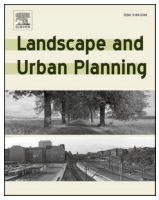
Landscape and Urban Planning 246 (2024) 105023

Contents lists available at ScienceDirect

Landscape and Urban Planning

journal homepage: www.elsevier.com/locate/landurbplan



The quality of Swedish adolescents' outdoor life and its relationship with self-esteem and well-being

Mark Wales [a,*], Eva Hoff [b], Fredrika Mårtensson [a], Jan-Eric Englund [c]

[a] Department of People and Society, Swedish University of Agricultural Sciences, Alnarp, Sweden
[b] Department of Psychology, Lund University, Lund, Sweden
[c] Department of Biosystems and Technology, Swedish University of Agricultural Sciences, Alnarp, Sweden

HIGHLIGHTS

- The quality of adolescent outdoor life is positively associated with well-being.
- Examined differences between seasons, sexes and living environments.
- Girls were less satisfied with their outdoor environments than boys.
- Suburban areas were perceived as safer than rural and urban areas.
- The Covid-19 pandemic had limited effect on adolescents' time spent outdoors.

ARTICLE INFO

Keywords:
Youth
Mental health
Outdoor environment
Public space
Neighbourhood
Planning

ABSTRACT

This study investigates the relationship between outdoor life and the well-being and self-esteem of Swedish adolescents aged 12–15 years old (n = 320), residing in three different living environments in the south of Sweden. The study employed a questionnaire that was administered twice during a school year that included questions on time spent outdoors, environmental quality and the perceived benefit of the outdoor environment. Additionally, the study used standardized scales to measure life satisfaction, self-esteem and mental health. The results of the study revealed that adolescents who had more positive perceptions of their outdoor environment and being outdoors reported higher life satisfaction and self-esteem, as well as better mental health. Notably, girls' generally perceived their outdoor environments as lower quality compared to boys across different seasons. Furthermore, variations between living environments and seasons were also observed. Overall, the study underscores the importance of promoting outdoor life and highlights specific areas planners should address to create outdoor environments with possible benefits for the well-being of adolescents of different ages, sexes and living in different communities.

1. Background

When adolescents have the resources to meet their needs and aspirations, they thrive and can realise their capacity (Chawla, 2015; Patton et al., 2016). These resources may come from within the individual or their surroundings (Bronfenbrenner, 1994). Well-being can be seen as an ongoing process of interaction between the resources available to an individual and their needs, including their capacity to meet life's challenges and achieve their goals (Dodge, Daly, Huyton, & Sanders, 2012; Lercher, 2003). Environments which lack the resources individuals might need can thus be seen as failing to provide the conditions necessary for well-being, making the study of environmental quality essential (Devlin, 2018). Well-being is multidimensional, specific to an individual's experiences and culture (King, Renó, & Novo, 2014), and includes both positive (salutogenic) and negative (pathologic) aspects co-existing together (Dodge et al., 2012; Karademas, 2007). Well-being can be seen as the presence of positive attributes, such as life satisfaction and positive affect, and the absence of negative attributes, such as stress, risky behaviours and negative affect (Diener & Ryan, 2009). Individuals actively participate in the creation of their own well-being by using the

* Corresponding author at: PO Box 190, SE-234 22 Lomma, Sweden.
E-mail addresses: mark.wales@slu.se (M. Wales), eva.hoff@psy.lu.se (E. Hoff), fredrika.martensson@slu.se (F. Mårtensson), Jan-Eric.Englund@slu.se (J.-E. Englund).

https://doi.org/10.1016/j.landurbplan.2024.105023
Received 16 May 2023; Received in revised form 21 November 2023; Accepted 1 February 2024
Available online 22 February 2024

resources available to them to meet their needs (Korpela, 1992; Lercher, 2003). Through a process of self-regulation, individuals use attributes in their environment to mitigate possible threats and restore and build capacities (Korpela, 1992; Markevych et al., 2017). People's own evaluations of their lives and environments are therefore central to the study of well-being (Diener & Ryan, 2009).

Mental health problems among adolescents are a primary public health concern in many high-income countries (Bor, Dean, Najman, & Hayatbakhsh, 2014; Collishaw & Sellers, 2020; Erskine et al., 2015), including Sweden, where self-reported complaints, such as stress and psychosomatic symptoms, have increased (Bremberg, 2015; Laundy Frisenstam, Van Den Bosch, Chen, Friberg, & Osika, 2017; Löfstedt, Arnarsson, Corell, Lyyra, Madsen, Torsheim, & Eriksson, 2020). This trend is especially prominent among Swedish secondary school students, and girls in particular (Hagquist, 2015; Löfstedt et al., 2020), with adolescents living in cities more likely to report psychosomatic symptoms (Laundy Frisenstam et al., 2017). Despite these trends, levels of life satisfaction have remained relatively stable in recent decades (Folkhälsomyndigheten, 2018). Studies have also suggested that the well-being of Swedish adolescents was largely unaffected by the Covid-19 pandemic, which has been attributed to the fact that secondary schools and related routines continued as normal for the most part during the pandemic (Chen, Osika, Henriksson, Dahlstrand, & Friberg, 2022; Hörbo, Johansson, Garnow, Garmy, & Einberg, 2021).

It has been suggested that humans possess an innate desire to enhance their fit with the environment (Uzzell & Moser, 2006). Adolescence is a critical period for expanding one's range of movement and discovering what everyday environments have to offer, and the increasing autonomy during this period is essential for this (Cox, 2020). By exploring their environment, young people develop environmental strategies to meet their needs and actively contribute to their own development (Korpela, 2002). Environments rich in affordances therefore stand a better chance of meeting individual needs (Kyttä, Broberg, & Kahila, 2012). Affordances refer to the functional significance of an environment as perceived by the individual (Heft, 2010). In line with this, the concept of developmental affordances has been utilised to connect environmental affordances with the specific developmental tasks of adolescents (Owens, 2017). In addition, independent mobility, or the ability to move about without adult supervision, is associated with increased opportunities for physical activity, nature contact and social interaction (Cox, 2020; Owens, 2020). Independent mobility and the actualisation of affordances are essential components of youth-friendly environments (Kyttä, 2004). It is also important to consider how young people interact with and attribute meaning to their environment (Kyttä & Broberg, 2014; Lopes, Cordovil, & Neto, 2018). Developing attachments to place can contribute to the satisfaction of key psychological needs such as belonging and self-esteem (Jack, 2008; Scannell & Gifford, 2017), as well as feelings of safety, security and comfort (Colburn, Pratt, Mueller, & Tompsett, 2020; Whitlock, 2007). As many mental health problems in adulthood have their roots in adolescence (Solmi et al., 2022), the attitudes, behaviours and values formed in relation to place during adolescence can play a key role for long-term health and well-being (Fleary, Joseph, & Pappagianopoulos, 2018; Sawyer et al., 2012).

The quality of outdoor environments has received increasing attention as a source of adolescent well-being (Fleckney & Bentley, 2021; Mavoa et al., 2019; Nordbø, Nordh, Raanaas, & Aamodt, 2020; Zhang, Mavoa, Zhao, Raphael, & Smith, 2020; Wales, Mårtensson, Hoff, & Jansson, 2022), providing opportunities for socialising, physical activity and retreat (Clark & Uzzell, 2006; Owens, 2020). Public spaces can also serve adolescents' overall development, social relations, identity formation and emotional connections to place (Fleckney & Bentley, 2021; Owens, 2020). However, urban planning practices, such as densification, and concerns about safety and lifestyle have been linked to negative consequences for Swedish adolescents' access to and use of their surroundings (Cele, 2015; Sandberg, 2012). It has also been suggested that Swedish adolescents' needs are often overlooked in planning processes (Cele & van der Burgt, 2013; Sundevall & Jansson, 2020). Adolescents' use of public spaces is also complex and often contested, and they may be perceived as both at risk and a source of risk for others (Brunelle, Brussoni, Herrington, Matsuba, & Pratt, 2018; Cox, 2020). For this reason, adolescents are regularly excluded from public spaces through the use of public policy and urban design practices a (Owens, 2002; Pyyry & Tani, 2016). Moreover, cyberspace has become an increasingly significant space for socialising, playing and identity formation (Mesch, 2010), with possible implications for adolescents' relationship with their local outdoor environments (Jensen, 2011). While there is a general concern adolescents are spending less time outdoors and more time indoors on digital devices (Larson et al., 2018; Oswald, Rumbold, Kedzior, & Moore, 2020), relatively little is known about the outdoor lives of Swedish adolescents. A 2015 study found that boys spent more time both outdoors and on screens compared to girls (Winkvist et al., 2015), while another study found that outdoor time during school decreased significantly with age across all seasons (Pagels, Raustorp, Guban, Fröberg, & Boldemann, 2016). Studies on the effects of the Covid-19 pandemic are mixed, with some studies suggesting increases in both screen and outdoor time among Swedish adolescents (Kerekes et al., 2021; Martinsson, Garmy, & Einberg, 2022), while other reports suggest no significant changes in health behaviours (Chen et al., 2022).

The study of the relationship between the outdoor environment and well-being is more precisely the study of the relationship between an individual and their specific environment (Moser, 2009), and this perception is influenced both by the unique qualities of the environment and the bond between the individual and place (Chatterjee, 2005; Horelli, 2006). Failure to recognise and accommodate adolescents' needs in the process of placemaking can lead to a mismatch between their needs and the affordances provided by the outdoor environment. Understanding how adolescents' experience and perceive their living environments can therefore provide valuable insight into the success of society (e.g., parents, urban planners, schools) to meet their environmental needs. Although individuals' perceptions of their surroundings are unique, places are not typically designed with specific individuals in mind (Horelli, 2007). Thus, exploring how places can meet the needs of adolescents as a group can improve the "collective environment fit" of this age group (Horelli, 2007). In this study, we aim to investigate how Swedish adolescents perceive their everyday outdoor environments. We define this concept as the "quality of adolescent outdoor life."

