

Environmental child-friendliness under pressure: The impact of infill densification in modernist residential areas

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ABSTRACT

As the assets of modernist planning, sometimes called the welfare landscape, are affected by densification, the implications for people need to be studied. One group with special needs is children, where child-friendly environments can support their use, health and well-being. A single case study was conducted in a district of central Uppsala, Sweden, where parts of a former modernist multi-family residential area have recently been densified with infill development. The methods included initial document studies and field observations, followed by a questionnaire survey on the child-friendliness of the local environment in different sub-areas. No statistically significant differences were found between densified and non-densified subareas, but the areas considered most child-friendly were near the largest park in the area. Respondents reported that densification had resulted in small open spaces and car traffic that limited children's use. Assets from the welfare landscape supported child-friendliness, based on both previous planning and long-term management. The case provides an example of densification with infill resulting in both loss of open space and car traffic solutions that increase car access. If infill is to support use by children and other vulnerable groups, and thus social sustainability, it must better incorporate qualities for a child-friendly environment.

1. Introduction

Contemporary spatial planning discourses in Europe and beyond are strongly influenced by the ideal of the compact city, which once emerged as a reaction against modernist planning (McFarlane, 2016). Since then, compactness has also become a strategy for sustainable development (Bibri, Krogstie, & Kärrholm, 2020), associated with multiple sustainability goals such as protecting land, reducing carbon emissions, and stimulating socio-economic effects (Wicki & Kaufmann, 2022). However, densification plans and more compact cities can lead to several different types of effects, both positive and negative (Ahlfeldt & Pietrostefani, 2017). For example, a literature review found positive correlations for transportation and the economy, but negative correlations for ecology, social impacts, and health (Berghauser Pont, Perg, Haupt, & Heyman, 2020). Building density per se has not been shown to guarantee a reduction in car traffic, neither in large cities (Ferreira & Batey, 2011) nor in smaller towns (Qviström, Bengtsson, & Vicenzotti, 2016).

Other authors have pointed to the very different ways in which

densification takes physical form, which requires a contextual understanding of each case (Schmidt-Thomé, Haybatollahi, Kyttä, & Korpi, 2013) and adapted development processes (Lehman, 2016). Still, if dense multifamily environments are also to be successful in terms of social sustainability through neighborhood satisfaction and well-being, the importance of meeting certain qualities has been raised. These qualities have been described as including access to green spaces, mixed land uses, public transportation, limited car traffic, and social equity, as well as limited noise, litter, and fear of crime (Mouratidis, 2019). Other studies highlight the need to provide public green space as well as walkable access to transit and services (Billig, Smith, & Moyer, 2020), and to avoid high-rise density due to microclimate reasons (Lehman, 2016).

Densification projects can be implemented as infill developments within already existing built up areas (Schmidt-Thomé et al., 2013). Infill developments depend on local policies and practices and therefore vary between different parts of the world (Bibby, Henneberry, & Halleux, 2021). It can have advantages through development of vacant or underutilized land such as brownfields, like former industrial areas

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(Salvati & Lamonica, 2020). It can also be a strategy to limit urban sprawl (Mohammadi-Hamidi, Beygi Heidarlou, Fürst, & Nazmfar, 2022). However, infill often affects green spaces that were previously intended for recreation, as later changes in attitudes and ideals in planning argue for the quality of open spaces as a substitute for quantity (Littke, 2015), which contradicts the claimed importance of access to green spaces in dense areas (Billig et al., 2020; Mouratidis, 2019). Thus, a major problem with densification projects is the lack of green space provision in terms of quality, quantity and social equity (Haaland & van den Bosch, 2015), which particularly affects vulnerable groups such as children (Sundevall & Jansson, 2020), and require more understanding among e.g. planners (Bauer & Duschinger, 2024).

Densification processes in recent decades have strongly transformed parts of the legacy of modernist planning, resulting in a patchwork of planning styles (Qviström, 2022). There is an urgent need to better understand the results of densification as well as the typology of modernist planning and its landscapes before they disappear (Qviström, 2022). In Sweden, as well as in neighbouring countries, structures from modernist planning have been described as welfare landscapes, being a materialization of a multifaceted welfare discourse (Pries & Qviström, 2021). During the development of Sweden’s so-called Million homes program in the 1960s and 1970s (Hall & Vidén, 2005), much attention was given to the provision of multi-family residential areas with large outdoor spaces for recreation as well as car traffic separated from pedestrians (Pries & Qviström, 2021). Although the planning ideals of compact cities have created pressure for change, these areas are now often highly valued by residents, while a major problem is the level of maintenance, which is often perceived as too low (Mack, 2021). For the user group of children, studies have pointed to the value of standard-influenced modernist playground planning that provides access to large open spaces and play facilities, while the lack of variation may be negative (Jansson & Persson, 2010).

As densification trends with infill change the welfare landscape, more knowledge is needed about the effects, including the perspectives and uses of residents. There are cases where infill areas have been perceived as quite attractive (Schmidt-Thomé et al., 2013). However, residents often view infill development in their neighborhoods negatively (Wicki & Kaufmann, 2022). Despite the goals of providing access to green spaces, limited car traffic, etc. during infill (Mouratidis, 2019), residents may experience a loss of open and green spaces and neighborhood character, as well as increased traffic (Arvola & Pennanen, 2014; McConnell & Wiley, 2010), which can lead to negative emotional reactions (Skrede & Andersen, 2022). Residents’ arguments, even if valid, may be dismissed in decision making if they are against densification, as their perspectives then go against compact city policies (Wolsink, 2016), which may include references to NIMBYism and anti-growth sentiments (Wicki & Kaufmann, 2022). However, negative views of limited green space and car-friendly planning may also affect new residents after moving to densified areas (Jansson & Schneider, 2023).

