that girls feels that they are treated as unfair (Persson, 2022). Also, in reasons why adolescents quit doing sports; statistically significant gender differences were found in happiness and joy of playing football, injuries, and lack of suitable options for playing and participating in football (Persson, 2022). Future research should be implemented in Tromsø to find out and solve the root causes of why adolescents are quitting, and further invest in interventions that might minimize dropouts for adolescents in the future – and keep those who still are participating.

Definition of organized activity

Organized activity has not been specified enough to get a good enough understanding, of which kind of organized activity that influences the results of feelings of loneliness. Any type of organized activity might vary a lot; thus, a further investigation of which kind of activity adolescents have been doing previously, which now makes them report different feelings of loneliness, would be of interest in future research. Additionally, a study design that provides the opportunity to follow children into adolescence, in relation to their habits of participation in a specific organized activity would be beneficial, to investigate how adolescents occupy their leisure-time. This is interesting, because results in this study presents that having

participation in any organized activity before but not anymore, had higher odds to report feelings of loneliness.

4.5 Future practice

The nature of organization

How organized activity is implemented and organized should be considered in the future. Focusing more supportive and healthier environment for participation in organized activity in early adolescence might be a preventive action. This is supported by Persson (2022) study, which emphasizes that there are structural reasons why for instance girls are quitting in sports more frequently than boys. Lack of options, how resources and economy is distributed and how the structure and organization is prioritized between gender in clubs is presented as reasons for quitting (Persson, 2022). As in this thesis, these results are retrieved from adolescents' own perception of the situation.

Socioeconomic status (SES)

Doing organized activities results in additional expenditures for everyone in general. Income and wealth in families, might influence adolescents participation levels. Reducing the general costs of participation, might be a preventive action that could help to minimize those who end up not participating, due to economic restrictions. Cost could be a barrier to participate in organized activities; not having enough money after covering essentials for everyday living, additional cost of getting to the activities and even having to pay for multiple children (ORIMA, 2021). Some will struggle more than others to pay or have restricted opportunities to participate due to economic restrictions.

5 Conclusion

There are no statistically significant association between participation in organized activity and self-reported feelings of loneliness, among adolescents who attended lower secondary school in 2018 in Tromsø. Results in this study showed that there were higher odds of feeling lonely if previously participating in organized activity but not anymore, compared to currently participate in organized activity. Due to the cross-sectional design, it is difficult explain the causes of these results. This thesis focused on any organized activity, which is a broad term, and thus, makes it even harder to understand where, and the rationale behind why some adolescents in Tromsø municipality are reporting feeling lonely. Further, more thorough research is required in the future to find out why the adolescent population in Tromsø are reporting feeling lonely in relation to participation in organized activity, to develop interventions that might act as preventive.

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Appendix

Table 7: Supplementary table 1. Demographic characteristics, including missing cases, Ungdata 2018, Tromsø municipality

During the previous week, have you ever felt lonely?

	Total N (%)	Feeling very lonely	Moderate feelings of loneliness	A little bit	Not bothered at all	Missing
Total N (%)	1888 (100%)	206 (10,9%)	208 (11%)	444 (23,5%)	940 (49,8%)	90 (4,8%)
Gender						
Boys	936 (49%)	51 (5,8%)	71 (8,1%)	184 (21%)	569 (65%)	61 (6,5%)
Girls	940 (49,8)	152 (16,7%)	133 (14,6%)	258 (28,3%)	369 (40,5%)	28 (3%)
Grade						
8 th	653 (34,6%)	59 (9,7%)	68 (11,2%)	127 (20,9%)	355 (58,3%)	44 (6,7%)
9 th	622 (32,9%)	68 (11,4%)	76 (12,7%)	145 (24,3%)	308 (51,6%)	25 (4%)
10 th	605 (32%)	78 (13,3%)	64 (10,9%)	170 (28,9%)	276 (46,9%)	17 (2,8%)

Table 8: Supplementary table 2. Description of co-variates, including missing cases for each co-variate, Ungdata 2018, Tromsø municipality