This study investigates the quality of adolescent outdoor life and its relationship with the well-being and self-esteem of adolescents aged 12–15 year olds in the south of Sweden. The aim is to improve our understanding of how Swedish adolescents perceive and use their everyday outdoor environments with benefits for their overall well-being. To achieve this, this paper aims to address three key questions:

- How much time do Swedish adolescents spend outdoors?
- How do perceptions and use of outdoor environments differ between sexes, seasons and living environments?
- What are the associations between perceptions and use of outdoor environments and adolescent well-being and self-esteem?

2. Study design and sampling

2.1. Methods

This paper presents results from a questionnaire that is part of a larger mixed methods study examining adolescent outdoor life and well-being. In the present study, Grade 7 and 8 students from schools in three different living environments (rural, urban and suburban) in the south of Sweden completed a paper questionnaire during school time, once during the autumn/winter of 2020 and again during the spring/summer of 2021. The questionnaire, which took 15–30 min to complete,

included self-report measures of their time spent outdoors, their perceptions and use of the outdoor environment, their well-being and self-esteem. Ethics approval was attained from the Swedish Ethical Review Authority (Dnr 2019-06487).

The questionnaire was completed by 320 students between October 2020 and January 2021 and again by 208 students between May and June 2021, of which 189 completed it on both occasions while 19 filled it in on the second occasion only. Approximately 57 % of the participants were girls in both periods. Participants were 12–15 years old (mean = 13.3; SD = 0.6 autumn/winter and mean = 13.8; SD = 0.7 spring/summer). The average daily temperature during the autumn/winter period ranged between 7 and 10 °C in October and 0 °C in January, with an average of 45 sunshine hours per month and sunset between 3:30–4:30 pm. The average daily temperature during the spring/summer ranged between 11 and 16 °C, with an average of 260 sunshine hours per month and sunset between 9:00–10:00 pm. See Table 1 for a summary of the demographic characteristics of the sample.

The three subsamples in this study were selected to represent different living conditions commonly found among families with adolescents in Sweden. The urban sample is from a coastal city of roughly 360,000 people, including students from three schools in neighbourhoods dominated by three to five-story apartment buildings with courtyards as well as students from a school in a neighbourhood dominated by a mix of detached and terraced houses with some apartments and its own main street with shops and restaurants. The suburban sample included students from a commuter village located 20 km outside of the coastal city, with a population of around 4,000 people, and dominated by detached houses with private gardens. A previous study in this village revealed high levels of independent mobility among 10–11 year olds (Wales, Mårtensson, & Jansson, 2021). Finally, the rural sample included students from schools in two inland communities from the same municipality, with populations of 10,000 and 4,500 people. The neighbourhoods are dominated by detached houses with gardens, with easy access to surrounding coniferous forests and lakes. The nearest larger city is located 90 min away by car.

2.2. Measures

Before commencing data collection, the questionnaire was pre-tested with a small focus group of four 13–15 year olds. Participants completed the questionnaire and provided feedback on any questions that were difficult or unclear. They were also asked to provide alternative wordings if necessary. Based on this feedback the questionnaire was revised. Next, the revised questionnaire was pilot tested with a class of 58 ninth grade students to assess its comprehensibility and appropriateness for the target age group. Feedback was used to further refine the questionnaire before it was administered.

2.2.1. Independent variables

Participants were first asked to state their age, birth year and sex (based on the question "I am: boy/girl/other"). The next section included questions about time spent outdoors. Participants were asked how much time they had spent outdoors (>one hour, 30–60 min, <30 min) on weekdays and weekends in the weeks preceding the completion of the questionnaire. In order to capture possible influences from the Covid-19 outbreak in February 2020, they were also asked if they thought they had spent more, the same or less time outdoors than normal during the spring and autumn of 2020 (asked in autumn/winter 2020) and the winter of 2020 and spring of 2021 (asked in spring/summer 2021).

The 20-item *Quality of Adolescent Outdoor Life Scale* (QAOLS) was created for the specific purpose of this study and contains five subscales. The face and concept validity of the items was scrutinized by experienced researchers in the field of outdoor environments for children. The scale includes items relating to adolescents' use and perception of their everyday outdoor environments. Independent mobility was assessed using four items (e.g. "I can easily move around on my own outdoors"), perceived affordances was assessed using five items (e.g. "There are lots of different things I can do"), perceived safety was assessed using three items (e.g. "I feel safe outdoors during the day"), emotional affinity toward being outdoors was assessed using four items (e.g. "I feel happy when I am outdoors") and perceived time spent outdoors was assessed using four items (e.g. "I spend a lot of time outdoors"). A 6-point scale was used and participants indicated their agreement with each statement with a higher value indicating a higher quality of outdoor life. Cronbach's alpha for the scale was 0.88 for both autumn/winter and spring/summer.

The *perceived benefit of the outdoor environment* contains three items on how the participants evaluate the role of the outdoor environment and its potential benefits for their lives at large: The outdoor environment where I live is "good for me", "good for my health" and "good for my social life." Agreement with each item was indicated on a 6-point scale. A higher value indicates they perceive the outdoor environment as more beneficial for them. Cronbach's alpha was 0.83 for both autumn/winter and spring/summer.

2.2.2. Dependent variables

Subjective well-being in recent weeks was measured using two scales. The 7-item *Students' Life Satisfaction Scale* (SLSS; Huebner, 1991) was used to measure participants' overall satisfaction with their lives in recent weeks (e.g. "I have a good life"). Cronbach's alpha for this scale was 0.87 in autumn/winter and 0.89 in spring/summer. The 40-item *Multidimensional Student Life Satisfaction Scale* (MSLSS; Huebner, 1994; Huebner & Gilman, 2002) was used to assess participants' satisfaction with five important life domains: self, school, friends, family and living environment. Both scales use 6-point scales, with higher mean scores indicating higher levels of life satisfaction. All negative items were reversed before mean scores were calculated. Cronbach's alpha was 0.93 for both autumn/winter and spring/summer.

Rosenberg's Self-Esteem Scale (Rosenberg, 1965) measured self-esteem. The scale includes ten items (e.g., "On the whole, I am satisfied with myself"). A 4-point scale was used, with a higher mean score indicating better self-esteem. All negative items were reversed before mean scores were calculated. Cronbach's alpha was 0.90 for autumn/winter and 0.92 for spring/summer.

The *Depression, Anxiety and Stress Scale-21* (DASS-21; Lovibond & Lovibond, 1995) was used to measure mental health (i.e. negative emotional states) during the previous week. Depression was measured using seven items measuring symptoms such as lack of interest (e.g., "I felt that I had lost interest in just about everything") and hopelessness (e.g., "I felt that I had nothing to look forward to"). Anxiety was measured using seven items measuring symptoms such as autonomic arousal (e.g., "I felt scared without any good reason") and skeletal muscle effects (e.g., "I experienced trembling e.g., in the hands"). Stress was measured using seven items measuring symptoms such as difficulty relaxing (e.g., "I found it difficult to relax") and being easily agitated (e.g., "I found myself getting upset rather easily"). Each item was scored 0–3, with a

Table 1
Summary of the demographic characteristics of the sample.

	autumn/winter n = 320	spring/summer n = 208
Demographics		
Age, mean (SD)	13.3 (0.613)	13.8 (0.663)
Boy, n (%)	137 (42.8)	88 (42.3)
Girl, n (%)	182 (56.9)	119 (57.2)
Sex = other, n (%)	1 (0.3)	1 (0.5)
Grade 7, n (%)	206 (64.4)	155 (74.5)
Grade 8, n (%)	114 (35.6)	53 (25.5)
Urban, n (%)	87 (27.2)	32 (15.4)
Suburban, n (%)	116 (36.2)	71 (34.1)
Rural, n (%)	117 (36.6)	105 (50.5)

higher mean score indicating poorer mental health. Cronbach's alpha for DASS-21 was 0.91 for autumn/winter and 0.93 for spring/summer.

2.3. Statistical analysis

The analyses were conducted using IBM SPSS Statistics 26 and R version 4.1.2. Both autumn/winter and spring/summer had less than 3 % missing data overall and missing values were therefore imputed using the expectation maximization algorithm (Tabachnick & Fidell, 2013). A handful of univariate outliers in both autumn/winter and spring/summer were identified after examining histograms and boxplots and cases deemed deviant were assigned a new score for the specific variable that was one unit larger or smaller (0.1) than the next most extreme score that was not deemed an outlier in order to make them less problematic (Tabachnick & Fidell, 2013). After examining Mahalanobis distances, nine cases ($p < 0.001$) were identified as being multivariate outliers and were subsequently removed from all analyses. In order to be able to include an individual who identified as "other" for sex in analysis, they were coded as a girl because their responses were better aligned with those observed in girls than boys. However, in analyses specifically focusing on statistical differences between sexes, such as differences in QAOLS scores between boys and girls, this individual was not included.

For comparisons between time spent outdoors, a chi-square test is used for independent samples and a sign test for paired samples, with 5 % as the level of significance. To see if there were any significant differences in QAOLS scores (including subscales) and perceived benefit scores according to sex, season and living environment, a mixed model with person (=ID) as random variable and the fixed factors sex (girl or boy), season (autumn/winter or spring/summer) and living environment (rural, suburban or urban) was used with interactions as fixed factors. Tukey's post hoc test with significance level $p \leq 0.05$ was used to explore significant differences between the least squares means. To analyse the model, the function lmer from package lme4 in R was used, and for the post hoc tests the function emmeans from package emmeans.