The effects of densification on different user groups, such as children and families, have been little studied. Access to sufficient outdoor space is a basic prerequisite for a child-friendly environment (Broberg, Kyttä, & Fagerholm, 2013; Jansson, Herbert, Zalar, & Johansson, 2022), which is put at risk when moving to compact cities. There is a lack of knowledge about the possible benefits of densification, especially for children and families (Bierbaum & Vincent, 2013), and how children’s use of the local environment is affected by developments (Marzi & Reimers, 2018). Furthermore, in order to provide well-functioning open and green spaces for different user groups, not only planning is of interest, but also its relationship to both design and long-term management, including daily maintenance (Braubach et al., 2017).

1.1. Child-friendly environments

The concept of Child-Friendly Environments (CFE) is used here as a

theoretical framework. CFE has its origins in the UN Convention on the Rights of the Child (UN, 1989) and the UNICEF-supported Child Friendly Cities initiative (UNICEF, 2004). CFE has many benefits for children and communities, including the opportunity for children to develop multiple competencies, motivation, and stewardship in relation to nature (Malone, 2013). However, there are large knowledge gaps regarding the realization of CFE through governance processes, that is, how to integrate children’s rights into physical planning and development of actual environments (Cordero-Vinueza, Niekerk, & van Dijk, 2023).

While much of the literature on CFE has focused on children’s participation, a literature review (Jansson et al., 2022) identified ten contributing socio-physical qualities: green and open spaces, access, safety, fairness and inclusion, social connection, play and leisure, freedom, clean environment, involvement and learning, where access to green and open spaces is a basic requirement (see Table 1). This is in line with Kyttä’s (2004) theory, based on earlier publications such as Moore (1986), which describes the core of CFE as the combination of two main qualities: the amount of actualized affordances and the extent of children’s independent mobility. CFE thus depends on a variety of places with content of interest to children, combined with children’s freedom to discover, access, and use these places.

Children’s independent mobility is important for many aspects of their health and development (Shaw et al., 2015). In particular, having autonomous time to use the local environment for play and mobility is valuable for children’s well-being (Weir, 2023). Despite this, children’s independent mobility has declined in many parts of the world over several decades (Shaw et al., 2015). Children’s independent mobility is complex and influenced by different types of factors: in the physical environment, in the social environment, and in relation to children’s sociodemographic characteristics (Marzi & Reimers, 2018). Nevertheless, the built environment is known to have a significant impact (Bagheri & Zarghami, 2020). For example, traffic restrictions such as separating cars from pedestrians (Sharmin & Kamruzzaman, 2017) and moderate building density (Broberg et al., 2013) can be positive, while high building density, land use mix, and high motor traffic have been found to be barriers (Bagheri & Zarghami, 2020; Sharmin & Kamruzzaman, 2017).

Affordances, as the other most important quality for CFE, are “perceptible characteristics of the environment that have functional significance for an individual” (Heft, 2010, p. 18). They are “both objectively real and psychologically significant” (Heft, 2010, p. 19) and thus describe how environments relate to users and their actions (Lerstrup & Konijnendijk van den Bosch, 2017). With a variety of

Table 1
Socio-physical qualities of child-friendly environments (Jansson et al., 2022).

| Theme | Description |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Green and open spaces | a wide variety of both green environments and other places that children can easily reach and use |
| Access | proximity and well-functioning pedestrian and bicycle networks and structures that enable children to reach different places independently |
| Safety | regulation of traffic and other unpredictable risks and promotion of perceived safety |
| Fairness and inclusion | an inclusive environment providing access to different spaces, activities and facilities regardless of socio-economic status, age, gender, ethnic background, religious affiliation or disability |
| Social connection | both the physical environment and the people in it that create connection and a sense of belonging |
| Play and leisure | a variety of opportunities for play and activities |
| Freedom | children’s freedom of movement and opportunities to use and challenge themselves in the outdoor environment |
| Clean environment | an environment free from litter, pollution, noise and other things that can interfere with and prevent use |
| Involvement | opportunities for children to be actors who can both formally participate in and can informally influence their environment |
| Learning | environments that support development and skill building |

affordances, each of which also provides “variation and uniqueness, size and gradation, and novelty and change” (Lerstrup & Konijnendijk van den Bosch, 2017, p. 59), children’s environments become truly rich in possibilities. This can include variation between formal and informal places (Cele, 2015), features programmed for specific uses or unprogrammed (Sundevall & Jansson, 2020), and also different levels of management and maintenance (Jansson, Sundevall, & Wales, 2016). Such variation in affordances can attract children and support them in forming relationships with places (Chatterjee, 2005; Kytä, 2004).

The aim of this study is to increase knowledge about how residents perceive child-friendliness after densification projects through infill in multi-family, welfare-era neighborhoods. A key research question is: How is the child-friendliness of environments in modernist welfare landscapes affected by infill development? The study looks at child-friendly environments as experienced by local adults.

2. Methods

This study is based on a single case study of an urban area, using mixed methods: initial document analysis and observation, followed by an online survey sent to local residents. The case area consists of two urban districts in central Uppsala, Sweden: Kvarngärdet and Kapellgärdet. The area was chosen for the study because it contains elements of both a welfare landscape and also later densification development. It is characterized by both residential areas planned in the 1960s and 1970s with housing heights of mainly two stories, but also some of both one and six stories, and more recent infill based on densification planning ideals, including buildings of mainly six stories, but also some from four to eleven stories. It thus represents a true

patchwork of planning styles (Qviström, 2022), where the infill provides both more built land and higher building heights.

