Norwegian University
of Life Sciences

Master's Thesis 2023 30 ECTS
Faculty of Landscape and Society

Residents' Use of Neighborhood Surroundings for Activity and Recreation

A Cross-Sectional Study in Kvernevik, Stavanger Using Public Participation GIS (PPGIS)

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Preface

The pursuit of this master's degree has been a demanding yet fulfilling journey that has expanded my knowledge and enhanced my comprehension of public health. Despite several months of intensive work, analytical thinking, and frustration, I believe this experience has been important to my personal and professional growth.

I would like to express my sincere gratitude to my excellent supervisor, Emma Charlott Andersson Nordbø. In addition to your academic expertise, you have also been structured and reliable, providing me with highly needed stability and predictability throughout this period. Furthermore, your concrete feedback and pedagogical guidance have been invaluable, and I don't believe I would have been able to complete this master's thesis without your help.

I would also like to thank everyone who has supported me in various ways during this period. Thank you to friends and colleagues who have shown understanding and support, not only through uplifting conversations and encouraging messages but also through restorative workouts that have helped me to recharge and regain focus. A special thanks to family and friends who have helped me with proofreading and revisions.

Finally, thank you to my dear Jørgen. I don't think you know how much you have meant to me during this period. You have ensured that I could focus on my master's thesis while taking care of me when I have forgotten to do so myself. Additionally, you have given me perspective and reminded me that there are more important things in life than a master's thesis. I am looking forward to our wedding next year.

Ragnhild Nygaard
Oslo, May 2023

Abstract

Background: Our surroundings are fundamental for human health, well-being, and quality of life. The neighborhood environment includes various arenas used for different activities and recreational purposes. By using more advanced technologies and methods like Public Participation Geographic Information System (PPGIS), spatial analyses can provide a more comprehensive understanding about residents' use of neighborhood surroundings to develop health-promoting environments.

Purpose: This study aims to examine residents' use of their neighborhood surroundings for activity and recreational purposes in Kvernevik, Stavanger. Additionally, potential associations between sociodemographic factors, access to facilities and use of the neighborhood surroundings are explored.

Method: This cross-sectional study used data collected in the NORDGREEN project. The study employed a web-based Maptionnaire survey that combined conventional survey question with interactive map-based questions based on PPGIS methodology. QGIS 3.22 was used for the spatial analyses of the map-based data. The study sample consisted of adult residents (>18 years) living in Kvernevik with marked home locations (n=326). Associations between sociodemographic factors, access to environmental qualities and use of the neighborhood surroundings were examined using linear regression models.

Main findings: Participants marked an average of 2.3 locations in the neighborhood. The marked places (n=553) were everyday activity and recreational places (ARP) and favorite places (FP). Land use characteristics of the ARP and FP differed significantly with FP being located more frequently in green spaces and less frequently in residential areas. Participants with higher education marked significantly more places compared to those with lower education, and those with no minors or no children travelled significantly farther distances to their marked locations compared to those with younger children. No other significant differences between the sociodemographic groups were observed. Access to certain facilities like playgrounds, everyday facilities, and forests and rocky areas, were significantly associated with the number of mapped places and/or the distance parameters.

Conclusion: The results of this master thesis indicate differences in how people use their neighborhood surroundings for activity and recreation, both in general and among various sociodemographic groups. Additionally, access to certain facilities seems to influence usage patterns. Policymakers, urban planners, and public health professionals should consider these findings when developing activity-friendly and health-promoting neighborhoods.

Sammendrag

Bakgrunn: Omgivelsene våre er grunnleggende for menneskers helse, trivsel og livskvalitet, og nærmiljøet består av en rekke arenaer for ulik aktivitet og rekreasjon. Ved å bruke mer avansert teknologi og metode slik som deltakerorienterte geografiske informasjonssystemer (PPGIS) er, kan vi nå få mer omfattende forståelse for innbyggernes bruk av nærmiljøet gjennom avanserte romlige analyser. Dette kan brukes i utviklingen av helsefremmende nærmiljø.

Formål: Formålet med denne studien er å undersøke bruk av nærmiljøet for aktivitet og rekreasjon blant innbyggere i Kvernevik i Stavanger. Videre undersøkes det hvordan sosiodemografiske faktorer og tilgang på fasiliteter er assosiert med bruk av nærmiljøet.

Metode: Denne tverrsnittstudien bruker data samlet inn som en del av NORDGREEN-prosjektet. Studien benyttet seg av Maptionnaire, en internettbasert undersøkelse i henhold til PPGIS-metoden som kombinerer tradisjonelle spørsmål med interaktive, kartbaserte spørsmål. QGIS 3.22 ble brukt til de romlige analysene. Studieutvalget bestod av voksne innbyggere i Kvernevik over 18 år med markerte hjemsteder (n=326). Sammenhengene mellom sosiodemografiske faktorer, tilgang til nærmiljøfasiliteter og bruk av nærmiljøet ble undersøkt ved hjelp av lineære regresjonsmodeller.

Hovedfunn: Deltakerne markerte i gjennomsnitt 2,3 steder hver. De markerte stedene som ble identifisert i undersøkelsen (n=553) var aktivitets- og rekreasjonssteder (ARP) og favorittsteder (FP). Det ble funnet signifikante forskjeller i arealbruk mellom ARP og (FP) hvor FP i større grad ble lokalisert til grøntområder og i mindre grad til boligområder. Innbyggere med høyere utdanning markerte signifikant flere steder sammenlignet med dem med lavere utdanning, og innbyggere med voksne barn eller ingen barn dro signifikant lenger til sine markerte steder sammenlignet med innbyggere med yngre barn. For de øvrige sosiodemografiske variablene ble det ikke funnet noen signifikante forskjeller. Visse fasiliteter, som lekeplasser, hverdagsfasiliteter, skogsområder og svaberg, viste signifikante innvirkninger på antall markerte steder og/eller avstandsparameterne.

Konklusjon: Resultatene fra denne masteroppgaven tyder på forskjeller i hvordan nærmiljøet brukes til aktivitet og rekreasjon på et generelt grunnlag. Det virker også å være forskjeller i bruk mellom noen sosiodemografiske grupper. Videre påvirker tilgang til visse fasiliteter bruksmønstrene. Beslutningstakere, byplanleggere og folkehelsepersonell bør ta hensyn til disse funnene ved utvikling av aktivitetsvennlige og helsefremmende nærmiljø.

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List of abbreviations

ARP	Activity and recreational places
CI	Confidence interval
FKB	Felles kartdatabase (a shared database for public geographical data in Norway)
FP	Favorite places
GIS	Geographical information system
GLM	General Linear Model
PPGIS	Public Participation Geographic Information System
SD	Standard deviation
WHO	World Health Organization

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1. INTRODUCTION

Our surroundings are fundamental for human health, well-being, and quality of life (Norwegian Directorate of Health, 2022). The neighborhoods, in which we all live and reside, represent the settings where a wide range of activities take place (Gallagher et al., 2015). The first International Conference on Health Promotion in 1986 emphasized the importance of the environment in promoting health and well-being (World Health Organization, 1986). The significance of the environment has also received increased attention in Norway, and governmental reports and action plans have highlighted the importance of developing health-promoting neighborhoods to tackle the rise of noncommunicable diseases, inactivity and unhealthy lifestyles (Norwegian Directorate of Health, 2018; Norwegian Institute of Public Health, 2018).

Creating walkable and activity-friendly neighborhoods, as well as everyday destinations and places for leisure activities, have been suggested as areas of intervention for supporting the development of health-promoting neighborhoods (Meld. St. 19 (2018-2019); Ministry of Health and Care Services, 2020). These areas of intervention have been suggested with the intention of increasing levels of physical activity, for example through exercising, sport practice or restoration (Ministry of Health and Care Services, 2020). However, use of the neighborhood environment for activity and recreational purposes is found to be influenced by a range of sociodemographic factors, like gender, age, and family situation, as well as factors in the built and natural environment like access to green spaces or proximity to sport facilities (Frank et al., 2019; Naidoo & Wills, 2016; Nordbø, 2019; Sallis et al., 2006). Understanding how such factors influence use of neighborhoods is crucial for Norwegian municipalities as they are responsible for the systematic public health work and environmental planning (Norwegian Directorate of Health, 2018; Planning and Building Act, 2008; Public Health Act, 2012).

By using more advanced technologies and methods like Public Participation Geographic Information System (PPGIS), we can now capture how inhabitants use their neighborhood surroundings through spatial analyses of citizens' mappings. Thus, we receive place-specific information related to people's use and experiences in particular contexts, which are analyzed along with e.g., sociodemographic information (Brown & Kyttä, 2014). This enables the understanding of how people use their neighborhoods in relation to environmental

surroundings of their residence and individual-level data. In this study, data gathered through the Maptionnaire survey has been used, which is a PPGIS tool. The thesis has been conducted as part of the NORDGREEN project with the purpose to investigate use of neighborhood surroundings for activity and recreational purposes among residents of Kvernevik, Stavanger. The insights gained from this study have the potential to inform future planning processes to facilitate the promotion of health and physical activity through health-promoting local community development.

1.1 The structure of the thesis

This thesis is written as a monograph, divided into seven chapters. The introductory chapter has set out the purpose and scope of the research. Chapter 2 presents the contextual background of the thesis, discussing relevant empirical and theoretical aspect related to the research questions. In Chapter 3, the purpose of the study and corresponding research questions are presented. Chapter 4 describes the research design and methods employed, including a presentation of the sample, selected variables, statistical analyses, and a brief assessment of ethical aspects. The thesis results are presented in Chapter 5, followed by a discussion of both empirical findings in light of existing evidence and theory and study strengths and limitations in Chapter 6. It also highlights the implications of the study for public health in Norway. Finally, Chapter 7 concludes the thesis by pulling together the key findings discussed in Chapter 6.

2. BACKGROUND

In this chapter, relevant concepts, existing empirical knowledge on the topic, and theory are presented. Moreover, various guidelines, legislations and public health reports that are relevant for the purpose of the thesis are highlighted. The background will provide a conceptual and theoretical understanding of the rationale for what is being studied.

2.1 Health

With the aim of creating health-promoting environments, it is necessary to define health as it can be understood differently between countries, cultures, and professions. The definitions of health vary, reflecting different perspectives and historical contexts, including biopsychosocial and medical approaches (Hjort, 1982). A commonly used definition of health, which also emphasizes well-being, is the World Health Organization's (WHO) definition from 1946, expressing health as "a state of complete physical, mental, and social well-being and not merely the absence of disease and infirmity" (World Health Organization, 1946). Although this definition has been criticized for being almost unreachable, it is a comprehensive definition that considers physical, mental, and social factors. This definition is sound politically and academically grounded, and very much used in public health policies as it challenges our understanding of health and makes us think beyond health as absence of sickness and injuries (Meld. St. 15 (2022-2023); Øversveen et al., 2021). From a more cultural perspective, Norwegians often consider health as a feeling of well-being, function, positive affective state, coping and energy, and nature is also a central part of the conceptualization (Fugelli & Ingstad, 2001). The latter is particularly important in this thesis as it represents a setting for various activities and recreation (Remme et al., 2021), and as such, a potential health-promoting setting. This study is based on a comprehensive understanding of health that includes physical, mental, and social factors. Through this holistic approach, the focus is on comprehending the numerous factors that impact health and facilitate opportunities for physical activity. Health determinants play a central role in this regard.

2.1.1 Determinants of health

The determinants of health refer to the range of interacting factors from different levels that influence health and well-being of individuals and populations (Marmot & UCL Institute of Health Equity, 2014; Naidoo & Wills, 2016). These determinants can be broadly classified

into three categories: biological and genetic factors, social and economic factors, and environmental factors (Naidoo & Wills, 2016; World Health Organization, 2010). Biological and genetic factors include aspects such as age, gender, and genetic predispositions to certain diseases and conditions. These factors can have a significant impact on health outcomes but cannot be modified. Social and economic factors, such as income, education, occupation, and social support networks, can influence health through their effects on access to resources, opportunities, and social connections, which in turn affect behaviors, exposures, and stressors (Marmot & UCL Institute of Health Equity, 2014; Naidoo & Wills, 2016). Environmental factors include both physical and social aspects of the environment, such as air and water quality, exposure to toxins, access to green spaces, and safety (Lopez, 2012; Naidoo & Wills, 2016). These factors represent both exposure of harmful agents but also health-promoting areas and opportunities for healthy behaviors such as activity (Zhang et al., 2023).
Understanding the determinants of health is critical for improving health outcomes and reducing health disparities. Interventions that target these determinants can have significant impacts on public health, both globally and nationally (Marmot & UCL Institute of Health Equity, 2014; Norwegian Directorate of Health, 2018; World Health Organization, 2013). As the focus of this thesis is on the linkages between individual characteristics, neighborhood environmental qualities and the utilization of the neighborhood environment for activity and recreational purposes, the following sections will provide an in-depth exploration on these aspects.

2.2 Defining neighborhoods surroundings

The neighborhood surroundings, also known as neighborhood environment, represents the immediate environmental settings where people live, learn, work, and play (Meld. St. 19 (2018-2019); Naidoo & Wills, 2016; World Health Organization, 1986). It is widely recognized that a person's daily environment, consisting of both physical and social factors, along with intrapersonal factors and perceptions of environment, contribute to form an individual's behavior (Sallis et al., 2006).
According to a Norwegian definition, the neighborhood surroundings are defined as (translated):

> "The physical environment in which we reside, encompassing everything from densely populated urban areas to sparsely populated rural areas. Key elements of the neighborhood include residential areas, parks, open spaces, roads, streets,

playgrounds, natural and recreational areas, cultural landscapes, and institutions such as kindergartens and schools" (Meld. St. 19 (2014-2015)).

Along with the physical characteristics mentioned above, community centers and services, land use, transport infrastructure, and accessibility are also considered as important built environment features within the neighborhood (Lopez, 2012; Norwegian Directorate of Health, 2014; Schulz & Northridge, 2004). Natural features like forests, watersheds, rocks, plants, and air and water pollutant are often considered as a part of the natural environment within neighborhoods (Lopez, 2012; Naidoo & Wills, 2016; Schulz & Northridge, 2004; Taylor & Hochuli, 2017; World Health Organization, 2016). Moreover, green urban areas, as well as blue spaces and coastal zones, are also considered as natural settings with great relevance for the neighborhood environment and public health (Remme et al., 2021; World Health Organization, 2016). Besides the physical environment, the social environment also plays a crucial role in the neighborhood. The social environment in a neighborhood refers to e.g., relationships between the residents, community engagement, networks, crime, and safety (Marmot & UCL Institute of Health Equity, 2014; Naidoo & Wills, 2016). Moreover, cultural practices, religious beliefs, and social values can also be considered as a part of the social environment (Marmot & UCL Institute of Health Equity, 2014; Sallis et al., 2006). Features of the social environment can indeed impact utilization of neighborhood facilities (Kerr et al., 2016; Norwegian Directorate of Health, 2014), but the focus of this study is on the physical environment in particular. Thus, key physical qualities that have been shown to be relevant for utilization of neighborhood environments will be highlighted later in the background.

2.3 Neighborhood as an area for health-promotion and activity

Norwegians spend most of their time within their neighborhood area (Oppøyen, 2023). Thus, the physical and social environment within the neighborhood, coupled with the availability of services, create a setting with significant potential to foster people's health and well-being (Frank et al., 2019; Kärmeniemi et al., 2018; Naidoo & Wills, 2016; Norwegian Directorate of Health, 2021; Sallis et al., 2020). Traffic, air and noise pollution, residential density, presence of parks and playgrounds within walking distance from home, pedestrian environment, and availability of green spaces have shown to influence health in both positive and negative ways (Frank et al., 2019; Naidoo & Wills, 2016; Nieuwenhuijsen, 2016; Smith et al., 2017; Zhang et al., 2023). Exposure to air and noise pollution are often understood as risk factors for various chronic diseases (Frank et al., 2019), whereas a good pedestrian

environment supports active travel behavior, which is health-promoting (Smith et al., 2017). Exposure to green spaces in neighborhoods have been reported to positively influence health by reducing the risk of type II diabetes and all-cause mortality, and it is also found to be both psychologically and physiologically restorative causing better mental health and reduced stress (Figari et al., 2019; World Health Organization, 2016). Areas that promote physical activity and active living, like sport fields, parks, and playgrounds, have shown similar health benefits along with contributing to increased social interaction between residents (Jansson & Persson, 2010; Taylor et al., 2015). Neighborhoods also offer a range of services such as shops, schools, sports facilities, community centers, and religious places that promote health by fostering social and physical activities (Fongar & Thorén, 2022; Jones et al., 2013; Naidoo & Wills, 2016). On the other hand, lack of social relationships, low perceived safety, or crime represent health hazards associated with negative health effects, such as stress, depression, or isolation (Frank et al., 2019; Naidoo & Wills, 2016; Umberson & Montez, 2010). Moreover, environments that are perceived as unsafe can inhibit walking and use of parks (Kerr et al., 2016; Yu & Lippert, 2016). Notably, studies show differences in the distribution of facilities, as well as different usage patterns between neighborhoods (Oppøyen, 2023). Therefore, context-specific knowledge at the neighborhood level is needed for municipalities to develop health- and activity-promoting neighborhoods, and this thesis contributes to the understanding of the factors that impact use of neighborhood facilities in a Norwegian context.

2.3.1 Pathways linking neighborhood surroundings and health

The relationship between neighborhood surroundings and health is complex, involving multiple components that affect various aspects of health (Frank et al., 2006; Gong et al., 2016). Numerous studies have explored these complex relationships, resulting in various pathways and models. The model proposed by Sallis et al. (2006) is particularly relevant to this thesis as it aligns with the determinant perspective previously discussed. The model uses a socioecological approach as it seeks to illustrate the various determinants influencing active living behaviors in neighborhoods, as well as the interactions between the determinants and their impact on each other (Sallis et al., 2006). The fundamental idea of this study is that the utilization of the neighborhood surroundings is influenced by both individual and environmental factors. This is supported by Sallis et al. (2006) which communicate the complexity of active living and use of neighborhood surroundings for activity. Therefore, the model serves as the basis of this thesis. Although this thesis takes into account certain factors from different levels in the model, it is not feasible to include everything in this study. Hence,

further knowledge about other factors influencing the use of neighborhood surroundings is necessary.

2.4 Use of neighborhood surroundings

Research on health promotion, activity, and recreation have highlighted several areas and destinations that are commonly used in the neighborhood, including sports facilities and green spaces (Ministry of Health and Care Services, 2020; Norwegian Directorate of Health, 2015). Sport fields and indoor sport facilities like swimming pools and gyms may support specific sports or leisure activities while green urban areas or natural features like woodlands and coastal areas may stimulate recreational walking and related activities (Fong et al., 2018; Kajosaari & Laatikainen, 2020). The latter settings are commonly used for restoration and recovery from everyday life (Figari et al., 2019; Kaplan, 1995; World Health Organization, 2016).

A longitudinal analysis of activity and use of facilities from 1999 to 2015 in Norway found that the usage of accessible facilities, such as hiking trails, private gyms, illuminated tracks, and weight and strength rooms, has increased over the years (Breivik & Rafoss, 2017). Especially use of facilities within nature have increased since 1999 to 2015 (Breivik & Rafoss, 2017). In contrast, traditional sports facilities have seen a decrease in usage among the population (Breivik & Rafoss, 2017). There seem to be regional differences in use where gyms and illuminated tracks are less used in western Norway compared to other regions, while walking trails, green urban areas and open field spaces are more frequently used. These differences are, however, minor. Other facilities for activity and recreation are equally used between regions, though slight variations exists (Breivik & Rafoss, 2017).

