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Providing contact with nature for young generation - A case study of preschools in the City of Poznań, Poland

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ABSTRACT

Contact with nature is valuable for the health, wellbeing and development of children. Meanwhile, the urban environment and the contemporary urban lifestyle limit the opportunity for contact with nature. Given that children aged three to six years spend a significant amount of time in preschool, we aimed to: 1) investigate children's opportunities to contact with nature during their time in preschool, including the availability of these schools' own outdoor spaces and neighbouring green spaces for visiting; 2) recognise preschools' practices in using available green spaces to enable children to have contact with nature; 3) identify the impact on the outdoor activities provided by preschools of factors such as the COVID-19 pandemic and preschool managers' awareness of the importance of children's contact with nature. We undertook GIS spatial analyses, an online survey, a telephone interview and a statistical analysis. We found that preschools enjoy various opportunities to use external green spaces due to their location at the background of the urban tissue and green infrastructure. However, regardless of the availability of neighbouring green spaces, as many as 45.6 % of 103 preschools declared visiting external green spaces at least once a week. Furthermore, as many as 97.7 % of 88 preschools declared that their children enjoyed their outdoor spaces at least once a day, spending a daily average of 103 min outdoors. We observed differences between the practices of public and non-public preschools in this regard. The COVID-19 pandemic did not change the frequency of use of most of the institutions' own outdoor spaces, but it did significantly reduce visits to external green spaces. Our results indicate that there is considerable awareness of the importance of contact with nature for children's development, providing promising conditions for future improvements towards more nature-oriented solutions. The results provide a baseline for implementing and monitoring improvements regarding human nature relations.

1. Introduction

Contact with nature results from opportunities and personal inclination towards interacting with nature (Cox et al., 2017). Contemporary urbanisation and densification in many cities decrease the number of opportunities for contact with nature (Soga et al., 2018). This manifests itself in the reduction of urban green spaces, which is observed in various cities, especially in Central and Eastern European cities (Kabisch and Haase, 2013; Littke, 2015; Badiu et al., 2019). Even in "green" cities, uneven availability of and accessibility to green spaces can limit the opportunities for human-nature interaction (Wüstemann et al., 2017). On top of that, the attractiveness of green spaces can also play an important role in developing the willingness to spend the time outdoors (Fongar

et al., 2019). In addition, an urban lifestyle makes people spending time in buildings rather than outdoors (Cox et al., 2017), shifting from real life to the virtual one (Pyle, 2003). According to Pyle (2003), the resulting decline in the connection with the real world leads to extinction of experience that precipitates a cycle of disaffection and ultimate separation from nature. As a result, physical and mental disconnection from nature become an issue.

Children represent a vulnerable group of residents for whom limited contact with nature might have particularly negative consequences. To emphasise the problem of decreasing contact with nature, Louv (2005) proposed a metaphor of "Children's Nature Deficit". While scientists agree on the essence of the problem, the debate as to the causes and how to overcome it continues (Dickinson, 2013). Dickinson (2013) emphasises

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that not only physical presence and time spent in green spaces, but also emotional attachment is crucial to strengthen the relationship between children and nature.

The benefits of contact with nature for human health and wellbeing are more and more recognised. This includes, among others, the impact on children's emotional (Flouri et al., 2014) and social wellbeing (Raney et al., 2019; Mygind et al., 2021), the development of motor fitness (Fjørtoft, 2004) and the increase in physical activity, contributing to obesity reduction (McCurdy et al., 2010; McBride, 2012; Raney et al., 2019).

Contact with nature is not only valuable for health and wellbeing but also for the development of the young generation (Mustapa et al., 2015). Children intuitively explore the natural environment for play and learning (Fjørtoft, 2001). According to the theory of affordance (Gibson, 1979), such an environment provides possibilities for using it in creative ways. Children may enhance their environmental experience through experimentation, observation, and exploration as well as through playing outdoor, subconsciously learning about the environment (Acar, 2014). Therefore, nature-based play and learning are important for children's development (Fjørtoft, 2001; Bienenstock, 2010; Raney et al., 2019).

The above-mentioned growing body of evidence and the increasing awareness of the benefits gained through contact with nature are reflected in various programmes in early childhood educational settings, such as nature preschools or forest kindergartens (Sobel, 2017; Williams-Siegfriedsen, 2017). They are also mirrored in outdoor preschool standards (DCYF, 2018) and guidance for nature play in the built environment (Evergreen, 2013), just to name a few examples. However, initiatives to bring nature closer to preschool children exist to varying degrees across countries. Indeed, while they are gaining strong interest in the United States or in the Scandinavian countries (Ulset et al., 2017; Barrable, 2019; Cordiano et al., 2019; Chawla, 2020), elsewhere they are still not common. Poland is one country where the concepts of contact with nature in education and nature-based solutions (NbS) targeting children's needs are yet neither commonly applied nor widely studied (Kleszcz, 2016; Szlauzys, 2019), even though initiatives to up-scale natural playgrounds are appearing here (Kosmala, 2014; Komorowska et al., 2019; Miasto Poznań, 2020).

Early childhood educational settings are places where increased opportunities for play in nature can have a valuable impact on children's overall development (Bento and Dias, 2017; Brussoni et al., 2017), while preparing them for a smooth transition to school. However, studies in this field usually focus on the impact of contact with nature on children considered within a specific context of well-being, health or pro-environmental behaviour (Chawla, 2020), whereas deeper insights into the factors that contribute to overall opportunities for contact with nature in preschools and their neighbourhoods are still missing.

Taking the above into account, the aims of this paper are as follows:

- 1) to identify opportunities for children's contact with nature during their time in preschool, including the availability of these schools' own outdoor spaces and neighbouring green spaces;
- 2) to recognise preschools' practices in using available green spaces to enable children to have contact with nature; and
- 3) to identify the impact on the outdoor activities provided by preschools of factors such as the COVID-19 pandemic and managers' awareness regarding the importance of contact with nature for children.

We are convinced that recognising the existing opportunities for contact with nature is crucial for directing future actions not only in the case study of Poznań but in any city that wants to ensure or improve contact with nature for children. This is a promising direction in urban policy since through providing opportunities for regular outdoor play during childhood, we might influence the inclination towards interacting with nature in the future (Bixler et al., 2002; Thompson et al., 2008; Soga and Gaston, 2016). This in turn proves to be beneficial for humans and nature (Chawla, 2020).

2. Materials and methods

2.1. Study framework

We framed our research (Fig. 1) taking into consideration that opportunities for preschoolers to come into contact with nature results from: 1) the availability of preschools' own outdoor spaces that can be used by children (Podawca, 2018) as well as the availability of neighbouring green spaces that can be visited with children (Rice and Torquati, 2013); and 2) the frequency and duration of outdoor activities in green spaces resulting from preschools' practices.

We considered that the availability of green spaces is connected with a preschool's location at the background of the urban tissue and green infrastructure (GI) as well as the local conditions linked with the building's primary functions and associated outdoor spaces.

The preschool practices that contribute to opportunities for children to come into contact with nature may be influenced by factors such as: 1) legal regulations framing the curriculum documentation for outdoor activities and programmes, including contact with nature (Bilton and Waters, 2017); 2) preschool managers' awareness of the importance of contact with nature that can be reflected in their provision of outdoor activities, as knowledge of (Bilton and Waters, 2017) and an orientation towards nature play an important role in encouraging its use (Cox et al., 2017); 3) parental support for children's outdoor activities and contact with nature in preschool (Bento and Dias, 2017; Erdem, 2018); 4) season and weather conditions (Tucker and Gilliland, 2007); 5) air quality (Castell et al., 2018); and 6) the ongoing COVID-19 pandemic, which has affected practices in providing children with contact with nature due to the extraordinary health and safety procedures implemented in preschools (Cordovil et al., 2021; Delvecchio, 2021).

Of course, such factors differ in their importance depending on the national or local context. Consequently, in this Poland-based study we took into consideration that the national law refers to outdoor activities in preschool education only very briefly (RMEN, 2017) and therefore the organisation of daily routines largely relies on preschool practices supervised by its manager. Furthermore, opportunities for contact with nature are not commonly considered by parents as a key factor when choosing a preschool (Our Kids, 2019); rather, their main priority is to find a place for their child in preschool in a context where places are limited (see Section 2.2). Finally, the restrictions implemented in Poland due to the COVID-19 pandemic have compelled preschools to re-organise their garden areas, such as by delimiting zones for children from different groups (to minimise contact among them), disinfecting equipment and prohibiting the use of any facilities that cannot be sufficiently disinfected (for example, sandpits) and reducing the use of external green spaces (GIS, 2020). Nevertheless, preschools have remained open during the majority of the pandemic.

With regard to seasonal variations, our study focused on the season from spring to autumn, being the most active time for contact with nature in this case study's geographical context. Furthermore, the summer season is characterised by better air quality, reporting only sporadic exceedances of PM10 daily limits (Czernecki et al., 2017).

Thus, based on the factors recognised in the literature as influencing practices in providing preschool children with contact with nature, we investigated preschool managers' attitudes towards the importance of contact with nature for children's development as well as the impact of COVID-19 pandemic as the most relevant for our case study.