2.1. Document analysis and field observations

A combination of document analysis and observations was carried out in the spring of 2021 to get an initial overview of the area and its planning. Related planning documents from the 1960s and 1970s were collected during visits to the city archive at the Municipality of Uppsala. One detailed development plan from the area was excluded because it had been replaced by a newer version in connection with the densification in recent years.

Field observations were made on three occasions at different times and days, from March to June 2021. All types of open spaces including streets, parks, playgrounds, and accessible yards were observed and documented with written notes and photographs. Virtual observations using Google Street View were used throughout the study to further explore the area.

2.2. Online survey

The online survey was created in a survey program provided by Netigate. It consisted of parts about the general use and qualities of the outdoor environment, previously reported elsewhere (Jansson & Schneider, 2023). This paper concerns the three following parts of the survey, with a total of 12 questions (see Appendix 1) related to the outdoor environment and children: 1) how well the content of the outdoor environment functions for children, 2) opportunities for children’s independent mobility, and 3) existing and/or missing facilities or places

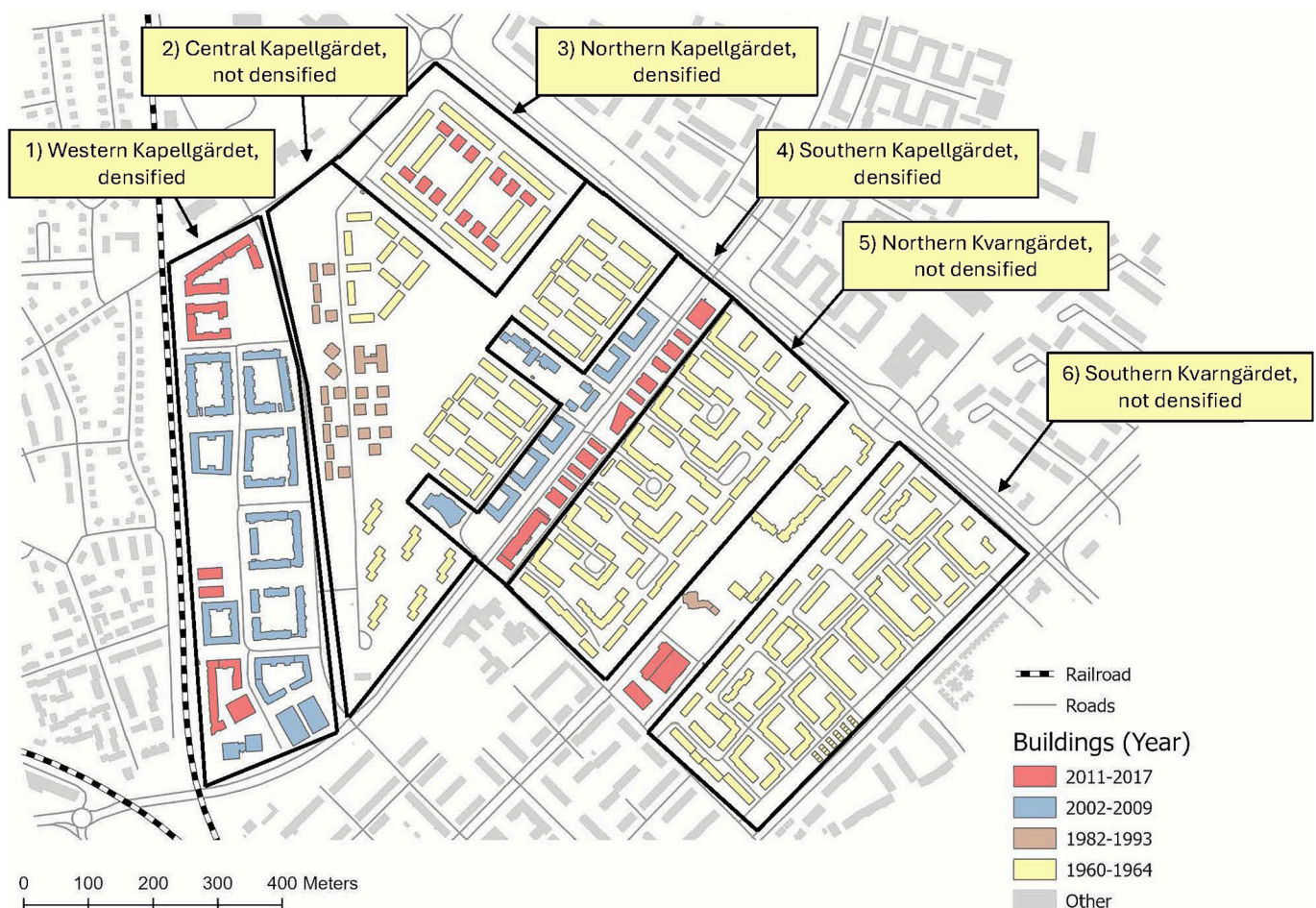


Fig. 1. The case area divided into six sub-areas.

for children. In addition, five questions were asked about the socio-demographic profile of the respondents. The survey included multiple choice, rating, and open-ended questions.