Finally, separate hierarchical multiple linear regression analyses were performed for each of the four dependent variables to investigate the specific contribution of independent variables. The same was performed for the five dimensions of MSLSS. Independent variables were entered in four steps for each model. Model 1 controlled for demographics factors (sex and living environment). Age, grade and school effects were controlled for but were removed from models due to non-significant results. Model 2 controlled for behavioural variables (time spent outdoors). Variables related to changes in time spent outdoors during the pandemic were not included as they were only found to be a significant predictor during spring/summer for DASS-21. Model 3 added environmental quality variables (QAOLS) and Model 4 added attitudinal variables (perceived benefit of the outdoor environment). Preliminary analyses were performed for all models to ensure no violation of assumptions. Results are interpreted using a significance level of $p \leq 0.05$.

3. Results

Descriptive statistics for both seasons are provided in Table 2. Correlations for all variables can be found in the Appendix (Table A1 and A2).

3.1. How much time do Swedish adolescents spend outdoors?

A full summary of time spent outdoors can be found in the Appendix (Tables A3–A5).

During the autumn/winter, 34.4 % of adolescents reported spending more than one hour outdoors on weekdays, while during the spring/summer this number doubled to 70.2 %. Furthermore, 20.3 % of participants reported spending less than 30 min outdoors on weekdays in the autumn/winter compared to 3.8 % during the spring/summer. On weekends, the proportion of adolescents spending more than one hour outdoors increased from 49.4 % during the autumn/winter to 75.5 % during the spring/summer. The overall comparison for time spent outdoors shows a significant difference between autumn/winter and spring/summer for weekdays and weekends (chi-square test, $p < 0.001$). There was also a significant difference in time spent outdoors between weekdays and weekends during the autumn/winter (sign test, $p < 0.001$), but not during the spring/summer (sign test, $p = 0.40$). See Fig. 1 for comparisons between seasons and time of week.

Table 2
Descriptive statistics of the sample for autumn/winter and spring/summer.

Variables	autumn/winter n = 320	spring/summer n = 208
Independent variables, mean (SD)		
Quality of Adolescent Outdoor Life Scale	4.59 (0.63)	4.67 (0.63)
Independent Mobility (QAOLS)	5.16 (0.67)	5.13 (0.74)
Perceived Affordances (QAOLS)	4.34 (0.91)	4.27 (0.97)
Perceived Safety (QAOLS)	4.76 (0.93)	4.66 (0.95)
Emotional affinity (QAOLS)	4.59 (0.95)	4.74 (0.83)
Time spent outdoors (QAOLS)	4.13 (0.98)	4.57 (0.95)
Perceived benefit of the outdoor environment	4.78 (0.85)	4.77 (0.91)
Dependent variables, mean (SD)		
SLSS	4.51 (0.92)	4.58 (0.98)
MSLSS	4.74 (0.56)	4.65 (0.61)
MSLSS self	4.64 (0.72)	4.66 (0.78)
MSLSS friend	5.32 (0.66)	5.26 (0.67)
MSLSS school	4.04 (0.93)	3.87 (1.00)
MSLSS family	5.05 (0.79)	4.87 (0.89)
MSLSS living environment	4.66 (0.79)	4.59 (0.79)
Self Esteem	3.06 (0.60)	3.05 (0.65)
DASS-21	0.69 (0.52)	0.72 (0.59)
Depression	0.57 (0.61)	0.59 (0.66)
Anxiety	0.63 (0.54)	0.68 (0.62)
Stress	0.87 (0.62)	0.90 (0.69)

The differences between girls and boys and between seasons are illustrated in Fig. 2. There is no significant difference in time spent outdoors, except for on weekdays during the spring/summer (chi-square test, $p = 0.036$).

The differences between living environments and seasons are illustrated in Fig. 3. For all environments, except the urban sample on weekends, participants reported spending significantly more time outdoors during the spring/summer compared to the autumn/winter. During the autumn/winter, the proportion of participants who spent more than one hour outdoors on weekends was significantly higher compared to weekdays in the suburban and urban environments. However, during the spring/summer the difference was only significant for the rural environment.

The pandemic began in Sweden during the spring of 2020. According to the results, 69.7 % of participants perceived they had spent roughly the same time outdoors during the spring following the outbreak of the pandemic compared to what they usually do at that time of year, with 13.4 % reporting less and 16.9 % more time outdoors. During the autumn of 2020, 54.1 % of participants perceived that they had spent roughly the same time outdoors as usual, while 20.6 % perceived that they had spent less time outdoors and 25.3 % more time outdoors. The figures remained roughly the same during the winter of 2020, but in the spring of 2021 34.6 % reported spending more time outdoors than is normal for that time of year, while just 7.2 % perceived they had spent less time outdoors.

3.2. How do perceptions and use of outdoor environments differ between sexes, living environment and seasons?

In the analysis of the independent variables of sex, living environment and season (autumn/winter or spring/summer) and their interactions, there were no significant interactions with living environment. However, there were sometimes interactions observed

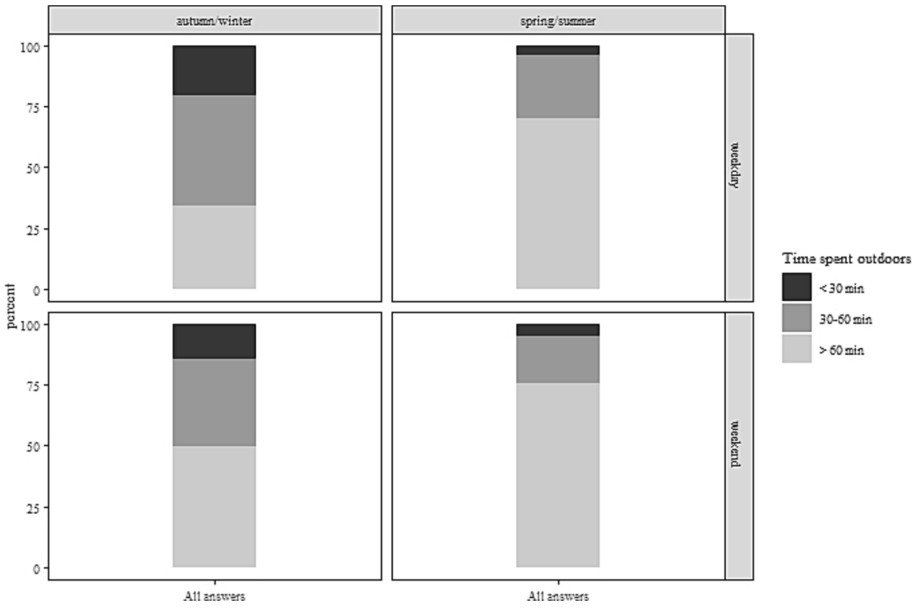


Fig. 1. Time spent outdoors for the different seasons and time of week.

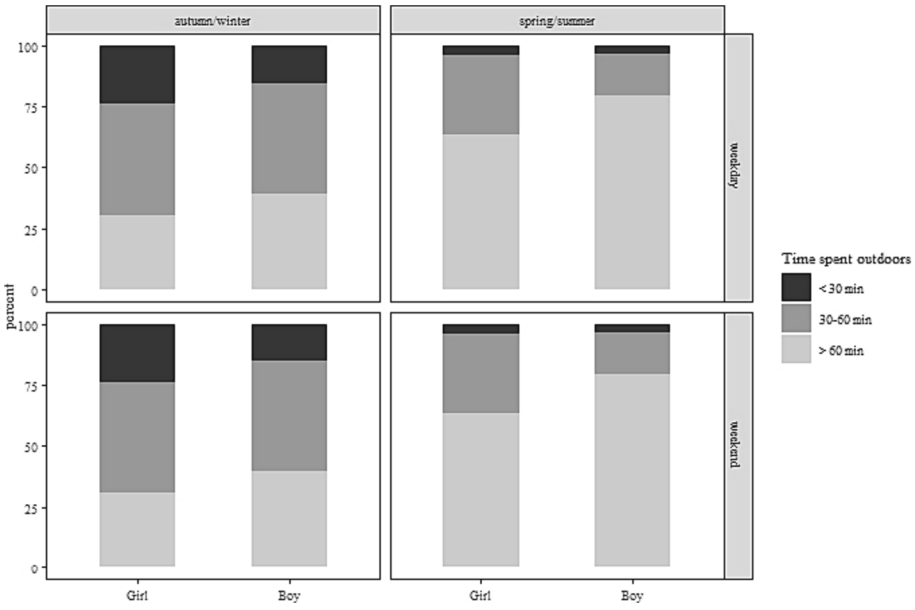


Fig. 2. Time spent outdoors for boys and girls for the different seasons and time of week.

between sex and season. As a result, the results are described using the least squares mean values (LS mean in tables) of living environment overall across both seasons and separately with combinations of sex and season.

The Quality of Adolescent Outdoor Life Scale (QAOLS) scores did not significantly differ between living environments. During both seasons, girls had significantly lower QAOLS scores compared to boys. Boys had significantly higher scores on QAOLS in spring/summer compared to autumn/winter, but this was not observed for the girls (Table 3). There were no significant differences found in the perceived benefits of the outdoor environment between sexes, living environments or seasons (Table 4).

The study also analysed the subscales of QAOLS. Perceived time spent outdoors did not differ significantly between living environments or sex, except for a significant difference during spring/summer. Independent mobility scores did not differ significantly between living environments, but girls scored significantly lower than boys during spring/summer. The rural sample had significantly higher mean scores for perceived affordances when compared to the suburban sample (Table 5), and boys had significantly higher mean scores than the girls during spring/summer. The suburban sample had significantly higher mean scores for perceived safety compared to the rural and urban samples (Table 6), while girls scored significantly lower on perceived safety during both seasons. There were no significant differences for the emotional affinity subscale.