In our study we additionally considered that the conditions and factors that contribute to opportunities for contact with nature may vary between public and non-public preschools. This is due to the fact that institutions of different status may have varied location conditions (e.g. buildings designed primarily for educational functions as opposed to buildings designed for other purposes) and similarly adopt different practices towards outdoor activities. Bearing in mind that non-public preschools are gaining popularity and often allow children to stay longer than public institutions (Our Kids, 2019), we found it relevant to

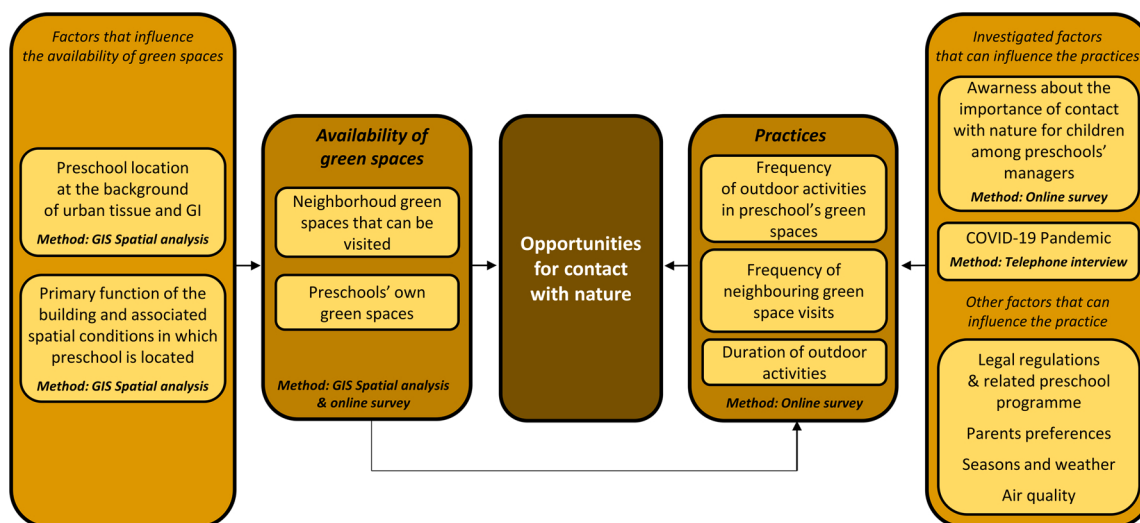
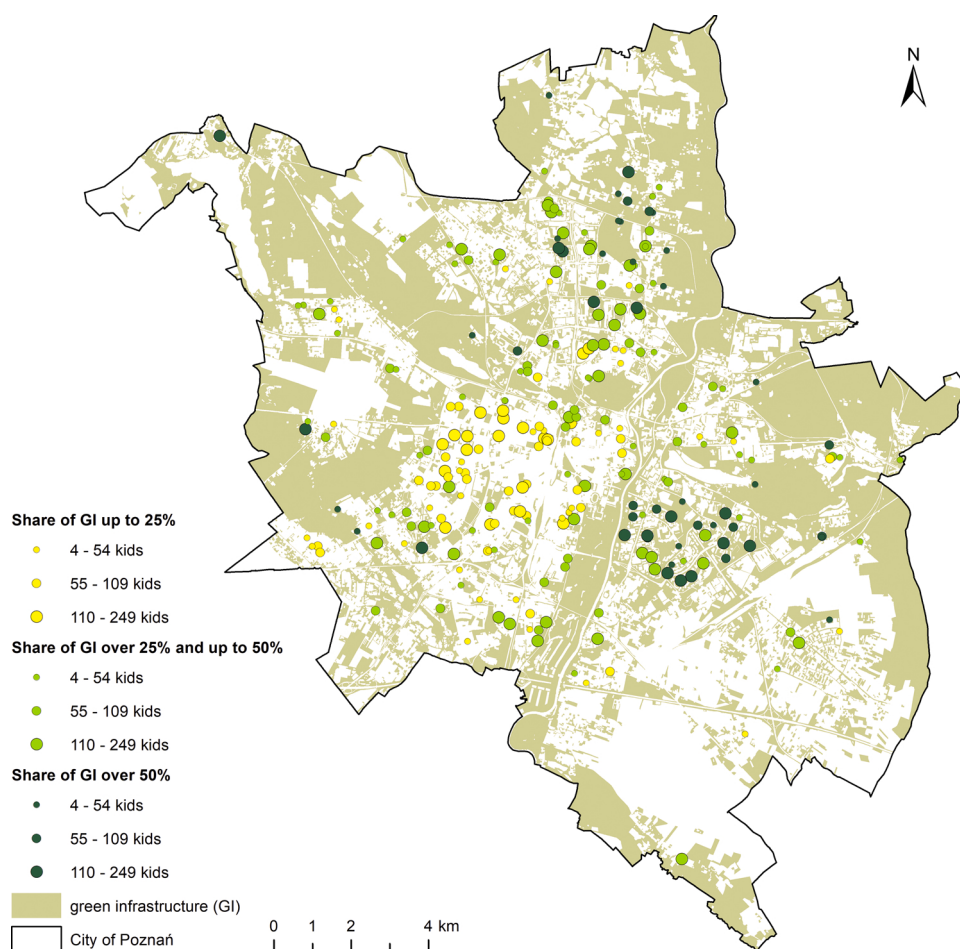


Fig. 1. Study approach - methodological framework.

Fig. 2. Location of preschools in Poznań according to their size (number of children) and green infrastructure distribution (shares of GI in preschool buffers $r = 300$ m).

investigate the differences between these two groups of preschools in terms of the opportunities they offer for children to come into contact with nature.

2.2. Case study description

Poznań is a city with a population of approximately 500,000 inhabitants, including 21,473 children aged three to six years (Statistics Poland, 2019). According to the Department of Education of the Poznań City Hall, in 2019, there were 264 preschools in Poznań, including 139 public ones with 15,441 children and 123 non-public ones with 4856 children (see Fig. 2 in Section 3).

Preschools are part of the early childhood education system, which includes public and non-public institutions. In Poland, preschool education is obligatory for children at the age of six, but it is also provided for children who are three to five years old. However, the number of applicants to these preschools often exceeds the number of places available (Kurzyńska-Chmiel, 2021). Both public and non-public preschools implement educational programmes that incorporate the core preschool curriculum and employ teachers with the qualifications specified for public preschools. However, public preschools are obligated to provide free education, upbringing and care at the time determined by the governing body for no fewer than five hours a day and they must follow a recruitment procedure based on the principle of universal availability (Education Law, 2021).

In Poland, the goals of preschool education, the educational tasks of preschools, and the effects of the implementation of tasks in the form of goals achieved by children at the end of preschool education are formulated in Regulation of the Minister of National Education of February 14, 2017, on core curriculum preschool education and general core curriculum for primary schools, including students with moderate or severe intellectual disabilities, general education for the 1st level thematic schools and general education for special schools preparing for work (RMEN, 2017). According to this regulation, one of the tasks of preschools is to “create conditions allowing for safe, independent exploration of the natural area surrounding a child, stimulating the development of sensitivity and enabling cognition values and standards relating to the natural environment, adequate to child development stage”. This regulation indicates that the organisation of classes outdoors should be part of the daily work with each age group. This applies to both public and non-public preschools that have to take into account the provisions of preschool curriculum as a basis for their education programs (Education Law, 2021). It is worth noting here that the previous regulations recommended that children should spend at least one fifth of their time (or one quarter for the youngest children) in preschool each week outdoors in the preschool’s garden, playground or in a local park, for instance (RMEN, 2012). Nevertheless, this law did not provide details about how contact with nature should be organised. Instead, it only provided a general framework for preschools’ practices.

2.3. Study materials and methods applied

2.3.1. Spatial analysis of green space availability

We analysed the availability of green spaces with the use of the ArcMap software and the “Near” and “Multiple ring buffer” tools, taking into account the diversity of preschools in terms of the status of the preschool (public and non-public) and the number of children.

We used vector spatial data characterising the distribution of GI in the city, obtained from the Database of Topographic Objects (BDOT10k, 2015) and the Urban Atlas (UA, 2012). Their content and resolutions correspond to the topographic maps at a scale of 1:10,000. Data on the number of preschools, their status, location and information on the number of preschoolers as of October 1, 2019, were obtained from the Education Department of the Poznań City Hall.

First, we calculated, for each preschool, the nearest distances to city parks, forests, open green infrastructure (open GI) and GI in total (without

blue infrastructure). Within open GI, we included city parks, forests as well as copse areas, semi-natural green areas, urban green associated with sport and recreation areas, urban green associated with housing areas, urban green associated with educational complexes, urban green of historical forts, botanical and zoological gardens and other open urban green areas predominantly used for recreation. From this group, we excluded urban green areas that have been recognised as unsuitable for visiting with preschoolers (e.g. green spaces associated with industrial sites or transportation infrastructure).

Next, using the multiple ring buffer tool, we analysed the share of the above-mentioned types of GI elements in the surface of buffers created with a radius representing a distance of 100, 300, and 500 m from preschools. We applied such buffers taking into account the United Nations Children’s Fund’s (UNICEF, 2018) child-responsive urban planning recommendations. According to those recommendations, the 100 m distance threshold corresponds to the mean value of the assisted walking mobility standard for children between two and six years old defined between 50 and 200 m. The 300 m distance threshold matches the mean value of the independent walking mobility standard for children between six and twelve years old specified between 200 and 400 m. Additionally, we used a maximum 500 m buffer radius, approximately corresponding to a seven-minute walking distance (De Sousa Silva et al., 2018).

Finally, we investigated the functions of the buildings in which preschools are located. Based on the BDOTk10 database, we checked whether they were intentionally designed for children’s education, or whether education is only a secondary function, as doing so may translate to the local spatial conditions.

2.3.2. Online survey and interviews in preschools

We invited a total of 264 preschools to participate in the online survey. The survey was conducted between January and March 2020, just before the breakout of the COVID-19 pandemic in Poland. We received 104 answers. The aim of the survey was to acquire data on:

- 1) the frequency and the duration of the outdoor activities organised by preschools in their own outdoor spaces as well as visits in external green spaces located in their neighbourhood;
- 2) the availability of green spaces within preschools’ outdoor premises, including their share of permeable surfaces, shrubs, lawns and crops, the latter being understood as vegetable/fruit/herb gardens as well as tree cover;
- 3) preschool managers’ awareness of the importance of contact with nature for children’s development.