The importance of outdoor facilities and green paces has increased due to urban densification, as noted by Peschardt et al. (2012). Also, the COVID-19 pandemic emphasized the importance of outdoor facilities such as green urban areas and public open spaces (Venter et al., 2020). Outdoor activities and natural facilities are significant sources to activity and recreation among Norwegian adults (Strøm et al., 2016). According to The Norwegian Directorate of Health (2015), 53% of Norwegian adults engage in leisure walking in outdoor surroundings at least once a week, with hiking in forests and open spaces being the most preferred activity for both genders. Statistics Norway (2021) also found that 92.5% of the

population had walked in parks or nature environments close to their home location in 2021. Likewise, a study conducted in Denmark found that 43% of participants used green urban areas daily and as many as 91.5% visited such places at least once a week (Schipperijn et al., 2010). Hiking trails, wilderness areas, parks, and green urban areas have been stated as frequently visited in several Scandinavian countries (Breivik & Rafoss, 2017; Schipperijn et al., 2010). However, people seem to visit larger green spaces more often and spend longer time in such areas (Schipperijn et al., 2010), though other small, informal areas also are reported to be well-appreciated and visited (Peschardt et al., 2012). Although Norwegian and Nordic research have emphasized certain areas for activity and recreation in the neighborhood, less is known about context-specific use of neighborhood surroundings. Therefore, it is necessary to obtain knowledge on this topic from different contexts. Also, certain built environment characteristics and sociodemographic factors seem to impact use of facilities. This will be delved into in the following sections.

2.5 Sociodemographic differences in use

Individual characteristics of the residents like age, gender, and family situation, can also influence use of neighborhood surroundings as it contributes to different perceptions and behaviors (Barton, 2009; Sallis et al., 2006). Examining differences in the use of neighborhood surroundings between sociodemographic groups can provide important information to reduce the rising problem of health inequities as well as creating healthy environments for residents across sociodemographic groups (Goldblatt et al., 2023). The following sections delve into several intrapersonal variables.

In terms of gender differences, studies from Scandinavia have found women to be more active in green urban areas than men (Fongar & Thorén, 2022; Ode Sang et al., 2016). This finding is in contrast to the results of a review on high-income countries conducted by Lee og Maheswaran (2011). Figari et al. (2019) state women and men to use green urban areas for different purposes and in different ways. There are empirical indications that women value nature experiences more, while men have a higher level of physical activity when they are in green urban spaces (Figari et al., 2019). At the same time, statistics from the European Commision (2018) found men engaging more in physical activities at a sport club or at work, which is also supported by Eime et al. (2018). Furthermore, women tend to be physically active at home or on the way between home and facilities like school, work, or shops

(European Commision, 2018). Looking at use of facilities for activity and recreation in a Norwegian context, women have increased their use of hiking trails and private gyms the last decades while men seem to use traditional sport facilities more (Breivik & Rafoss, 2017). Also, swimming pools and indoor sport facilities are more likely to be used by women (Breivik & Rafoss, 2017).

There are also differences between age groups regarding their use of neighborhood surroundings. Sport participation is more likely among younger adults, and thus, sport fields are more used by younger adults (Breivik & Rafoss, 2017; European Commision, 2018). Elderly in Sweden seem to participate in a greater number of nature-related activities than younger residents (Ode Sang et al., 2016). Breivik og Rafoss (2017) reported similar findings from Norway. Furthermore, Suárez et al. (2020) found elderly in Norway to prefer natural areas near water, while younger adults preferred more urban places with recreation facilities.

Several studies indicate the relevance of life events for transport behavior and physical activity (Christiansen et al., 2014; Scheiner & Holz-Rau, 2013) and parenthood is stated as an event of matter. Bellows-Riecken og Rhodes (2008) found a negative relationship between parenthood and physical activity, where mothers being least active. The findings indicated clearly more inactivity among parents with dependent children though the number and/or age of children were equivocal (Bellows-Riecken & Rhodes, 2008). According to a recent study from Canada, parents with children in preschool reported neighborhood destinations like parks, playgrounds, arenas, schools, and sport fields as relevant for their child's active play, their own active recreation, and their coactivity (Hunter et al., 2022). There are clear indications that the findings from foreign studies also apply to Norway (Breivik & Rafoss, 2017).

Socioeconomic status, here measured through education, affects physical activity and health but also people's ability to use their neighborhood surroundings (Kari et al., 2020; Syse et al., 2018; van Wijk et al., 2017). It is therefore highly relevant to look at differences between socioeconomic groups. In Norway, people with higher education are more active than people with lower education (Breivik & Rafoss, 2017; Norwegian Directorate of Health, 2015) and usage of private fitness centers and illuminated ski trails seem to be more common among people with higher education. In a Danish study, higher socioeconomic status was positively associated with use of green urban areas (Schipperijn et al., 2010). This is supported by Figari

et al. (2019). Opposite, swimming pools, shooting ranges, and open spaces are more used by people with lower education (Breivik & Rafoss, 2017), though swimming also have been associated with higher education (Karusisi et al., 2013). However, certain areas or facilities like hiking trails, outdoor open spaces, parks, and green spaces seem to be egalitarian used between people with different social classes and levels of education (Breivik & Rafoss, 2017).

Next to education, ethnicity impact health and use of settings in several ways. Immigrant populations are often overrepresented among people with low socioeconomic status and limited resources (Goldblatt et al., 2023) which may impact their health and active living but also ability to use the neighborhood surroundings. A study from the Norwegian Directorate of Health found that in general, immigrants were less active than Norwegians, and participate less in organized sports (Kjøllesdal et al., 2019). Findings from Breivik og Rafoss (2017) found immigrants from non-Western countries to report less use of facilities in natural environments like forests and green urban areas but a higher use of facilities for self-organized activities. Immigrants from Western countries did not report the same usage frequency. This is supported by the review of Figari et al. (2019), who also found the use of activity facilities, like green urban areas, to differ between immigrants.

Variations in use of different settings among sociodemographic groups suggest that specific knowledge about the factors that influence usage among different groups of people is necessary. As a result, this study addresses the gap in such knowledge within the Norwegian population.

2.6 Environmental factors contributing to the use of neighborhoods surroundings

Characteristics within the neighborhood surroundings that facilitate or hinder active living and health have been broadly studied (Bird et al., 2018; Smith et al., 2017; Zhang et al., 2023). Despite some conflicting evidence, meta-analyses and systematic reviews conclude that certain characteristics such as land use diversity, population density, destination accessibility, and infrastructure like connectivity and neighborhood design are all predictors of activity and recreation as well as health outcomes (Bird et al., 2018; Ewing & Cervero, 2010; Gascon et al., 2019; Giles-Corti et al., 2016; McCormack & Shiell, 2011; Saelens & Handy, 2008; Smith et al., 2017; Zhang et al., 2023). Furthermore, the perceived proximity of green urban areas appears to have a strong correlation with visitation and use, with a critical

distance of 300 meters being identified as particularly important as usage tends to decrease beyond this distance (Fongar & Thorén, 2022; Schipperijn et al., 2010). This is supported by Figari et al. (2019). Additionally, studies suggests that "crowdedness" and perceived safety have a negative impact on the use of neighborhood facilities (Figari et al., 2019; Rahm et al., 2021). A recent systematic review found the neighborhood built environment to be associated with health-related fitness regardless of physical activity (Frehlich et al., 2022). Similar findings have been found in Norwegian studies considering usage of neighborhood facilities (Figari et al., 2019; Fongar & Thorén, 2022). Several studies also show important co-effects of these characteristics, like impact on climate, safety, and social engagement (Bird et al., 2018; Brand et al., 2021; Sallis et al., 2015).

To understand the influence of neighborhood built environment on use of settings for activity and recreational purposes, a wide range of environmental measures is needed (Brownson et al., 2009). Two characteristics of the neighborhood surroundings have been used in this study to better understand the impact on utilization: diversity and access to facilities.

2.5.1 Diversity

Evidence emphasizes the importance of diversity for health-promotion and activity (Gong et al., 2016; Saelens & Handy, 2008). Herein, diversity is conceptualized as land use diversity and diversity in terms of facilities.

Land use diversity

Land use is a term used to describe use of land in built-up areas, and can include areas used for housing, business, recreation, transportation, or infrastructure purposes (Steinnes, 2013). Land use diversity refers to the level of variety in the types of land uses that exist within a specific geographic area (Steinnes, 2013). Land use diversity has been found to be positively associated with both transport-related and leisure-time physical activity (Christian et al., 2011; Fongar & Thorén, 2022; Kaczynski et al., 2010; Saelens & Handy, 2008). Additionally, it has been suggested as a neighborhood-level predictor of active living (Christian et al., 2011). Hillnhütter (2016) proposed that land use diversity can decrease the perceived distances to neighborhood facilities, which may increase walking and other activities among residents (McCormack et al., 2008).

Green urban areas and natural features such as forests and coastal areas have gained increased attention as important key elements in land use policy because they provide space for recreation and leisure and make the living environment more attractive (Feltynowski, 2023; James et al., 2015; Twohig-Bennett & Jones, 2018). These areas encourage physical activities such as walking, playing, cycling, and exercising (Feltynowski, 2023; James et al., 2015; Twohig-Bennett & Jones, 2018). Moreover, diversity in green spaces, in terms of size, function, and structure, appears to influence use (Fongar & Thorén, 2022). Quality and maintenance are also important characteristics that affect use of facilities (Figari et al., 2019). Jansen (2017) suggested that both size and quality of green spaces are associated with higher levels of physical activity. Furthermore, people seem to be more willing to walk longer distances to green spaces and natural features of greater size (Peschardt et al., 2012) but the evidence is conflicting (Schindler et al., 2022). Interestingly, Kaczynski et al. (2010) found that greater land use diversity around parks was related to a lower likelihood of physical activity in the park. In contrast, parks with low land use diversity but more facilities were more likely to be used for physical activity. Opposite findings were found by Fry et al. (2021). Figari et al. (2019) found land use diversity, next to other characteristics like presence of waters and number of facilities, to impact use of such areas. It is hard to determine to what degree land use diversity impact utilization of neighborhood surroundings as the evidence is conflicting, but the concept has been stated as important in government policy guidelines (Ministry of Local Government and Regional Development, 2019; Norwegian Directorate of Health, 2018), and thus, need to be considered in planning and development of cities and settlements. More knowledge addressing this aspect within the Norwegian context is important for planning purposes.

Diversity of facilities

Diversity of facilities as conceptualized in Cervero og Kockelman (1997), is commonly studied within the residents' defined neighborhood area. Evidence highlights the need for a diverse range of amenities close to home, such as grocery shopping, leisure activities, kindergartens and schools, and healthcare (Albacete et al., 2017; Elldér et al., 2020; Lee & Moudon, 2008; Páez et al., 2012). Some amenities, like schools, healthcare, and grocery stores, have been emphasized as particularly important to have near home since residents are not willing to walk more than one kilometer to reach these activities and services (Barton et al., 2012; Lee & Moudon, 2008; Páez et al., 2012). These facilities are also among the most frequently visited neighborhood destinations in everyday life (Lee & Moudon, 2008; Páez et

al., 2012). In qualitative and quantitative studies, respondents often stress the importance of having the opportunity to choose from many different amenities (Kajosaari & Laatikainen, 2020; Næss, 2012; Næss et al., 2017). For certain sociodemographic groups, like elderly, a diversity of facilities nearby home is particularly important as it can promote mobility and independence, which may in turn lead to a greater use of facilities (Gu et al., 2022). However, the diversity of facilities is highly connected to centrality as cities and urban areas show a greater variety in facilities and easier access to activity and recreational destinations than rural areas (Breivik & Rafoss, 2017; Norwegian Directorate of Health, 2015; Oppøyen, 2023). Also, diversity is linked to other built environment characteristics like accessibility, infrastructure, and population density. Thus, understanding how diversity of facilities influence use of the neighborhood surroundings require a context-sensitive approach, which is applied in this study.

2.5.2 Access to facilities

Access to facilities, also known as destination accessibility in urban and transport planning (Ewing & Cervero, 2010), has been conceptualized and measured in a number of ways. Talen (1997) states that defining accessibility parameters is challenging due to the dynamic nature of accessibility across different societal groups and contexts.

The concept of facilities is broad covering both indoor and outdoor facilities, and utilitarian and recreational destinations. McCormack og Shiell (2011) proposed that residents might actively seek out particular destinations that offer specific attributes, such as parks that provide facilities for team sports, restoration, running, or cycling, which correspond to their preferred types of physical activities. Other facilities are more specialized with the intention to stimulate physical activity, such as sport halls, sport fields, gyms, and swimming pools. Having these facilities within the neighborhood can be important resources for activity among the residents (Diez Roux & Mair, 2010). Yet, this is not being supported by the findings of Kajosaari og Laatikainen (2020). Despite some conflicting evidence, the Norwegian Directorate of Health (2021) found individuals to be more active if their residential or workplace are in close proximity to parks, green spaces, recreational facilities, exercise and sport facilities, as well as important meetings places and everyday destinations such as schools and shops. Thus, it can be assumed that certain facilities in the neighborhood surroundings play a crucial role in the population's usage and engagement in physical activities.

Access to facilities can be both perceived and objectively measured (Brownson et al., 2009), and geographical information systems (GIS) software are commonly used for providing objective measures. This thesis focuses on the objective measures of access, and when analyzing accessibility to neighborhood destinations, intensity and distance are two important measures that can be utilized in GIS-based analyses (Brownson et al., 2009). The following sections will briefly define and elaborate how intensity of facilities and distance can be objectively captured.

Intensity

Intensity is measured as either number of facilities per area or as the proportion of specific facilities within an area (Brownson et al., 2009). Number of facilities within a neighborhood have been associated with more physical activity and active travel (Cox et al., 2021; Kaufman et al., 2019; Næss et al., 2019). Further, Liu et al. (2020) found having more facilities within the neighborhood may stimulate to a higher physical activity level than proximity. A Norwegian study suggests that provision of facilities contributes to better conditions for walking or cycling and reduced car dependence as residents are encouraged to choose local options (Næss et al., 2019). The proportion of green spaces in neighborhood surroundings has demonstrated positive impacts on both physical activity and usage, particularly during times of personal or community stress (Berdejo-Espinola et al., 2021; Venter et al., 2020). There is also strong evidence for a positive effect of provision of parks and playgrounds on active travel and health (Smith et al., 2017; Sugiyama et al., 2012; Zhang et al., 2023), although similar associations were not found by Schulz et al. (2016).

Distance

Distance is affected by the characteristic of the built environment (Ewing & Cervero, 2010). Objectively distance can be operationalized as temporal or spatial but also straight-line distance or network distance (Yi et al., 2019). Evidence shows that distance impact use of both utilitarian and recreational destinations, and shorter distances are correlated with higher levels of activity (Bjørkelund et al., 2016; Gunn et al., 2017; Sugiyama et al., 2012; Tcymbal et al., 2020). Salvo et al. (2018) suggests that individuals are more likely to report willingness to visit recreational sites, such as parks and facilities, when these locations are located in close proximity to their home (Salvo et al., 2018). This also seem to apply for retail and service

destinations (Bjørkelund et al., 2016; Sugiyama et al., 2012). On the other hand, longer distances are associated with lower frequency of use (Raza et al., 2022). Having access to a diverse range of destinations within walking distance can increase walking trips, which also have been linked to unplanned social encounters and a stronger sense of community (Ewing & Cervero, 2010). The previous sections have demonstrated that a wide range of built environment characteristics can influence opportunities for activities and recreation within a neighborhood setting. Thus, more knowledge on how such factors are related to use of the neighborhood surroundings is important.

2.7 Public health relevance and anchoring

2.7.1 Public health challenges

The neighborhood surroundings is a key determinant of public health, and use of activity and recreational facilities as well as active living in general are essential components of a healthy lifestyle (Norwegian Directorate of Health, 2018, 2021). By creating neighborhoods that support active living and increase use of health enhancing facilities, policymakers, urban planners, and community leaders can help promote physical activity, prevent chronic diseases, and improve public health. As a part of the systematic public health work, National Public Health reports present the state of public health in Norway every fourth year, and just recently a new report was launched, Meld. St. 15 (2022-2023). Although public health in Norway is good in general and life expectancy is high, there are still significant social health inequalities, with those who have higher education and better economic status experiencing fewer health problems and longer life expectancy (Meld. St. 15 (2022-2023)). Noncommunicable diseases continue to dominate, accounting for 87% of the total burden of disease, which has been the case for several decades (Meld. St. 15 (2022-2023)).

2.7.2 Policies

Global public health

Norway has adopted the 17 Sustainable Development Goals (SDG) of the United Nations (UN), and the government's work towards achieving these goals is closely tied to public health efforts (Norwegian Directorate of Health, 2018). Three of the SDG goals are considered particularly relevant for this thesis. SDG #3 seeks to guarantee access to good health and well-being for all individuals, which is one of the main purposes of public health work (Norwegian Directorate of Health, 2018). SDG #10 aims to decrease inequalities within

and among nations which is highly relevant as social inequalities are rising in Norway like stated earlier. SDG #11 focuses on creating inclusive, safe, and sustainable cities and communities, including preserving green spaces. In Norway, the government's strategies to achieve these goals include preventive and health-promoting work, reducing social health disparities, and ensuring access to green spaces for all which in turn have been associated with use of neighborhood surroundings (Norwegian Directorate of Health, 2018).

National public health

The Norwegian government exerts influence on public health through various domains. National Public Health Reports present strategies for public health in Norway and comprise the anchoring for action plans. "Together for Active Lives" is the most recent National Action Plan for Physical Activity (Ministry of Health and Care Services, 2020). The vision of the plan is to make movement and physical activity a natural choice for everyone throughout life, which is especially important to prevent noncommunicable diseases (Ministry of Health and Care Services, 2020). Moreover, the plan has two main goals: 1) to make society more activity-friendly and 2) to increase the level of physical activity in the population. Prioritized areas are walk and activity-friendly communities, leisure time, daily life, health and care services, and developing knowledge and innovation. The former three are especially emphasized in this thesis. The interventions suggested in the action plan is aimed at the entire population though targeted efforts are being made towards different groups in the population (Ministry of Health and Care Services, 2020). With the increased focus on neighborhood surroundings, more information is needed about the use of these settings to make sure the actions taken are effective in creating healthier neighborhoods. Thus, this thesis contributes to relevant knowledge about activity in neighborhood surroundings with intention to meet the national goals for public health.

Numerous laws and legislations are also pertinent to public health policies. The Norwegian Public Health Act has had a significant impact on the development of public health in Norway since its implementation in 2012 (Norwegian Directorate of Health, 2020; Public Health Act, 2012). As public health has evolved, it has become a part of all sectors and is anchored in the plans of local communities. The purpose of The Public Health Act is based on health promotion, and it emphasizes the need for systematic public health work (Public Health Act, 2012). Through this act, each municipality is responsible for monitoring the overall health of the population and identifying factors that contribute to or hinder good health. The Public

Health Act also provides directives on the methods and approaches to be used in executing public health initiatives, such as health in all policies, principles of participation, sustainable development, reducing social health inequalities, and the principle of precautionary (Public Health Act, 2012). This study focuses on health promotion in urban planning, with a specific relevance on sustainable development and the precautionary principle. The Public Health Act is closely related to The Plan and Building Act, which is the most crucial tool available to municipalities and counties for setting goals and strategies tailored at local and regional conditions for societal and health development (Planning and Building Act, 2008). Land use objectives are a central component of the act, and planning anchored in The Plan and Building Act is a vital element of public health as it involves a multidisciplinary approach. The law forms the basis for relevant national guidelines such as the National Expectations Regarding Regional and Municipal Planning. The latest version of this guideline emphasizes the need to empower local planning processes and facilitate the development of activity-friendly local communities (Ministry of Local Government and Regional Development, 2019).