3.3. *How do perceptions and use of outdoor environments predict well-being and self-esteem?*

Results for all hierarchical multiple regression analyses are shown in Table 7. Results for hierarchical multiple regression models for MSLSS subscales are shown in Table A6 in the Appendix. The standardized

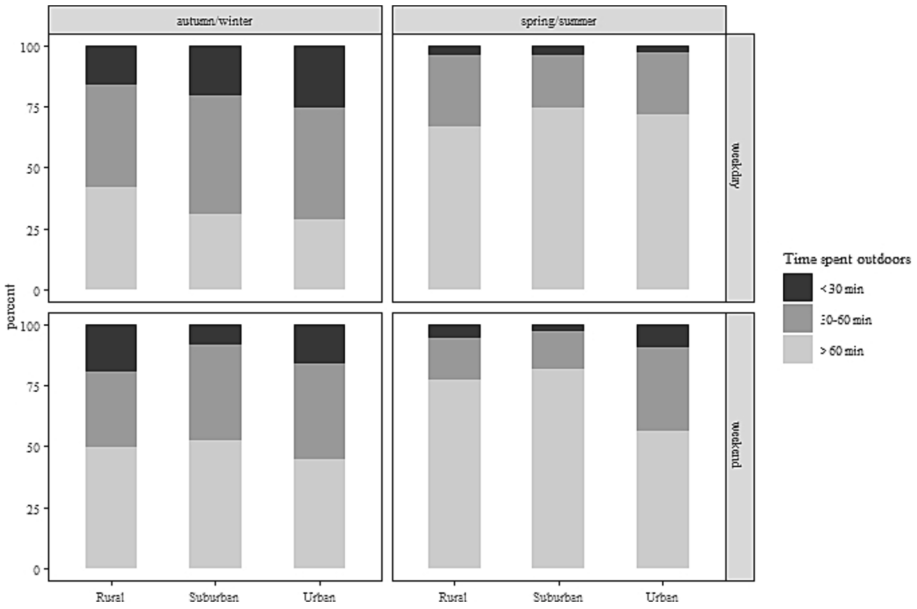


Fig. 3. Time spent outdoors for different living environments for the different seasons and time of week.

Table 3
Least squares means for QAOLS. For environment, levels with a common letter are not significantly different.

Environment	LS mean		autumn/winter	spring/summer	
Suburban	4.71 a	**Girl**	4.51	4.50	ns
Rural	4.62 a	**Boy**	4.66	4.82	sign
Urban	4.53 a		sign	sign	

Table 4
Least squares means for Perceived benefit of the outdoor environment life. For environment, levels with a common letter are not significantly different.

Environment	LS mean		autumn/winter	spring/summer	
Rural	4.80 a	**Girl**	4.77	4.69	ns
Suburban	4.79 a	**Boy**	4.77	4.82	ns
Urban	4.70 a		ns	ns	

Table 5
Least squares means for QAOLS subscale Perceived affordances. For environment, levels with a common letter are not significantly different.

Environment	LS mean		autumn/winter	spring/summer	
Rural	4.45 a	**Girl**	4.26	4.12	ns
Urban	4.38 ab	**Boy**	4.43	4.43	ns
Suburban	4.11b		ns	sign	

Table 6
Least squares means for QAOLS subscale Perceived safety. For environment, levels with a common letter are not significantly different.

Environment	LS mean		autumn/winter	spring/summer	
Suburban	4.98 a	**Girl**	4.47	4.23	sign
Rural	4.62b	**Boy**	5.00	5.07	ns
Urban	4.48b		sign	sign	

coefficient and significance level of each variable are included in tables. All models are at the 95 % confidence level.

3.3.1. Overall life satisfaction

Being a girl was significantly associated with lower life satisfaction in all models. During the autumn/winter, time spent outdoors on weekdays (but not weekends) was positively associated with life satisfaction (Model 2). However, during the spring/summer, time spent outdoors was not significantly associated with life satisfaction. After adding environmental quality variables in Model 3, behavioural variables were no longer significant in both seasons. Environmental quality was found to be positively associated with life satisfaction during both the autumn/winter ($\beta = 0.378$) and spring/summer ($\beta = 0.258$). After adding attitudinal variables in the final model, environmental quality remained a significant predictor in the autumn/winter ($\beta = 0.291$), while the perceived benefit of the outdoor environment was not found to be significantly associated with life satisfaction. However, in the spring/summer, it was the perceived benefit of the outdoor environment ($\beta = 0.237$) that was significantly associated with life satisfaction, not environmental quality. Final models accounted for 19 % of the variance in the autumn/winter and 21 % of the variance in the spring/summer.

3.3.2. Multidimensional life satisfaction

In Model 1, individuals residing in the suburban settlement ($\beta = 0.141$) had significantly higher MSLSS scores during the autumn/winter compared to those living in the urban settlement. Sex was not found to be significantly associated with MSLSS in any of the models. After introducing behavioural variables in Model 2, living environment was no longer a significant predictor. Spending 30 min or more outdoors on weekdays was found to be significantly associated higher MSLSS scores during both seasons. Nevertheless, when environmental quality variables were added in Model 3, time spent outdoors lost its significance. Instead, environmental quality was found to have a positive association with MSLSS during both the autumn/winter ($\beta = 0.566$) and spring/summer ($\beta = 0.418$). In the final model, both environmental quality (autumn/winter: $\beta = 0.385$; spring/summer: $\beta = 0.229$) and the perceived benefit of the outdoor environment (autumn/winter: $\beta = 0.265$; spring/summer: $\beta = 0.317$) were significantly associated with MSLSS during both seasons. Final models accounted for 32 % of the variance in the autumn/winter and 26 % in the spring/summer.

The analysis of the five dimensions of the scale revealed that

Table 7
Results from regression models for all dependent variables.

	Variables	SLSS		MSLSS		Self-esteem		DASS-21	
		Autumn/ winter β	Spring/ summer β	Autumn/ winter β	Spring/ summer β	Autumn/ winter β	Spring/ summer β	Autumn/ winter β	Spring/ summer β
Model 1	Sex (ref: boys)	−0.243***	−0.331***	−0.074	−0.110	−0.315***	−0.340***	0.282***	0.367***
	Suburban (ref: urban)	−0.008	0.060	0.141*	0.095	0.004	0.047	−0.055	−0.082
	Rural (ref: urban)	−0.023	0.030	0.124	0.048	−0.057	−0.019	−0.020	−0.090
Model 2	Sex (ref: boys)	−0.220***	−0.297***	−0.051	−0.074	−0.289***	−0.321***	0.262***	0.349***
	Suburban (ref: urban)	−0.021	0.056	0.124	0.075	−0.002	0.027	−0.052	−0.100
	Rural (ref: urban)	−0.048	0.045	0.104	0.045	−0.093	−0.032	0.011	−0.119
	> 1 h outdoors (weekdays)	0.215*	0.320	0.217*	0.517**	0.310***	0.313	−0.255**	−0.279
	30–60 min outdoors (weekdays)	0.188*	0.142	0.209**	0.368*	0.241***	0.253	−0.203**	−0.143
	> 1 h outdoors (weekends)	0.053	0.111	0.093	0.177	−0.095	0.077	0.109	−0.020
	30–60 min outdoors (weekends)	−0.016	0.137	0.060	0.130	−0.107	0.0004	0.128	−0.114
Model 3	Sex (ref: boys)	−0.189***	−0.242***	−0.004	0.016	−0.269***	−0.287***	0.239***	0.317***
	Suburban (ref: urban)	−0.068	0.031	0.054	0.034	−0.032	0.011	−0.018	−0.085
	Rural (ref: urban)	−0.055	0.021	0.094	0.006	−0.098	−0.047	0.016	−0.105
	> 1 h outdoors (weekdays)	0.079	0.197	0.013	0.316	0.223**	0.236	−0.156	−0.207
	30–60 min outdoors (weekdays)	0.099	0.064	0.075	0.242	0.184*	0.205	−0.138	−0.098
	> 1 h outdoors (weekends)	−0.104	0.038	−0.142	0.059	−0.195*	0.032	0.223*	0.022
	30–60 min outdoors (weekends)	−0.104	0.115	−0.071	0.093	−0.163*	−0.014	0.191*	−0.101
	Quality of Adolescent Outdoor Life	0.378***	0.258***	0.566***	0.418***	0.241***	0.160*	−0.276***	−0.149*
Model 4	Sex (ref: boys)	−0.198***	−0.259***	−0.024	−0.008	−0.276***	−0.300***	0.245***	0.333***
	Suburban (ref: urban)	−0.068	0.045	0.055	0.053	−0.031	0.022	−0.018	−0.099
	Rural (ref: urban)	−0.057	0.017	0.088	0.002	−0.100	−0.050	0.018	−0.102
	> 1 h outdoors (weekdays)	0.093	0.086	0.043	0.168	0.233**	0.152	−0.165	−0.105
	30–60 min outdoors (weekdays)	0.103	−0.024	0.084	0.124	0.187*	0.138	−0.141	−0.016
	> 1 h outdoors (weekends)	−0.108	0.071	−0.149	0.102	−0.197*	0.056	0.226*	−0.008
	30–60 min outdoors (weekends)	−0.104	0.134	−0.071	0.119	−0.163*	0.001	0.191*	−0.119
	Quality of Adolescent Outdoor Life	0.291***	0.116	0.385***	0.229**	0.179*	0.053	−0.218**	−0.019
	Perceived benefit of the outdoor environment	0.127	0.237**	0.265***	0.317***	0.091	0.179*	−0.085	−0.218**

*p < 0.05, **p < 0.01, ***p < 001.

environmental quality was significantly associated with higher satisfaction with self, family, friends, school and living environment during both seasons in Model 3. After adding attitudinal variables, it remained a significant predictor for all dimensions across seasons except for family and school during the spring/summer. The perceived benefit of the outdoor environment was positively associated with satisfaction with friends and living environment during both seasons, and with family and school during the spring/summer only. In the final model, rural participants had significantly higher satisfaction with their living environment than urban participants during the autumn/winter. During the autumn/winter, individuals who spent more than 30 min outdoors on weekdays were significantly more satisfied with self than those who spent less than 30 min outdoors on weekdays. However, on weekends, more time outdoors was significantly associated with lower satisfaction with self.