		<i>During the previous week, have you ever felt lonely?</i>			
		Feeling very lonely	Moderate feelings of loneliness	A little bit	Not bothered at all
Sad, unhappy, depressed?	1791				
Never	762	4 (2%)	10 (4,8%)	95 (21,5%)	653 (69,7%)
A little	528	15 (7,3%)	59 (28,5%)	228 (51,6%)	226 (24,1%)
Often	297	54 (26,3%)	100 (48,3%)	98 (22,2%)	45 (4,8%)
Very much	204	132 (64,4%)	38 (18,4%)	21 (4,8%)	13 (1,4%)
Missing	97 (5,1%)				
Do you smoke?	1786				
Never	1585	161 (78,9%)	178 (86,6%)	400 (90,5%)	846 (90,5%)
Did it before	127	27 (13,2%)	15 (7,3%)	27 (6,1%)	58 (6,2%)
Seldom	46	9 (4,4%)	7 (3,4%)	10 (2,3%)	20 (2,1%)
Weekly	16	3 (1,5%)	3 (1,5%)	4 (0,9%)	6 (0,6%)
Missing	102 (5,4%)				
Intake of alcohol?	1787				
Never	1051	100 (49%)	102 (49,3%)	233 (53%)	616 (65,8%)
Seldom	457	56 (27,5%)	63 (30,4%)	127 (28,9%)	211 (22,5%)
Sometimes	204	31 (15,2%)	34 (16,4%)	65 (14,8%)	74 (7,9%)
1-3 times a month	58	13 (6,4%)	6 (2,9%)	15 (3,4%)	24 (2,6%)
Weekly	17	4 (2%)	2 (1%)	0 (0%)	11 (1,2%)
Missing	101 (5,3%)				

Are you being bullied?	1777				
Never	961	54 (26,5%)	54 (26,3%)	193 (44,5%)	660 (70,7%)
Seldom	659	106 (52%)	108 (52,5%)	202 (202%)	243 (26%)
Occasionally	97	18 (8,8%)	31 (15,1%)	27 (6,2%)	21 (2,2%)
Often	60	26 (12,7%)	12 (5,9%)	12 (2,8%)	10 (1,1%)
Missing	111 (5,9%)				
Exercise	1752				
Never	256	50 (25,3%)	24 (11,5%)	52 (12,2%)	130 (14,1%)
Seldom	664	75 (37,9%)	84 (40,4%)	166 (39,1%)	339 (36,8%)
Occasionally	470	41 (20,7%)	58 (27,9%)	121 (28,5%)	250 (27,1%)
Often	362	32 (16,2%)	42 (20,2%)	86 (20,2%)	202 (21,9%)
Missing	136 (7,2%)				
Family's economy during the previous 2 years	1769				
Very good salary	803	59 (7,3%)	76 (9,5%)	178 (22,2%)	490 (61,0%)
Good salary	581	65 (11,2%)	65 (11,2%)	144 (24,8%)	307 (52,8%)
Neither	290	52 (17,9%)	50 (17,2%)	88 (30,3%)	100 (34,5%)
Quite low salary	80	23 (28,7%)	14 (17,5%)	20 (25%)	23 (28,7%)
Very low salary	15	5 (33,3%)	2 (13,3%)	2 (13,3%)	6 (40%)
Missing	119 (6,3%)				

Table 9: Supplementary table 3: Co-variates included in analyses, including missing cases, Ungdata 2018, Tromsø municipality

	OR	P-value	95% CI Lower	95% CI Upper
<i>Variables</i>				
Gender	1.58	<0,001	1,217	2,045
Family's economy the previous 2 years	1.23	0,009	1,053	1,429
SEP	1.16	0,306	0,873	1,544
Smoking	0.78	0,074	0,593	1,025
Alcohol intake	1.00	0,987	0,845	1,187
Unhappiness, sadness, depression,	4.75	<0,001	3,993	5,643
Exercise	0.99	0,908	0,870	1,132
Bullying	0.44	<0,001	0,364	0,543