Local public health

Lastly, the local planning within municipalities bear the responsibility for public health within their communities, which entails planning and implementing interventions for neighborhoods, activity facilities, everyday destinations, and services (Public Health Act, 2012). In Stavanger, a new strategy and action plan for public health were adopted in 2023, both anchored in the municipal and regional master plans. The priority areas of the municipal master plan focus on early intervention, community and meeting places, good living environments and neighborhoods, and reducing social inequality in health through urban planning (Municipality of Stavanger, 2023a). These areas are identified based on local public health challenges, such as increasing social health inequalities, particularly in education, where the differences in life expectancy between levels of education are significantly higher than the general population (Norwegian Institute of Public Health, 2023). Since this thesis is part of a development process in a district in Stavanger, the knowledge generated from this study can provide vital information about the use of neighborhood surroundings among the residents within the case area. This information can subsequently be employed in local public health initiatives to achieve the goals and visions at all levels in Stavanger municipality.

3. OBJECTIVE

Over the years, there has been a growing recognition that the neighborhood surroundings plays a significant role in promoting health and well-being (World Health Organization, 2018), and research has revealed links between the neighborhood physical and social environment, health, and active living, and that the characteristics of the physical and social environment may influence the use of the neighborhood (Choi et al., 2017; Kerr et al., 2016; Smith et al., 2017). With increasing urbanization and densification, the availability of suitable areas for activities and recreation has diminished (Norwegian Directorate of Health, 2021). Thus, understanding how neighborhood surroundings are being used is essential in order to identify areas of priority to preserve health-promoting spaces. While some studies have examined the impact of neighborhood surroundings on health and active living in Scandinavia (Björk et al., 2008; Kajosaari et al., 2019; Nordbø, 2019), only a few have included adults over the age of 18 (Stefansdottir et al., 2019). There have been no previous studies in Norway using Maptionnaire or similar PPGIS methodologies.

Thus, the purpose of this study is to investigate use of neighborhood surroundings for activity and recreational purposes among residents living in Kvernevik, Stavanger. Based on this, the following research questions will be addressed:

- How do residents in Kvernevik use their neighborhood surroundings for activity and recreational purposes, and what characterizes the places used?
- Are there any associations between sociodemographic characteristics, access to environmental qualities, including facilities and green spaces, and the use of neighborhood surroundings for activity and recreational purposes?

4. METHODS

This chapter focuses on the research process of the thesis and provides explanations for the decisions made. First, it introduces the study area, followed by the methodology, and data collection, as well as the study participants. Then, the chapter delves deeper into the different variables used in the analysis and the specific statistical analyses conducted. Finally, the chapter briefly touches upon ethical considerations relevant to this study.

4.1 Study area

This study has been conducted as part of the project NORDGREEN – *Smart planning for Healthy and Green Nordic Cities* (Nordregio, 2023). The project involves six municipalities from the Nordic region, including Stavanger, in which this present study was conducted. Stavanger is the fourth largest city in Norway and is located in Rogaland County in the southwestern part of Norway. The municipality covers an area of 241 km^2 and has a population of about 145 000 inhabitants spread over nine districts. One of the districts is Madla, and within Madla we find the neighborhood Kvernevik (Figure 1), which is the study area of this thesis. Kvernevik has about 4700 inhabitants. Over a longer period, Kvernevik has scored low on numerous surveys concerning living conditions, and policymakers and municipal planners are currently working on developing the area (Municipality of Stavanger, 2023b). In connection to ongoing development processes, the municipality needed more knowledge about the residents' use and experiences of the neighborhood surroundings. This present study provides such knowledge by using a web-based PPGIS methodology, which will be describe in further detail in the next section.

Figure 1. *Map section of Stavanger taken from Geodata and processed in ArcGIS. The red square marks the position of Kvernevik.*

4.2 Study design and methodology

In this study, a quantitative cross-sectional design was applied to address the study aim and corresponding research questions. A web-based survey was developed by researchers from Nordregio and Norwegian University of Life Sciences in collaboration with representatives from Stavanger municipality. The survey consisted of conventional questions combined with an advanced PPGIS application called Maptionnaire (https://maptionnaire.com/), which allowed the participants to precisely locate places visited in the neighborhood and answer detailed information regarding their use of the specific places, e.g., frequency of visits. In the survey's mapping view, respondents were initially instructed to mark their home location. Next, they were asked to identify locations used in everyday life for activity and recreation, as well as their favorite places. The activity and recreational places (ARP) and favorite places (FP) were divided due to a hypothesis of different use between these destinations based existing knowledge (Korpela & Hartig, 1996; Korpela et al., 2008). Herein, home locations will be referred to as home locations, while the ARP and FP together represent mapped places. The conventional questions covered sociodemographic information like gender, age, place of birth, education, and family situation. A translated version of the survey is attached in the Append. The data collected through the Maptionnaire application was combined and analyzed together with geographical datasets from the Norwegian Mapping Authority (e.g., FKB-Arealbruk, and FKB-Bygning) and Copernicus Land Monitoring Service (e.g., Urban Atlas 2018) for analyses in QGIS (for further details see section 4.4 Key variables of interest).

4.3 Subjects

During autumn 2021, residents aged ≥18 years living in Kvernevik were invited to participate in the PPGIS-survey through direct messages in Digipost, and the survey was also promoted on social media and at prominent locations in and around Stavanger. A total of 577 participants responded to the survey. Six respondents were removed due to answers being submitted before the survey was officially launched. Additional five respondents were removed as they were <18 years at the time of responding. Of the 566 remaining respondents, 326 had marked their home location. Only respondents that had marked their home location were included in this study, and the final sample therefore consisted of the 326 participants.

4.4 Key variables of interest

As Maptionnaire offers numerous possibilities, the key variables of interest were provided in various formats. Sociodemographic characteristics of the respondents, which serve as independent variables, were obtained from data collected through the conventional part of the survey. The place-based variables derived from the survey's mapping view (home locations, ARP, and FP) and from GIS computations within 500 meters of home locations based on existing geographical datasets. A GIS software (QGIS 3.22) was utilized for the spatial analyses of the data from the survey's mapping view as well as destination accessibility around each home location. All key variables were processed and analyzed in SPSS Statistics. Subsequent sections will present the key variables of interest and spatial analyses in greater detail.

4.4.1 Characterization of the mapped places

The participants had marked a total of 944 places in Kvernevik in the survey's mapping view, of which 65 map makings were excluded due to the following reasons: mapping done before the survey was officially launched, duplicates of home location, mappings made by participants <18 years old or mappings located outside the neighborhood area of Kvernevik. The remaining 879 places, which includes home locations, ARP, and FP, were analyzed as described below.

To address the first research question, all mapped places were characterized according to land use, frequency of visits and mean distance from home locations. The analyses were performed for all places together and stratified into ARP and FP.

- Land use characterization of mapped places, ARP, and FP into six categories were conducted based on available land use data and information from the Norwegian Mapping Authority and the Urban Atlas Mapping Guide (European Union, 2011; Norwegian Mapping Authorities, 2022a, 2022b). The six categories were derived based on previous studies (Aune-Lundberg & Strand, 2021; Broberg et al., 2013a; Frank et al., 2004). This resulted in the following land use categories: "Agricultural", "Green spaces", "Industrial sites", "Residential areas and related spaces", "Sport and leisure facilities" and "Water and coastal areas".
- Frequency of visits to mapped places, ARP, and FP was assessed through the following question "How often are you here?" that the participant received for each

mapped place. The options ranged from "several times a day" to "a few times per year". Frequency of visits was dichotomized to "regularly" (i.e., daily or weekly) or "rare" (i.e., monthly, rarely, or never) as done in Christiansen et al. (2014).

- Mean distances from each participant's home location to their respective mapped place(s), ARP and/or FP were computed through a spatial join with Distance Matrix in QGIS. The distances were treated as continuous measures.

Reclassifications of land use categories were conducted prior to the final analyses. Multiple home locations were classified within "traffic areas" like streets and intersections closely located to residential areas. Therefore, traffic areas were incorporated into "residential areas and related spaces". Additionally, there were few mapped places located in high- and low-density areas. Consequently, the "residential areas and related spaces" category was not stratified based on residential density as done in the Urban Atlas Mapping Guide (European Union, 2011). Two of the areas originally classified as "agricultural" were later detected as "green spaces" by online GIS such as Google Earth and Norgeskart. Thus, they were reclassified to "green spaces".

4.4.2 Outcome variables – use of the neighborhood

To examine associations between sociodemographic characteristics, neighborhood qualities, and use of the neighborhood surroundings the following outcome variables were used in analyses:

- Number of mapped places was based on a count of how many ARP as well as FP each participant had marked in the mapping view of the survey. This variable was treated as a continuous variable in the analyses.
- Mean distances to mapped place(s), ARP and/or FP were based on the calculations using spatial join. These variables were also treated as continuous outcome variables. A description of how these variables were derived has already been provided in section 4.4.1 Characterization of the mapped places

4.4.3 Independent variables of interest

Intensity of neighborhood facilities and green spaces

In computations of access to environmental qualities like neighborhood facilities and green spaces, a buffer surrounding the residential address of the survey participants is commonly

used (Nordbø et al., 2018). The radius of the buffer typically ranges from 400 m to 1600 m, with 800 m as the most common (Yi et al., 2019). This represents the 10-15 min walking distance from homes (Institute of Transport Economics, 2017). In this study the neighborhood surroundings were measured based on the mean distances from home location to mapped places, calculated through spatial join. Based on knowledge derived from these analyses, a 500-meter circular buffer was used to measure the neighborhood facilities of interest within the defined area.

The respondents home locations and their 500 meters circular buffers were used to measure the accessibility intensity of certain neighborhood facilities and green spaces. National building and land use datasets from the Norwegian Mapping Authority and Copernicus Land Monitoring Service were used in the analyses. To increase the specificity, the analysis distinguished between intensity of indoor and outdoor sport facilities, playgrounds, other built-up and public areas, and green spaces. In summary, the following facilities were identified and used to measure intensity of environmental qualities like neighborhood facilities and green spaces.

- Number of neighborhood facilities: The number of different facilities within the circular buffer, derived from FKB-Arealbruk and FKB-Bygning by the Norwegian Mapping Authority (2022a, 2022b). The variable was further divided into four subdomains:
    - Indoor sport facilities (i.e., swimming pools, sport halls, sport centers).
    - Outdoor sport facilities (i.e., sport fields and courts).
    - Playgrounds (i.e., public areas smaller than 200 acres built for playing)
    - Everyday facilities (i.e., kindergartens, schools, stores, museums, libraries, religious facilities, or community centers).
- Proportion of green urban areas: The proportion of green urban areas, like parks and other public green spaces for predominantly recreational use, within the buffer of each home location was measured using Urban Atlas 2018 data provided from Copernicus Land Monitoring Service (2020). Intersection analysis with this data and home locations buffers were used to calculate the proportions.
- Proportion of forests and rocky areas: The proportion of natural and semi-natural areas as well as wetlands within the buffer of each home location was measured using Urban Atlas 2018 data provided from Copernicus Land Monitoring Service (2020). Intersection analysis with this data and home locations buffers were used to calculate

the proportions. The name “proportions of forests and rocky areas” was chosen because these areas were mainly composed of forests and rocky formations.

Sociodemographic variables

The sociodemographic variables, also referred to as intrapersonal variables, were used as independent variables in the analyses aimed at addressing the research question regarding utilization of neighborhood surroundings among various sociodemographic groups. Additionally, these variables were considered as possible confounding factors based on prior research and theoretical knowledge.

Respondents answered questions about their sociodemographic characteristics, such as gender, age, place of birth, education, and family situation. The results were recoded and categorized based on existing evidence and definitions. Gender was naturally categorized as “female” or “male” whereas “others”, which account only a couple of participants, were recoded as missing. Age, calculated from year of birth, were grouped into following categories following different life stages (i.e., “18-29”, “30-49”, “50-64”, “>65”). The Norwegian Public Road Administration uses the same categorizations (Norwegian Public Roads Administration, 2017). The four options capturing place of birth were reclassified to “Stavanger”, “another part of Norway” or “outside of Norway” to account for ethnicity. Education was recoded into “higher education” (university or vocational) or “otherwise” (primary education, secondary education or tertiary education) based on Stefansdottir et al. (2019) and the definitions by Statistics Norway (Statistics Norway, 2019). Family situation was considered in terms of age of the child(ren). Based on the categorization in Christiansen et al. (2014), this study categorized family situation as “families with children in kindergarten or primary school”, “families with children in secondary school”, or “families with no minors or no children”. This categorization was chosen to take into consideration the independence of the child(ren).

4.5 Statistical analyses

IBM SPSS Statistics version 29.0 was utilized to perform all statistical analyses. Descriptive characteristics of the total sample and mapped places, as well as the ARP and FP, were analyzed using descriptive statistics. Results of these analyses are reported as frequencies, proportions, and mean values along with the standard deviations and percentages. Missing

values for descriptive characteristics of the total sample are also reported. Chi-square statistics were used to examine differences between ARP and FP in terms of land use, frequency of visits, and mean distances.

The independent variables in this study were different types of variables. The sociodemographic variables were treated as categorical and the environmental qualities as continuous variables. Bivariate analyses were used to compare sociodemographic groups whereas T-tests were used to test for differences between groups of education and gender, while ANOVA were performed in the comparison of family situations, age groups, and places of birth. Pearson correlations were used to examine the relationship between the continuous variables measuring intensity of access to neighborhood facilities and green spaces and use of neighborhood facilities. Due to complexity in data and multiple system missing values, the sample size varied between the analyses. Missing values were therefore excluded analysis by analysis by SPSS. This way of treating missing values was chosen to use as many cases as possible for each analysis as the total sample was relatively small.

To examine associations between sociodemographic characteristics, access to environmental qualities such as facilities and green spaces and the use of neighborhood surroundings for activity and recreational purposes, two different models were conducted, both using General Linear Model (GLM) in the analyses. Model 1 was adjusted for individual-level covariates that may be associated with use of neighborhood surroundings such as gender, age, education, place of birth, and family situation. Given that access to facilities may impact use of neighborhood surroundings, measures of destination accessibility were treated as potential confounders. Model 2 therefore adjusted for both individual-level covariates and environmental qualities like accessibility intensity of indoor sport facilities, outdoor sport facilities, playgrounds, and everyday facilities, as well as proportions of green urban areas and forests and rocky areas, respectively.

Effect estimates reported are unstandardized *B* with standard deviations or 95% confidence interval (CI). *P*-values <.05 are considered statistically significant.

4.8 Ethical considerations

In accordance with The Nuremberg Code and The Declaration of Helsinki, the participants were provided with written information about the survey, storage of data, and rights as participants (Førde, 2014). They also had to give their written consent before starting the survey. Participating in the survey was voluntary, and the respondents could quit at any time without any explanation or consequences. They were also allowed to skip questions they did not want to or could answer.

Personal information of the participants was stored separate from the mapping of ARP and FP. In all publications, including this master thesis, personal identifiable data has been removed, rewritten, or categorized to keep the data anonymous. Access to the data lasted only for a limited period and analyses was conducted through an internal research server at NMBU.

As the PPGIS survey has been conducted as part of the NORDGREEN project, a notification form had already been submitted to Norwegian Centre for Research Data (now Norwegian Agency for Shared Services in Education) before recruitment of participants and data collection started. Once it was decided that I was going to use the data for my master thesis, changes in the notification form were notified to NSD ("Endring i meldeskjema") by supervisor Emma C. A. Nordbø. The changes involved adding me (Ragnhild Nygaard) as project participant with access to the data material. These changes were approved by NSD 24.08.22 (reference number: 296605).

5. RESULTS

This chapter will present a summary of the statistical analyses conducted in the study. It commences with descriptive statistics of the study participants and mapped areas followed by an illustration of the mapped places in Kvernevik. Subsequently, the chapter discusses the usage of neighborhood surroundings by the residents, including the results obtained from chi-square tests for the mapped places. Furthermore, associations between sociodemographic characteristics and usage of neighborhood surroundings are presented. Finally, the chapter examines the associations between access to facilities and usage of neighborhood surroundings.

5.1 Descriptive statistics of study participants and mapped places

Table 1 presents the characteristics of the 326 individuals included in the final sample, as well as their environmental qualities within 500 meters of their home location. There was a preponderance of female participants (67.5%), and the majority (62.9%) were born in Stavanger. The age ranged from 18 to 80, with the majority being aged 30-49 years old (54.6%). 51.8% had higher education. Just above one third, (34.0%) had children in kindergarten, primary school, or both, while 29.8% had no minors or no children.

The participants had an average of 1.3 indoor and 5.6 outdoor sport facilities within 500 meters from home. A high number of playgrounds was identified within the buffers (n=27.6). On average, there were 10.8 everyday facilities (i.e., kindergartens, schools, stores, museums, libraries, religious facilities, or community centers) within 500 meters from home location. A total average of 14.6% green spaces were found within the 500-meter buffers, of which 8.2% were green urban areas (e.g., parks) and 8.4% were forests and rocky areas.

***Table 1**. Individual sociodemographic characteristics and environmental qualities within 500 meters from home location (n=326).*

Sociodemographic characteristics, n (%)		
Gender		
Female	220 (67.5)	
Male	105 (32.2)	
Missing	1 (0.3)	
Age		
18-29	50 (15.3)	
30-49	178 (54.6)	
50-64	62 (19.0)	
>65	10 (3.1)	
Missing	26 (8.0)	
Family situation		
Kindergarten or primary school	111 (34.0)	
Secondary school	32 (9.8)	
No minors or no children	97 (29.8)	
Missing	86 (26.4)	
Education		
Higher education	169 (51.8)	
Otherwise	74 (22.7)	
Missing	83 (25.5)	
Place of birth		
Stavanger	205 (62.9)	
Another part of Norway	95 (29.1)	
Outside of Norway	26 (8.0)	
Missing	0 (0.0)	
Environmental qualities		
	n (SD)	**Min-max**
Indoor sport	1.3 (0.79)	0-3
Outdoor sport facilities	5.6 (2.66)	1-11
Playgrounds	27.6 (10.24)	0-53
Everyday facilities	10.8 (4.81)	0-21
Proportion of green spaces	**% (SD)**	**Min-max**
Green urban areas	8.16 (3.43)	0.52-13.98
Forests and rocky areas	8.39 (8.03)	0.00-25.76

The participants mapped a total of 879 places, of which 360 were ARP, 193 were FP, and 326 were home locations. On average, each participant mapped 2.3 places in Kvernevik. An illustration of the mapped places in Kvernevik is given in Figure 2.