3.3.3. Self-esteem

Being a girl was significantly associated with lower levels of self-esteem compared to boys in all models and during both seasons. Adding behavioural variables revealed a positive association between time spent outdoors on weekdays and self-esteem during the autumn/winter (Model 2). In Model 3, environmental quality was significantly associated with higher self-esteem during both the autumn/winter (β = 0.241) and spring/summer (β = 0.160). Spending more time outdoors on weekdays during the autumn/winter was significantly associated with self-esteem. However, more time spent outdoors on weekends was significantly associated with lower self-esteem during the autumn/winter. These associations remained consistent in the final model. Environmental quality remained significantly associated with self-esteem during the autumn/winter (β = 0.179), but not the spring/summer. Additionally, the perceived benefit of the outdoor environment was only significantly associated with self-esteem during the spring/summer (β = 0.179). Final models accounted for 17 % of the variance during the autumn/winter and 15 % during the spring/summer.

3.3.4. Mental health

During both seasons, girls had significantly lower levels of mental health than boys across all models. In Model 2, spending more than 30 min outdoors on weekdays was significantly associated with better mental health (i.e. lower DASS-21 scores) in the autumn/winter but not

the spring/summer. In Model 3, time spent outdoors on weekends, not weekdays, was significant during the autumn/winter. However, during the spring/summer, time spent outdoors was not significant in any of the models. Environmental quality was significantly associated with better mental health in Model 3 during both the autumn/winter ($\beta = -0.276$) and spring/summer ($\beta = -0.149$). In the final model, environmental quality remained significantly associated with DASS-21 in the autumn/winter ($\beta = -0.218$), but not the spring/summer. The perceived benefit of the outdoor environment was only significantly associated with lower DASS-21 scores during the spring/summer ($\beta = -0.218$). Additionally, more time spent outdoors on weekends was significantly associated with poorer mental health (i.e. higher DASS-21 scores). Final models accounted for 15 % of the variance during the autumn/winter and 17 % during the spring/summer.

4. Discussion and implications

This study examined the relationship between the quality of outdoor life and adolescent well-being. Our findings indicate the outdoor environment can have positive effects on the well-being and self-esteem of boys and girls living in different communities in Sweden. After controlling for age, sex, living environment and time spent outdoors, environmental quality (QAOLS) was associated with higher levels of overall and multidimensional life satisfaction and self-esteem, as well as lower levels of depression, anxiety and stress. This is in line with previous research suggesting outdoor environments can offer multiple pathways to well-being including mitigation of mental health issues, psychological restoration, and the building of positive attributes and capacities (Chawla, 2015; Hartig, Mitchell, De Vries, & Frumkin, 2014; Mygind et al., 2019; Zhang et al., 2020). It should be noted, however, that due to the cross-sectional nature of the study, causality cannot be inferred.

A somewhat unexpected finding was that the relationship between environmental quality and dependent variables changed after the perceived benefit of the outdoor environment was added to final models. While environmental quality was significantly associated with higher multidimensional life satisfaction (MSLSS) during both seasons, perceived benefit replaced it during the spring/summer for overall life satisfaction (SLSS), self-esteem and mental health. However, during the autumn/winter, environmental quality remained significantly associated with all dependent variables. One possible explanation is that participants may have become more aware of the subject matter after filling out the questionnaire for the second time. Additionally, during the colder and darker periods of the year, the benefits of being outdoors may be less apparent than during the warmer months. It is also possible that environmental quality is more critical for the perception and use of outdoor environments during the autumn/winter. Prior studies from Sweden have reported reduced physical activity and school ground use during the winter (Jansson, Abdulah, & Eriksson, 2018; Pagels et al., 2016), while it has been suggested that the value attributed to children's outdoor activities by families, neighbourhoods and societies might vary across the seasons (Ergler, Kearns, & Witten, 2016). However, seasonal variations have not been extensively studied in relation to the relationship between the outdoor environment and adolescent well-being. Our findings indicate planning initiatives targeting the quality of outdoor environments during the autumn/winter may be effective in promoting more positive attitudes toward being outdoors throughout the year. Future studies should therefore look to better understand the relationship between attitudes to being outdoors and environmental quality.

Measures of life satisfaction are commonly employed to assess and compare levels of subjective well-being among adolescents (Due et al., 2019; Proctor, Linley, & Maltby, 2008). However, the outdoor environment has received little attention as a source of life satisfaction for adolescents. Research on the effect of urban greenspace on life satisfaction is prevalent in relation to the general population (Ayala-Azcárraga, Diaz, & Zambrano, 2019; Jabbar, Yusoff, & Shafie, 2021) and life satisfaction is increasingly seen as reflective of liveability (Wu, Chen, Yun, Wang, & Gong, 2022). For adolescents, school and neighbourhood influences on adolescents' life satisfaction are usually the focus (Oberle, Schonert-Reichl, & Zumbo, 2011; Proctor et al., 2008). Neighbourhoods play a central role in fulfilling the needs of adolescents, fostering a sense of community and belonging, and generating feelings of satisfaction (Moser, 2009; Pooley, Pike, Drew, & Breen, 2002). Participation in leisure activities has also been linked to life satisfaction through the fulfilment of the psychological need for autonomy, competence and relatedness (Leversen, Danielsen, Birkeland, & Samdal, 2012). Our results are in line with these findings and suggest the outdoor environment might contribute to the fulfilment of their needs and thus their satisfaction with their life as a whole, as well as specific aspects of everyday life such as friends and school.

Research suggests that adolescents' favourite places can contribute to maintaining good levels of self-esteem and self-regulation (Korpela, 2002). While previous studies on the relationship between the outdoor environment and self-esteem are somewhat inconsistent (Mygind et al., 2021; Tillmann, Tobin, Avison, & Gilliland, 2018), our findings suggest that the outdoor environment might serve as an arena for activities influencing how adolescents' feelings about themselves. Interactions with friends and others in outdoor environments are essential to adolescents' social lives and can contribute to the development of their social competence, self-identity and self-esteem (Cox, 2020; Owens, 2017). Previous studies also suggest that engagement with and activity in nature or greenspaces can improve self-esteem (Mygind et al., 2019; Owens, 2009; Tillmann et al., 2018). Additionally, participation in outdoor activities, such as sports, can improve perceived competencies and promote positive feelings about oneself (Bowker, 2006; Wagnsson, Lindwall, & Gustafsson, 2014). It has been suggested that promoting girls' participation in outdoor activities is one way to reduce sex differences in self-esteem (Dishman et al., 2006; Richman & Shaffer, 2000).

There is a growing focus on targeting and preventing mental health problems in adolescents and our results suggest the outdoor environment has potential to contribute to this work. While our findings found a negative association between environmental quality and negative emotional states, it is important to point out that individuals with mental health issues may also value the outdoor environment for its health-promoting ability. Previous studies have shown that natural and green environments can help improve coping skills (Chawla, Keena, Pevec, & Stanley, 2014; Tillmann et al., 2018) and restore emotional balance in adolescents' (Akpinar, 2021; Korpela, Kyttä, & Hartig, 2002; Mennis, Mason, & Ambrus, 2018). Despite the well-established benefits of natural and green environments, the specific characteristics of these settings that are most beneficial for adolescent mental health are not well understood (Fleckney & Bentley, 2021). For example, while adults may prefer serene environments, adolescents may seek out less serene settings for safety reasons (Akpinar, 2021). Additionally, the relationship between poor living environments and mental health problems works in both directions (Dupéré, Leventhal, & Vitaro, 2012; Kim, 2010), with individuals with mental health problems more likely to perceive their surroundings as unfavourable (Fagg, Curtis, Clark, Congdon, & Stansfeld, 2008). This highlights the need for further research to identify the specific qualities of outdoor environments that promote self-regulation and restoration in adolescents, as well as the potential for improving living environments to prevent mental health problems.

Based on our findings, it is clear that there are seasonal differences in the amount of time adolescents spend outdoors, with more time spent outdoors during the spring/summer compared to the autumn/winter. Adolescents also spent more time outdoors on weekends compared to weekdays during the autumn/winter, but not during the spring/summer. Interestingly, the study found that more time spent outdoors on weekdays was positively associated with self-esteem and satisfaction with self during the autumn/winter, while more time spent outdoors on weekends was negatively associated with self-esteem (as well as

satisfaction with self) and mental health. While this might seem counterintuitive, the findings suggest adolescents might spend time outdoors for different reasons throughout the year. One possible explanation could be that going outdoors during the autumn/winter may be of particular importance for individuals with low self-esteem or mental health issues. For example, it could be that they spend more time outdoors in order to escape unsupportive environments at home. Another possible scenario could be that these individuals may be less involved in scheduled indoor activities (e.g. handball training) during the autumn/winter, making them more reliant on the outdoor environment. In addition, research also suggests even short periods of time outdoors can be beneficial. For example, breaks as short as 4 min during school time can be enough to restore attention levels (Ma, Le Mare, & Gurd, 2015). Thus, encouraging short periods of time outdoors can potentially have positive effects on adolescent well-being. However, it is difficult to draw conclusions on the relationship between time spent outdoors and well-being due to a lack of longitudinal data and other confounding factors. Qualitative research is also needed to shed more light on these differences.