We applied the survey method as it is often used in research on natural playscapes and natural playgrounds of preschools and their connectivity to the GI (e.g. Jansson, 2010; Akpinar, 2017; Wang et al., 2018; Suchocka et al., 2019).

In March 2021, we conducted a supplementary telephone interview with preschools that took part in the online survey. The aim of the interview was to investigate how the COVID-19 pandemic (identified as a new factor affecting practices in preschools) has altered preschoolers’ use of internal and external green spaces and affected their opportunities to come into contact with nature. We interviewed the preschool representatives, mostly managers, who had previously filled out the online survey. An interview including a presentation of its aim and clarifications required five to ten minutes. We used a spreadsheet to record all the answers. The data collected were analysed using STATISTICA software.

2.3.3. Statistical analysis

We applied statistical analysis based on STATISTICA software and the existing literature (Stanisz, 1998, 2007; Hill and Lewicki, 2006). The criteria for the application of parametric methods were not met (lack of normal distribution and lack of variance homogeneity of the analysed variables describing distances to the GI as well as GI shares in analysed buffer zones). Thus, in order to test statistical hypotheses regarding the

differentiation of the availability of GI in the vicinity of the preschools (expressed as the distance between the preschool and the nearest GI element (m)) and the share of GI in the total area of buffers around the preschools (% in buffers with a radius of 100, 300 and 500 m), we used the non-parametric Mann–Whitney *U* test, the sign test, Friedman's analysis of variance (ANOVA) and Kendall's concordance methods. To analyse the survey and interviews data, including awareness of the importance of children's contact with nature, cross-tabulation with Pearson Chi-square, Spearman-R correlation as well as Mann-Whitney *U* test were used. For testing purposes we assumed the level of statistical significance of $\alpha = 0.05$.

3. Results

3.1. Location of preschools against the background of green infrastructure

Spatial distribution of the preschools at the background of the GI of the city was varied and uneven (Fig. 2). The greatest availability of green areas (> 50 %) was found in the vicinity of preschools located in the central-eastern and northern parts of the city (multifamily residential areas). Housing estates in these parts of the city were predominantly built in the 1960s to the 1980s in the socialist economic system. The lowest availability of GI (up to 25 %) was characteristic of the surroundings of preschools located in the central-western part of the city, with dense tenement buildings and a low share of green spaces (area of Grunwald, Jeżyce, Ogrody and Św. Łazarz).

The share of green areas increased with the distance from preschools, as measured in buffers with a radius of 100, 300 and 500 m (Fig. 3). The described pattern applied to both public and non-public preschools. Comparison between those two groups of preschools shows the significant difference in the share of green areas in total in their vicinity (as much as 8.7 pp. when comparing the shares in buffers $r = 100$ m) in favour of public preschools (Fig. 3). Statistically, a significant differentiation was confirmed by the results of the median *U* Mann-Whitney test ($Mdn_{public} = 31.65$, $N = 56$, $Mdn_{non-public} = 20.37$, $N = 45$, $U = 904.5000$, $Z = 2.4256$, $p = 0.0153$).

As shown in Fig. 3, the availability of green spaces in the nearest surrounding of preschool was higher for public preschools.

In the next step, the availability of surrounding green areas, taking into account the distance criterion, was analysed (Table 1). The average distance to the nearest element of GI was only 35 m in total. This distance to all types of green areas with the exception of forests was smaller for the public preschools and greater for the non-public preschools. The average distance to areas of open GI was 41 m, while to city parks it was 981 m. These distances were shorter for the public preschools (31 and 806 m, respectively) and longer for the non-public preschools (53 and 1176 m, respectively). The non-public preschools were located at an average distance of 838 m from forests, in contrast to 1040 m for the

Table 1

Statistics on availability – average distance (m) from preschools to green areas.

Status of preschool	Statistics	Distance (m) to the nearest green infrastructure (GI)				Friedman ANOVA Chi Square
		Parks	Forests	GI open	GI total	
Average distance						
All***	<i>M (m)</i>	981	944	41	35	663.8577, <i>p</i> < 0.0001 (<i>N</i> = 264, <i>df</i> = 3)
	<i>SD</i>	1128	677	49	43	
Public**	<i>M (m)</i>	806	1040	31	29	362.0531, <i>p</i> < 0.0001 (<i>N</i> = 139, <i>df</i> = 3)
	<i>SD</i>	1098	663	41	39	
Non-public*	<i>M (m)</i>	1176	838	53	42	308.0301, <i>p</i> < 0.0001 (<i>N</i> = 125, <i>df</i> = 3)
	<i>SD</i>	1134	679	54	45	

M – mean distance, *SD* – standard deviation.

*** Sign Test (all preschools): Parks and Forests ($Z = 2.0310$, $p = 0.0422$); GI open and GI total ($Z = 9.1111$, $p = 0.0000$).

** Sign Test (public preschools): Parks and Forests ($Z = 3.7320$, $p = 0.0002$); GI open and GI total ($Z = 4.8000$, $p = 0.0000$).

* Sign Test (non-public preschools): Parks and Forests ($Z = 0.8944$, $p = 0.3711$); GI open and GI total ($Z = 7.6169$, $p = 0.0000$).

public preschools.

Particular attention was drawn to the fact that relative to their non-public counterparts, the public preschools were characterised by a better availability of city parks and a lower availability of forests in their vicinity. Urban parks, due to their arrangement of varied land cover, facilities (tree clusters, lawns, bushes, flower beds, often water ponds and playgrounds) and often safety protection are attractive places to visit with preschool children. Forests, however, are natural play spaces, ensuring close contact with nature. In summary, the public preschools located in greener areas had greater potential to provide outdoor activities in contact with nature than their non-public counterparts. However, it has to be pointed out that green spaces of the most natural character, such as forests, were less available for such usage due to distance.

Overall, 92.8 and 88.6 % of the preschools, respectively, are located within 100 m from any element of GI or elements of open GI (Fig. 4). Looking into more details, this relates to 92.8 and 92.1 % of public preschools and 92.8 and 84.8 % of non-public preschools, respectively.

The following figure illustrate the differences in the availability of GI within defined distances from preschools, taking into account the number of children attending preschools (Fig. 5).

As many as 18,983 children (93.5 %) attend preschools with a GI available within 100 m (including 93.9 % of children from public preschools and 92.4 % from non-public preschools), and 18,426 pupils (90.8 %) attend preschools with an open GI within 100 m (including

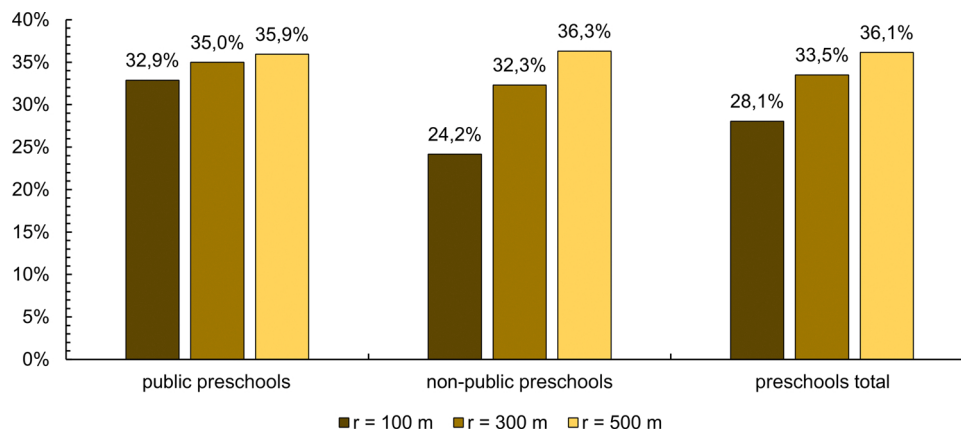


Fig. 3. Average share (%) of green infrastructure in preschool vicinity ($r = 100, 300, 500$ m).

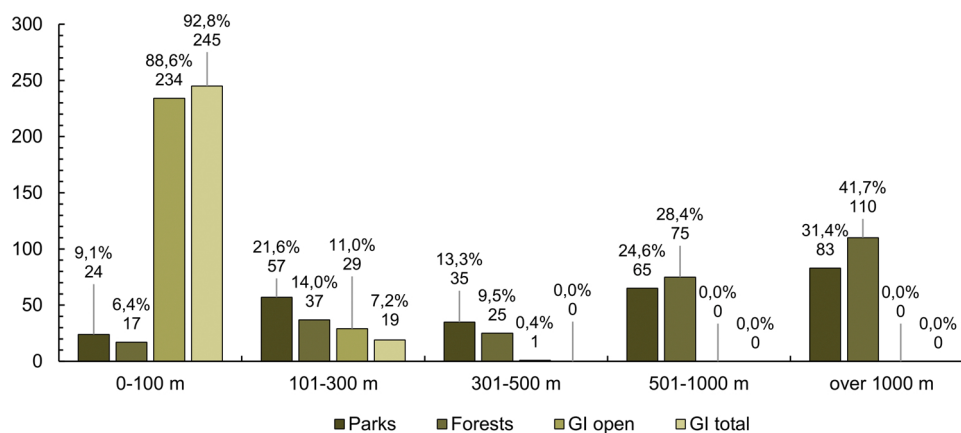


Fig. 4. Distribution of the preschools with respect to selected types of green areas.