In order to compare densified and non-densified portions of the case area, the area was divided into six sub-areas, three of which had been densified by infill development and three of which had not (see Fig. 1). The densified sub-areas are 1. Western Kapellgärdet, 3. Northern Kapellgärdet and 4. Eastern Kapellgärdet, and the non-densified were 2. Central Kapellgärdet, 5. Northern Kvarngärdet and 6. Southern Kvarngärdet, which consist mainly of welfare landscapes. Still, each sub-area has its own character. Of the densified sub-areas, Northern Kapellgärdet has been densified on open spaces both outside and inside existing yards, while infill in Western Kapellgärdet has been built on a former industrial area, thus brownfield. In the Eastern Kapellgärdet, infills were built on open green or gray spaces in connection with existing residential areas and a main road. Due to the proximity of the sub-areas, they have all been affected by the developments of recent years and share much of the same experiences of the case area as a whole, but presumably to different degrees.

Questions about the functions of the outdoor environment for children were asked on two environmental scales, about the outdoor environment in the immediate area (within 50 m of the home, mainly covering the sub-area) and about the case area as a whole. This was done to separate between the outdoor environment in the immediate area and the area as a whole, allowing comparison between residents in densified and non-densified sub-areas also on their closest outdoor environments.

Before the questionnaire was sent out to local residents, it was tested on a limited number of people, all with connections to the study area. Two responses with feedback were used to adjust the survey. It was then sent to all addresses of residents in the area after being ordered from Statens personadressregister, SPAR, (the Swedish National Register of Personal Addresses), which identified 5913 different and relevant addresses. A QR code and a link to the online survey were printed on physical postcards that were distributed in May (late spring) 2022. Both the postcard and the survey were written in Swedish. The online survey was open for 3.5 months.

2.3. Analysis

Survey results were analyzed using IBM SPSS Statistics 26, with one-way analysis of variance followed by Tukey's test used to identify statistically significant results (at the 5 % significance level). Responses to open-ended questions were analyzed qualitatively through thematic analysis by coding and sorting them into themes. Planning documents were scanned and portions relevant to the research questions were synthesized. Field observations of the area were used to support the description of the characteristics of the built environment. The structure of the results is based on the results of both qualitative and quantitative analysis of the survey responses, supported by the findings from the document analysis and field observations. The presented data is mainly qualitative. In the analysis of the quantitative evaluation questions, the answer option "I don't know" was excluded.

3. Results

3.1. Background information

A total of 595 responses were collected, giving a response rate of 10 %, of which 523 (8.8 %) were complete. The age distribution of the respondents was fairly even, as was the gender distribution between men and women, with a few non-binary people and people who did not want to specify their gender. Nearly half of the respondents had lived in the area for 1–5 years, while only a few (2 %) had lived there all their lives. A large share (40 %) of the respondents lived in the densely populated area of Western Kapellgärdet (1), both because of the large number of residents there and because of the comparatively high

response rate (13 %).

The majority of respondents did not have children living at home (see Fig. 2). The proportion of respondents with children living at home varied greatly between the sub-areas, from 30 % in Western Kapellgärdet (1) and Northern Kvarngärdet (5) to 2 % in Northern Kapellgärdet (3). The age of the children also varied. In Western, Central and Eastern Kapellgärdet (1, 2, 4), children aged 0–6 years were most common at home, while in Kvarngärdet (5, 6), respondents mainly had children over 17 years at home.

3.2. Function of the outdoor environment

Numerical differences were found between different sub-areas and between different age groups concerning the rated function of the outdoor environment for children and youth. In summary, the outdoor environment around Central and Northern Kapellgärdet (sub-areas 2 and 3), with a large park in the center, was considered to function better than other sub-areas for children in general (see Figs. 3 and 4). In particular, the non-densified Central Kapellgärdet (sub-area 2) got high mean values, while many in other sub-areas found the area at large better than their immediate area. However, comparing between all densified and all non-densified sub-areas, the difference in how well the content of the outdoor environment was perceived to function for children and youth was not statistically significant.

3.3. Existing places and facilities for children and youth

When in open questions asked about good places and facilities for children and youth in Kvarngärdet and Kapellgärdet, respondents described parks, playgrounds, and the school area with its connecting footpaths and bicycle paths. The large park in the non-densified Central Kapellgärdet (2) with mature vegetation, green open spaces, a playground and a skate park was mentioned by respondents from all sub-areas as valuable for children and young people and as a place used by and inclusive of all age groups. It was described for its social qualities: "It's good that there are opportunities for fun activities for children and youth (skateboarding, soccer, playing) in the area. It makes it lively and joyful even for those of us who are no longer active ourselves. The area around the skate park is also used for barbecues, picnics, etc." (man, > 65 years old from sub-area 4).

Proximity, size, and quality of the green spaces were all brought up as important for use by children and families. A smaller and relatively new park in the densified Western Kapellgärdet (1) with a small hill, a green open area and a playground was also considered a good place for children, especially by respondents who lived nearby. The playground was particularly appreciated by parents of younger children. However, the size, age and design of the larger park in Central Kapellgärdet was considered better: "[The large park] is quite nice because there are a lot of trees, lawns and shrubs. The vegetation is mixed and not just an open boring surface. You can find your own place to sunbathe or read a book. In [the smaller park] there is nowhere to get a 'corner', it is completely open. No shrubs." (woman, 36–50 years old, sub-area 1). The lack of mature vegetation in the small park also means a lack of shade in the summer months: "The [small] park closest to my house is very exposed to the sun in the summer. It is impossible to protect oneself from the sun and the grass is completely burnt" (man, 26–35 years old, sub-area 1).

