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Original article

Demographic, social, and environmental factors predicting Danish children's greenspace use

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ABSTRACT

Evidence suggest that greenspace use can be associated with children's physical, mental, social health and well-being. Accordingly, contemporary children's declining greenspace use prompts a need to understand the factors that affect frequency of use. Aiming to determine to what extent demographic, environmental and social factors predict greenspace use for 6–15-year-old children in Denmark a national survey was distributed. Responses from 3171 parents showed that 49.5 % of the children used greenspace almost every day during the summer season. Multivariate binary logistic regression analysis showed that the number of types of greenspace within walking or cycling distance from home was a strong predictor for daily use. Parental concern and encouragement also predicted use, but less so. Child age and geography were the only demographic predictors for using greenspace almost every day. Findings from the present study suggests that providing opportunity for choosing between various types of greenspace within walking or cycling distance might be an effective way to stimulate children's use of greenspace.

1. Introduction

A recurring conclusion across a rapidly growing body of research is that greenspace can be associated with children's physical, mental, social health and well-being (Chawla, 2015; Mygind et al., 2019, 2021; Tillmann et al., 2018). Greenspace can facilitate a wide range of low-cost activities and the availability of greenspace is frequently linked to increased levels of recreational physical activity (Boone-Heinonen et al., 2010; Ferreira et al., 2007; Jones et al., 2009; J.; Author et al., 2010). However, it seems evident that contemporary children are spending less time in greenspace than previous generations (Kellert et al., 2017; Lincoln R. Larson, Green, & Cordell, 2011). The decline in children's greenspace use gives rise to concern as children potentially fail to benefit from the many health gains that are associated with being in greenspaces. Globally, the majority of children (11–17 years) do not meet current physical activity guidelines, and Denmark is no exception with an overall prevalence of insufficient physical activity (in 2016) of 84,5 % (Guthold et al., 2020). Promoting greenspace use could contribute to more children meeting the recommended 60 min of daily moderate to

vigorous-intensity physical activity (WHO, 2018) and thereby be an expedient investment in children's health and well-being.

To be able to stimulate children's use of greenspace, it is essential to understand the factors that affect their use of these spaces. From other studies we know that the extent of children's use of greenspace varies across a range of non-modifiable demographic factors, including age (Braun and Dierkes, 2017; Kellert et al., 2017; L. R. Larson et al., 2010; Lincoln R. Larson et al., 2011), gender (Lincoln R. Larson et al., 2011; Lincoln R. Larson et al., 2019), ethnicity (Hunt et al., 2016; Kellert et al., 2017; Lincoln R. Larson et al., 2011) and the socio-economic status of their parents (Delisle Nyström et al., 2019; Hunt et al., 2016; Tandon et al., 2012). In addition, a number of modifiable factors associated with children's use of greenspace have been identified. These comprise a range of environmental factors, including biophysical factors such as building density and geography (Islam et al., 2016; Kellert et al., 2017), recreational facilities and amenities (Veitch et al., 2016) and the availability and accessibility of greenspace (Bloemsma et al., 2018; Islam et al., 2016). Access to greenspaces is more than physical availability and proximity, and encompasses perceived or functional access which

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relates to a diversity of social factors (Wang et al., 2015). These social factors include children's levels of independent mobility, which refers to the freedom that children have to move around their neighbourhood without adult supervision (A. Carver et al., 2012; Wen et al., 2009). Children's levels of independent mobility relate to parental (and professional) concerns over children's safety with regards to e.g. traffic, strangers and drugs (Carver and Crawford, 2010; Foster et al., 2014) and to increased adult overprotection, hyper-parenting and supervision in childhood outdoor activities (Janssen et al., 2016; Little, 2010). Also, children's outdoor spatial behaviours are influenced by parents' behaviours and attitudes towards greenspace use (Hunt et al., 2016; Kyttä et al., 2018).

The multitude of factors that affect greenspace use highlight the complexity of planning innovations to stimulate use in children and prompts a need for further knowledge on the significance of demographic, social and environmental factors to establish effective strategies. Limited research so far has empirically tested multidimensional factors for children's greenspace use at a national level. And, in Denmark, currently no nationally representative research on children's use of greenspace is available, nor has the multitude of factors that affect greenspace use been systematically explored. Moreover, inconsistent findings regarding socio-economic differences associated with greenspace use prompt a need for further studies (Akpınar, 2017; Zhang et al., 2019). For school-aged children (6–15 years old), use of greenspace can take place in different contexts; during school hours (e.g. Udeskole (Bentsen and Jensen, 2012)), as part of organised leisure time activities (e.g. in sports clubs) or self-organised, either with or without parental involvement. Using data from a national survey to examining 6–15-year-old children's current use of greenspace in Denmark, the aim of this paper is to investigate to what extent demographic, social and environmental factors predict the frequency of greenspace use in Danish children. By operationalizing environmental factors as accessibility of different types of greenspace and social factors as parental encouragement and concern, the aim of the paper will be addressed by answering the following research questions: 1) How often do Danish children use greenspaces? 2) What demographic differences in greenspace use are present? 3) How do social and environmental factors predict greenspace use?