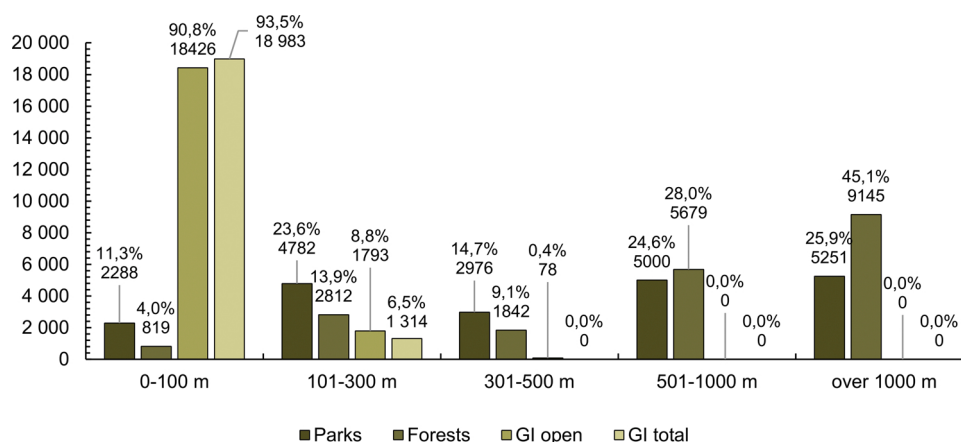


Fig. 5. Availability of selected types of green areas for preschoolers attending preschools.

92.8 % children from public preschools and 84.3 % from non-public preschools). In the case of other types of green spaces, parks appear to be available within a radius of up to 100 m for 2288 preschoolers (including 12.2 % of children from public preschools and 8.4 % from non-public preschools). In contrast, only 819 children attending preschools have such availability of forests (including 3.4 % of children from public preschools and 6.1 % from non-public preschools) (Fig. 5).

The location of the preschool in the background of a GI shows the opportunity of preschool staff to take the children outside to enable contact with nature. The available open GI provides such potential within a distance of 100 m for most of the children (90.8 %). However, the role of urban parks and forests in building potential for children-nature contact is limited. Parks located within 100 m from preschools can serve only for 11.3 % children attending preschools, and forests are only available for 4 % of the children. The higher share of children might get to with their teachers to parks (23.6 %) and to forests (13.9 %) that are located within next 200 m.

3.2. Local spatial conditions and availability of preschools' own outdoor spaces

In over 89 % of cases, public preschools are located in buildings designed for preschool or school education (Table 2), a large part of which is located in spacious locations well connected with GI. The percentage of preschools in such buildings in the group of non-public entities was less than 37 %. The remaining part of non-public preschools was located in single-family residential buildings (<22 %), multi-family residential buildings (>19 %), office buildings (<9 %),

Table 2

Type of buildings in which preschools are located.

Type of building	Public preschools		Non-public preschools	
	No. of preschools	No. of children	No. of preschools	No. of children
preschool and school buildings	124	14,398	46	2062
multi-family residential buildings	7	410	24	792
single-family residential buildings	3	343	27	730
office buildings	3	217	11	468
hospital and medical care buildings	1	30	7	198
other buildings	1	43	10	606
Total	139	15,441	125	4856

hospital and medical care buildings (<6 %) and other buildings (8 %). Preschool education in such buildings has a secondary function. These are usually preschools at workplaces or in private apartments, for which the location criterion did not take into account the availability of green spaces for education and play. Of nine preschools without their own outdoor spaces, as many as eight were located in buildings for which preschool education is only a secondary function.

Nevertheless, in Poznań, most of the preschools (91.3 %) that took part in the survey had their own outdoor space beyond the building; this was the case for both the public (92.9 %) and the non-public preschools

Table 3
Share of green areas in preschools own outdoor spaces.

Status of preschool	Number of preschools (count) with a declared share of a given surface				
	very large share (>50 %)	large share (26–50 %)	moderate share (11–25 %)	small share (10–0,1 %)	lack of a given surface (0 %)
Permeable surfaces					
All, $N = 95^*$	70	17	2	4	2
Public, $N = 52$	42	8	2	0	0
Non-public, $N = 42$	27	9	0	4	2
Surface below tree canopy					
All, $N = 95^*$	6	22	35	19	13
Public, $N = 52$	2	15	26	7	2
Non-public, $N = 42$	4	6	9	12	11
Shrubs					
All, $N = 95^*$	5	13	39	29	9
Public, $N = 52$	0	9	27	15	1
Non-public, $N = 42$	5	4	12	13	8
Lawns					
All, $N = 95^*$	41	25	20	3	6
Public, $N = 52$	19	19	14	0	0
Non-public, $N = 42$	21	6	6	3	6
Flowerbeds					
All, $N = 94^*$	0	5	25	49	15
Public, $N = 52$	0	4	13	30	5
Non-public, $N = 41$	0	1	12	18	10
Crops (vegetable / herb / fruit garden)					
All, $N = 95^*$	1	2	8	47	37
Public, $N = 52$	0	1	4	30	17
Non-public, $N = 42$	1	1	4	16	20

* One institution did not indicate their status, hence N_{all} is higher than the sum of N_{public} and $N_{non-public}$.

(89.4 %). However, the share of green areas in these spaces varied across the preschools (Table 3).

Table 3 shows that almost 92 % of the analysed preschools' outdoor spaces had either a very large (>50 %) or a large (26–50 %) share of permeable surfaces. This was similar for the public (96 %) and the non-public institutions (86 %). Lawns tended to be the most spacious green spaces. As many as 73 % of the public preschools and 63 % of the non-public preschools had either a very large (>51 %) or a large (26–50 %) share of lawns within their outdoor spaces. The share of shrubs represented 0.1–25 % of the space in 81 % of the public preschools' gardens and 60 % of the non-public preschools' gardens. Flowerbeds and crops were mostly small, yet were present in 84 % of the public and 51 % of the non-public preschools' gardens. As many as 79 % of the public preschools had either a moderate (11–25 %) or a large (26–50 %) share of their surface below the tree canopy, while 55 % of the non-public preschools had either a small share (0.1–10 %) or no such surface at all.

3.3. Preschool practices in visiting neighbouring green spaces

The surrounding green spaces are used to a varying extent by the preschool staff visiting them with children (Fig. 6). As many as 45.6 % of preschools take the children outside at least once a week, whereas 34.9 % visit such places at least once a month; 16.5 % of preschools take children to the surrounding green spaces sporadically - few times a year, and only 2.9 % do not take this opportunity at all.

The distinction between public and non-public preschools shows that non-public preschools use the opportunity to visit and enjoy external green spaces more often than public ones. This differentiation was confirmed by the results of the median U Mann-Whitney test ($N_{public} = 56$, $N_{non-public} = 47$, $U = 804.500$, $Z = -3.3834$, $p = 0.0007$). As many as 65.9 % of non-public preschools declared that they take their children to visit external green spaces once a week or more frequently. At the same time, only 28.5 % of the public preschools declared to do this so frequently.

If we take into consideration preschools without their own outdoor space, seven out of nine declared to visit external green spaces at least few times a week, one visited such places at least once a week and another one several times a month. Such visits usually last up to 1 h (seven preschools) or longer (1–1.5 h) (two preschools).

The duration of a single visit to neighbouring green spaces most often lasted 0.5–1 h (54 %), rarely less (12 %). Longer trips, from 1 up to 2 h, accounted for 29 % of cases, and only 5 % of visits last over 2 h. This pattern was similar for both public and non-public preschools (Fig. 7).

Spearman-R analysis of the relation between the frequency of visits to neighbouring green spaces or the duration of children's stay in these areas and the share of green space (GI total) within 100, 300 and 500 m showed no relationships among these factors. Similarly, the distance to the visited green area outside the preschool does not depend on the presence of green areas within 100, 300 or 500 m around the preschool. Half (50.5 %) of the declared visits to neighbouring green spaces take place within 300 m from the preschool and next 44.1 % within a distance not exceeding 1 km (Fig. 8). At longer distances, the visits take place only occasionally (5.4 %). This shows that regardless of the available GI in close vicinity, preschools provide children contact with nature through visiting external green spaces located at different distances. This is particularly visible in the case of non-public preschools that, regardless of the lower availability of neighbouring green spaces, declared a higher frequency of visiting them.

The COVID-19 pandemic is significantly impacting the usage of external green spaces (Fig. 9). The frequency of visits decreased in most (75 %) of preschools. Only 20.7 % of preschools did not reduce their visits to external green spaces, and only few of them (4.4 %) declared to increase the frequency of using external green spaces. As much as 78 % of public preschools entirely stopped visiting external green spaces, whereas 40.5 % non-public preschools reduced their external trips. At the same time, 38.1 % of non-public preschools maintained the frequency of visiting green areas. The recognised differences between preschools of different status were considered statistically significant based on the results of the U Mann-Whitney median test ($N_{public} = 50$, $N_{non-public} = 42$, $U = 511.500$, $Z = -4.2172$, $p = 0.00002$).