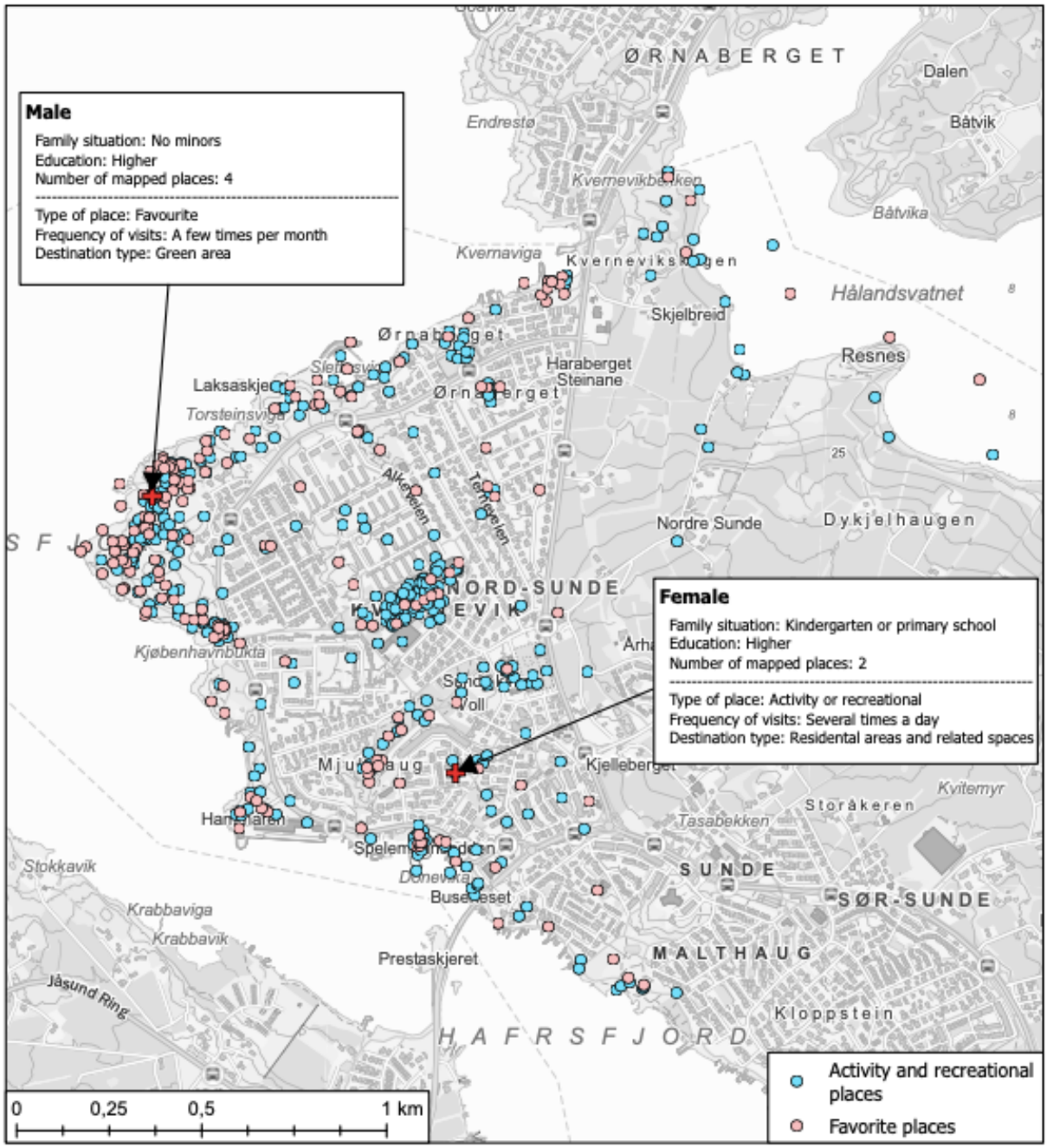

Figure 2. *An illustration of mapped places in Kvernevik, Stavanger. ARP are shown in blue, and FP in pink. Call-out boxes exemplify the features' attribute data.*

5.2 Residents' use of the neighborhood surroundings

As seen in Table 2 , 255 of the mapped places were in green spaces, of which 149 were ARP and 106 were FP. ARP were more commonly found in industrial sites, residential areas and related spaces, and sports and leisure facilities, whereas higher proportions of FP were identified in green spaces and water and coastal areas compared to ARP. There was a significant difference in land use between ARP and FP ($p<.001$). In terms of frequency of

visits, there was no differences between ARP and FP (p = .245). Most of the mapped places were visited regularly (n=301), though a higher proportion of FP was visited rare compared to the ARP. 73 of the participants reported that they visited their mapped places at least once a day. On average, the distance between home locations and mapped places was 573.3 meters, ranging from a minimum of 45 meters to a maximum of 1812 meters. The mean distance from home to ARP was 554.7 meters, while it was 53 meters longer for FP. The observed distance was not statistically significant.

Table 2. *Characteristics of mapped places, ARP and FP derived from the survey's mapping view.*

Characteristics of mapped places							
	Mapped places (n=553)		**Activity and recreational places (n=360)**		**Favorite places (n=193)**		***p*-value**
	n	*%*	*n*	*%*	*n*	*%*	
Land use categories							<.001[a]
Agricultural	58	10.5	38	10.5	20	10.4	
Green spaces	255	46.1	149	41.4	106	54.9	
Industrial sites	69	12.5	53	14.7	16	8.3	
Residential areas and related spaces	71	12.8	53	14.7	18	9.3	
Sport and leisure facilities	68	12.3	53	14.7	15	7.8	
Water and coastal areas	32	5.8	14	3.9	18	9.3	
Frequency							.245[a]
Regularly[c]	301	54.3	202	56.1	99	51.3	
Rare[d]	214	38.7	133	36.9	81	42.0	
Missing	38	6.9	25	6.9	13	6.7	
	Meters	*SD*	*Meters*	*SD*	*Meters*	*SD*	
Mean distance from home locations	573.3	380.2	554.7	371.1	607.9	395.2	.145[b]

[a] Results from X^2 comparing ARP and FP, [b] Results from t-tests comparing ARP and FP, [c] Regularly = daily or weekly, [d] Rare = monthly or rare

5.3 Associations between sociodemographic characteristics and use of neighborhood surroundings

Table 3 presents results from bivariate analysis of the relationship between inhabitants' sociodemographic characteristics and use of the neighborhood surroundings. The results showed no significant differences between gender, age groups and place of birth on any of the outcomes for use of the neighborhood surroundings. However, family situation was significantly associated with a higher mean number of mapped places among those with children in kindergarten or primary school. There were also significant differences between the three categories regarding distances to mapped places, ARP, and FP. Tukey's HSD test for multiple comparisons found a significant difference in distance to ARP between participants with no minors or no children and those with children in kindergarten or primary school (p=.017, 95% C.I. = [23.63-259.96]), and participants with no minors or no children reported on average their ARP 142 meter farther away from home locations. Similarly, participants with higher education reported a significantly higher number of mapped places compared to those with lower education (p<.001, 95% CI = [.38-1.34]). The mean distances to ARP and FP were also shorter among those with lower education, but the differences were not significant.

Table 3. *Bivariate associations between sociodemographic factors and use of neighborhood surroundings.*

	Unstandardized *B*, (SD)			
	Mean number of mapped places	**Mean distance to mapped places**	**Mean distance to ARP**	**Mean distance to FP**
Gender				
Female	2.30 (2.02)	573.4 (318.7)	539.0 (339.3)	607.3 (372.3)
Male	2.34 (1.78)	513.2 (290.4)	495.0 (296.1)	601.8 (445.6)
p-value	.890	.188	.384	.947
Age				
18-29	2.54 (2.60)	601.0 (342.0)	590.5 (373.7)	635.6 (349.7)
30-49	2.58 (2.15)	536.5 (255.7)	504.9 (275.4)	557.4 (316.5)
50-64	1.86 (1.00)	574.0 (373.7)	527.4 (386.4)	672.0 (450.0)
>65	1.17 (0.41)	585.4 (244.4)	619.1 (414.1)	581.5 (423.2)
p value	.068	.736	.656	.535
Family situation				
Kindergarten or primary school	2.93 (2.27)	491.1 (260.8)	471.2 (284.5)	498.7 (290.0)
Secondary	2.72 (2.61)	590.7 (366.1)	508.0 (378.9)	752.5 (469.2)
No minors or no children	1.94 (1.34)	632.8 (335.9)	626.3 (354.4)	658.5 (453.1)
p value	.010*	.017*	.021*	.035*
Education				
Higher education	2.70 (2.28)	584.1 (327.9)	562.4 (339.7)	625.8 (420.0)
Otherwise	1.84 (0.97)	523.8 (275.5)	480.5 (309.2)	542.0 (331.7)
p-value	<.001**	.248	.154	.322
Place of birth				
Stavanger	2.15 (1.91)	556.4 (306.0)	515.7 (313.5)	598.8 (367.6)
Another part of Norway	2.43 (1.93)	542.4 (295.3)	526.2 (331.3)	586.9 (374.6)
Outside of Norway	3.13 (2.10)	612.3 (424.7)	614.0 (404.5)	756.1 (637.8)
p-value	.146	.736	.548	.528

After adding all sociodemographic variables into the same model (Table 4), the results showed no significant associations between gender, age, or place of birth to any of the outcomes for use of the neighborhood surroundings. Moreover, the association between family situations and mean number of mapped places were no longer significant, indicating confounding effect. Participants with no minors or no children reported significantly farther distances to mapped places and ARP in the adjusted model as well, about 152 meters and 170 meters respectively. Even after adjusting for potential confounding variables, participants

with lower education still reported significantly lower number of mapped places compared to those with higher education, although to a lesser extent (p=.035, 95% CI = [-1.52- -.06]).

Table 4. *Adjusted associations between sociodemographic characteristics and use of neighborhood surroundings.*

	Regression coefficients (95% CI)[1]			
	Mean number of mapped places	**Mean distance to mapped place**	**Mean distance to ARP**	**Mean distance to FP**
Gender				
Female	Ref.	Ref.	Ref.	Ref.
Male	-.02 (-.74-.70)	-66.22 (-172.27-39.83)	-66.31 (-184.03-51.41)	-81.92 (-273.72-109.89)
Age				
18-29	Ref.	Ref.	Ref.	Ref.
30-49	-.54 (-1.63-.55)	17.32 (-144.22-178.86)	-1.85 (-190.33-186.63)	-16.22 (-266.40-233.97)
50-64	-.52 (-1.65-.61)	42.08 (-124.95-209.11)	-5.37 (-201.10-190.36)	83.13 (-187.04-353.29)
>65	-1.60 (-3.70-.49)	-160.12 (-470.00-149.76)	-37.09 (-412.42-338.25)	-329.52 (-909.65-250.61)
Family situation				
Kindergarten or primary school	Ref.	Ref.	Ref.	Ref.
Secondary school	.20 (-.83-1.23)	88.56 (-63.63-240.75)	19.552 (-155.36-194.46)	236.88 (-1.49-475.25)
No minors or no children	-.80 (-1.73-.14)	151.70 (13.35-290.04)*	170.43 (9.34-331.53)*	172.41 (-41.90-386.71)
Education				
Higher education	Ref.	Ref.	Ref.	Ref.
Otherwise	-.79 (-1.52 - -.06)*	-52.74 (-160.81-55.33)	-71.84 (-196.23-52.55)	-123.08 (-296.29-50.12)
Place of birth				
Stavanger	Ref.	Ref.	Ref.	Ref.
Another part of Norway	.35 (-.40-1.09)	34.59 (-74.50-143.68)	16.27 (-108.02-140.55)	60.25 (-112.03-232.52)
Outside of Norway	.92 (-.44-2.29)	102.03 (-100.00-304.06)	108.19 (-112.77-329.15)	144.27 (-193.79-482.32)

* $p < .05$

[1] Adjusted for all sociodemographic covariates in the model (gender, age, family situation, place of birth and education)

5.4 Associations between access to environmental qualities and use of the neighborhood surroundings

Table 5 presents the bivariate correlations between the outcomes for use of the neighborhood surroundings and access to environmental qualities like neighborhood facilities and green spaces. The findings reveal weak and negative correlations between all facilities and mean

number of mapped places. Although the proportion of forests and rocky areas had the highest correlation, it was weak and non-significant. Playgrounds and everyday facilities were positively correlated to multiple distance parameters, though not significant. Moreover, indoor sport and proportion of forests and rocky areas were the only variables significantly correlated with mean distance to ARP, r(191)=.17, *p*=.018 and r(149)=-.21, *p*=.012, respectively. The proportion of forests and rocky areas also showed significant negative correlations (p < .001) with the mean distance to mapped places and the mean distance to FP.

***Table 5**. Bivariate correlations between use of the neighborhood surroundings and environmental qualities around home locations.*

	Pearson correlation, *r*			
	Mean number of mapped places	**Mean distance to mapped place**	**Mean distance to ARP**	**Mean distance to FP**
Indoor sport facilities	-.05	-.06	-.17*	-.02
Outdoor sport facilities	-.06	-.12	-.14	-.15
Playgrounds	-.03	.05	.03	.04
Everyday facilities	-.08	.06	-.02	.09
Proportion of				
Green urban areas	-.03	-.09	-.10	-.14
Forests and rocky areas	-.12	-.28**	-.21*	-.34**

* $p < .05$

** $p < .001$

The adjusted associations between environmental qualities and use of neighborhood surroundings are presented in Table 6. As shown in the table, the direction of the relationships between some variables changed after adjusting. Specifically, outdoor sport facilities and playgrounds became positively associated with the mean number of mapped places, with playgrounds also showing significant association. Additionally, everyday facilities became significantly associated with the number of mapped places. On the other hand, indoor sport facilities were no longer significantly associated with mean distance to ARP. Proportion of forests and rocky areas remained significantly associated with the distance to mapped place, ARP, and FP.

Table 6. *Adjusted associations between use of the neighborhood surroundings and environmental qualities around home locations.*

	Regression coefficients (95% CI)[1]			
	Mean number of mapped places	**Mean distance to mapped place**	**Mean distance to ARP**	**Mean distance to FP**
Indoor sport facilities	-.51 (-1.27-.25)	-41.73 (-136.80-53.35)	-37.79 (-153.86-78.28)	4.31 (-155.48-164.10)
Outdoor sport facilities	.04 (-.34-.41)	13.59 (-33.17-60.35)	19.98 (-36.67 -76.64)	5.14 (-82.93-93.20)
Playgrounds	.15 (.001-.03)*	-5.90 (-25.02-13.23)	-8.47 (-31.97 -15.03)	-3.38 (-33.22-26.46)
Everyday facilities	-.31 (-.58- -.04)*	-4.98 (-38.34-28.38)	-9.69 (-49.68 -30.30)	-17.67 (-70.71-35.38)
Proportion of green urban areas	-.05 (-.30-.21)	.09 (-31.81-32.00)	6.27 (-33.04 -45.59)	5.64 (-47.66-58.95)
Proportion of forests and rocky areas	-.06 (-.12-.01)	-16.76 (-25.39- -8.14)**	-15.12 (-25.84 - -4.41)**	-18.16 (-32.04- -4.28)*

* $p < .05$

** $p < .001$

[1] Adjusted for sociodemographic variables (gender, age, family situation, place of birth and education) and all environmental covariates added in the model (indoor sport facilities, outdoor sport facilities, playgrounds, everyday facilities, proportion of green urban areas and proportion of forests and rocky areas).

6. DISCUSSION

This chapter discusses the study findings in the context of existing research and theory. At first, there is a brief summary of the main findings, followed by a discussion of the research questions using the study's results and available evidence. The last section of the chapter comprises a methodological discussion, encompassing an assessment of strengths and limitations of the study.

6.1 Summary of findings

On average, participants marked 2.3 locations in addition to their home location. Land use characterization, frequency of visits, and distance from home differed for the participants' ARP and FP but a significant difference was observed for the land use characterization only. The results revealed some differences in use of the neighborhood surroundings across sociodemographic groups. Participants without children or no minors reported significantly longer distances to their mapped places and ARP, and this result persisted even after adjusting for potential confounding factors. Moreover, participants with higher education reported a significantly greater number of mapped places compared to those with lower levels of education. This result also persisted in the adjusted model. Access to certain neighborhood facilities and green spaces within 500 meter of home was associated with the number of mapped places, as well as the distances to mapped places, ARP, and FP. After adjusting, playgrounds were positively associated with the number of mapped locations, while everyday facilities showed a negative association. The proportion of forests and rocky areas seemed to be significantly associated with all outcome variables, both before and after adjustment.

6.2 Use of neighborhood facilities for activity and recreational purposes

The majority of the mapped places were located in green spaces, which is not surprising given the preferences for such areas for activity and recreation in Norway (Breivik & Rafoss, 2017). Many report frequent usage of green spaces for recreational activities, and the numbers are increasing (Breivik & Rafoss, 2017). Also, considering Kvernevik's location near the coast with rocky outcrops, and ample green spaces, it is likely that these areas truly serve as important venues for residents to engage in physical activity and recreation. However, the survey's use of the term "recreation" may have resulted in a greater emphasis on recreation when marking areas, possibly leading them to map more places in green spaces as this is considered more recreational than urban areas (Fong et al., 2018). Furthermore, imprecise

markings by the participants in the survey's mapping view may have resulted in information biases. For example, it might be the case that e.g., water and coastal areas were supposed to be marked in green spaces or opposite as these land uses are located next to each other several places in Kvernevik. This methodological consideration will be delved deeper into later in the discussion. While sports facilities are typically associated with physical and recreational activities, the data shows that other land use categories are more important in this regard. This might be explained by the results of Kajosaari og Laatikainen (2020), indicating that use of sports facilities is influenced by accessibility but also other factors. Herein, sociodemographic differences might be an explanation to the low number of mapped places within this land use category, as more women than men responded, and women tend to utilize natural environments for recreational activities more than men, while men to a higher degree are reported to use sport facilities (Breivik & Rafoss, 2017). Additionally, data were collected during the pandemic which may have affected the usage patterns of neighborhood surroundings as people were in higher need of the psychological and physical benefits obtained from green urban areas, open spaces and forests due to social distancing, pressure of lockdown, and times of personal and community stress (Berdejo-Espinola et al., 2021; Korpilo et al., 2021; Venter et al., 2020). The studies from Norway, Finland and Australia found a remarkable increase in usage of outdoor recreational facilities, green urban areas, and forests during the restrictions (Berdejo-Espinola et al., 2021; Korpilo et al., 2021; Venter et al., 2020).

An interesting finding was the observed significant differences in land use categorization for ARP and FP. A higher proportion of FP were marked in green spaces and water and coastal areas, while for other land use categories, the opposite pattern was found. This may indicate that certain land uses are more likely to be classified as favorite areas, which is supported by Korpela et al. (2008). Green spaces and water and coastal areas have been shown to provide positive experiences and mental restoration (Figari et al., 2019; Fong et al., 2018; Kaplan, 1995), which likely influence residents' use of these areas and their consideration of these areas as favorite destinations for activity and recreation. It is also noteworthy that the least number as well as proportion of FP are classified as sport and leisure facilities. It is uncertain whether this is due to poor access to such facilities or whether people do not consider sports facilities as a favorite place.