The use of places was also related to the ways of getting there and how the places are connected. A schoolyard located between Northern and Southern Kvarngärdet (sub-areas 5 and 6) and the pedestrian and bicycle paths around the school were also mentioned by respondents living nearby: "[The] schoolyard (...) [has] something for all ages. Playgrounds, soccer field, ball field, and basketball courts. In the winter, a lot of people do ice skating there. Unfortunately, it seems to be disappearing" woman, 36–50 years old, sub-area 5). The schoolyard was rebuilt during 2022, which may be what the respondent is referring to. The paths around the school have been partially upgraded, with "lots of

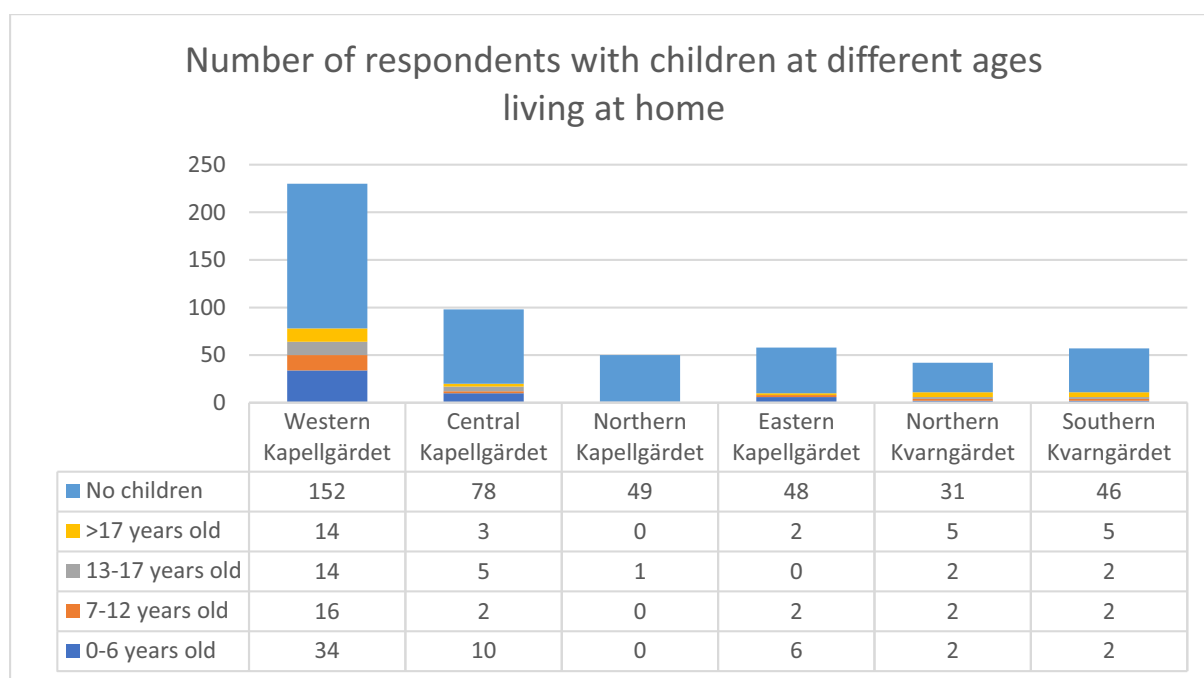


Fig. 2. Number of respondents with children at different ages living at home, in each sub-area.

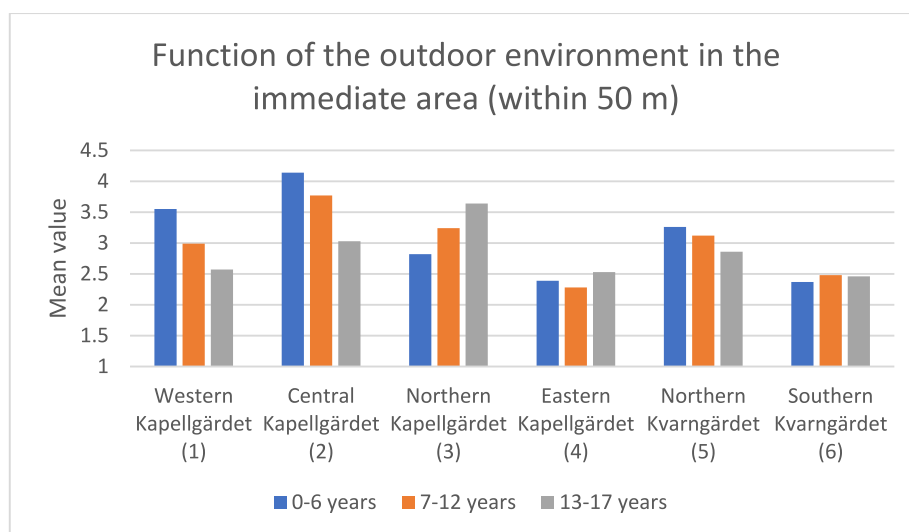


Fig. 3. Mean values of how well the content of the outdoor environments in the immediate area functions for children ages 0–6, 7–12 and 13–17 years old, on a scale from 1 = not well to 5 = very well.

little things along the whole stretch, little trampolines, etc.” (woman, 26–35 years old, sub-area 5), which was highly appreciated: “The avenue by [the school] is a favorite. I love walking there with my child and also by myself. Lush now in the summer!” (woman, 36–50 years old, sub-area 6).

3.4. Better places, maintenance and safety

However, according to the respondents, there is a need for more places and facilities for children and youth in Kvarngärdet and Kapellgärdet. More open green spaces, bigger and better playgrounds and strategies to limit traffic or access to busy roads are some of the things that respondents from the densified Western and Eastern Kapellgärdet (sub-areas 1 and 4) highlighted. For example, some pointed out that: “the nearest playgrounds are undersized for the

proportion of people and children living here” (man, 36–50 years old, sub-area 1) and that “there is a need for a soccer field. The children are relegated to the yard, which is much too small and fragile for ball games” (woman, >65 years old, sub-area 1).