Following the start of the Covid-19 pandemic, the outdoor environment received increased attention in relation to well-being (Jackson, Stevenson, Larson, Peterson, & Seekamp, 2021; Rosen et al., 2021; Venter, Barton, Gundersen, Figari, & Nowell, 2021). In Sweden, while some studies have reported an increase in outdoor participation (Hansen, Beery, Fredman, & Wolf-Watz, 2022; Hedenborg, Fredman, Hansen, & Wolf-Watz, 2022), others have pointed out the cancelation of children's out-of-school activities (Bohman, Ryan, Stjernborg, & Nilsson, 2021; Jenholt Nolbris et al., 2022). In line with this, our results are inconclusive, with little perceived change in time spent outdoors for most participants. This is consistent with a recent study that found no significant changes in adolescent health behaviours during the pandemic (Chen et al., 2022).

Contrary to previous studies (Larson et al., 2018; Winkvist et al., 2015), there were no significant differences in time spent outdoors between boys and girls, except for boys spending more time outdoors on weekdays during the spring/summer. One explanation could be that perceived safety issues are more of a concern for girls more during the lighter spring/summer months, while during winter months, the weather and darker evenings influence both boys' and girls' time spent outdoors. Recent studies from Sweden suggest both boys and girls generally feel safe when outdoors, but point out that whereas boys are more comfortable being alone, girls often seek out the company of others to feel safe (Johansson, Laflamme, & Eliasson, 2012; van der Burgt, 2013). In contrast to this, we found girls had significantly lower perceived safety scores during both seasons. Girls also had significantly lower environmental quality scores overall across seasons, which indicates the fit between girls and their outdoor environments is poorer than for boys. Moreover, girls scored lower on perceived affordances and independent mobility during the spring/summer. Our findings suggest that safety concerns may limit their opportunities to engage with and learn about their environment (Cox, 2020; Kyttä, 2004). Given that girls generally report lower levels of well-being and self-esteem than boys, these findings offer valuable insights into some of the barriers preventing girls from taking advantage of the benefits outdoor life may provide for their well-being.

While our results suggest there were no major differences between living environments in the overall quality of adolescents' outdoor life, analysis of QAOLS subscale scores revealed some differences. For example, rural adolescents had significantly higher perceived affordances scores across seasons compared to suburban adolescents, while suburban adolescents had significantly higher levels of perceived safety than their rural and urban counterparts. While much of the research on outdoor environments and well-being tends to focus on urban areas, our study underlines the importance of including a variety of communities that are representative of where adolescents live. Future research that explores how adolescents meet their needs in different living environments throughout the year can provide important knowledge on how to create more youth-friendly environments, with possible benefits for outdoor life and well-being.

4.1. Strengths and limitations

The study utilised self-report measures to assess participants' use of outdoor environments in their daily lives, as recommended in previous research studying the relationship between outdoor environments and well-being (Fleckney & Bentley, 2021; Zhang et al., 2020). However, it is important to acknowledge that self-report measures have limitations, as they do not capture actual exposure or use. To increase the reliability of findings, future studies should incorporate objective measures in addition to self-report measures. Additionally, there is currently a lack of standardisation in measures of environmental quality and definitions of different outdoor environments, making comparisons between studies difficult. The development of a standardised measure, such as the QAOLS used in this study, may increase the comparability of future research.

To our knowledge few studies have examined the relationship between the outdoor environment and adolescent well-being across seasons and different living environments. Data collection at two different time points during the pandemic also allowed us to comment on how the pandemic might have affected adolescents' outdoor lives as a whole. The Covid-19 pandemic did, however, present some issues for data collection. Because we could not visit all schools in person, instructions were provided for teachers supervising data collection. However, our absence means we are not able to comment on the data collection procedure. Furthermore, the absence of teachers during data collection led to participants filling in the questionnaire at different times, which may have affected the accuracy of comparisons between seasons.

It is also important to note that the study had limitations in recruiting participants from urban areas, with "survey burnout" and "lack of time" being cited by several schools we contacted. This suggests a heavy focus on urban adolescents' lives. While the four schools in the urban sample are all located in neighbourhoods with different socioeconomic conditions, poor response rate from three of the more inner-city schools meant the majority of participants attended a school in an area with above average socioeconomic conditions for this city. The outdoor environment is also not as representative of the rest of the city. Finally, this paper presents only the quantitative findings of the study and does not provide detailed information on environmental characteristics or outdoor activities that may contribute to well-being. Subsequent papers will present qualitative findings that will help shed further light on the findings presented in this paper.

5. Conclusion

The mental health and well-being of Swedish adolescents is a growing public health concern. Our study points to the potential of outdoor life to promote and maintain adolescent well-being and self-esteem. While it is widely acknowledged that girls often experience poorer mental health and self-esteem than boys, our findings suggest that their specific needs may not be met in their everyday outdoor environments. Moreover, our research emphasises the importance of recognising community-level differences in outdoor environments, including seasonal variations. These findings collectively underscore the ongoing need to better understand the characteristics and qualities of outdoor environments that are accessible to diverse groups of adolescents. This understanding has far-reaching implications for urban planning, public health and interventions targeting the promotion of well-being in different groups.

CRediT authorship contribution statement

Mark Wales: Formal analysis, Investigation, Methodology, Project

administration, Visualization, Writing – original draft, Writing – review & editing. **Eva Hoff:** Formal analysis, Methodology, Supervision, Writing – original draft, Writing – review & editing. **Fredrika Mårtensson:** Conceptualization, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Jan-Eric Englund:** Formal analysis, Methodology, Supervision, Writing – original draft, Writing – review & editing.

Declaration of competing interest

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.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.landurbplan.2024.105023.

References

Akpinar, A. (2021). How perceived sensory dimensions of urban green spaces are associated with teenagers' perceived restoration, stress, and mental health? *Landscape and Urban Planning, 214*, Article 104185.

Ayala-Azcárraga, C., Diaz, D., & Zambrano, L. (2019). Characteristics of urban parks and their relation to user well-being. *Landscape and Urban Planning, 189*, 27–35.

Bohman, H., Ryan, J., Stjernborg, V., & Nilsson, D. (2021). A study of changes in everyday mobility during the Covid-19 pandemic: As perceived by people living in Malmö, Sweden. *Transport policy, 106*, 109–119.

Bor, W., Dean, A. J., Najman, J., & Hayatbakhsh, R. (2014). Are child and adolescent mental health problems increasing in the 21st century? A systematic review. *Australian & New Zealand Journal of Psychiatry, 48*(7), 606–616. https://doi.org/10.1177/0004867414533834

Bowker, A. (2006). The relationship between sports participation and self-esteem during early adolescence. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement, 38*(3), 214.

Bremberg, S. (2015). Mental health problems are rising more in Swedish adolescents than in other Nordic countries and the Netherlands. *Acta Paediatrica, 104*(10), 997–1004. https://doi.org/10.1111/apa.13075

Bronfenbrenner, U. (1994). Ecological models of human development. *International encyclopedia of education, 3*(2), 37–43.

Brunelle, S., Brussoni, M., Herrington, S., Matsuba, M. K., & Pratt, M. W. (2018). Teens in Public Spaces and Natural Landscapes. *Handbook of adolescent development research and its Impact on global policy*.

Cele, S. (2015). Childhood in a neoliberal utopia: Planning rhetoric and parental conceptions in contemporary Stockholm. *Geografiska Annaler: Series B, Human Geography, 97*(3), 233–247. https://doi.org/10.1111/geob.12078

Cele, S., & van der Burgt, D. (2013). Participation, consultation, confusion: Professionals' understandings of children's participation in physical planning. *Children's Geographies, 13*(1), 14–29. https://doi.org/10.1080/14733285.2013.827873

Chatterjee, S. (2005). Children's friendship with place: A conceptual inquiry. *Children Youth and Environments, 15*(1), 1–26.

Chawla, L. (2015). Benefits of nature contact for children. *Journal of Planning Literature, 30*(4), 433–452. https://doi.org/10.1177/0885412215595441

Chawla, L., Keena, K., Pevec, I., & Stanley, E. (2014). Green schoolyards as havens from stress and resources for resilience in childhood and adolescence. *Health & Place, 28*, 1–13. https://doi.org/10.1016/j.healthplace.2014.03.001

Chen, Y., Osika, W., Henriksson, G., Dahlstrand, J., & Friberg, P. (2022). Impact of COVID-19 pandemic on mental health and health behaviors in Swedish adolescents. *Scandinavian Journal of Public Health, 50*(1), 26–32.

Clark, C., & Uzzell, D. L. (2006). The socio-environmental affordances of adolescents' environments. In *Children and their environments* (pp. 176–196).

Colburn, S., Pratt, M., Mueller, C., & Tompsett, C. J. (2020). How adolescents define their home neighborhoods conceptually and spatially. *Journal of Community Psychology, 48*(3), 709–725. https://doi.org/10.1002/jcop.22290

Collishaw, S., & Sellers, R. (2020). Trends in child and adolescent mental health prevalence, outcomes, and inequalities. *Mental Health and Illness of Children and Adolescents*, 1–11.

Cox, A. (2020). Freedom to flourish: Why independent mobility and access to the public realm is important for youth development. In *The Routledge handbook of designing public spaces for young people* (pp. 23–38). Routledge.

Devlin, A. S. (2018). *Environmental psychology and human well-being: Effects of built and natural settings*. Academic press.

Diener, E., & Ryan, K. (2009). Subjective well-being: A general overview. *South African Journal of Psychology, 39*(4), 391–406. https://doi.org/10.1177/008124630903900402

Dishman, R. K., Hales, D. P., Pfeiffer, K. A., Felton, G. A., Saunders, R., Ward, D. S., & Pate, R. R. (2006). Physical self-concept and self-esteem mediate cross-sectional relations of physical activity and sport participation with depression symptoms among adolescent girls. *Health Psychology, 25*(3), 396.

Dodge, R., Daly, A., Huyton, J., & Sanders, L. (2012). The challenge of defining wellbeing, 2, 222–235.