2. Materials and methods

2.1. Definition of greenspace

The concept *greenspace* is increasingly being used across a broad range of research disciplines, yet often sparsely or heterogeneously defined (Taylor and Hochuli, 2017). A comprehensive overview of the many explicit definitions and implicit applications is offered by Taylor & Hochuli (Taylor and Hochuli, 2017). In the present paper the concept *greenspace* broadly encompasses publicly accessible areas with natural vegetation, such as grass, plants or trees and may include built environment features, such as urban parks, as well as less managed areas, including beaches, forest, and nature reserves.

2.2. Study design and recruitment

This paper uses data from a national representative cross-sectional study asking Danish parents about their children's use of greenspace. The data collection was carried out by Statistics Denmark (DST Survey), a Danish governmental organization responsible for compiling statistics on the Danish society. A random sample of 10,000 parents of children between the ages of 1 and 15 years were invited to participate in the study (equalling 1% of all children in Denmark). The parents were recruited through E-boks, which is the official mandatory governmental portal for digital mail for all citizens in Denmark. Invitation letters were distributed at four time points (2,500 invitations per time point) between September 2018 and June 2019, to account for variations in

responses due to seasonality. Each respondent was only invited to participate at one of the four time points.

2.3. Data collection

The invitation letter to the parents included a personal web-link to an online questionnaire. In case of no response, a reminder was sent after approximately one week and another after two weeks. Finally, non-responsive parents were encouraged to participate by a phone call, if a telephone number was publicly available. The parents received the questionnaire but were asked to complete it together with their child if possible.

The survey development process took inspiration from existing Scandinavian surveys on children's use of greenspaces and involved researchers and practitioners from the 'Children & Nature – Denmark' collaboration (www.boernognatur.dk). The validity and reliability of the survey was pilot tested on 102 parents from the target group by Statistics Denmark and afterwards revised to a final version. A Danish version of the survey can be found on 'Children & Nature – Denmark' website¹.

Questions from the survey included in this paper were related to children's frequency of greenspace use, children's accessibility to greenspace, and parental barriers for their child to use greenspace. The specific survey questions are presented in table A (Additional file). The survey took 18 min in average to complete. The completed questionnaires were afterwards paired with demographic information on participants (age, gender, ethnicity, geography, household's educational level, income), retrieved from Statistics Denmark, as well as information on when the questionnaire was completed (Time points: September–October, November–December, January–March, May–June), to account for seasonal differences.

2.4. Measures and analysis

For this paper, only responses from parents of 6–15-year-old school children were included in the analysis. All analyses were performed using IBM SPSS Statistics version 26. Prior to the analysis, the representativeness of the study population in comparison to the total population of Danish children was tested. The demographic variables age, gender, ethnicity, geography, parental education, and household income were retrieved from Statistics Denmark and tested for significant differences using Pearson's Chi-square test. The study population was significantly different for ethnicity, household's educational level and household's income. However, we chose only to weight data based on the variable with the greatest difference between study population and total population, 'household's income'. Weighting variables reduces accuracy, and the more variables are being weighted the greater the risk that one weighted variable will interact or interfere with another weighted variable.

The outcome measure (children's frequency of greenspace use during the summer half-year) was re-coded into a dichotomous variable, to distinguish between 'less frequent' (≤ 2 –4 times per week) and 'frequent' (almost every day) greenspace users. The measure 'insufficient greenspace use' unites the two response categories [should use greenspace more] and [should use greenspace far more] in one (see table A, additional file). All modifiable factors were re-coded to be able to investigate if fewer parental barriers and access to several greenspaces were associated with frequent greenspace use. The variable *Accessibility to nearby greenspaces* was re-coded by adding all response options (1 beach, lake or river; 2 forest; 3 meadow or field; 4 park) into one variable with a response category going from 0 to 4 green spaces within walking- or bicycling distance. A greenspace is considered accessible if it

¹ <https://centerforboernognatur.dk/projekter/baseline-undersogelse/danske-boerns-aktiviteter-og-ophold-i-naturen/>

is within walking or biking distance from the child's home and can be used alone or under adult supervision. The variable *Parents' barriers* consisted of five barriers parents had for their children's use of greenspace, three barriers focusing on parent's risk and safety concerns and two focusing on parental supervision and encouragement (see table A in additional file for specific barriers). The variable was coded by transforming the response categories of the five barriers into the new categories 'Barrier' (combining the categories 'Completely agree' and 'Agree') and 'No barrier' (combining the categories 'Neither/nor', 'Disagree' and 'Completely disagree'). Hereafter, the five barriers were combined, creating a score going from 0 to 5 barriers in relation to the children's use of greenspace. Lastly, age was recoded into a categorical variable (6–9 yrs., 10–12 yrs., 13–15 yrs.).