	OR	P-value	95% CI Lower	95% CI Upper
<i>Variables</i>				
Gender	1.43	0,036	1,023	1,988
Family's economy the previous 2 years	1.12	0,187	0,945	1,337
SEP	0.92	0,618	0,657	1,283
Smoking	0.99	0,984	0,738	1,347
Alcohol intake	0.80	0,026	0,654	0,973
Unhappiness, sadness, depression	5.54	0,026	4,572	6,712
Exercise	0.88	0,159	0,754	1,047
Bullying	0.50	<0,001	0,403	0,613

*Highlighted results are statistically significant

Table 10: Supplementary table 4. Participation in organized activity and feelings of loneliness, Ungdata 2018, Tromsø municipality

During the previous week, have you ever felt lonely?

	Not bothered at all	A little bit	Moderate feelings of loneliness	Feeling very lonely
Are you, or have you ever been in any organizations, clubs, teams, or associations after the age of 10?				
Yes, I am participating	608 (54,6%)	276 (24,8%)	125 (11,2%)	105 (9,4%)
No, but I used to	199 (49,5%)	91 (22,6%)	56 (13,9%)	56 (13,9%)
No, never	81 (51,9%)	35 (22,4%)	14 (9%)	26 (16,7%)

Table 2 presents demographic characteristics of all participants regarding their level of participation in organized activity in relation to feelings of loneliness. 54,6% of all participants are participating now, and do not have any issues of feeling lonely. Of those who are feeling very lonely, only 9,4% have reported to participate in any organized activity, whereas 16,7% have never participated in any organized activity.

Table 11: Supplementary table 5: Numbers of participants in the second binary logistic regression analysis. Unadjusted and adjusted, Ungdata 2018, Tromsø municipality

	Total N
Included in analysis	N = 1672
1 = “Not bothered at all”, “A little bit”	N = 1290
2 = “Moderate feelings of loneliness”, “feeling very lonely”	N = 382

Table 12: Supplementary table 6. Binary logistic regression of participation in organized activity and feelings of loneliness, Ungdata 2018, Tromsø municipality

	Unadjusted			Adjusted		
	OR	P-value	95% CI	OR	P-value	95% CI
1 (Reference)						
2 No, but I used to	1.48*	0,003	(1,40-1,93)	1.28	0,19	(0,89-1,85)
3 No, never	1.33	0,15	(0,90-1,95)	0.88	0,65	(0,50-1,54)

*Adjustments variables: "Gender", "family's economy during the previous 2 years", "feelings of sadness, unhappiness, and depression", "socioeconomic status", "smoking", "alcohol intake", "exercise", "bullying"

*Highlighted results are statistically significant

For the second binary logistic regression analysis, there is only one statistically significant result in the second category; "No, but I used to" has an OR of 1.48 (95% CI: 1,40-1,93). Interpreted that there are 1.48 higher odds of feeling lonely, having participated in organized activity before, but not anymore; compared to those who actively doing any sort of organized activity. Adjustments were done including all co-variates in the binary logistic regression analysis, resulting in no statistically significant results, with an OR of 1.28 (95% CI: 0,89-1,85).

Table 13: Supplementary table 7. Adjustments in a binary logistic regression of participation in organized activity and feelings of loneliness, Ungdata 2018, Tromsø municipality

	OR	Adjusted P-value	Adjusted 95% CI
1 (Reference)			
2 No, but I used to	1.29	0,18	(0,89-1,86)
3 No, never	0.95	0,85	0,55-1,64)

*Adjustments variables: "Gender", "alcohol intake", "feelings of sadness, unhappiness, and depression", "bullying"

After including all co-variates in the adjustment in the second analysis, only four of those turned out to be statistically significant. Gender, intake of alcohol, feeling sad, unhappy, or depressed and bullying ended up with significant results.

Table 14: Supplementary table 8. Descriptive information of "Socioeconomic position"

SEP	Range	Maximum	Mean	Std. deviation
N = 1873	2,8	3,0	2,154	0,4978