Another issue raised was the lack and diminishing number of places for older children to gather and use: “There are only playgrounds for the younger ones. There is nothing for young people to do outdoors. Is unsafe at night. Lots of litter. And safe green spaces are disappearing. The soccer field/skateboard area and the basketball courts, which are frequently used by the majority of the young people every evening, are being removed from the schoolyard, so that the little that the young people could do now disappears completely” (woman, 36–50 years old, sub-area 5). This was also recognized by respondents living in Central Kapellgärdet, which was otherwise considered to be more child-friendly: “Slightly older children, young people, probably have a little less

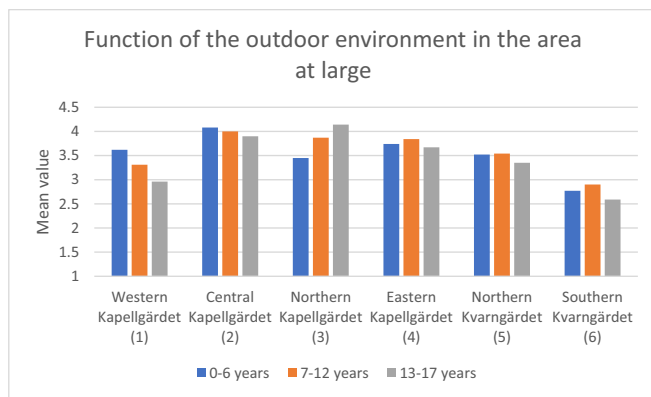


Fig. 4. Mean values of how well the content of the outdoor environments in the area at large functions for children aged 0-6, 7-12 and 13-17 years old, on a scale from 1 = not well to 5 = very well.

opportunity to find something fun to do" (man, >65 years old, sub-area 2). In some cases, the barrier was that the outdoor environment was perceived as unsafe: "[There is a need for] safer places for teenagers to hang out" (woman, 18-25 years old, sub-area 1). In others there was a lack of facilities or arranged places that were suitable for young people: "I wish there were more benches, an arbor or pavilion for young adults. More garden-like" (woman, 26-35 years old, sub-area 2).

Youth were described not only as a group in need of more places and facilities, but also as a safety issue. Some respondents expressed suspicion of youth in the area: "There are a lot of places where young people can hide and do mischief." (woman, 26-35 years old, sub-area 6). In some cases, youth were seen as a direct disturbance and source of irritation, linked to perceived bad behavior and crime: "Unfortunately, [the housing company] has put up a pergola with tables and benches in the yard, which gives young people who do not belong to our yard the opportunity to sit on the tables at night, with their feet on the benches, smoking hashish, selling drugs, I guess [...]. I have spoken to [the housing company] about this and asked them to remove the pergola, which actually is a kind of protection and shelter for the young people" (woman, >65 years old, sub-area 6).

The management and especially the level of maintenance of the outdoor environment was found to be an important factor in local child-friendliness, linked to perceived safety. Especially in the non-densified

Southern Kvarngårdet (6), a need for better maintenance of the outdoor environment was expressed: "Unfortunately there are no [good places or facilities for children and young people]. The nearby playgrounds are not up to date and full of cat litter" (50-65 years old, sub-area 6). Maintenance seems to have deteriorated in recent years: "The area used to be safe and well maintained. Now the housing company doesn't seem to care about the outdoor environment or the safety of the area. The playgrounds are broken and sometimes dangerous for the children. There is no supervision" (50-65 years, sub-area 6).

3.5. Independent mobility

No statistically significant difference was found between densified and non-densified sub-areas in how well children and youth can move freely in the outdoor environment (Fig. 5). However, numerically the outdoor environment in and around the non-densified Central Kapellgårdet (2) was considered better than other sub-areas for children of all ages in terms of their independent mobility.

The respondents in all sub-areas answered that the outdoor environment was better for the independent mobility of older children and not so good for young children (Fig. 5). In the plan descriptions for Eastern Kapellgårdet (4) from the 1960s, an underpass was described under the main road between Kvarngårdet and Kapellgårdet. When Eastern Kapellgårdet was densified in recent years, this underpass was removed, which increased the barrier effect of the road and may have had a negative impact on children's independent mobility.

The importance of a good combination of places and independent mobility was also expressed by residents. Playgrounds in yards or patios and shared open spaces were highlighted by several respondents as particularly good for children, and the lack of car traffic benefited their independent mobility: "Many small playgrounds in all the yards and no roads in the area mean that it is relatively safe for the children to move freely (under supervision of course)" (woman, 26-35 years old, sub-area 2). This was particularly pointed out by respondents in the non-densified Central Kapellgårdet (2). Another respondent wrote: "Our row house with garden, the connecting small street and the allotment [are my favorites]. I like all the shrubs, flowers and trees, and that the children can easily move between the houses" (woman, 36-50 years old, sub-area 2).