Descriptive analyses were used to assess how often Danish children use greenspaces and to identify what characterized greenspace users. Binary logistic regression analysis was performed to identify modifiable factors associated with children's frequency of greenspace use. Modifiable variables were tested for multicollinearity using linear regression before they were included in the analysis. No multicollinearity was found. In the first step of the binary logistic regression analysis, all modifiable factors, and demographic variables were included in the model. Time point for survey completion was included as a control variable. Only significant variables ($p < 0.05$) are presented in the results. A Hosmer-Lemeshow goodness-of-fit test was used to assess how well the models fit the data.

2.5. Ethics

The study, including the applied data-management procedure, was approved by Statistics Denmark and University of Copenhagen (Journal number 514-0215/21-5000). Statistics Denmark follows the 'Code of Practice for EU Statistics' and Danish legislation in relation to data management.² Statistics Denmark conducted the data collection and data storage. All analyses were conducted by the research group on a secure server and access required a special approval by Statistics Denmark. Results of the analysis were aggregated before they were exported from the secure server. Statistics Denmark is not obliged to obtain written consent, but instead must inform participants that they automatically give consent when answering the questionnaire.

3. Results

Out of the total sample of 4772 responding parents, 3601 parents had school-aged children (6–15-years old). A sub-sample of 3171 parents of school-aged children reported the frequency of their child's use of greenspace and were included in the analysis. Table 1 shows the characteristics of the 3171 participants. The table indicates a similar distribution in gender and geography compared to the total Danish population. However, the distribution of age, ethnicity, parental education level and income level of the study population were found to be significantly different from the total Danish population of 6–15-year-olds.

3.1. Greenspace use

Half of the children (49.5 %) used greenspace almost every day during the summer season (Table 2), and 45.4 % of the parents reported that they had four types of greenspaces (i.e., a beach, lake or river; a forest; a forest or field; and a park) within walking or cycling distance from their home. Only 1.3 % of parents reported that they had no greenspace within walking or cycling distance. In general, parents reported mostly forest (84.7 %) and parks (81.9 %) to be within walking or cycling distance.

Table 1

Characteristics of the study population compared to the total population in Denmark.

		Study population	Total population	N
				3171
Age	6–9 yrs.	34.8 %	38.5 %	3171
	10–12 yrs.	29.1 %	30.9 %	
	13–15 yrs.	36.1 %	30.6 %	
Gender	Boy	50.9 %	51.2 %	3171
	Girl	49.1 %	48.8 %	
Ethnicity	Danish	87.5 %	82.2 %	3171
	Immigrants/ Descendants	12.5 %	17.8 %	
Geography	North Jutland	10.1 %	9.6 %	3171
	Middle Jutland	23.0 %	22.8 %	
	South Denmark	21.9 %	20.6 %	
	Capitol	30.6 %	32.7 %	
	Zealand	14.3 %	14.3 %	
Parental education	Primary school or unknown	5.0 %	9.5 %	3000
	Secondary education	30.9 %	33.0 %	
	Higher education	64.1 %	57.6 %	
Household income (in DKK/year) ^{ab}	<199.999	22.5 %	35.5 %	3171
	200.000–299.999	43.2 %	37.5 %	
	+300.000	34.3 %	27.1 %	
Data collection time points	Round 1 (Sep. - Oct)	24.0 %		3171
	Round 2 (Nov. - Dec.)	25.2 %		
	Round 3 (Jan. - Mar.)	25.6 %		
	Round 4 (May - Jun.)	25.1 %		

^aHousehold income was weighted as it was significantly different from the total population.

^bTotal income for the household (after taxes and deductions) divided by the number of household members and converted into equalised adults.

Nearly half of parents (47.4 %) felt that their child did not use greenspace sufficiently often. These parents were asked whether their own behaviour or attitude constituted any barriers to their child's use of greenspace. One or two barriers towards more frequent use of greenspace were perceived by 27.9 % of parents. Only 3.0 % of parents perceived four or all five barriers to their child using greenspace more frequently. The most frequent barriers perceived by parents were their own lack of encouragement towards their child using greenspaces (24.9 %), and not taking their child to greenspaces more often (25.1 %). Being concerned about safety issues was the least experienced barrier (2.1 %).