3.4. Practices in using preschools' outdoor spaces

Most frequently (69 %) the outdoor area of preschools ($N = 88$) was used by preschoolers during their stay several times a day, in 28.7 % once a day and only in 2.3 % (two preschools) several times a week (Fig. 10). For public preschools, the frequency of use of their own outdoor green

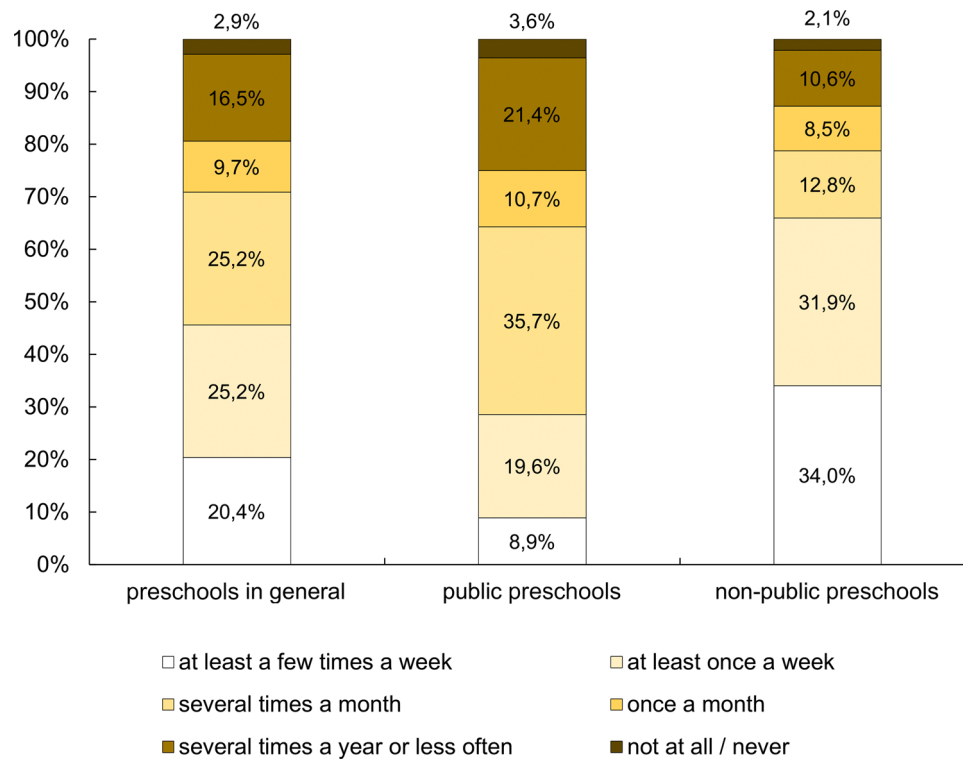


Fig. 6. How often, from spring to autumn, are children taken outside the preschool to enjoy the neighbouring green areas? ($N = 103$).

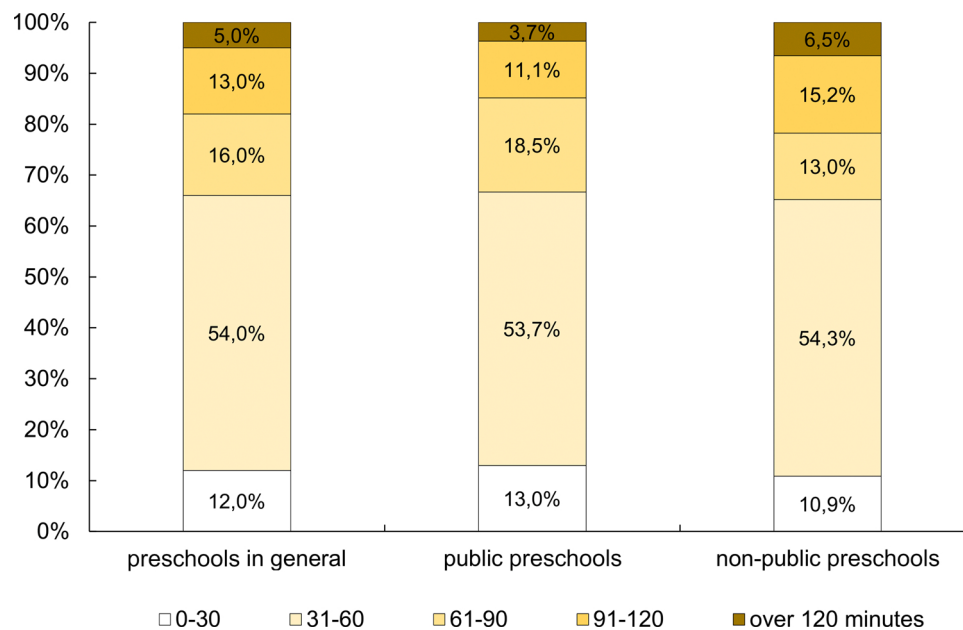


Fig. 7. How long is an average visit to external green areas? ($N = 101$).

spaces was higher ($N = 50$) than that for non-public preschools ($N = 38$) (differentiation confirmed by the results of the U Mann-Whitney median test, $U = 533.000$, $Z = 3.5086$, $p = 0.0005$) (Fig. 10).

We also checked the Spearman-R correlation between the frequency of using preschools' own outdoor spaces and the frequency of visiting external green areas. For preschools in general ($N = 88$), there was a significant negative correlation, with the increase in the frequency of using the own gardens, the frequency of visiting external green areas decreased (Spearman $R = -0.2332$, $p = 0.0287$). Such a correlation in the frequency of visits was not found between public and non-public preschools.

In most preschools each stay outside, lasted approximately 0.5–1 h (61.1 %); in 11.6 %, it only lasted up to 0.5 h, and in 15.8 %, it took up to 1.5 h (Fig. 11). Longer visits were not common (4.2 %). The general findings were similar for public and non-public preschools, but in the second case, there was a higher share (19 %) of preschools where children spend shorter time outdoors during one visit. On average, children, daily spent 103 min outdoor during their stay in the preschool's own outdoor space. However, in public preschools, this was 161 min per day, whereas in non-public institutions, it was 99 min per day. Taking into consideration both frequency of visit and length of stay, we can estimate

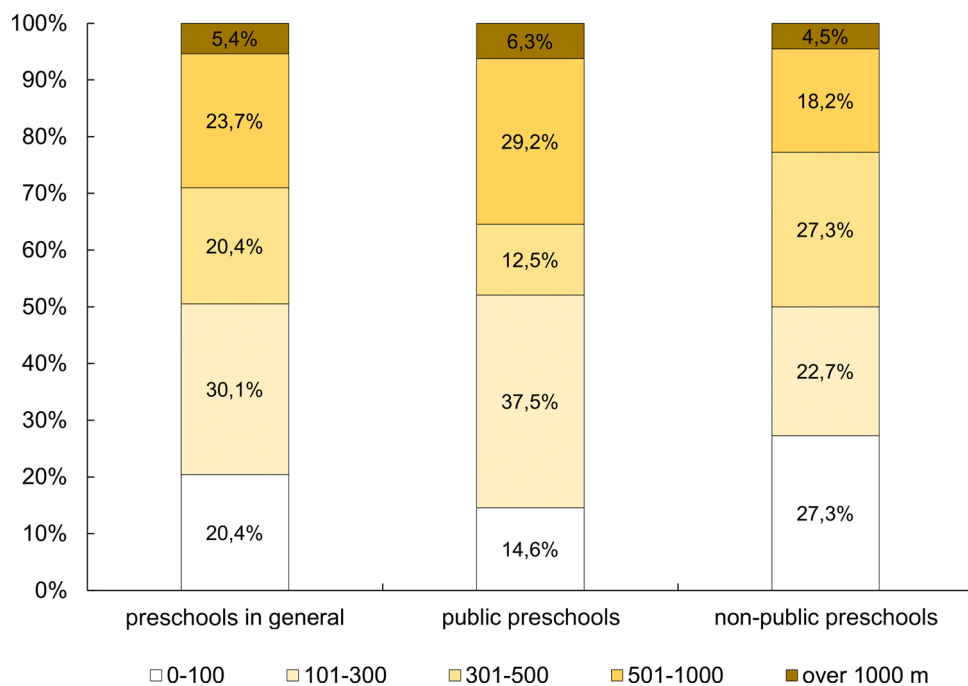


Fig. 8. How far is the most frequently visited green area away from the preschool? ($N = 93$).

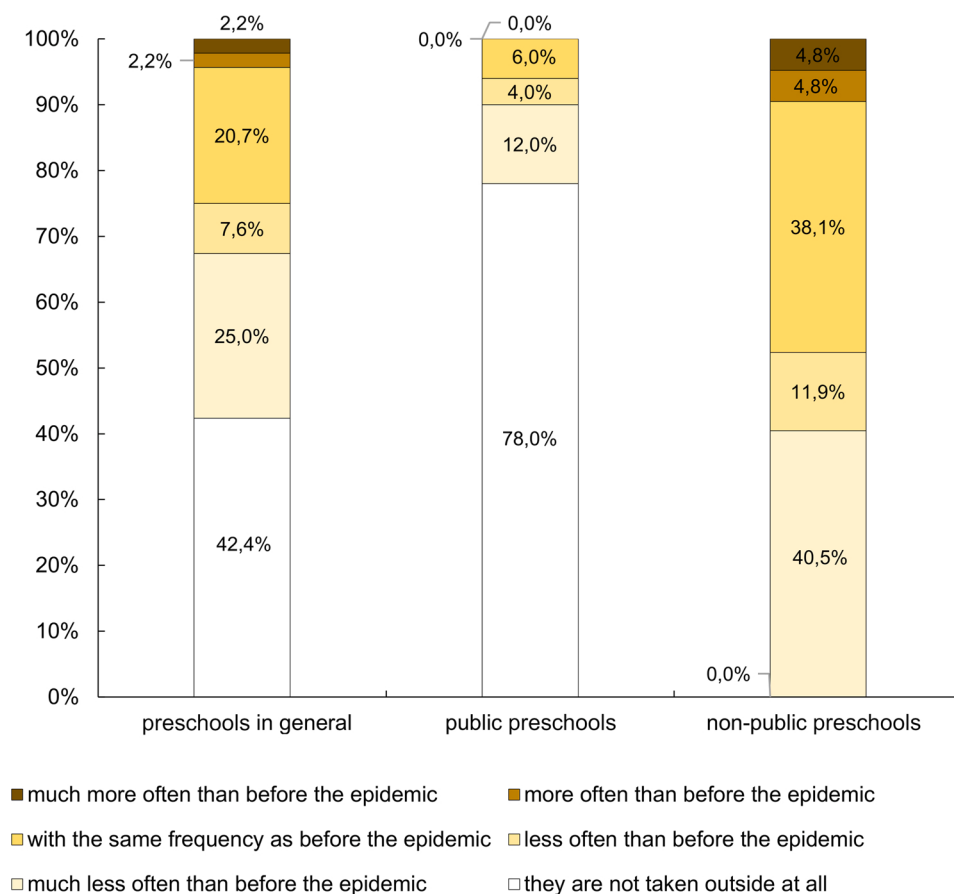


Fig. 9. Whether and how has the COVID-19 pandemic changed the frequency of visiting neighbouring outdoor areas? ($N = 92$).