However, heavy car traffic in some parts of the area was seen as an obstacle to children's independent mobility. In contrast to the non-densified Central Kapellgårdet (2) described above, many respondents from the densified Western and Eastern Kapellgårdet (sub-areas 1 and 4)

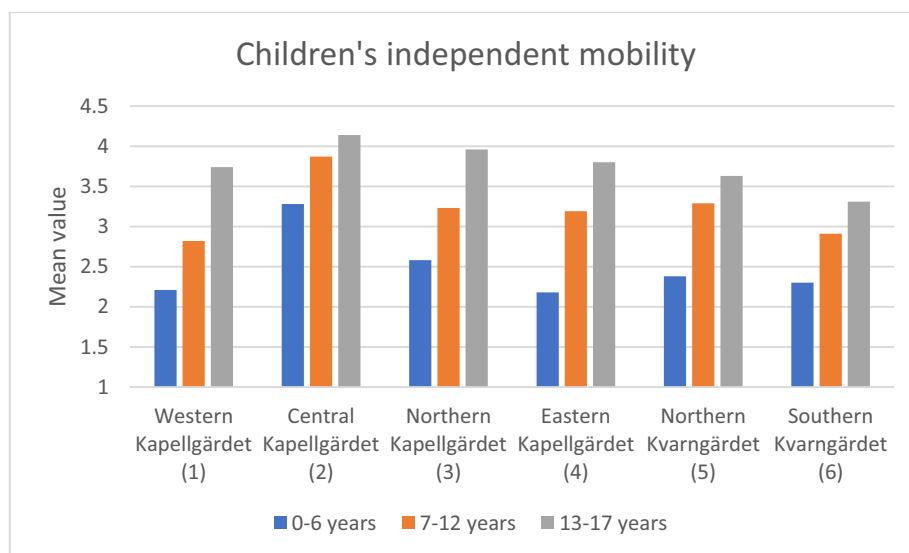


Fig. 5. Mean values for how well the outdoor environments in the area as a whole support children's independent mobility, on a scale from 1 = not well to 5 = very well.

mentioned traffic as an issue for children's safety: "The traffic situation is far from optimal. Smaller children cannot move safely between houses and parks. Even on residential streets, people drive fast" (man, 36–50 years old, sub-area 1). Fear of traffic also led to suggestions such as physical barriers to protect children: "The park [...] needs a fence to the street, children can run into the street after balls" (woman, 50–65 years old, sub-area 1).

4. Discussion

The results of the study highlight the problems of child-friendliness in densification that, in the process of new construction through infill, also reduces access, proximity and size of green and open spaces, and increases car traffic. It shows a specific case of densification of a modernist, welfarist residential area which can be described as a patchwork of planning styles (Qviström, 2022) with unique features and qualities (Schmidt-Thomé et al., 2013). It thus provides a case for understanding the different effects of planning on different user groups, such as children. The child-friendliness of the environment, in terms of affordances and independent mobility (Kytä, 2004), is described by residents as shrinking, especially in sub-areas heavily affected by densification. Despite the possible advantages of compact urban planning in several aspects (Wicki & Kaufmann, 2022), this case simply does not provide the many qualities needed for dense multi-family environments to be successful in terms of social sustainability, as described, for example, by Mouratidis (2019).

The ten socio-physical qualities that contribute to CFE (Jansson et al., 2022) were largely visible in the answers from the residents in this study, including a focus on the amount of actualized affordances and the extent of children's independent mobility (Kytä, 2004). CFE requires traffic restrictions such as the separation of cars from pedestrians (Sharmin & Kamruzzaman, 2017) and moderate building density (Broberg et al., 2013) combined with a variation of affordances (Lerstrup & Konijnendijk van den Bosch, 2017), while high building density, land use mix, and a lot of motorized traffic can create barriers to CFE (Bagheri & Zarghami, 2020; Sharmin & Kamruzzaman, 2017). The greater focus on the qualities green and open spaces, access, safety, play and leisure, and clean environment may be related to the adult perspective on children captured in the survey, while the qualities fairness and inclusion, social connection, freedom, involvement and learning may be better understood through more child-centered methods (Jansson et al., 2022).

Child-friendliness of environments was also connected to different ages. From the perspective of adult users provided by the survey results, young children are more in need of support for their independent mobility, while youth are more likely to lack sufficient places and facilities. It is well known that independent mobility tends to increase as children get older (Marzi & Reimers, 2018) and also that outdoor places are rarely provided for youth (Sundevall & Jansson, 2020). The complex view of youth revealed in the study results, seen both as in need of more places for them, and their outdoor life as disruptive and associated with, for example, crime, with proposals to remove places where youth meet is similar to in other studies (Gray & Manning, 2022).

Similar to previous studies, many residents viewed local infill development as mainly negative (Wicki & Kaufmann, 2022), experiencing loss of open and green spaces and neighborhood character, increased car traffic (Arvola & Pennanen, 2014; McConnell & Wiley, 2010; Mouratidis, 2019) and higher buildings (Lehman, 2016). The reference in literature to residents' negative experiences as NIMBYism (Wicki & Kaufmann, 2022) for opposing compact city policies (Wolsink, 2016), may be seen in a more complex way through the studied case, as the residents who have moved to new infill areas such as in Western Kapellgårdet (sub-area 1) also experience the lack of open space and CFE, not only those who have experienced the change. Furthermore, this sub-area being infill on former industrial areas provides insight into the complexity of densification, where infill on brownfields can be more

sustainable than on green spaces (Salvati & Lamonica, 2020) but still also requires a result that is socially sustainable. The negative perceptions from residents may be about emotions (Skrede & Andersen, 2022). However, it also appears to be about actual lack of spatial qualities (Bauer & Duschinger, 2024; Jansson & Schneider, 2023).

The findings contribute to the argument that high densities, where planning attitudes and ideas favour quality over quantity of open space (Littke, 2015), do not per se lead to well-functioning outdoor environments for people. Nor does limited car traffic automatically follow densification (Ferreira & Batey, 2011; Qviström et al., 2016), where this study instead shows the example of welfare era solutions to limit car traffic being removed when densifying, like the described underpass. Instead, qualities such as green spaces and walkable access to transit and services require active planning decisions (Billig et al., 2020). Also the qualities of child friendliness require special attention to be realized in physical spaces.