Table 3a and 3b depict the distribution of the non-modifiable demographic factors in relation to the two modifiable factors – parental barriers and accessibility to various types of greenspaces. Table 3a suggests that especially parents to younger children (6–9 yrs.) perceive traffic safety (43.0 %) and their child walking alone (52.2 %) as potential barriers, whereas too little encouragement and not taking their child to greenspaces were perceived equally across all age groups. Also, parents of girls seem to worry more about their child walking alone (31.8 %), than parents of boys (26.8 %). Ethnic minority parents more often perceive safety issues as a barrier, whereas Danish majority parents perceive too little encouragement and not taking their child to greenspaces as the most common barriers. Geographically, there is a relatively large variation in perceived barriers, however, parents living in the Capitol area seem to experience all five barriers more than parents from other regions. The capital area includes the municipality of Copenhagen and 12 surrounding municipalities. Lastly, parents with lower educational and income level more often perceive safety issues as a barrier, whereas parents from higher socioeconomic backgrounds

² <https://www.dst.dk/en/OmDS/lovgivning>

Table 2
Use of greenspace during summer season and modifiable factors related to use of greenspace, for original and re-coded variables.

		Percent	N
Outcome			
Frequency of greenspace use (re-coded)	Almost every day	49.5 %	1571
	≤ 2–4 times per week	50.5 %	1600
	Total		3171
How often do you think your child goes outside to one or more of the following spaces, during the summer season (April–September)?” (Beach, lake, or river; forest; meadow or field; park)	Almost every day	49.5 %	1571
	2–4 times per week	30.3 %	961
	1 time per week	10.9 %	347
	1–3 times a month	7.3 %	233
	Less than every month	1.5 %	48
	Never	0.3 %	11
	Total		3171
Modifiable factor – Accessibility			
Number of greenspace types (beach, lake or river; forest; meadow or field; park) within walking or cycling distance (re-coded)	4 out of 4	45.4 %	1347
	3 out of 4	33.3%	987
	2 out of 4	14.7 %	436
	1 out of 4	5.4 %	159
	0 out of 4	1.3 %	38
	Total		2967
Does one of the following spaces exist in walking- or bicycling distance from your home, which your child is able to use alone or with an adult?	Beach, lake or river	77.9 %	2423
	Forest	84.7 %	2619
	Meadow or field	72.2 %	2178
	Park	81.9 %	2530
	Total		3171
Modifiable factor – Parental barriers			
Number of parent barriers for their child to use greenspaces more frequently (re-coded)	5 out of 5	0.7 %	22
	4 out of 5	2.3 %	73
	3 out of 5	7.6 %	241
	2 out of 5	15.8 %	500
	1 out of 5	12.1 %	385
	0 out of 5	8.9 %	281
	Insufficient greenspace use	47.4 %	1502
	Sufficient greenspace use	52.6 %	1669
	Total		3171
	Worried about traffic	13.3 %	422
Barriers perceived by parents, for their child to use greenspaces more frequently.	Worried about walking alone	2.1 %	66
	Too little encouragement	13.8 %	438
	Rarely take my child to greenspaces	24.9 %	790
		25.1 %	795
	Total		3171

perceive too little encouragement and not taking their child to greenspaces as the most common barriers.

Table 3b shows some differences in perceived accessibility, in relation to the various non-modifiable background factors. Older children seem to have greater accessibility to various greenspaces than younger children – although parks did not differ significantly between the three age groups. A higher percentage of ethnic minority groups perceived to have access to parks (87.3 %), whereas ethnic Danish parents perceive to have greater access to greenspaces such as forest (86.9 %) and meadows or fields (73.7 %). Geographically, there is great variation in perceived accessibility across all types of greenspaces. This great variation is also present for the two socio-economic factors – education and income level.

3.2. Factors predicting greenspace use

Table 4 shows the results of a multivariate binary logistic regression analysis with ‘using greenspace almost every day’ as dependent variable, and access to nearby greenspaces, parental barriers, age, and geography as independent variables predicting the use of greenspace. The demographic variables gender, ethnicity, education and income, as well

as data collection time points were not found significant, and are not included in Table 4. The Hosmer-Lemeshow Goodness-of-fit-test indicated acceptable model fit.

In particular, the number of types of greenspaces that were perceived to be within walking or cycling distance from home is a strong predictor for using greenspace almost every day. Families that reported having zero out of four greenspace types within walking or cycling distance had an Odds Ratio of 0.26 for using a greenspace almost every day, compared to those families reporting to have four types of greenspaces within walking or cycling distance from home. Also, the Odds Ratio for using a greenspace almost every day gradually increased for each additional greenspace type within walking or cycling distance. Compared to children using greenspace sufficiently, children whose parents reported that they should use greenspace more frequently, had a lower Odds Ratio for using greenspace almost every day. The Odds Ratio for using a greenspace almost every day gradually decreased for each additional parental barrier. Child age and geographic location were the only significant demographic predictors for using greenspace almost every day. Compared to 13–15-year-olds, 10–12-year-olds and 6–9-year-olds had an Odds Ratio of 1.27 and 1.47, respectively, for using a greenspace almost every day.