Due, P., Eriksson, C., Torsheim, T., Potrebny, T., Välimaa, R., Suominen, S., & Damgaard, M. T. (2019). Trends in high life satisfaction among adolescents in five Nordic countries 2002–2014. *Nordisk välfärdsforskning| Nordic Welfare Research, 4*(2), 54–66.

Dupéré, V., Leventhal, T., & Vitaro, F. (2012). Neighborhood Processes, Self-Efficacy, and Adolescent Mental Health. *Journal of Health and Social Behavior, 53*(2), 183–198. https://doi.org/10.1177/0022146512442676

Ergler, C. R., Kearns, R., & Witten, K. (2016). Exploring children's seasonal play to promote active lifestyles in Auckland, New Zealand. *Health & Place, 41*, 67–77.

Erskine, H. E., Moffitt, T. E., Copeland, W. E., Costello, E. J., Ferrari, A. J., Patton, G., & Scott, J. G. (2015). A heavy burden on young minds: The global burden of mental and substance use disorders in children and youth. *Psychological Medicine, 45*(7), 1551–1563. https://doi.org/10.1017/s0033291714002888

Fagg, J., Curtis, S., Clark, C., Congdon, P., & Stansfeld, S. A. (2008). Neighbourhood perceptions among inner-city adolescents: Relationships with their individual characteristics and with independently assessed neighbourhood conditions. *28*(2), 128-142. 10.1016/j.jenvp.2007.10.004.

Fleary, S. A., Joseph, P., & Pappagianopoulos, J. E. (2018). Adolescent health literacy and health behaviors: A systematic review. *Journal of Adolescence, 62*(1), 116–127. https://doi.org/10.1016/j.adolescence.2017.11.010

Fleckney, P., & Bentley, R. (2021). The urban public realm and adolescent mental health and wellbeing: A systematic review. *Social Science & Medicine, 284*, Article 114242. https://doi.org/10.1016/j.socscimed.2021.114242

Folkhälsomyndigheten, F. (2018). Skolbarns hälsovanor i Sverige 2017/18. In: Grundrapport. https://www.folkhalsomyndigheten.se/contentassets.

Hagquist, C. (2015). Skolelevers psykiska hälsa. *Nordens välfärdscenter/Nordic Welfare Centre*.

Hansen, A. S., Beery, T., Fredman, P., & Wolf-Watz, D. (2022). Outdoor recreation in Sweden during and after the Covid-19 pandemic – Management and policy implications. *Journal of Environmental Planning and Management, 1–22*. https://doi.org/10.1080/09640568.2022.2029736

Hartig, T., Mitchell, R., De Vries, S., & Frumkin, H. (2014). Nature and health. *Annual Review of Public Health, 35*(1), 207–228. https://doi.org/10.1146/annurev-publhealth-032013-182443

Hedenborg, S., Fredman, P., Hansen, A. S., & Wolf-Watz, D. (2022). Outdoorification of sports and recreation: A leisure transformation under the COVID-19 pandemic in Sweden. *Annals of Leisure Research, 1–19*. https://doi.org/10.1080/11745398.2022.2101497

Heft, H. (2010). Affordances and the perception of landscape. *Innovative approaches to research landscape and health: Open space: People space, 2*, 9–32.

Hörbo, M., Johansson, C., Garnow, T., Garmy, P., & Einberg, E.-L. (2021). Experiences of stress – A focus group interview study among Swedish adolescents during the COVID-19 pandemic. *The Journal of School Nursing*. https://doi.org/10.1177/10598405211071002

Horelli, L. (2006). Environmental human-friendliness as a contextual determinant for quality of life. *Revue Européenne de Psychologie Appliquée/European Review of Applied Psychology, 56*(1), 15–22. https://doi.org/10.1016/j.erap.2005.02.012

Horelli, L. (2007). Constructing a theoretical framework for environmental child-friendliness. *Children, Youth and Environments, 17*(4), 267–292. https://doi.org/10.7721/chilyoutenvi.17.4.0267

Huebner, E. S. (1991). Initial development of the student's life satisfaction scale. *School Psychology International, 12*(3), 231–240.

Huebner, E. S. (1994). Preliminary development and validation of a multidimensional life satisfaction scale for children. *Psychological Assessment, 6*(2), 149.

Huebner, E. S., & Gilman, R. (2002). An introduction to the multidimensional students' life satisfaction scale. *Social Indicators Research, 60*(1–3), 115–122.

Jabbar, M., Yusoff, M. M., & Shafie, A. (2021). Assessing the role of urban green spaces for human well-being: A systematic review. *GeoJournal*, 1–19.

Jack, G. (2008). Place matters: The significance of place attachments for children's well-being. *British Journal of Social Work, 40*(3), 755–771. https://doi.org/10.1093/bjsw/bcn142

Jackson, S. B., Stevenson, K. T., Larson, L. R., Peterson, M. N., & Seekamp, E. (2021). Outdoor activity participation improves adolescents' mental health and well-being during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health, 18*(5), 2506. https://doi.org/10.3390/ijerph18052506

Jansson, M., Abdulah, M., & Eriksson, A. (2018). Secondary school students' perspectives and use of three school grounds of varying size, content and design. *Urban Forestry & Urban Greening, 30*, 115–123. https://doi.org/10.1016/j.ufug.2018.01.015

Jenholt Nolbris, M., Ragnarsson, S., Brorsson, A.-L., Garcia de Avila, M., Forsner, M., Kull, I., & Rullander, A.-C. (2022). Young children's voices in an unlocked Sweden during the COVID-19 pandemic. *Scandinavian Journal of Public Health, 50*(6), 693–702.

Jensen, L. A. (2011). Navigating Local and Global Worlds: Opportunities and Risks for Adolescent Cultural Identity Development. *56*(1), 62-70. 10.1007/s12646-011-0069-y.