The mean distance to mapped places was 573 meters, varying from 45 meters to 1812 meters. This shows a great variability in the distances to mapped places. Interestingly, the mean distance in this study is about 170 meters farther than the action radius of Norwegian adults (Norwegian Directorate of Health, 2021). This is noteworthy and may be explained by willingness to travel farther distances. McCormack et al. (2006) found this willingness to be influenced by both destination and personal characteristics. Like seen in Figure 2, the mapped places are located along the coastline and not within the center of Kvernevik. Thus, this destination characteristic can explain the increased distance to mapped places. Furthermore, despite non-significant differences between ARP and FP, there is still a difference where people travel about 50 meters farther to reach FP than ARP. There is relatively sparse evidence on FP, but Korpela et al. (2008) found such places to often locate in areas outside city centers, like watersides and woodlands, which may explain the increased distance as these areas are located towards the coastline as well. The fact that activity and recreation is likely to be undertaken outside the neighborhood surroundings has been proposed by several studies, though these studies refer to areas larger than Kvernevik (Hillsdon et al., 2015; Kajosaari & Laatikainen, 2020; Van Holle et al., 2012). Actually, these studies report the majority of activities to be conducted farther than 800 meters from home. This may explain the relatively low percentage of markings in areas for sports and leisure, as they might be areas that residents travel farther to reach and thus, not captured when Kvernevik's borders are used as the study's area limit. However, proximity and neighborhood surroundings are shown to be important for certain activities and destinations but also certain groups of the population, like elderly (Kajosaari & Laatikainen, 2020; Sugiyama et al., 2012). Therefore, the use of neighborhood surroundings must be broadly studied with different contexts and populations.

Otherwise, many of the places are used either daily or weekly, which is consistent with empirical evidence and previous research on the use of local facilities (Breivik & Rafoss, 2017; Figari et al., 2019; Schipperijn et al., 2010). However, a larger percentage of FP are used less frequently than ARP, which contradicts the findings of a Finnish study (Korpela & Hartig, 1996). Like stated, the evidence on FP is sparse, making conclusions inexpedient. It is also difficult to determine why there is a difference in frequency of visits, yet non-significant, since this is a cross-sectional study. Based on the number of markings, it appears that residents attribute more facilities in the neighborhood with ARP rather than FP, making FP rare and more special, and maybe also of greater value. Therefore, one hypothesis is that since FP might be considered more special, they are seldom visited, e.g., during weekends or

holidays. However, this study did not retrieve information about when and at what time the marked locations were visited. Another hypothesis could be the distance, which seems to be longer for FP. Distance can thus modify the use of FP. Future studies should consider collecting data on day and time of use, but also barriers and motivation for use to get more detailed insights into the use of neighborhood surroundings.

6.3 Associations between sociodemographic characteristics and use of the neighborhood surroundings

Family situation was significantly associated with all outcome measures on use of the neighborhood surroundings, but only the association between family situation and distances to mapped place and ARP remained significant after adjusting for confounders. The results suggest respondents with no minors or no children to report mapped places and ARP significantly farther away than respondents with children in kindergarten or primary school. This is not surprising knowing younger children are more dependent of their parents, requiring more parental care and attention (Nomaguchi & Bianchi, 2004), which may impact distance travelled due to lack of time or energy among the parents. Also, Bellows-Riecken og Rhodes (2008) found parents with dependent children to be more inactive than non-parents. The lack of time or energy and inactivity may impact the willingness to travel farther distances, as described elsewhere. Also, neighborhood preference and residential relocations have been suggested to be impacted by parental status (Scheiner & Holz-Rau, 2013). By so, parents with younger children may reside in more urban areas with greater intensity of facilities and shorter distances.

Individuals with higher education reported significantly greater number of mapped places compared to those with lower education, with a difference of 0.79 places. This association persisted even after adjusting for potential confounding factors. This is in line with previous studies reporting increased odds for using sport facilities as well as green urban areas in higher educated groups (Figari et al., 2019; Kajosaari & Laatikainen, 2020; Karusisi et al., 2013; Schipperijn et al., 2010). For green spaces, higher health literacy, increased focus on environment and living in neighborhoods that promote physical activity through better access and higher quality are suggested as possible explanations for increased use among highly educated individuals (Figari et al., 2019; Karusisi et al., 2013; Schipperijn et al., 2010; Xiao et al., 2019). For sports facilities, cost and economic resources are suggested as barriers,

favoring people with better income and higher education (Karusisi et al., 2013). Some of these factors may also explain the differences in the distance to activity and recreation sites, although these differences were not significant. Regardless, the difference in usage patterns between individuals with different levels of education are an important finding that can be used in urban planning and health promotion efforts to reduce the growing social health disparities.

The study found no significant differences between men and women regarding the outcome variables related to the use of the neighborhood, indicating similar usage patterns between the two genders. However, the results contradict the findings from a study conducted in Norway, which suggested gender differences in the use of facilities (Breivik Rafoss 2017). Additionally, this study is contrary to the studies conducted by Gil Solá og Vilhelmson (2022) and Hillsdon et al. (2015), which showed that men were more likely to use distant activities. The non-significant results and contradictory findings make it difficult to draw conclusions about the use of neighborhood surroundings among genders.

Although the elderly marked fewer mapped places compared to younger adults, this difference was not statistically significant, which is positive as it suggests that elderly use the neighborhood surroundings of Kvernevik to almost the same extent as adults and youths. Interestingly, participants over the age of 65 marked destinations for activity and recreation farther away than younger adults, particularly when compared to those aged 30-49, which aligns with similar results reported by Kajosaari og Laatikainen (2020). This can be explained with elderly's preferences of nature-related activities (Breivik & Rafoss, 2017; Ode Sang et al., 2016), which make them travel farther distances to access the green spaces located along the coastline in Kvernevik. Furthermore, leisure-time physical activity appears to temporarily increase with retirement transition, which may be due to a replacement of time spent for work or commuting, yet this is depending on activity levels before retirement (Barnett et al., 2012; Pulakka et al., 2020; Tuomola et al., 2023). In other words, active elderly may have more time to travel to their preferred destinations compared to younger adults. A Norwegian qualitative report showed that youngest age group (18-29 years) have less sense of neighborhood belonging than other age groups and therefore use areas farther away from home, particularly young newcomers (Hagen et al., 2016). Adults in the age group of 30-49 years are more tied up with obligations related to work, children, and family life (Christiansen et al., 2014). Additionally, given that 40.6% of adults aged 25-39 years report lacking time or experiencing

that physical activity requires too much effort as barriers to activity (Breivik & Rafoss, 2017), it is likely to substantially affect their use of the neighborhood. This may further indicate a need for areas in closer proximity to home locations. Nevertheless, age did not have a significant effect on the number of mapped places or distances to mapped places, whether for ARP or FP, indicating that older and younger people have similar use of their neighborhood surroundings for activity and recreation. It is crucial to incorporate this consideration in the planning process, to ensure that individuals of all ages can access services, facilities, and opportunities that enable them to remain active and engage with their community in Kvernevik.

The use of neighborhood surroundings did not differ significantly between ethnic groups. The results showed a quite wide confidence interval in the non-Norwegian group, likely due to the small sample size, making it difficult to draw conclusions as the results showed lower precision. Despite the uncertainty associated with these results, they tend to align with previous studies where ethnic minorities prefer and use areas farther away from their homes (Comber et al., 2008; Dai, 2011). This can be explained by cultural differences and preferences (Suárez et al., 2020). Although the results suggest greater distances to all destinations for non-Norwegian individuals, it should be noted that immigrants in Norway tend to use facilities for self-organized activities and sports (indoor and outdoor facilities) rather than natural facilities (Breivik & Rafoss, 2017), which are located in the city center of Kvernevik. This would lead to the hypothesis that distance measures should be shorter for non-Norwegian individuals, which is not the case. Many studies highlight the difficulties in determining the user needs of different ethnic groups, as this is largely influenced by background variables such as gender, age, and education, similar to those examined in this study (Figari et al., 2019). In many ways, this makes the immigrant population as heterogenous as the majority population. Therefore, it is important to look at the needs and preferences of the population as a whole and provide facilities for diverse use, rather than focusing on the usage patterns and preferences of individual ethnic groups (Figari et al., 2019).

6.4 Associations between access to environmental qualities and use of neighborhood surroundings

The correlation and regression analyses of the neighborhood facilities suggest that access to certain facilities and green spaces is associated with use of the neighborhood surroundings. Regarding mean number of mapped places, the correlations were negative and weak. Neither of the unadjusted results were significant but in the adjusted model, playgrounds and everyday facilities turned significant. The lack of significance in the unadjusted model might suggest that there were confounding variables affecting the relationship between playgrounds, everyday facilities, and number of mapped places. The adjusted model controlled for those confounding variables, allowing the significant relationship between playgrounds, everyday facilities, and number of mapped places to emerge.

Provision of playgrounds seems to significantly increase the use of neighborhood surroundings in terms of mean number of mapped places. This is supported by evidence. Refshauge et al. (2012) found provision of playgrounds to positively impact frequency of use in Danish respondents. A systematic review by Smith et al. (2017) also found this positive association. At the same time, other factors seem to impact use of these facilities, such as quality, social environment, and safety (Jansson & Persson, 2010; Refshauge et al., 2012; Smith et al., 2017). Factors contributing to use of such facilities differ between adults and children but also gender and context (Jansson & Persson, 2010). Therefore, more research is needed to fully understand how playgrounds impact use of neighborhood facilities and by so, promote health and well-being.

Opposite, access to everyday facilities within 500 meters of home were significantly negatively associated with number of mapped places in the adjusted model. Such facilities seem to be centrally located in Kvernevik or located close to bigger infrastructure areas. Like previously shown in Figure 2, the majority of mapped places are located in areas farther away from the urban center such as green spaces. In other words, when the number of everyday facilities increase, the number of mapped places decrease. A potential explanation might be that some of these facilities may not be considered as places for activity and recreation but rather errands and appointments, leading to fewer markings within and around these facilities as they are not primarily used for activity and recreation. Despite negative associations in this particular study, such facilities increase active travel, social encounters and health in general (Ewing & Cervero, 2010; Liu et al., 2020). Therefore, the complexity of these facilities must

be taken into consideration in urban planning and public health. Unfortunately, these associations were not considered in this this study.

Proportion of forests and rocky areas were negatively associated with all measures of use but only the distance parameters were significant. The results suggest that a greater proportion of forests and rocky areas within 500 meters of home decrease distance to mapped places, ARP and FP. This is not surprising as we know green spaces are commonly used for activity and recreation and thus, living in areas with more forests and rocky areas may mean shorter distances to preferred destinations. Larger green spaces such as forests and woodlands are associated with higher levels of physical activity, and several studies have pointed out that access to such areas in neighborhoods increases their usage, though there are some conflicting results in the literature (Figari et al., 2019; Kajosaari & Laatikainen, 2020; Peschardt et al., 2012; Schindler et al., 2022). Since we do not know who lives in the areas with high proportions of forests and rocky areas, we must be cautious in concluding that higher proportions lead to increased use, as different groups use areas differently and built environment characteristics such as size and quality affect use (Figari et al., 2019).

Indoor sport facilities were negatively correlated with mean distance to ARP and FP in the unadjusted model, but the distance to ARP was no longer significant and the association with FP became positive in the adjusted model. There was also a change in the direction of the association for outdoor sport facilities from the unadjusted to the adjusted model. This suggests that these facilities are influenced by sociodemographic variables and/or other environmental qualities. This is supported by empirical evidence showing that women are more frequent users of indoor facilities while men prefer outdoor sports facilities such as football fields, or that people with higher education generally have higher levels of physical activity and therefore use the neighborhood more than people with lower education (Breivik & Rafoss, 2017). Motivation and barriers among different population groups can also explain some of the differences (Breivik & Rafoss, 2017), but such factors were not considered in this study. An environmental explanation for the change in association might be that outdoor facilities are more equitably distributed across the neighborhood, making them more visible and accessible, and thus easier to locate and use for individuals who are physically active or interested in outdoor activities.

Overall, these findings emphasize the importance of considering both environmental and sociodemographic factors when examining patterns of use of the neighborhood facilities. The findings of this study provide valuable insights for policymakers and public health professionals, enabling them to develop more effective strategies to promote physical activity and improve overall health outcomes in diverse neighborhoods. Specifically, the identification of factors that influence the use of different types of facilities among various demographic groups can be used the development of targeted interventions aimed at increasing physical activity levels and improving health outcomes.

6.5 Methodical considerations

In this subchapter, study strengths and weaknesses are discussed. This includes considerations of study design, internal validity, and external validity.

6.5.1 Study design

This study is conducted using a quantitative cross-sectional design. A quantitative approach was considered suitable for addressing the research questions in this study as the aim was to gain insight into the general rather than the specific but also study associations (Ringdal, 2018). However, a major weakness of cross-sectional studies is the lack of information on causality, as well as the loss of the temporal dimension as relationships between the use of facilities, intrapersonal variables and environmental factors are examined at a given time (Webb et al., 2020). Therefore, conclusions must be drawn with caution (Webb et al., 2020). Nevertheless, this study design is preferable to others for addressing the purpose and research questions of this study. The PPGIS methodology allows for the collection of both individual and place-specific data, which can be integrated through geospatial analysis to gain a more comprehensive understanding of usage patterns and experiences. This approach has been used in several studies, although not yet in Norway (Broberg et al., 2013b; Kajosaari & Laatikainen, 2020; Kyttä et al., 2012; Kyttä et al., 2016).

6.5.2 Intern validity

It is important to ensure consistency between what is intended to be investigated and what is actually being investigated, that is, high internal validity (Rød, 2017). Internal validity can be threatened by systematic errors, which can be broadly classified as selection bias, information bias, and confounding (Webb et al., 2020), which will be discussed in the following sections.

Selection bias

Selection bias arises when the individuals in the sample are not a true representation of the population being studied, resulting in a systematic difference between the sample and the population it was intended to represent (Webb et al., 2020). This is critical for the study's ability to generalize its findings beyond the sample (Webb et al., 2020). Based on the sociodemographic characteristics presented in Table 1, certain groups seem to be either over- or underrepresented. Women, people with higher education, or people aged 30-49 are well represented in the sample. These population groups have shown to be frequent users of the local environment and likely speak for a certain type of use (Breivik & Rafoss, 2017; Figari et al., 2019). Although these groups must be included in such studies, it is crucial to also obtain insights from individuals who utilize the nearby surroundings differently to promote usage among various groups of the population. In this study, for example, the elderly or people with lower education seem to be underrepresented. To assess whether selection bias exists, it is important to investigate representativeness. Compared to data from the district level, it can be seen that the age groups 50-64 and >65 are underrepresented in this study while the younger group of 30-49 is overrepresented (Statistics Norway, 2022). Women are also overrepresented compared to men (Statistics Norway, 2022). About 21% of people have a non-Norwegian ethnic origin in Stavanger (Norwegian Institute of Public Health, 2019), while in this study, 8% have non-Norwegian background. Hence, this could suggest that this particular demographic group is also underrepresented in the study. Obtaining reliable data on family situation is challenging, but the fact that there is a greater percentage of children aged 0-17 in the Madla district than in the rest of the country suggests that the sample is possibly representative, since most participants have children within that age range. The percentage of individuals with higher education aligns with the population in both Madla and Stavanger. However, as expected, there is an insufficient representation of individuals with lower education. To sum up, some of the sociodemographic groups appear to be adequately represented, while others are over- or underrepresented. This impacts the study's validity, and as a result, one must be careful when using its findings for urban planning and decision-making. To obtain more reliable and comprehensive data on usage patterns, future studies should strive to reach out to individuals who use the local environment less frequently or in different ways than captured in this study.

Of the original sample of 571 participants, 245 individuals (42.9%) were excluded, negatively impacting the validity of the study. Incomplete markings of home locations or markings

outside the defined boundaries were among the reasons for exclusion. This is typical of PPGIS surveys, as highlighted in Brown og Kyttä (2014), and leads to lower response rates. It is difficult to draw conclusions for those with incomplete markings, but hypotheses include lack of time, language barriers, energy or motivation to complete the survey (Brown & Kyttä, 2014). To ensure representativeness and more variation in results, a larger sample size is desirable. Future studies should facilitate better completion rates while ensuring better representation of the population. However, it is important to acknowledge that not everyone can be reached with the available time and resources, and decisions must be made accordingly.

Education and family situation have particularly high proportions of missing values (>25.5%), and it may be difficult to determine whether they are missing at random (MAR) or missing not at random (MNAR), i.e., whether they are random or systematic dropouts (Choi et al., 2019; Donders et al., 2006). One hypothesis is that individuals with lower education may be less willing to conceal their educational attainment level due to negative attitudes (Kuppens et al., 2018). Another hypothesis is that these questions came later in the survey and therefore had a lower response rate, as suggested by Kato og Miura (2021). Nonetheless, the dropout can impact the effect estimates in either direction. However, it is considered a strength that missing values have been handled analysis by analysis in order to get as big samples as possible. This is particularly important considering the initial sample size was relatively small.

Furthermore, the study did not consider residential self-selection, indicating people to reside in neighborhoods that support their preferences (van Wee & Cao, 2022). For example, individuals who prefer an active lifestyle may choose to live in neighborhoods close to recreational venues or specific sports facilities (Scheiner & Holz-Rau, 2013). Additionally, sociodemographic factors and life stage can also impact one's choice of neighborhood (Christiansen et al., 2014).

Information bias

Information bias, also known as measurement error, occurs when the information obtained from the sample is incorrect. This can be due to both systematic and random errors caused by several factors, such as measurement instruments like GIS or imprecise definitions or lack of clarifications (Webb et al., 2020). This can result in misclassification, either differential or

non-differential (Webb et al., 2020). In this study, land use categories were recoded and aggregated into larger categories based on detailed descriptions in the Urban Atlas Mapping Guide (European Union, 2011). This reclassification may have been done on erroneous grounds and consequently produce information bias in the sense that marked places that should have been placed in one category are defined as something else. There is particularly uncertainty related to green spaces, which originally consisted of the categories "green urban areas" and "natural and semi-natural areas". By retaining these categories, one could determine whether more mapped places are marked in forests and rocky areas than green urban areas to increase the specificity of the results. However, these categories were aggregated to one land use category due to methodological simplifications but also because these areas seemed more alike in Kvernevik compared to traditionally green urban areas and forests or woodlands. There is particularly reason criticize this aggregation when proportions for green urban areas and forests were distinguished for the accessibility analyses around the home locations. Additionally, the PPGIS method may have resulted in misclassifications as participants may have marked imprecisely (Brown & Kyttä, 2014). Particularly, markings in water may have been classified as green spaces or agricultural areas since these are areas located close to the water's edge.

Although Maptionnaire represents a completely new tool for data collection, it cannot be denied that it involves self-reporting and subjective evaluations, which may be subject to information biases like recall bias. There is reason to believe that certain population groups have overestimated while others have underestimated usage, resulting in non-differential misclassification of use. For example, it is believed that the COVID-19 pandemic may have given a false picture of usage, as restrictions led to increased use of outdoor facilities and nature among certain population groups (Venter et al., 2020). Furthermore, seasonal variations may have resulted in underreporting of usage since data collection was carried out in October, a period which studies have shown that time spent in the neighborhood surroundings is decreasing (Guan et al., 2021; Roemmich & Johnson, 2014). Although not included in this study, there were questions related to this specific topic in the survey. A quick look at the responses indicated that the majority of places were used throughout the year. Therefore, there is reason to believe that the reported usage is valid in terms of seasonal variations. The fact that participants themselves have marked the locations is a strength as the participants define their own neighborhood but there is still a risk of information bias due to imprecise markings as well as differences in mapping effort (Brown & Kyttä, 2014). Brown

(2016) found mapping effort to be highest among those livelihoods closely related to the purpose of the study. The ability to zoom in on the map may have reduced the level of imprecision in the participants' markings. However, obtaining objective measurements of use of neighborhood surroundings based on e.g., GPS tracking could have provided additional valuable insights and may be considered as a complementary method in future studies.