4. Discussion and conclusion

4.1. Danish children’s greenspace use

Almost half (49.5 %) of the children used greenspace almost every day during the summer season, and 90.7 % used greenspaces at least once a week (Table 2). Findings from a comparable study conducted in the U.K. indicate that Danish children are common greenspace users. In comparison, 15 % of British children (0–15-year-olds) used a natural environment every day and 70 % used a natural environment at least once a week (Hunt et al., 2016). Even though the compared study used a different term to describe the examined environment the conceptual content is similar. Also, both studies employed a broad contextual scope, which includes both leisure and school time. Unfortunately, comparable Scandinavian research that measures children’s frequency of greenspace use is – to our knowledge - not available. A study on use of nature spaces by Norwegian children’s (6–12-year-olds) is available, but this study did not provide aggregated results for frequency of use (Gundersen et al., 2016). Overall, the basis for comparison in a Scandinavian context is weak.

Despite the high share of frequent use of greenspaces, significant potentials for increasing Danish children’s use of greenspace further seem both evident and desirable. First, almost half of the parents thought that their child should use greenspaces more often, which could indicate a prevalent parental support. Second, only half of the Danish children used greenspace on an almost daily basis, which leaves room for increased use of greenspace for the other half. Bearing in mind that greenspace offers a publicly accessible and effective pathway to facilitate increased levels of recreational physical activity (Ferreira et al., 2007; Jones et al., 2009; Author et al., 2013) there is reason for setting higher targets for children’s greenspace use.

4.2. Demographic predictors of greenspace use

The less frequent users of greenspace show no other common characteristics than age and geographical location with regards to socio demographics. These findings are inconsistent with previous research as several studies report significant differences in the use of greenspace for different population segments (Delisle Nyström et al., 2019; Giles-Corti and Donovan, 2002; Lincoln R. Larson et al., 2019; Tandon et al., 2012). In a British study, the frequency of children’s visits to natural environments was linked to ethnicity and socio-economic status (Hunt et al., 2016). Similar findings were reported in a North American context showing that racial and ethnic minority youth (and adults) typically

Table 3a
Modifiable parental barriers related to use of greenspace grouped by non-modifiable demographic factors.

		Parental barriers (N = 1502)				
		Worried about traffic	Worried about getting hurt	Worried about walking alone	Too little encouragement	Rarely take my child to greenspaces
Age**	6–9 yrs.	43.0 %	6.7 %	52.2 %	55.0 %	53.3 %
	10–12 yrs.	27.7 %	3.0 %	25.3 %	54.7 %	55.4 %
	13–15 yrs.	16.5 %	3.6 %	13.9 %	49.0 %	50.6 %
Gender*	Boy	29.2 %	3.7 %	26.8 %	51.0 %	51.6 %
	Girl	26.8 %	5.2 %	31.8 %	54.4 %	54.4 %
Ethnicity**	Danish	26.2 %	2.2 %	27.0 %	53.7 %	54.2 %
	Immigrants/Descendants	41.5 %	19.7 %	44.1 %	44.7 %	43.6 %
	North Jutland	28.3 %	1.4 %	27.5 %	47.8 %	46.4 %
Geography*	Middle Jutland	25.8 %	4.8 %	24.0 %	54.2 %	48.6 %
	South Denmark	25.1 %	5.3 %	25.7 %	45.7 %	49.9 %
	Capitol	30.7 %	5.1 %	35.6 %	56.9 %	58.9 %
	Zealand	30.3 %	2.5 %	28.9 %	54.2 %	54.7 %
Parental education*	Primary school or unknown	43.8 %	15.6 %	32.8 %	37.5 %	35.9 %
	Secondary education	29.8 %	5.7 %	30.3 %	53.9 %	51.6 %
	Higher education	26.3 %	3.1 %	28.4 %	53.0 %	54.5 %
Household income (in DKK/year)*a	–199,999	35.9 %	11.1 %	36.6 %	50.3 %	50.0 %
	200,000–299,999	25.6 %	3.0 %	27.2 %	50.4 %	53.0 %
	+300,000	24.9 %	1.3 %	27.0 %	56.2 %	56.1 %

^aTotal income of the household (after tax and other deductions) divided by the number of household members and converted into equalised adults. Pearson chi-square test of significant difference between demographic groups. * = P value < 0.05, ** = P value < 0.001.

spend less time in natural outdoor settings and face more constraints to nature-based recreation than their white counterparts (Johnson et al., 2001; Kellert et al., 2017; Lincoln R. Larson et al., 2011; Parker and Green, 2016). Neither of these interlinkages were significant in a Danish context (Gentin, 2015). This might reflect the generally high levels of equity in the Scandinavian countries (Aaberge et al., 2002).