Johansson, K., Laflamme, L., & Eliasson, M. (2012). Adolescents' perceived safety and security in public space—A Swedish focus group study with a gender perspective. *Young, 20*(1), 69–88.
Karademas, E. C. (2007). Positive and negative aspects of well-being: Common and specific predictors. *Personality and Individual Differences, 43*(2), 277–287.
Kerekes, N., Bador, K., Sfendla, A., Belaatar, M., Mzadi, A. E., Jovic, V., & Nguyen, N. T. A. (2021). Changes in adolescents' psychosocial functioning and well-being as a consequence of long-term covid-19 restrictions. *International Journal of Environmental Research and Public Health, 18*(16), 8755.
Kim, J. (2010). Neighborhood disadvantage and mental health: The role of neighborhood disorder and social relationships. *Social science research, 39*(2), 260–271.
King, M. F., Renó, V. F., & Novo, E. M. L. M. (2014). The concept, dimensions and methods of assessment of human well-being within a socioecological context: A literature review. *Social Indicators Research, 116*(3), 681–698. https://doi.org/10.1007/s11205-013-0320-0
Korpela, K. (2002). Children's environment. *Handbook of environmental psychology*, 363–373.
Korpela, K., Kyttä, M., & Hartig, T. (2002). Restorative experience, self-regulation, and children's place preferences. *Journal of Environmental Psychology, 22*(4), 387–398. https://doi.org/10.1006/jevp.2002.0277
Korpela, K. (1992). Adolescents' favourite places and environmental self-regulation.
Kyttä, M. (2004). The extent of children's independent mobility and the number of actualized affordances as criteria for child-friendly environments. *Journal of Environmental Psychology, 24*(2), 179–198. https://doi.org/10.1016/s0272-4944(03)00073-2
Kyttä, M., & Broberg, A. (2014). *The multiple pathways between environment and health* (pp. 1–54). Wellbeing: A Complete Reference Guide.
Kyttä, A. M., Broberg, A. K., & Kahila, M. H. (2012). Urban environment and children's active lifestyle: SoftGIS revealing children's behavioral patterns and meaningful places. *American Journal of Health Promotion, 26*(5), e137–e148. https://doi.org/10.4278/ajhp.100914-quan-310
Larson, L. R., Szczytko, R., Bowers, E. P., Stephens, L. E., Stevenson, K. T., & Floyd, M. F. (2018). Outdoor time, screen time, and connection to nature: Troubling trends among rural youth? *Environment and Behavior, 51*(8), 966–991. https://doi.org/10.1177/0013916518806686
Laundy Frisenstam, K., Van Den Bosch, M., Chen, Y., Friberg, P., & Osika, W. (2017). Self-reported psychosomatic complaints in Swedish children, adolescents, and young adults living in rural and urban areas: An internet-based survey. *JMIR Public Health and Surveillance, 3*(1), e9.
Lercher, P. (2003). Which health outcomes should be measured in health related environmental quality of life studies? *Landscape and Urban Planning, 65*(1–2), 63–72.
Leversen, I., Danielsen, A. G., Birkeland, M. S., & Samdal, O. (2012). Basic psychological need satisfaction in leisure activities and adolescents' life satisfaction. *Journal of Youth and Adolescence, 41*(12), 1588–1599. https://doi.org/10.1007/s10964-012-9776-5
Löfstedt, P., Arnarsson, A., Corell, M., Lyyra, N., Madsen, K., Torsheim, T., … Eriksson, C. (2020). On the time trends among school-aged children in the Nordic countries. *European Journal of Public Health 30*(Supplement_5), ckaa165. 1065.
Lopes, F., Cordovil, R., & Neto, C. (2018). Independent mobility and social affordances of places for urban neighborhoods: A youth-friendly perspective. *Frontiers in Psychology, 9*. https://doi.org/10.3389/fpsyg.2018.02198/full
Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the depression anxiety stress scales (DASS) with the beck depression and anxiety inventories. *Behaviour Research and Therapy, 33*(3), 335–343.
Ma, J. K., Le Mare, L., & Gurd, B. J. (2015). Four minutes of in-class high-intensity interval activity improves selective attention in 9-to 11-year olds. *Applied Physiology, Nutrition, and Metabolism, 40*(3), 238–244.
Markevych, I., Schoierer, J., Hartig, T., Chudnovsky, A., Hystad, P., Dzhambov, A. M., & Fuertes, E. (2017). Exploring pathways linking greenspace to health: Theoretical and methodological guidance. *Environmental Research, 158*, 301–317. https://doi.org/10.1016/j.envres.2017.06.028
Martinsson, E., Garmy, P., & Einberg, E.-L. (2022). School nurses' perceptions about student's wellbeing during the covid-19 pandemic in Sweden. *The Journal of School Nursing*, 10598405221112443.
Mavoa, S., Lucassen, M., Denny, S., Utter, J., Clark, T., & Smith, M. (2019). Natural neighbourhood environments and the emotional health of urban New Zealand adolescents. *Landscape and Urban Planning, 191*. https://doi.org/10.1016/j.landurbplan.2019.103638
Mennis, J., Mason, M., & Ambrus, A. (2018). Urban greenspace is associated with reduced psychological stress among adolescents: A Geographic Ecological Momentary Assessment (GEMA) analysis of activity space. *Landscape and Urban Planning, 174*, 1–9. https://doi.org/10.1016/j.landurbplan.2018.02.008
Mesch, G. (2010). Wired Youth. doi:10.4324/9780203855102.
Moser, G. (2009). Quality of life and sustainability: Toward person–environment congruity. *Journal of Environmental Psychology, 29*(3), 351–357. https://doi.org/10.1016/j.jenvp.2009.02.002
Mygind, L., Kjeldsted, E., Hartmeyer, R., Mygind, E., Bolling, M., & Bentsen, P. (2019). Mental, physical and social health benefits of immersive nature-experience for children and adolescents: A systematic review and quality assessment of the evidence. *Health & Place, 58*, Article 102136. https://doi.org/10.1016/j.healthplace.2019.05.014
Mygind, L., Kurtzhals, M., Nowell, C., Melby, P. S., Stevenson, M. P., Nieuwenhuijsen, M., & Enticott, P. G. (2021). Landscapes of becoming social: A systematic review of evidence for associations and pathways between interactions with nature and socioemotional development in children. *Environment International, 146*, Article 106238. https://doi.org/10.1016/j.envint.2020.106238
Nordbø, E. C. A., Nordh, H., Raanaas, R. K., & Aamodt, G. (2020). Promoting activity participation and well-being among children and adolescents: A systematic review of neighborhood built-environment determinants. *JBI Evidence Synthesis, 18*(3), 370–458.
Oberle, E., Schonert-Reichl, K. A., & Zumbo, B. D. (2011). Life satisfaction in early adolescence: Personal, neighborhood, school, family, and peer influences. *Journal of Youth and Adolescence, 40*(7), 889–901. https://doi.org/10.1007/s10964-010-9599-1
Oswald, T. K., Rumbold, A. R., Kedzior, S. G. E., & Moore, V. M. (2020). Psychological impacts of "screen time" and "green time" for children and adolescents: A systematic scoping review. *PLoS One, 15*(9), e0237725.
Owens, P. E. (2002). No teens allowed: The exclusion of adolescents from public spaces. *Landscape Journal, 21*(1), 156–163.
Owens, P. E. (2009). In pursuit of nature: The role of nature in adolescents' lives. *Journal of Developmental Processes, 4*(1), 43–58.
Owens, P. E. (2017). A place for adolescents: The power of research to inform the built environment.
Owens, P. E. (2020). A Fundamental Need. The Routledge Handbook of Designing Public Spaces for Young People: Processes, Practices and Policies for Youth Inclusion.
Pagels, P., Raustorp, A., Guban, P., Fröberg, A., & Boldemann, C. (2016). Compulsory school in- and outdoors—Implications for school children's physical activity and health during one academic year. *International Journal of Environmental Research and Public Health, 13*(7), 699. https://doi.org/10.3390/ijerph13070699
Patton, G. C., Sawyer, S. M., Santelli, J. S., Ross, D. A., Afifi, R., Allen, N. B., & Viner, R. M. (2016). Our future: A Lancet commission on adolescent health and wellbeing. *The Lancet, 387*(10036), 2423–2478. https://doi.org/10.1016/s0140-6736(16)00579-1
Pooley, J. A., Pike, L. T., Drew, N. M., & Breen, L. (2002). Inferring Australian children's sense of community: A critical exploration. *Community, Work & Family, 5*(1), 5–22. https://doi.org/10.1080/13668800020006802a
Proctor, C. L., Linley, P. A., & Maltby, J. (2008). Youth life satisfaction: A review of the literature. *Journal of Happiness Studies, 10*(5), 583–630. https://doi.org/10.1007/s10902-008-9110-9
Pyyry, N., & Tani, S. (2016). Young peoples play with urban public space: Geographies of hanging out. *Play and Recreation, Health and Wellbeing, 9*.
Richman, E. L., & Shaffer, D. R. (2000). IF YOU LET ME PLAY SPORTS: How might sport participation influence the self-esteem of adolescent females? *Psychology of Women Quarterly, 24*(2), 189–199. https://doi.org/10.1111/j.1471-6402.2000.tb00200.x
Rosen, M. L., Rodman, A. M., Kasparek, S. W., Mayes, M., Freeman, M. M., Lengua, L. J., & McLaughlin, K. A. (2021). Promoting youth mental health during the COVID-19 pandemic: A longitudinal study. *PLoS One1, 16*(8), e0255294.
Rosenberg, M. (1965). Rosenberg self-esteem scale (SES). *Society and the adolescent self-image*.
Sandberg, M. (2012). *"De är inte ute så mycket" Den bostadsnära naturkontaktens betydelse och utrymme i storstadsbarns vardagsliv*.
Sawyer, S. M., Afifi, R. A., Bearinger, L. H., Blakemore, S.-J., Dick, B., Ezeh, A. C., & Patton, G. C. (2012). Adolescence: A foundation for future health. *The Lancet, 379*(9826), 1630–1640. https://doi.org/10.1016/s0140-6736(12)60072-5
Scannell, L., & Gifford, R. (2017). Place Attachment Enhances Psychological Need Satisfaction. *Environment and Behavior, 49*(4), 359–389. https://doi.org/10.1177/0013916516637648
Solmi, M., Radua, J., Olivola, M., Croce, E., Soardo, L., Salazar De Pablo, G., & Fusar-Poli, P. (2022). Age at onset of mental disorders worldwide: Large-scale meta-analysis of 192 epidemiological studies. *Molecular Psychiatry, 27*(1), 281–295. https://doi.org/10.1038/s41380-021-01161-7
Sundevall, E. P., & Jansson, M. (2020). Inclusive Parks across Ages: Multifunction and Urban Open Space Management for Children, Adolescents, and the Elderly. *International Journal of Environmental Research and Public Health, 17*(24), 9357. https://doi.org/10.3390/ijerph17249357
Tabachnick, B. G., & Fidell, L. S. (2013). Using multivariate statistics: International edition. *Pearson2012*.
Tillmann, S., Tobin, D., Avison, W., & Gilliland, J. (2018). Mental health benefits of interactions with nature in children and teenagers: A systematic review. *Journal of Epidemiology and Community Health, 72*(10), 958–966. https://doi.org/10.1136/jech-2018-210436
Uzzell, D., & Moser, G. (2006). Environment and quality of life. *Revue Européenne de Psychologie Appliquée/European Review of Applied Psychology, 56*(1), 1–4. https://doi.org/10.1016/j.erap.2005.02.007
van der Burgt, D. (2013). Spatial avoidance or spatial confidence? Young people's agency in the active negotiation of risk and safety in public space. *Children's Geographies, 13*(2), 181–195. https://doi.org/10.1080/14733285.2013.828455
Venter, Z. S., Barton, D. N., Gundersen, V., Figari, H., & Nowell, M. S. (2021). Back to nature: Norwegians sustain increased recreational use of urban green space months after the COVID-19 outbreak. *Landscape and Urban Planning, 214*, Article 104175.
Wagnsson, S., Lindwall, M., & Gustafsson, H. (2014). Participation in organized sport and self-esteem across adolescence: The mediating role of perceived sport competence. *Journal of sport and exercise psychology, 36*(6), 584–594.
Wales, M., Mårtensson, F., Hoff, E., & Jansson, M. (2022). Elevating the role of the outdoor environment for adolescent wellbeing in everyday life. *Frontiers in Psychology, 13*, 774592.
Wales, M., Mårtensson, F., & Jansson, M. (2021). You can be outside a lot': independent mobility and agency among children in a suburban community in Sweden. *Children's Geographies, 19*(2), 184–196.
Whitlock, J. (2007). The role of adults, public space, and power in adolescent community connectedness. *Journal of Community Psychology, 35*(4), 499–518. https://doi.org/10.1002/jcop.20161

Winkvist, A., Hultén, B., Kim, J.-L., Johansson, I., Torén, K., Brisman, J., & Bertéus Forslund, H. (2015). Dietary intake, leisure time activities and obesity among adolescents in Western Sweden: A cross-sectional study. *Nutrition Journal, 15*(1). https://doi.org/10.1186/s12937-016-0160-2

Wu, W., Chen, W. Y., Yun, Y., Wang, F., & Gong, Z. (2022). Urban greenness, mixed land-use, and life satisfaction: Evidence from residential locations and workplace settings in Beijing. *Landscape and Urban Planning, 224*, Article 104428. https://doi.org/10.1016/j.landurbplan.2022.104428

Zhang, Y., Mavoa, S., Zhao, J., Raphael, D., & Smith, M. (2020). The association between green space and adolescents' mental well-being: A systematic review. *International Journal of Environmental Research and Public Health, 17*(18), 6640. https://doi.org/10.3390/ijerph17186640