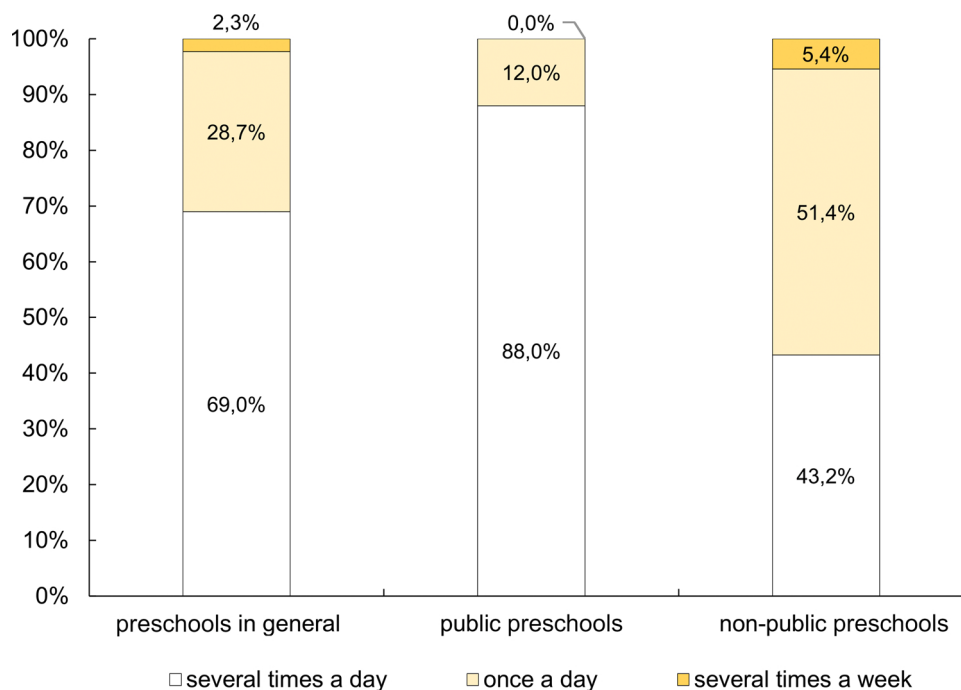


Fig. 10. How often, from spring to autumn, are children taken to the preschool garden to enjoy the green areas? ($N = 88$).

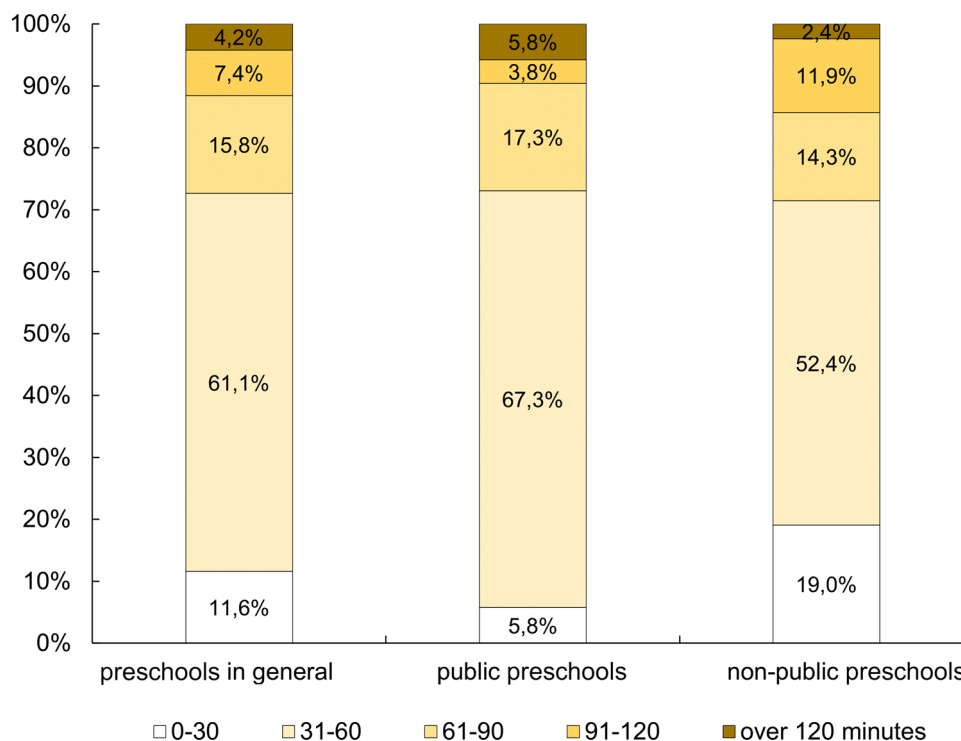


Fig. 11. How long does a single stay of children in the preschool outdoor area last? ($N = 95$).

that 54 % of preschoolers spend at least 2 h a day outdoor during their time in preschool in the spring-autumn season.

The conducted interviews revealed that in most of the preschools (83 %), the pandemic did not impact the frequency of use of outdoor internal green spaces (Fig. 12). Only 11.3 % of the preschools declared to use their own area to a lesser extent, whereas 5.6 % declared the opposite situation. However, 20 % of the public preschools declared that they had reduced the frequency of visits to their gardens, whereas the majority of non-public preschools declared no changes, and 10.5 % of them even

declared an increased use of their own green spaces. Those differences in the distributions were statistically significant based on the results of the U Mann-Whitney median test ($N_{public} = 50$, $N_{non-public} = 38$, $U = 701.000$, $Z = -2.0934$, $p = 0.0363$).

3.5. Awareness of the importance of contact with nature

Another feature considered in the study was the awareness about the importance of contact with nature for the physical, mental, social,

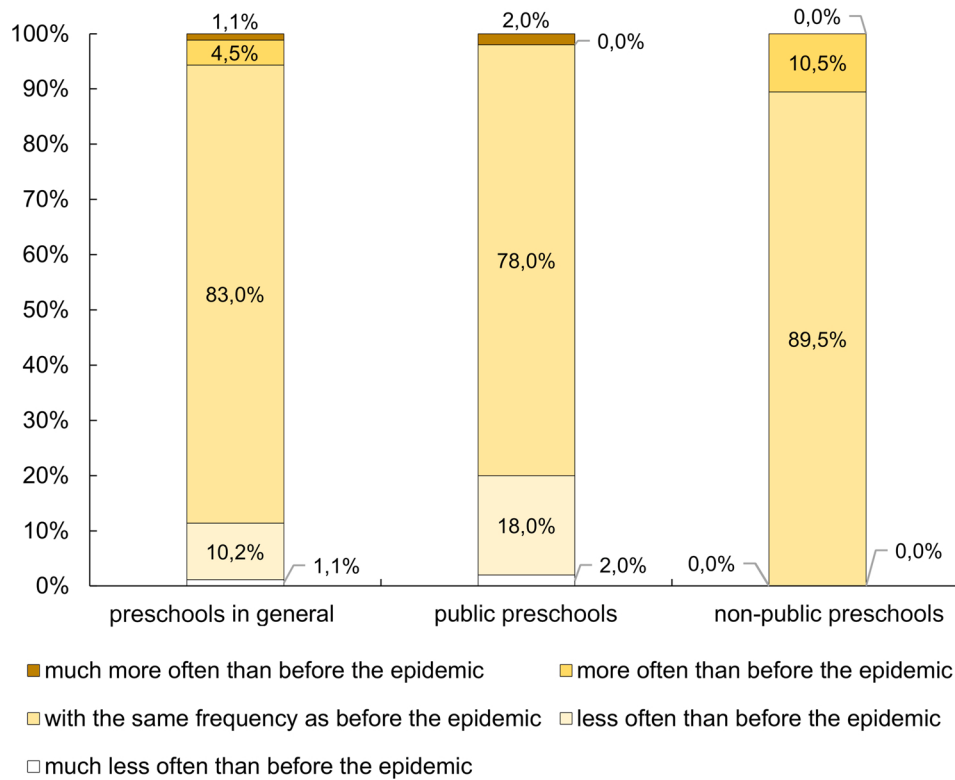


Fig. 12. Whether and how has the COVID-19 pandemic the frequency of using the preschools' own outdoor space? ($N = 88$).

emotional and general development of children (Fig. 13). The majority of respondents assessed children's contact with nature as very important (76.0–94.2 %) or an important factor (5.8 %–17.3 %). Only a few described it as moderately important (0.0–1.9 %). Nobody assessed contact with nature as of little or no importance for the development of preschoolers (Fig. 13). Those findings were similar for public and non-public preschools; the only difference was the slightly higher value assigned to contact with nature for social development in non-public preschools.

We were interested in whether awareness of the importance is driving outdoor activities, including visiting neighbouring green spaces and time spent in preschools' own green spaces. Our study showed that there is a relation between the awareness of the importance of contact with nature for physical development and social skills development and the presence of own outdoor spaces in the preschools. The respondents from preschools with a green area more often considered contact with nature as highly important for the physical and social development of children (95.8 and 79.6 % of responses, respectively) than those of preschools without their own green area (77.8 and 55.6 % of responses), which was confirmed by the results of the Pearson Chi-square test (Table 4). No statistically significant differences in the distribution of the answers were found for other areas of child development. In addition, higher awareness about the importance of contact with nature for children's physical, social and general development was associated with more frequent usage of the preschools' own outdoor spaces, although this relationship was inconsiderable (Spearman $R = 0.1284$, $p < 0.0001$; Spearman $R = 0.1290$, $p < 0.0001$; Spearman $R = 0.0954$, $p < 0.0001$, respectively). However, there was no relation found between the awareness and the duration of single stay in the preschool's outdoor space.