The inclusion of participants who resided in border areas of other neighborhoods, which may affect both the distance and the number of marked places, may have caused information bias by misleading representation of the participants in Kvernevik. At the same time, several studies highlight the importance of letting residents define their own neighborhood (Hasanzadeh et al., 2017; Rinne et al., 2022). This was used to justify the inclusion of participants who live outside the Kvernevik area.

The utilization of GIS for objective measurements of the neighborhood is advantageous, especially when coupled with questionnaire data to provide a more comprehensive understanding of the utilization of neighborhood surroundings by the participants. Nonetheless, the utilization of buffers and area limitations can be regarded as a methodological limitation as there is a high likelihood that participants use other areas for activities than what their buffers represent (Hillsdon et al., 2015; Kajosaari & Laatikainen, 2020; Van Holle et al., 2012). Efforts were made to mitigate this issue by using the average distance to mapped places as a basis for selection the buffer size, which was 500 meters. However, based on evidence of average distances traveled to destinations for activity and recreation, it may be questioned whether the buffer distance should have been even larger (Yi et al., 2019). Additionally, one can critique the usage of straight-line buffers as opposed to network buffers. The latter has been shown to be particularly pertinent for facilities located near the road network, such as indoor sports facilities, as they are frequently overrepresented by straight-line buffers (Kajosaari & Laatikainen, 2020). Nevertheless, both buffer size and straight-line distances were deemed adequate in this case area as it is a relatively small area with a compact city center. Future research should more thoroughly consider the use of network buffers as well as larger buffer sizes, particularly if the area under investigation is larger or has a different structure than Kvernevik.

The neighborhood facilities were converted to points in the GIS analyses to determine the number of points within each buffer as a measure of intensity. However, this approach may

represent a limitation as it does not consider the size of the area or building. Consequently, certain facilities that are actually located within 500 meters from home may not be captured, leading to underrepresentation, lower accuracy of the data and potential information bias. Specifically, outdoor sports facilities are susceptible to underrepresentation due to larger extents. Nonetheless, the small sizes of the facility areas in Kvernevik reduces this issue. For green spaces such as green urban areas and forests, a conversion was not performed as it would significantly underestimate the accessibility of such facilities within a 500-meter buffer. Instead, the study calculated the buffer percentage according to WHO's indicator recommendations, which is considered a strength of the study (World Health Organization, 2016). At the same time, this measurement does not consider the quality of the green spaces, which may impact the use of neighborhood surroundings (Figari et al., 2019), but also, explain some of the negative associations found. This account for both green spaces but also built-up facilities like indoor sport facilities or playgrounds (Figari et al., 2019; Limstrand, 2008). Having a high number of facilities nearby does not necessarily guarantee accessibility if the quality is poor. In such cases, people may choose to travel farther to use higher quality facilities, which is reflected by the maximum distance observed in this study where some participants traveled up to almost two kilometers to reach certain locations. In future studies, it is important to take into account the quality of facilities in order to gain a better understanding of the use of neighborhood surroundings.

Confounding

As research on associations between variables might be explained by other variables, confounding variables must be addressed. When controlling for confounding variables, we can see if the associations are true and not caused by the effect of other variables (Webb et al., 2020). Confounding arises when the groups being compared are not perfectly matched and differ in factors other than the exposure status (Webb et al., 2020). In this study, potential confounding variables were included based on what the literature suggests may impact the results. Sociodemographic variables such as gender, age, education, place of birth, and family situation in terms of the age of children were included because differences in use have been shown between these groups. In an attempt to control for differences in destination accessibility that have been shown to affect use, intensity of environmental qualities was treated as a potential confounder. Due to differences in available data, other studies have employed different confounders to account for environmental characteristics (Nordbø et al., 2019; Aarts et al., 2013). Despite efforts to account for potential confounders, there is always

a risk of other confounding variables not being adjusted for (Webb et al., 2020). For example, this study did not account for built environment characteristics such as population density, as done by Nordbø et al. (2019). This is a factor that can contribute to access to facilities as well as usage patterns. Therefore, it is possible that the estimates may be affected by other unadjusted factors.

6.5.3 External validity

External validity refers to whether the results of a study can be generalized from the sample to the target population (Webb et al., 2020). In this case, it refers to whether the findings related to the use of neighborhood surroundings for activity and recreation can be applied to adults in Norway and potentially in a broader context. The study has a notable advantage in that it encompasses participants from diverse sociodemographic backgrounds and analyzes variations among them. Nevertheless, there are certain limitations in the sample that may reduce generalizability. Some groups are overrepresented or underrepresented in comparison to the population, for instance, the majority of women making it difficult to generalize the results to men, and the underrepresentation of the elderly population.

Despite attempts to consider urban and rural areas through accessibility measures, there are many areas in Norway that are either more urban or more rural and consequently have more or fewer facilities available (Oppøyen, 2023). It is difficult to generalize the results to such areas. However, there are many small towns or suburban areas in Norway that resemble Kvernevik in terms of size and facility availability. Therefore, it can be assumed that the results to some extent can be relevant to similar context although the results are highly context dependent. This also entails that generalizing the results to other countries with different demographics, culture, climate, and nature focus should be done with caution.

6.6 Implications for public health and future research

This study contributes to the knowledge base of public health work in Norway focusing on developing activity-friendly and health-promoting neighborhoods. The novelty of the study should also be emphasized as it represents one of the first studies in Norway that uses the Maptionnaire tool grounded in PPGIS methodology for investigating use of the neighborhood surroundings, and such tools and methodology will likely be very useful in future studies and development processes across Norway.

More specific, this study contributes with knowledge to local urban planning and public health policies by indicating which areas are used, how often they are used, and which distances people travel to get to the respective places. It is evident that green spaces seem to be important areas for activity and recreation. Thus, these areas seem especially critical to maintain as urbanization lead to land use challenges. Considering that distance is a barrier for many, especially those with the greatest need for nearby activity and recreation opportunities due to reduced health, mobility, and social networks, the importance of preserving green spaces within the neighborhood in future public health policy and urban planning is emphasized. Since this is a cross-sectional study, only differences in usage have been identified, not how they change with development and time, nor why certain areas promote usage. Therefore, future studies should follow the development of use through longitudinal studies and examine the motivations and barriers behind usage patterns with more qualitative methods.

This study also provides relevant knowledge on how different sociodemographic groups use their neighborhood surroundings. Despite some methodological weaknesses, the results indicate that level of education and family situation seem to play a role for usage, both in terms of how many places in the neighborhood surroundings being used and the distance to those places. This emphasizes the importance of considering the diverse needs and preferences of different sociodemographic groups when designing and implementing neighborhood surroundings for activity and recreation. Addressing vulnerable groups with the aim of reducing social health inequalities is highly relevant in the recently presented public health report (Meld. St. 15 (2022-2023)), which strengthens the relevance of this particular study. Thus, future research could investigate the underlying mechanisms and motivations behind the observed usage patterns across different sociodemographic groups.

The methodological approach of this study, in which PPGIS were used for data collection, has several relevant implications. PPGIS provides an unique opportunity to gain a more detailed understanding of use while involving and engaging citizens and allowing them to define their neighborhood (Brown & Kyttä, 2014). The importance of involving citizens in the development of health-promoting environments is emphasized in a systematic review by Salvo et al. (2018). Additionally, the use of GIS offers opportunities for transdisciplinary collaboration, which is highly needed in the field of public health (Sallis et al., 2006). Map-

based methods can provide a common language with other sectors that are relevant to public health, including urban planning, transportation, architecture, and landscape architecture, in order to facilitate transdisciplinary collaboration. This is particularly important now that public health is being included in municipalities' planning processes in accordance with legislations (Planning and Building Act, 2008). By using a language that multiple sectors understand, such as in this present study, there is a greater likelihood of implementing effective health-promoting interventions aimed at improving population health and reducing social health inequalities.

7. CONCLUSION

According to the findings of this master thesis, the results indicate differences in how people use their neighborhood surroundings for activity and recreation, both overall and among various sociodemographic groups. Particularly education and family situation seem to play a role for usage. Furthermore, the use of neighborhood surroundings appears to be affected by intensity of facilities, such as playgrounds, everyday facilities and forests and rocky areas. Despite this study being the first to use the PPGIS tool Maptionnaire on Norwegian adults and addresses several key issues in public health, there are some methodological limitations that necessitate cautious interpretation of the results. More research is necessary to evaluate causality and relationships over time, and future studies could consider using more objective measures of usage.

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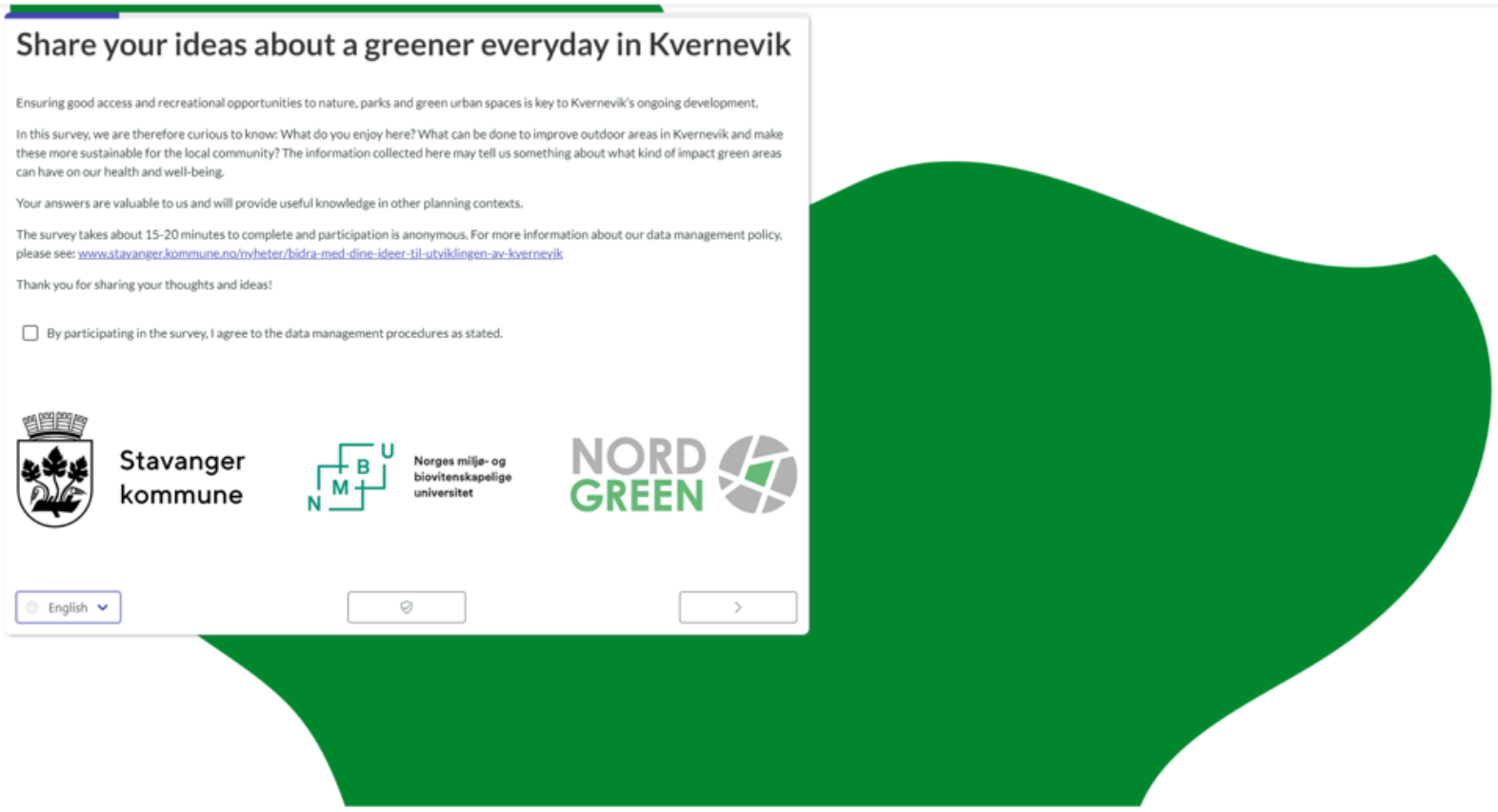
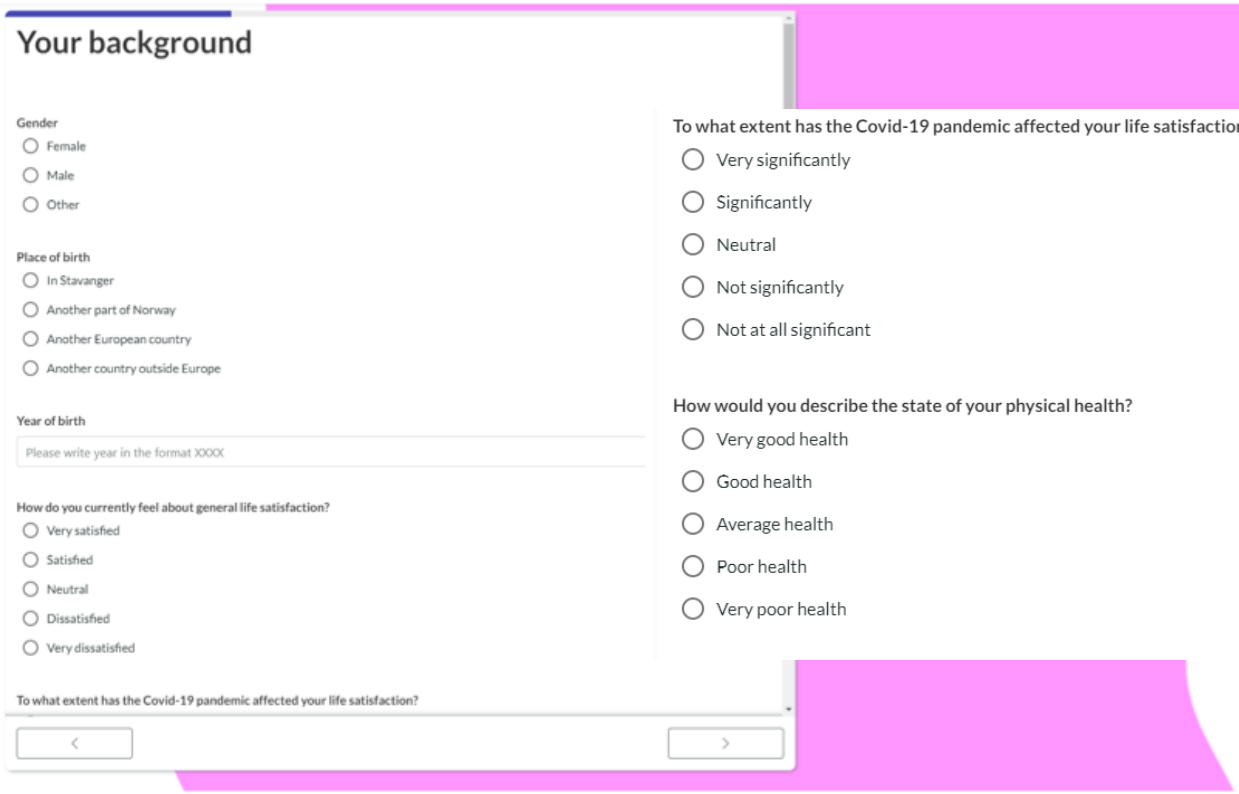
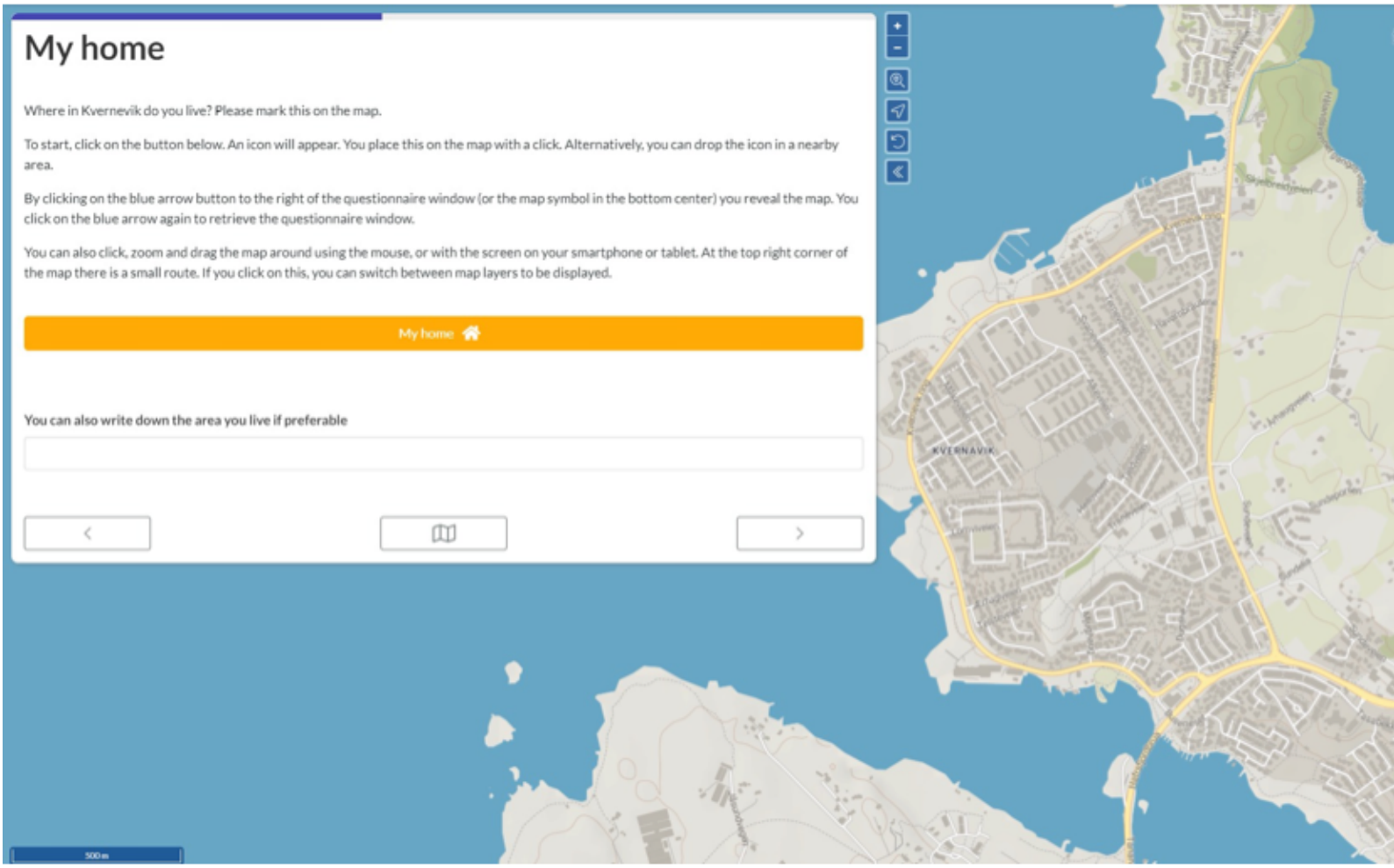
Appendicies

Appendix A. PPGIS survey in Kvernevik, Stavanger




Your background
Gender
Female
Male
Other
Place of birth
In Stavanger
Another part of Norway
Another European country
Another country outside Europe
Year of birth
Please write year in the format XXXX
How do you currently feel about general life satisfaction?
Very satisfied
Satisfied
Neutral
Dissatisfied
Very dissatisfied
To what extent has the Covid-19 pandemic affected your life satisfaction?
To what extent has the Covid-19 pandemic affected your life satisfaction?
Very significantly
Significantly
Neutral
Not significantly
Not at all significant
How would you describe the state of your physical health?
Very good health
Good health
Average health
Poor health
Very poor health


My home
Where in Kvernevik do you live? Please mark this on the map.
To start, click on the button below. An icon will appear. You place this on the map with a click. Alternatively, you can drop the icon in a nearby area.
By clicking on the blue arrow button to the right of the questionnaire window (or the map symbol in the bottom center) you reveal the map. You click on the blue arrow again to retrieve the questionnaire window.
You can also click, zoom and drag the map around using the mouse, or with the screen on your smartphone or tablet. At the top right corner of the map there is a small route. If you click on this, you can switch between map layers to be displayed.
My home
You can also write down the area you live if preferable
KVERNAVIK
500 m

In the polls below, please range to what degree you....