The linkage, however, between age and frequency of greenspace use resonates with multiple studies that demonstrate that ‘outdoor time’ appears to decline in adolescence when compared with early childhood (Braun and Dierkes, 2017; Kellert et al., 2017; L. R. Larson et al., 2010; Lincoln R. Larson et al., 2011). The findings might suggest that rather than being conceived as a group sharing certain demographic characteristics, less frequent greenspace use could be understood as a behaviour that is more likely to occur during adolescence (Kaplan and Kaplan, 2002). From a life course perspective, this can be seen as a temporary pause in a person’s engagement with greenspace. Consequently, the less frequent greenspace users can only to a limited degree be identified and targeted directly. However, the ostensibly broad appeal of greenspace, regarding gender, ethnicity, income, and education, makes an even stronger case for investing in greenspace use among Danish children. By all accounts, publicly accessible greenspace constitutes an expedient pathway to promotion of health and well-being that go beyond most prevailing demographic boundaries.

4.3. Accessibility of greenspace as modifiable predictor of greenspace use

Similar to earlier national studies in Denmark (Author et al., 2010), the results showed that the overall accessibility of greenspace is high for Danish children, with nearly all parents (98,7 %) reporting that their child had at least one greenspace within walking or cycling distance from home.

In previous studies, accessibility to greenspaces has been related to ethnicity and socioeconomic conditions. Minority children from low-income communities typically had fewer opportunities to access natural areas and, therefore, fewer opportunities to enjoy the benefits of time in nature (Gordon-Larsen et al., 2006; Holt et al., 2009; Lincoln R. Larson et al., 2019). However, in the present study some greenspaces were more accessible to low-SES groups, whereas other types of greenspaces were more accessible to high-SES groups (Table 3b). This may explain why the regression model in the present study showed no

relation between SES or ethnicity and frequency of greenspace use.

Generally, proximity of greenspace is especially important for children, as their outdoor lives predominantly take place in the vicinity of the home (Florgård and Forsberg, 2006; Gundersen et al., 2016; Author et al., 2010). While nearly all Danish children had a greenspace within walking or cycling distance, the odds of using greenspace almost every day were significantly higher for each additional type of greenspace within walking or cycling distance. Almost half of the parents (45,4 %) reported that four types of greenspaces were accessible. Perhaps being able to choose between using various types of greenspaces nearby is the main predictor for daily use of greenspace by children. Having a choice of different types might make it possible to select the greenspace that best suits the preferences in terms of facilities, experiences, and the type of activity desired. E.g., having a park with a good nature playground nearby will likely encourage the use of that playground, while a nearby meadow area with a safe walking and cycling trail might be the perfect place for a child to practice cycling independently, and having both options is likely to increase use of greenspace. Another possible explanation might be that having multiple types nearby allows for selection of the most preferred ‘quality’ or ‘nature experience’, perhaps even varying at different times of the year.

While distance to the nearest greenspace is a measure that is commonly used in studies on the use of greenspace, the fact that the number of greenspaces nearby is a good predictor for greenspace use, has been found in other studies. For example, a large comparison of different measures of park access in eight countries (Author et al., 2017) revealed that the number of nearby parks, and not the distance to the nearest park, was a significant predictor of park use.

From a city planning and greenspace provision policy point of view, the findings imply that it is important to provide all children with a variety of greenspaces within walking or cycling distance to increase the chances of children using greenspace.

4.4. Parental concern and encouragement as modifiable predictor for greenspace use

Compared to parents that reported that their child was using greenspace sufficiently, children of parents that perceived barriers for using greenspace had a lower Odds Ratio of visiting greenspace almost every day. These results resonate with previous research that links

Table 3b
Modifiable greenspace accessibility related to use of greenspace grouped by non-modifiable demographic factors.