We also did not identify a relation between the awareness of the importance of contact with nature and the frequency of visits or the length of stay in the neighbouring green spaces. There was also no relation between the awareness and the distance to the visited external green space.

4. Discussion

4.1. The place of preschools in providing children contact with nature

The commonness of preschool education increased during the last two decades. According to statistics, the share of children aged between four and the starting age of compulsory education in Poland participating in preschool education increased from 58.3 % in 2000 to 93 % in 2018 (EUROSTAT, 2018). This is one of the EU Sustainable Development Goals (SDG) indicator set that monitors progress towards SDG 4 on ensuring inclusive and quality education for all.

Public preschools in Poland are usually open from 6 to 7 a.m. until 4 to 5 p.m. Non-public institutions can work even longer. This means that children sometimes might spend up to 10 h daily in such an institution. This problem is echoing in the media (Zubik, 2019) and shows the importance of preschools in providing children contact with nature, as they might have limited opportunity for this after a long day in preschool. Bento and Dias (2017) formulate similar concerns about the need to integrate time and space to play outside in education planning and intervention, starting in early education settings.

A factor influencing the provision of contact with nature in preschools is curricular documentation or knowledge of contemporary research literature in this field (Bilton and Waters, 2017). In Poland, the recommendation for providing preschoolers with opportunities to spend at least one fifth of their time in preschool outdoors (e.g. in the preschool's garden or playground, or in a local park) each week was previously enshrined in law (RMEN, 2012), but has since been changed by the new regulations of RMEN (2017). The regulation in force today is more general in nature and does not formulate specific standards for daily routines. Similar regulations are applied in other countries (DoHC, 2006; Department for Education in UK, 2012; Bilton, 2014; NDET, 2017). Only some countries define detailed guidance, such as the minimum time that preschools should provide for outdoor activities (European Commission/EA-CEA/Eurydice, 2019). However, regardless of the formal regulation, our results show that the awareness of the importance of contact with nature

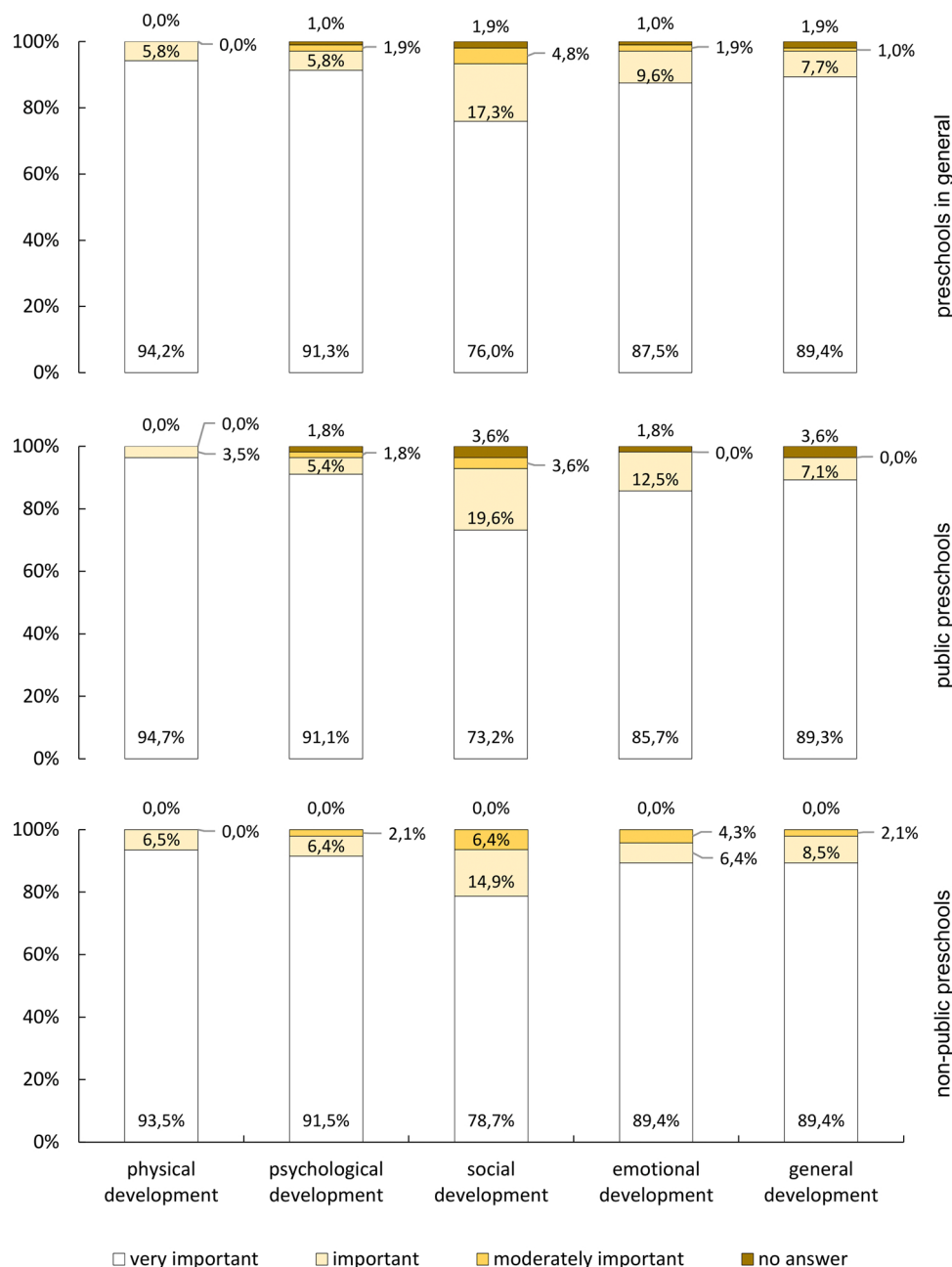


Fig. 13. The importance of contact with nature for the physical, mental, social, emotional and general development of children in the opinion of the respondents ($N = 104$).

for the development of children in preschools in Poznań is extremely high. The responses from Polish preschools emphasised the importance of contact with nature for physical development. This is in line with findings from England and with Welsh studies, where preschool staff also indicate that the most common reason for children being outside is physical development. However, their response rate in this aspect was lower due to different questions and more diverse potential answers (Bilton and Waters, 2017). The awareness expressed in preschools' responses reflects the scientific results that confirm such impact of interacting in nature on children's physical development (Fjørtoft, 2001; Frost et al., 2012) and psychological wellbeing (Brussoni et al., 2017).

Less, but still a high awareness considers the impact of contact with nature for social skills development. Taking into account that in Poland, at the country level, more than half of the families (53.3 %) have one child, one third (35.2 %) have two children and only 11.5 % have more children (Chochorowska et al., 2016), developing social skills through

contact with other children in outdoor activities in preschool can be of additional high importance. The higher awareness expressed by preschools with their own outdoor spaces might result from their observations and experience that other preschools do not have.

Despite identifying high awareness of the importance of contact with nature for children's physical, social and general development, our study found only a small relationship between this and the frequency of children's use of preschool gardens. However, we did not detect a similar relationship with regard to the duration nor the frequency of preschoolers' visits to external green spaces. This may be a result of the high level of awareness among most of the preschool representatives and the lack or very few other opinions expressed in the survey on the one hand and the usually frequent outdoor activities provided by early education institutions on the other hand.

Our study also took into consideration the status of the preschools, as this variable has rarely been considered in previous studies, despite its

Table 4
Contact with nature and the development of preschool children.

Groups	Does the preschool have an internal outdoor area?			
	No		Yes	
	%	Count	%	Count
How important in your opinion is contact with nature for children's physical development?				
<i>Pearson Chi-square (χ^2) = 4.90604, df = 1, p = .026765</i>				
important	22.22 %	2	4.21 %	4
very important	77.78 %	7	95.79 %	91
all groups	8.65 %	9	91.35 %	95
How important in your opinion is contact with nature for children's social development?				
<i>Pearson Chi-square (χ^2) = 6.76894, df = 2, p = .033899</i>				
moderately important	22.22 %	2	3.23 %	3
important	22.22 %	2	17.20 %	16
very important	55.56 %	5	79.57 %	74
all groups	8.82 %	9	91.18 %	93

potential to indicate differences in opportunities for contact with nature owing to varied spatial conditions and practices. We found that in Poland, the local conditions of public and non-public preschools can vary due to the historical and legal aspects of establishing preschools, which have changed over time (Podawca, 2018).

4.2. Opportunities of contact with nature

4.2.1. Internal and external opportunities for contact with nature

The opportunities of contact with nature varied among preschools due to the availability of preschools' own green spaces and the location at the background of the city's GI, providing natural play spaces outside the preschool. As many as 91.3 % of the preschools taking part in the survey declared having their own outdoor space, which varied in its share of different types of green spaces. Our results show that despite different opportunities preschools, are taking the advantage of existing resources to provide contact with nature, either in their own area or in the neighbouring green spaces. Interestingly, the share of green spaces in close proximity to preschools was neither related to the frequency nor to the duration of visits. The green spaces in the vicinity are rarely forests or urban parks, therefore, other types of green space are more available for visitation by preschools pupils. This emphasises the importance of view, that for such purpose, in an urban context, informal green spaces can be more valuable than a distant nature reserve (Pyle, 2003). Considering the potential for creating valuable natural play spaces, this finding highlights the importance of not only designing green spaces for children, but also shaping informal urban green spaces that can be used by children. Contact with nature in the vicinity of a preschool is also valuable in the light of the decrease in the number of children that have the opportunity to experience an outdoor environment in their neighbourhood due to common transportation by car and limited freedom in independent movement in the case of older children (Bilton, 2010). A scale of children's outdoor activities deficit is highlighted by Tandon et al. (2012); the authors show that in the U.S., approximately half of all preschool-aged children are not being taken outside to play each day. Even though The National Kids Survey in the U. S. showed that most children (> 62.5 %) spend at least 2 h outdoors daily, nature-based activities were less frequent than many alternatives (Larson et al., 2011).