1 = To a very small degree
5 = To a very large degree

Enjoy the area you live

1 — 5

Feel a sense of belonging in your community

1 — 5

During daytime, feel safe when you are outside

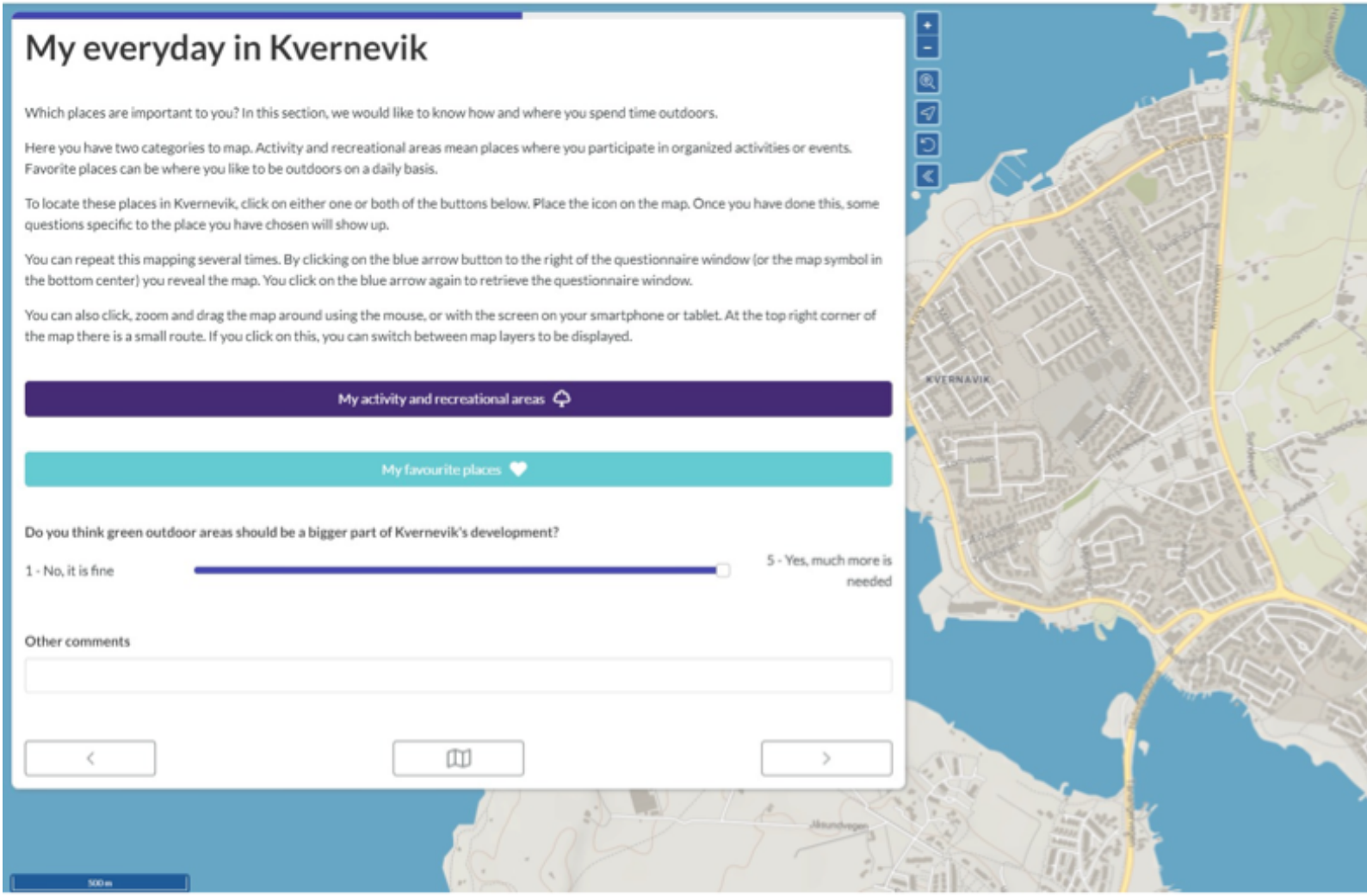
1 — 5

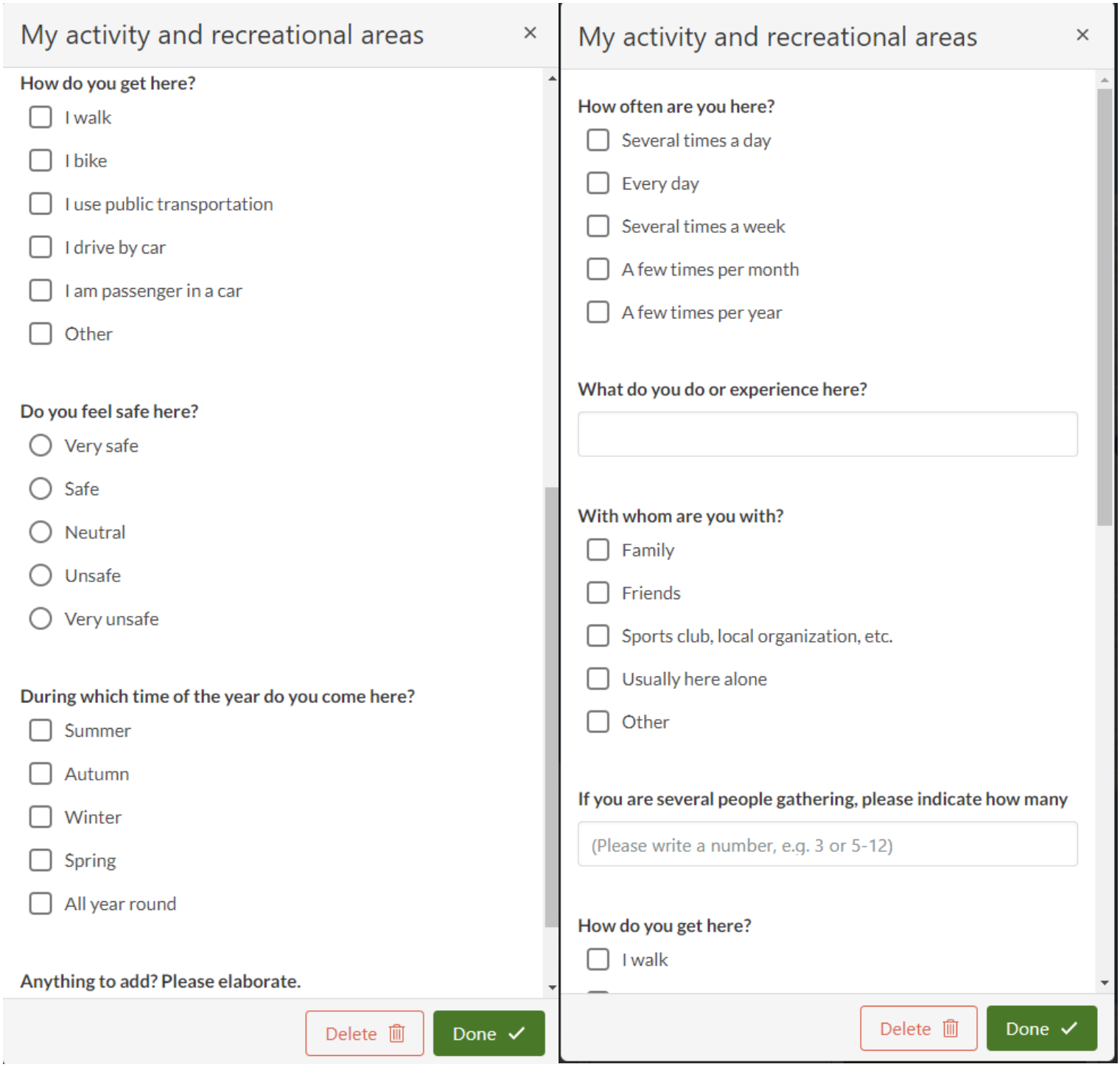
During evening time, feel safe when you are outside

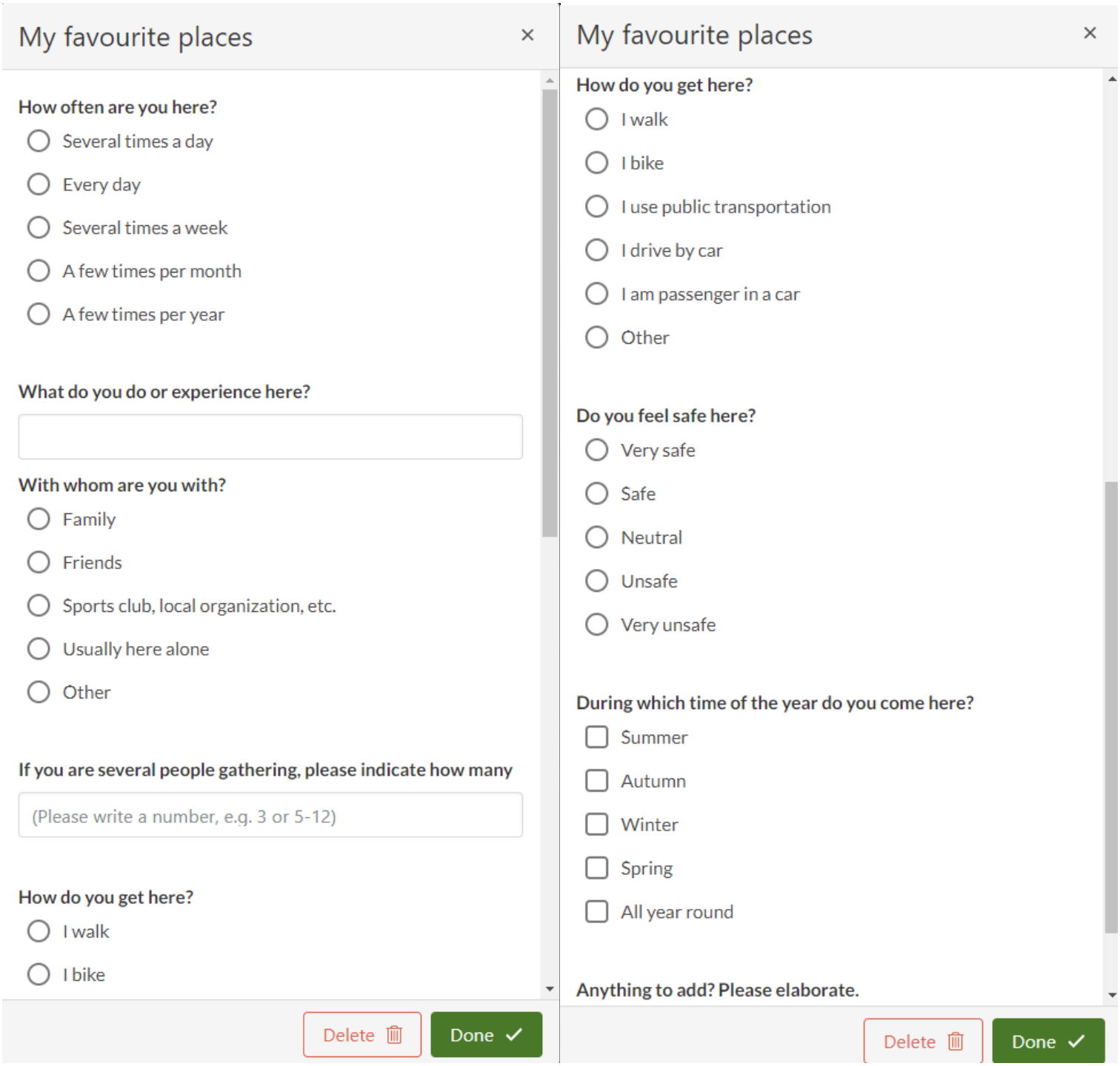
1 — 5

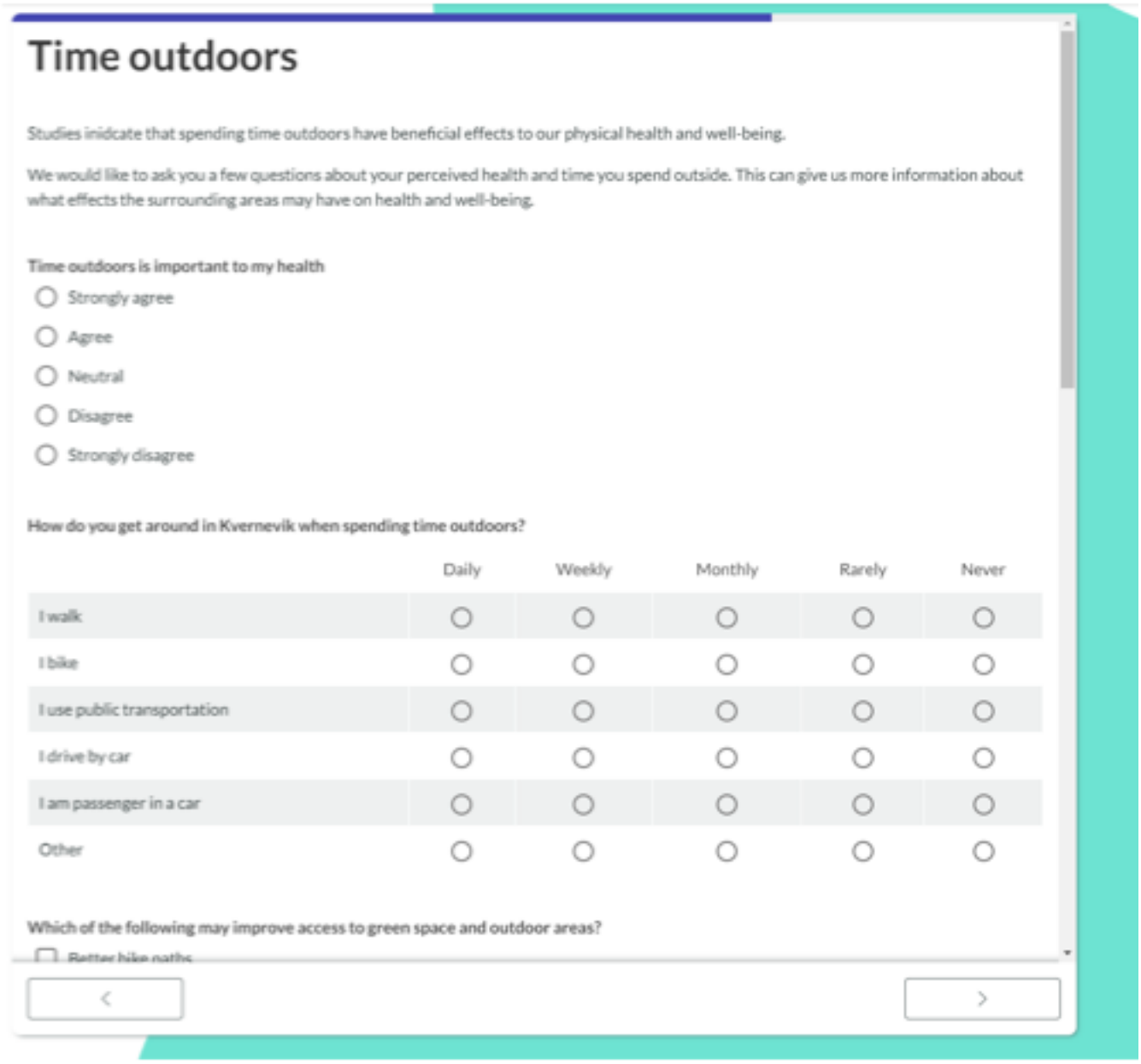
Are part of a community

1 — 5




My activity and recreational areas
How do you get here?
I walk
I bike
I use public transportation
I drive by car
I am passenger in a car
Other
Do you feel safe here?
Very safe
Safe
Neutral
Unsafe
Very unsafe
During which time of the year do you come here?
Summer
Autumn
Winter
Spring
All year round
Anything to add? Please elaborate.
Delete
Done
My activity and recreational areas
How often are you here?
Several times a day
Every day
Several times a week
A few times per month
A few times per year
What do you do or experience here?
With whom are you with?
Family
Friends
Sports club, local organization, etc.
Usually here alone
Other
If you are several people gathering, please indicate how many
(Please write a number, e.g. 3 or 5-12)
How do you get here?
I walk
Delete
Done


My favourite places
How often are you here?
Several times a day
Every day
Several times a week
A few times per month
A few times per year
What do you do or experience here?
With whom are you with?
Family
Friends
Sports club, local organization, etc.
Usually here alone
Other
If you are several people gathering, please indicate how many
(Please write a number, e.g. 3 or 5-12)
How do you get here?
I walk
I bike
Delete
Done
My favourite places
How do you get here?
I walk
I bike
I use public transportation
I drive by car
I am passenger in a car
Other
Do you feel safe here?
Very safe
Safe
Neutral
Unsafe
Very unsafe
During which time of the year do you come here?
Summer
Autumn
Winter
Spring
All year round
Anything to add? Please elaborate.
Delete
Done



Time outdoors

Studies inidcate that spending time outdoors have beneficial effects to our physical health and well-being.

We would like to ask you a few questions about your perceived health and time you spend outside. This can give us more information about what effects the surrounding areas may have on health and well-being.