There is a need to pay special attention to vulnerable groups, such as children, when their living environments change (Bierbaum & Vincent, 2013; Marzi & Reimers, 2018). This study gives insight into how children and families depend on a well-functioning built environment, where easy access to sufficient and varied outdoor space is a basic requirement for a child-friendly environment (Broberg et al., 2013; Jansson et al., 2022). The results of this study confirm that a main problem of densification is the risk of lack of quality, quantity, and social equity in green space provision (Haaland & van den Bosch, 2015), a lack that causes problems in particular for vulnerable groups such as children (Sundevall & Jansson, 2020; Veitch et al., 2017). This leads to the need to also consider social aspects of sustainable development (Skrede & Andersen, 2022), and in particular the current large knowledge gaps in the realization of CFE in physical planning and actual environments (Cordero-Vinueza et al., 2023).

The qualities developed in the open spaces of the welfare landscape have been influenced by both modernist planning and long-term management. The materialization of a welfare discourse in residential areas still shows assets in the form of large open spaces for recreation and traffic separated from pedestrians (Pries & Qviström, 2021). To a large extent, it is the existing qualities of welfare planning that provide CFE in the case studied, planning that has also been found valuable for residents in previous studies (Mack, 2021). These include values such as well-established vegetation that provides valuable shade and shelter. Also, the initial lack of variation in many modernist outdoor spaces, such as between playgrounds (Jansson & Persson, 2010), appears to have been developed into more varied affordances over time through management.

However, while residents value these assets, today there is also a general lack of management, including low levels of maintenance (Mack, 2021). This neglect causes major problems for some parts of the welfare landscape, as seen in this study. Lack of management and maintenance can be linked to low perceived safety (O'Brien, 2005). It may also be part of a strategy of continuous densification, with such radical transformations as infill development seen as a solution to unkempt and neglected green spaces (Zalar & Pries, 2022). Well-functioning maintenance of spaces seems to be of great importance for the quality of outdoor environments, where a strategic management approach needs to focus on both day-to-day maintenance and long-term development over time to suit children, young people and other user groups (Braubach et al., 2017).

This study generated valuable insights, particularly through qualitative data obtained from open-ended survey questions. However, certain limitations should be noted. The overall response rate was relatively low, and the sample included a limited number of respondents with children living at home. Furthermore, the study employed a simplified division into sub-areas of different character for the analysis. While this approach was practical for this study, future research could benefit from more advanced methods to better capture the complexities of densification and its effects.

5. Conclusions

This study provides some insights into how CFE can be affected by planning and management of the environment over time. Today, the assets of welfare planning still provide support for use and child-friendliness, while densification projects run the risk of reducing access to sufficiently large, varied and high-quality green and open spaces for all ages, providing a range of activities and shade, and also of limiting independent mobility, particularly for children. Although older children move more independently than younger children, the lack of youth-friendly places creates particular challenges and contradictions. A densification agenda that does not take sufficient account of all social sustainability goals can lead to a major loss of quality for people in the built environment. If densification is realized in a way that results in a lack of well-functioning living environments for several user groups, including children, it exposes a major problem of contemporary planning. As open space management interacts with planning, several processes of change need to be considered. The qualities of child-friendliness need special attention and requirements in both planning and management to be realized. There is a need to look more closely at current planning ideals and how they are materialized, including from the perspectives of children and other users.

CRedit authorship contribution statement

Märil Jansson: Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Funding acquisition, Conceptualization. **Julia Schneider:** Writing – review & editing, Writing – original draft, Visualization, Formal analysis.

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Declaration of competing interest

None.

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Appendix 1

Survey – questions and options

a) Do you have children living at home?

1. Yes, aged 0–6
2. Yes, aged 7–12
3. Yes, aged 13–17
4. Yes, older than 17
5. No

b) How well does the content of the outdoor environment function for children and youth of different ages in the area closest to your home (within 50 meters)?

0–6 years

1. Not well
2. ____

3. ____
4. ____
5. Very well
6. I don't know

7–12 years

1. Not well
2. ____
3. ____
4. ____
5. Very well
6. I don't know

13–17 years

1. Not well
2. ____
3. ____
4. ____
5. Very well
6. I don't know

c) How well does the content of the outdoor environment function for children and youth of different ages in Kvarngärdet and Kapellgärdet as a whole?

0–6 years

1. Not well
2. ____
3. ____
4. ____
5. Very well
6. I don't know

7–12 years

1. Not well
2. ____
3. ____
4. ____
5. Very well
6. I don't know

13–17 years

1. Not well
2. ____
3. ____
4. ____
5. Very well
6. I don't know

d) How well does the outdoor environment in Kvarngärdet and Kapellgärdet function for the independent mobility of children and youth?

0–6 years

1. Not well
2. ____
3. ____
4. ____
5. Very well
6. I don't know

7–12 years

1. Not well
2. _____
3. _____
4. _____
5. Very well
6. I don't know

13–17 years

1. Not well
2. _____
3. _____
4. _____
5. Very well
6. I don't know

- e) Are there any places/facilities in Kvarngärdet and Kapellgärdet that are particularly suitable for children and youth, and if so, which ones?

Open-ended answer

- f) Is there a need for more/other places for children and youth in Kvarngärdet and Kapellgärdet, and if so, which ones?

Open-ended answer

Data availability

For more data from the study, see the data report (in Swedish): schneider-j-et-al-20230315.pdf (slu.se).

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