4.2.2. Frequency, duration and quality of contact with nature

Our studies revealed that, 54 % of the children spent at least 2 h a day outside during their time in preschool in the spring-autumn season. Assuming that the standard daily stay in preschool last 8–9 h, this is 22–25 % of the time preschoolers spend in educational entity. In comparison to Norwegian preschoolers, who spend 70 and 31 % of their time in the preschool outdoors (in the summer and winter semester,

respectively) (Moser and Martinsen, 2010), this might seem not much. On the other hand, in Portugal, the time that children spent outside in early education settings is shorter and varies between 16 and 30 min (Bento and Dias, 2017). This shows that there is no unique pattern of providing preschoolers contact with nature, and national differences are significant in this respect.

Paediatric health care prescribes outdoor play in nature as a practical, cost-effective and easy method to address children's various health conditions (McCurdy et al., 2010). This is linked with the physical activity of children, which is stimulated by the outdoor environment (Burdette and Whitaker, 2004). Vanderloo et al. (2013) show that preschoolers participate in 10 times more energetic play when outdoors. Health recommendations encourage physical activity of children for at least 60 min per day (AAP, 2006). In respect to outdoor activities, Bilton (2010) (after Bento and Dias, 2017) recommends a duration of a minimum of 40 min per day to gain the benefits related to outdoor play. Against this background, the preschools in Poznań provide sufficient time outdoors in most cases (97.7 % declared to provide children daily outdoor activities in their own outdoor spaces), with a period of more than 30 min per one time (88 % of preschools). On the other hand, there is space for improvement. It should be noted that various factors impact the time of outdoor activities, namely weather conditions, quality of air or, currently, the ongoing pandemic, limiting existing opportunities for contact with nature.

Recent studies have shown that not only staying outdoors is important for children's overall development but also the design of the learning and play environments (Barbour, 1999; Luchs, Fikus, 2013, 2016; Acar, 2014).

Therefore, there is a great need for a deeper exploration of green spaces design through the prism of affordance of nature-based activities. Designing open-ended spaces and activities should balance child-initiated and adult-guided experiences in nature, contributing on the one hand to the development of children's place identity and environmental competency in using the environment, and on the other to children's appreciation for the natural world (Green, 2013). Interventions in regard to supporting preschools in providing better contact with nature through the transformation of their outdoor spaces into nature-oriented playgrounds have already been initiated by the City of Poznań (Badam Poznań, 2017). However, the idea to include outdoor learning is not entirely new, and as Kruszwicka et al. (2020) suggests, the classic pedagogical concepts by Rudolf Steiner, Maria Montessori and Friedrich Froebel, or other "natural" pedagogical ideas such as the pedagogy of experiences, also reflect the importance of education "in nature".

The observed advancement in the approach to children-nature interaction is also present in other countries. For example, in England, the Natural Connections Demonstration Project was established to support schools and teachers in including outdoor learning into their planning and practices (Edwards-Jones et al., 2016). In Portugal, an early childhood centre initiated a project to transform educational practices from typical indoor activities to a regular use of the outdoor environment (Bento and Dias, 2017). Those initiatives, enhancing the children-nature interaction, move traditional indoor approaches towards more nature-oriented ones.

4.2.3. The effect of COVID-19 on providing preschoolers contact with nature

The COVID-19 pandemic has serious impacts on the everyday life in societies worldwide. In Poland, preschools remained open for children (until 26 March 2021), although extraordinary sanitary restriction and safety procedures were established. The interviews conducted with preschools show that the situation in most of preschools did not impact the frequency of use of their own outdoor green spaces. However, it significantly impacts the usage of external green spaces. This partially results from temporary implemented restrictions on outdoor behaviour, limiting access to parks and recreational outdoor spaces. Although, urban parks and large outdoor, open spaces have been recognised as safe places for outdoor activities and social interaction during the pandemic

(Xie et al., 2020). The reduced frequency of visits to external green spaces can have the strongest impact on the physical activity of preschoolers attending preschools without their own outdoor green space or those with an outdoor space of limited affordances for children-nature interaction. Regarding the COVID-19 pandemic, the Ministry of National Education, in cooperation with the Chief Sanitary Inspectorate in Poland, advised preschools to provide outdoor activities while maintaining a safe distance from third parties - preferably on the internal outdoor area of the entity, and if this is not possible, to visit nearby recreational areas (GIS, 2020). To provide safe conditions for outdoor activities, it is recommended to clean or disinfect external outdoor equipment before children can use it and to regularly clean or disinfect internal outdoor equipment or if it is not possible to exclude it from usage (GIS, 2020). As a consequence, preschools limited their visits to external green spaces. Similarly, a decrease in children's organised outdoor physical activity has been revealed in one of the first studies on how COVID-19 restrictions impact the activity of children in Western Australia (Nathan et al., 2021). A study from Canada indicated that the restrictions are associated with an overall decrease in the time spent on outdoor play among children and youth (De Lannoy et al., 2020).

This revealed the importance of arrangement and design of preschools' own outdoor green spaces to provide quality contact with nature in nature-oriented play space for preschoolers. Considering that policies on the access to the outdoors during the COVID-19 might limit outdoor play among children and youth (De Lannoy et al., 2020), further policy decisions should consider the development of nature-oriented playgrounds or play spaces as solutions for the deficit in contact with nature. For preschools without own outdoor spaces, policies ensuring an opportunity for outdoor activity in external green spaces are crucial.

4.2.4. Study limitation

Our analysis of spatial opportunities in providing preschoolers with opportunity for contact with outdoor environments was not limited to the premises of the preschools, but also considered the potential of neighbouring green spaces. However, one must bear in mind that our study had some limitations. First, due to data generalisation, city-scale assessment of green space availability was unable to capture the quality of green space. Second, our study revealed the average time and frequency of outdoor activities provided by preschools in Poznań, but we did not differentiate our study by age group, although, a UNICEF (2018) report has shown that even young children represent a diverse group, to whom different recommendations might be addressed. Third, we focused on the spring-autumn season, which is the most active times for interacting with nature; however, different weather conditions during the winter create alternative opportunities for contact with nature. In order to build our understanding of this topic, it would be helpful to extend this study by recognising seasonal differences in outdoor activities. Finally, another crucial aspect pertains to the way in which children spend their time outdoors interacting with nature, but due to its complexity this aspect was beyond the scope of this study. It thus represents a research gap that needs to be addressed in the future.

5. Conclusions

To ensure children contact with nature, preschools use their own outdoor areas as well as external green spaces in their neighbourhood. We have shown that preschools have various opportunities to use external green spaces due to their location at the background of the urban tissue and GI. We found that preschoolers are generally taken to visit neighbouring green spaces located within 300 m (50.5 %); 94.6 % visits did not exceed 1 km. Most frequently (54 %), outdoor visits to external green spaces lasted between 30 and 60 min. This indicates the importance of spatial planning in ensuring the presence of neighbouring green spaces as a part of space for early-stage education.

Concurrently, as many as 97.7 % of the preschools in the study declared that their pupils enjoyed their outdoor spaces at least once a

day, spending a daily average of 103 min outdoors in the spring-autumn season. However, the extent to which these spaces are covered with vegetation was found to vary. Nevertheless, deeper insights into the character of preschools' outdoor spaces is needed in order to recognise whether and to what extent these places provide nature-based play spaces for children. This is crucial because the design of spaces such as gardens and playgrounds influence not only how nature is experienced but also nature connectedness, in turn building positive attitudes towards nature.

The availability of green spaces as well as various practices in providing children with contact with nature proved to vary between the public and the non-public preschools. Compared to their non-public counterparts, the public preschools were found to be characterised by a greater availability of neighbouring GI, including parks, but a lower availability of forests. Although the non-public preschools were located in less green surroundings and frequently declared a lower share of green spaces in their outdoor areas, they more frequently took children outside to neighbouring green spaces (65.9 % of the non-public versus 28.5 % of the public preschools declared making visits at least once a week). By contrast, the public preschools declared that their pupils use their green spaces more frequently (88 % claimed several times a day) than their non-public counterparts (43.2 % claimed several times a day).

The preschools' outdoor activities have changed due to the COVID-19 pandemic. For instance, they have significantly reduced their visits to external green spaces (especially in the case of the public preschools). Nevertheless, the pandemic has not significantly affected the frequency with which they use their own outdoor spaces.

These findings highlight the importance of locating preschools in buildings and associated spaces dedicated for educational purposes. Moreover, they emphasise the crucial role of preschools' practices in providing outdoor activities customised to the varied availability of green spaces.

At this background, the public and non-public preschool managers' very high awareness of the importance of contact with nature for children's development provides promising conditions for future improvements towards more nature-oriented solutions. The opportunities for contact with nature identified offer a baseline that can serve as a guideline for implementing and monitoring improvements that will help ensure healthier children and better human-nature relations in the future.

Our study has shown that most preschools use available resources to take children outdoors. Nevertheless, there is still room for improvement.

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CRedit authorship contribution statement

Iwona Zwierzchowska: Conceptualization, Methodology, Investigation, Resources, Writing - original draft, Writing - review & editing, Visualization, Supervision, Project administration. **Piotr Lupa:** Conceptualization, Methodology, Formal analysis, Investigation, Resources, Writing - original draft, Writing - review & editing, Visualization.

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.

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