Time outdoors is important to my health

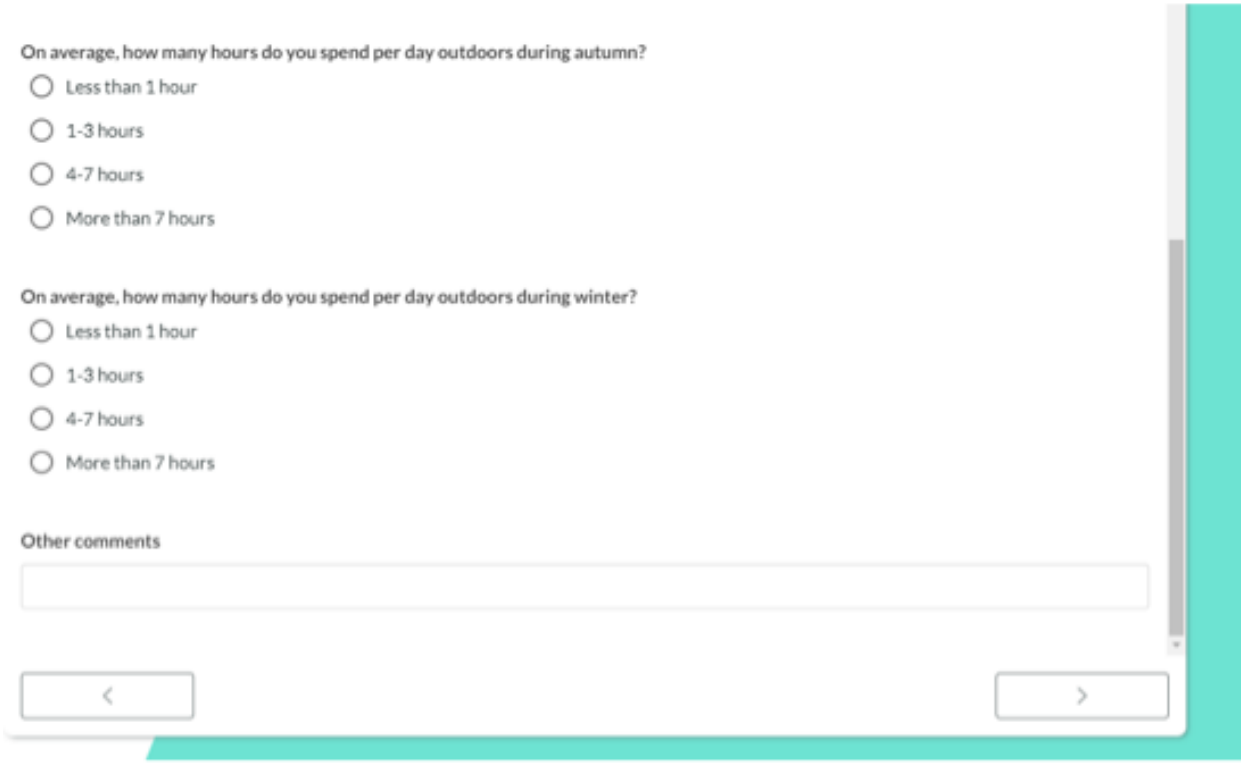
- ○ Strongly agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly disagree

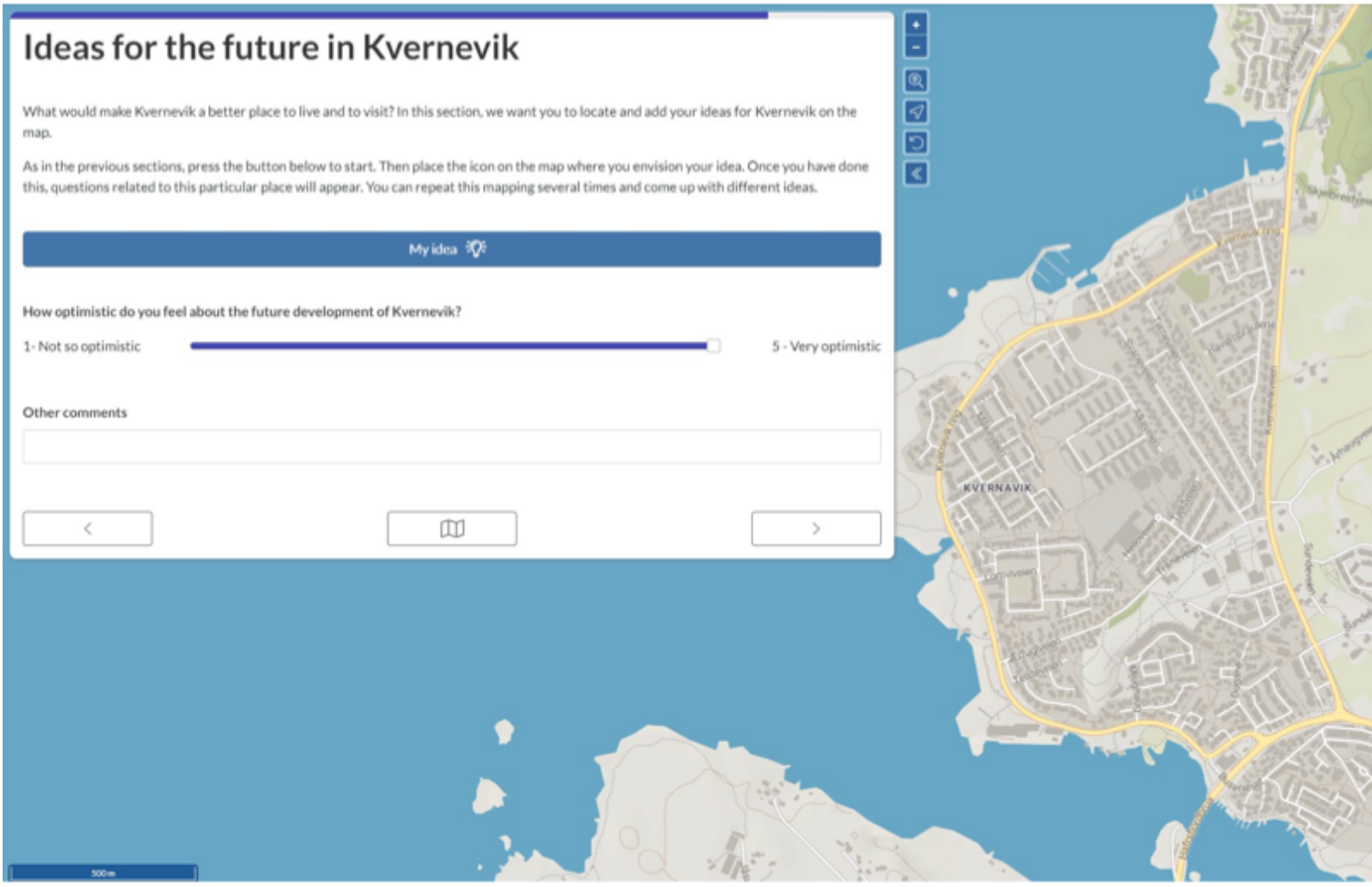
How do you get around in Kvernevik when spending time outdoors?

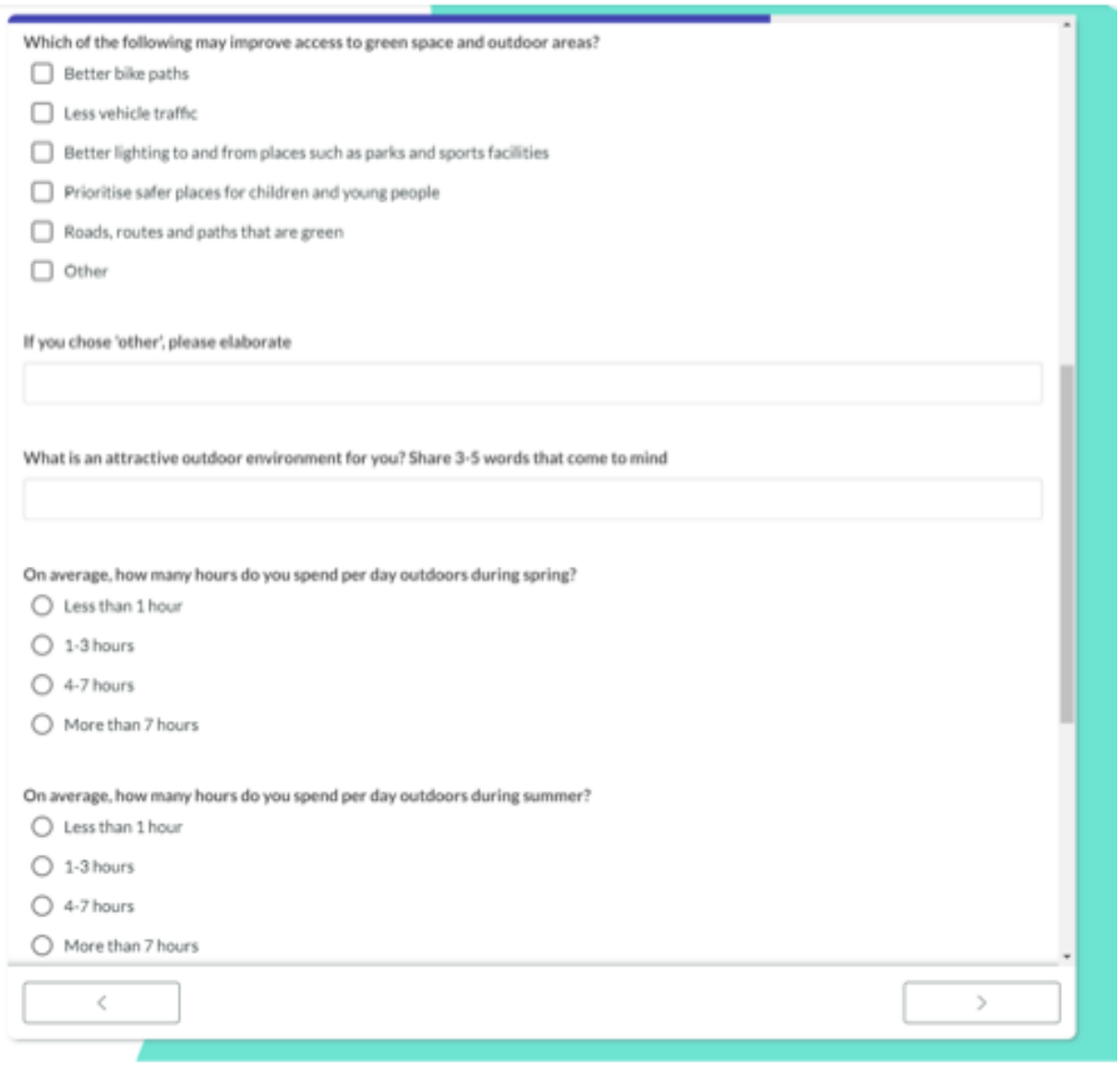
	Daily	Weekly	Monthly	Rarely	Never
I walk	○	○	○	○	○
I bike	○	○	○	○	○
I use public transportation	○	○	○	○	○
I drive by car	○	○	○	○	○
I am passenger in a car	○	○	○	○	○
Other	○	○	○	○	○

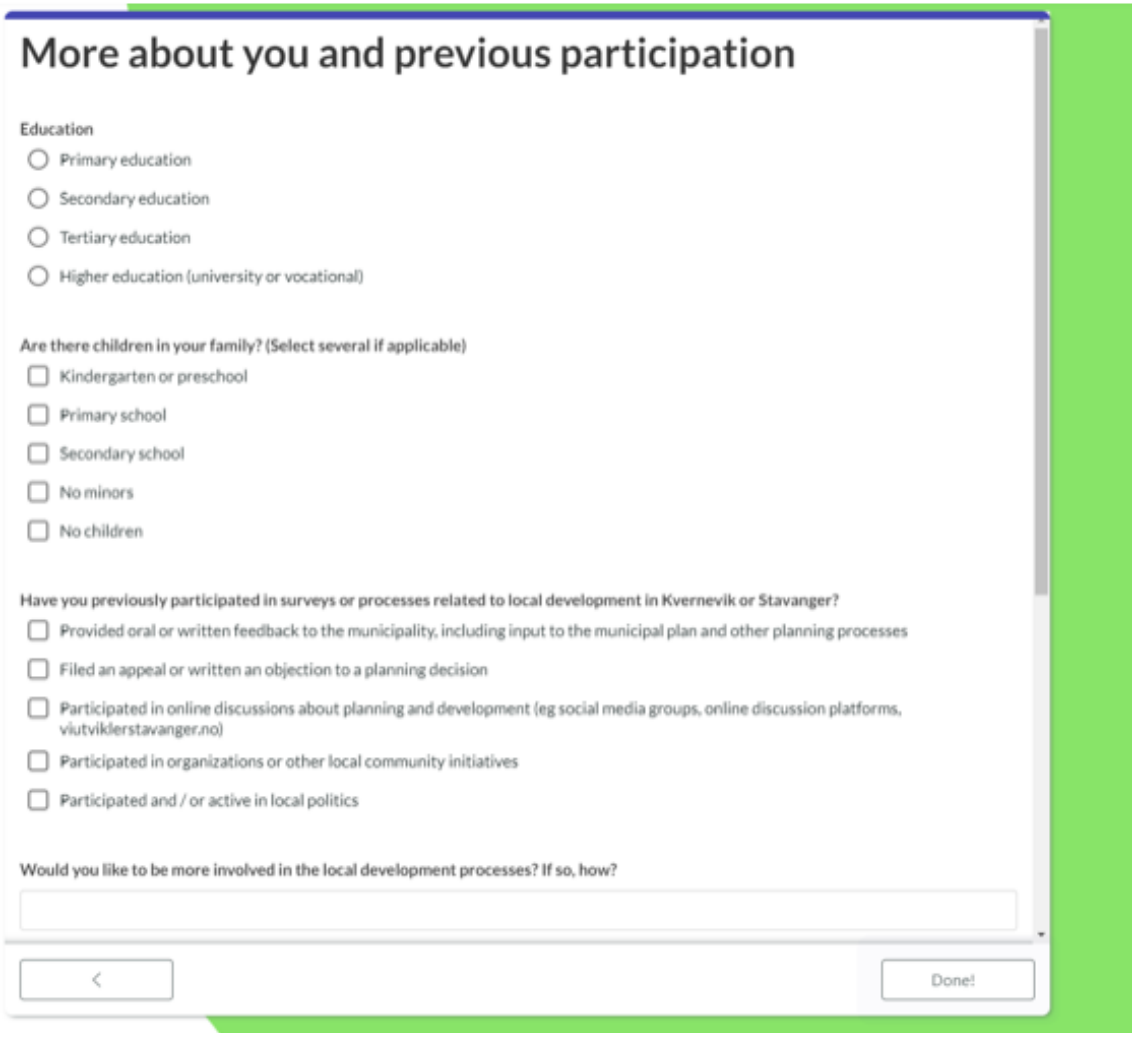
Which of the following may improve access to green space and outdoor areas?

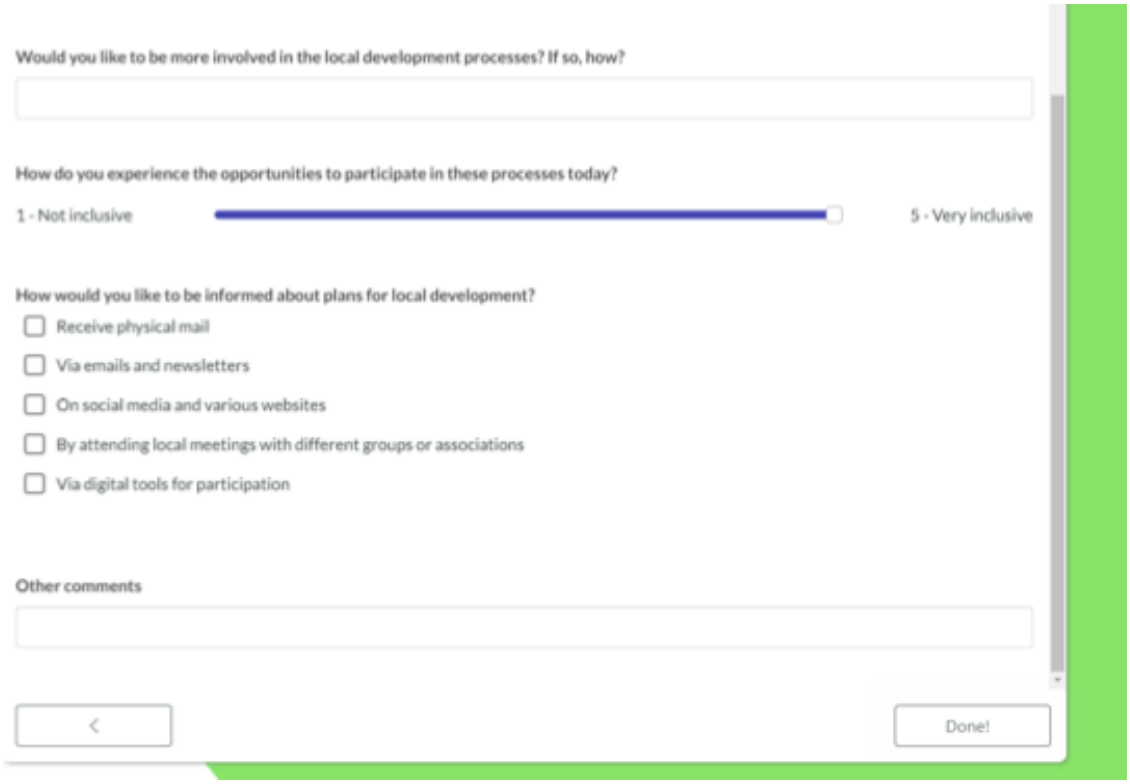
☐ Better bike paths


On average, how many hours do you spend per day outdoors during autumn?
Less than 1 hour
1-3 hours
4-7 hours
More than 7 hours
On average, how many hours do you spend per day outdoors during winter?
Less than 1 hour
1-3 hours
4-7 hours
More than 7 hours
Other comments


Ideas for the future in Kvernevik
What would make Kvernevik a better place to live and to visit? In this section, we want you to locate and add your ideas for Kvernevik on the map.
As in the previous sections, press the button below to start. Then place the icon on the map where you envision your idea. Once you have done this, questions related to this particular place will appear. You can repeat this mapping several times and come up with different ideas.
My idea
How optimistic do you feel about the future development of Kvernevik?
1- Not so optimistic
5 - Very optimistic
Other comments
KVERNAVIK


Which of the following may improve access to green space and outdoor areas?
Better bike paths
Less vehicle traffic
Better lighting to and from places such as parks and sports facilities
Prioritise safer places for children and young people
Roads, routes and paths that are green
Other
If you chose 'other', please elaborate
What is an attractive outdoor environment for you? Share 3-5 words that come to mind
On average, how many hours do you spend per day outdoors during spring?
Less than 1 hour
1-3 hours
4-7 hours
More than 7 hours
On average, how many hours do you spend per day outdoors during summer?
Less than 1 hour
1-3 hours
4-7 hours
More than 7 hours


More about you and previous participation
Education
Primary education
Secondary education
Tertiary education
Higher education (university or vocational)
Are there children in your family? (Select several if applicable)
Kindergarten or preschool
Primary school
Secondary school
No minors
No children
Have you previously participated in surveys or processes related to local development in Kvernevik or Stavanger?
Provided oral or written feedback to the municipality, including input to the municipal plan and other planning processes
Filed an appeal or written an objection to a planning decision
Participated in online discussions about planning and development (eg social media groups, online discussion platforms, viutviklerstavanger.no)
Participated in organizations or other local community initiatives
Participated and / or active in local politics
Would you like to be more involved in the local development processes? If so, how?
Done!


Would you like to be more involved in the local development processes? If so, how?
How do you experience the opportunities to participate in these processes today?
1 - Not inclusive
5 - Very inclusive
How would you like to be informed about plans for local development?
Receive physical mail
Via emails and newsletters
On social media and various websites
By attending local meetings with different groups or associations
Via digital tools for participation
Other comments
Done!

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