		Accessibility (N = 2967)			
		Beach, lake or river	Forest	Meadow or field	Park
Age**	6–9 yrs.	75.3 %	83.7 %	70.7 %	81.1 %
	10–12 yrs.	77.2 %	83.2 %	69.8 %	81.5 %
	13–15 yrs.	80.8 %	86.9 %	75.7 %	83.0 %
Gender	Boy	77.8 %	85.4 %	73.1 %	82.1 %
	Girl	77.9 %	84.0 %	71.4 %	81.7 %
Ethnicity**	Danish	78.0 %	86.9 %	73.7 %	81.2 %
	Immigrants/Descendants	76.7 %	68.1 %	61.2 %	87.3 %
	North Jutland	72.3 %	86.1 %	79.0 %	82.5 %
	Middle Jutland	74.7 %	87.8 %	77.8 %	81.5 %
Geography**	South Denmark	77.9 %	91.6 %	80.6 %	78.0 %
	Capitol	80.9 %	74.2 %	55.6 %	87.1 %
	Zealand	80.4 %	90.3 %	81.0 %	77.0 %
	Primary school or unknown	70.1 %	78.8 %	67.6 %	85.3 %
Parental education	Secondary education	75.8 %	85.5 %	78.7 %	80.1 %
	Higher education	79.4 %	84.8 %	69.5 %	82.5 %
Household income (in DKK/year) **a	–199,999	74.3%	79.1 %	69.5 %	82.0 %
	200,000–299,999	76.6%	86.4 %	75.7 %	78.6 %
	+300,000	81.6%	86.3 %	70.0 %	85.0 %

^aTotal income of the household (after tax and other deductions) divided by the number of household members and converted into equalised adults. Pearson chi-square test of significant difference between demographic groups. * = P value < 0.05, ** = P value < 0.001.

parental concerns over children’s safety (Carver et al., 2012; Janssen et al., 2016; Tillberg Mattsson, 2002; Timperio et al., 2004) and increased adult overprotection, hyper-parenting and supervision of childhood outdoor activities (Janssen, 2015; Little et al., 2011; Skår and Krogh, 2009) with reductions in outdoor play, physical activity, and use of greenspace. Some studies even suggest that social factors, such as parental anxieties about children’s safety, changing leisure time patterns and increased adult supervision, constitute more significant barriers than environmental factors, such as accessibility, landscape quality and public provision of play facilities (Skår et al., 2016a; Valentine and McKendrick, 1997). Findings from the present study, however, suggest that – in a Danish context - accessibility is a stronger predictor for greenspace use than parental concerns and encouragement.

Notwithstanding, parents still play an important role in children’s outdoor spatial behaviours. Adults are very important facilitators of children’s use of greenspace, with children being more likely to visit more frequently when the adults in their household are frequent visitors (Hunt et al., 2016; Kytta et al., 2018; Lincoln R. Larson et al., 2011) and when adults encourage and supervise use (Skår et al., 2016b). This resonates with the finding in the present study that the most frequent barriers experienced by parents were their own lack of encouragement towards their child using greenspaces more often (24,9 %), and not taking their child to greenspaces more often (25,1 %).

Parental barriers to greenspace use are related to ethnic and socioeconomic conditions (Janssen et al., 2016), which is supported in the current study. Generally, ethnic minority parents reported higher levels of concern and lower levels of encouragement regarding children’s greenspace use (Table 3a). Generally, similar relationships were found between SES (income and education levels) and parental barriers, as parents with lower SES levels reported higher levels of concern and lower levels of encouragement and participation in children’s greenspace use compared to the more affluent parents (Table 3a). These results may reflect both differences in perceived accessibility of safe and suitable greenspaces and differences in cultural or social dispositions, but this cannot be determined based on this study. In overall terms, the relation between SES and ethnicity and perceived parental barriers were small and mixed, which may explain why the regression model in the present study showed no linkage between SES or ethnicity and frequency of greenspace use.

The present findings are in keeping with previous research, but also indicate some cultural differences. Being concerned about safety issues was generally of little importance to Danish parents. Although most parents feel a personal responsibility to consider and cater for their children’s safety, perceptions of risk are very much subject to cultural interpretation (Prince et al., 2013). Children’s outdoor free play is still seen as a highly prioritized part of childhood in Scandinavia (Little, 2010; Prince et al., 2013; Sandseter, 2012). In an international comparison of children’s independent mobility levels, Denmark is among the highest-ranking countries, which, among other things, is influenced by parents’ attitudes to children’s risk and safety (Shaw et al., 2015).

4.5. Strengths and limitations

The strength of the current study is that it includes data from a large national sample of Danish children recruited over four time periods and weather seasons.

However, several limitations should be considered. First, in the current study, respondents were asked to recall how often their child used greenspaces during summer seasons (April-September). As some parents received the survey during winter season, some may have had difficulties remembering several months back. The regression analysis accounted for variation by including the four data collection time point as a control variable. The variable was not significant, suggesting that the period of the data collection did not influence the outcome variable. Another limitation is, that parents were asked to fill out the questionnaire on behalf of their children. Generally, parents’ abilities to recall their child’s greenspace use might be questionable, and more specifically, parents’ knowledge of their children’s independent or school-based greenspace use may be limited. The research team tried to accommodate this challenge by asking parents to fill out the questionnaire together with their child. Furthermore, we decided only to investigate children’s frequency of greenspace use during summer season. It seems reasonable to expect that greenspace use is different during the winter season and that other barriers might be important to consider during this season. Additionally, recent studies distinguish conceptually between greenspace and bluespace (White et al., 2021; WHO, 2021). The data set in the current study, however, does not allow for an analysis that breaks down the outcome measure into greenspace and bluespace. This may have been a limitation in the study, and future studies should aim to make possible this distinction. Finally, quality of greenspace was not examined in the current study. As quality of greenspace may affect greenspace use, this should be considered as a limitation.

4.6. Conclusion

Data from a national survey examining use of greenspace by 6–15-year-old children in Denmark was used to investigate to what extent demographic, social and environmental factors predict the frequency of greenspace use in Danish children.

Table 4

Binary logistic regression analysis with *using greenspace almost every day* as dependent variable, and *access to nearby greenspaces, barriers perceived by parents, geography, and age* as independent variables (N = 3171).

		Crude %	N	P-value	Odds Ratio	95 % confidence interval	
						Lower	Upper
Number of greenspaces (beach, lake or river; forest; meadow or field; park) within walking or cycling distance	4 out of 4 (Ref. category)	55.6 %	749	0.00			
	3 out of 4	51.0 %	503	0.02	0.82	0.69	0.97
	2 out of 4	39.7 %	173	0.00	0.54	0.43	0.68
	1 out of 4	28.3 %	45	0.00	0.33	0.23	0.48
	0 out of 4	26.3 %	10	0.00	0.26	0.12	0.54
Number of parental barriers for their child to use greenspaces more frequently	5 out of 5 barriers	45.5 %	10	0.37	0.65	0.25	1.67
	4 out of 5 barriers	35.6 %	26	0.00	0.45	0.27	0.75
	3 out of 5 barriers	40.7 %	98	0.00	0.48	0.36	0.64
	2 out of 5 barriers	38.8 %	194	0.00	0.47	0.38	0.59
	1 out of 5 barriers	41.3 %	159	0.00	0.52	0.41	0.65
Age	0 out of 5 barriers	43.4 %	122	0.00	0.54	0.41	0.71
	Sufficient greenspace use ^b (Ref. category)	57.6 %	962	0.00			
	6–9 yrs.	53.9 %	594	0.00	1.47	1.22	1.76
Geography	10–12 yrs.	49.9 %	461	0.01	1.27	1.05	1.53
	13–15 yrs. (Ref. category)	45.1 %	516	0.00			
	North Jutland	54.2 %	174	0.78	0.96	0.71	1.30
Constant	Middle Jutland	47.9 %	350	0.03	0.75	0.59	0.97
	South Denmark	53.1 %	369	0.40	0.90	0.70	1.16
	Capitol	43.6 %	423	0.01	0.72	0.57	0.93
	Zealand (Ref. category)	56.0 %	255	0.03			
				0.34	1.616		

^aThe regression model included additional variables (gender, ethnicity, education, income, data collection time points) accounted for in the analysis, but were not found significant, and thus, not included in this table.

^bThose parents identifying their child to use greenspaces adequately did not answer questions on barriers.

Almost half of the children used greenspace almost every day during the summer season, and 9 out of 10 children used greenspace at least once a week. Child age and geographical location (region) were the only significant demographic predictors for using greenspace almost every day. While nearly all Danish children had a greenspace within walking or cycling distance, the odds of using greenspace almost every day were significantly higher for each additional type of greenspace within walking or cycling distance. This suggests that being able to choose between using various types of greenspaces within walking or cycling distance is a key predictor for a high frequency of greenspace use. The Odds Ratio for visiting a greenspace almost every day decreased for each additional barrier perceived by the parents. Findings from the present study, however, suggest that accessibility is a stronger predictor for greenspace use than parental concerns and encouragement.

Municipalities could aim to provide a variety of different greenspaces (e.g. size, facilities, quality) close to where people live to facilitate more frequent greenspace use. Future studies could benefit from a focus on the amount of time spent in greenspace and how this time was spent, and correlate that with the perceived and measured quality of the greenspace, from both a parent and child perspective to provide more specific recommendations for provision of greenspaces. Furthermore, municipalities and health promoters could aim to influence parents' awareness of their role in encouraging (and constraining) children's greenspace use, through information, facilitation, and education. Future research could integrate more social and environmental factors in the research of factors that affect children's greenspace use. For example, the integration of technology as a new way of enhancing parents' sense of security and children's experience of greenspace use has been established as a relevant social factor by others (Nielsen and Arvidsen, 2021).

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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