Urban green spaces for the social interaction, health and well-being of older people – an integrated view of urban ecosystem services and socio-environmental justice

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Abstract

Urban green spaces provide multiple ecosystem services to city residents and are considered an important element of socio-environmental justice. For older people, urban green spaces are important for health and well-being because they provide spaces for physical activity and social interaction. They can be regarded as spaces of encounter. Drawing on a comprehensive dataset of park visitation patterns, demographic characteristics and social network patterns, we explore older people's urban green space visitation patterns for the case of Berlin (Germany). We found that older people who have close social networks use urban parks more often than those who are more isolated in their daily lives. Self-estimated good health also contributes to more frequent park use. We discuss these findings along the three dimensions of socio-environmental justice: distributive, interactional and procedural. Based on our findings, we develop a framework that calls for an integrated view of these three justice dimensions, which all contribute equally and inseparably to a just provision of urban ecosystem services. Most importantly, we recommend urban planning to understand the city as an integrated socio-ecological system in which the planning and design of urban green spaces focus on providing ecosystem services together with enabling the creation of social networks in order to increase socio-environmental justice**.**

Keywords: Urban ecosystem services, socio-environmental justice, urban parks, elderly, physical and mental health, urban planning, places of encounter

1. Introduction

Urban green spaces provide a number of ecosystem services to improve the health and well-being of city residents. Bolund and Hunhammar (1999) describe urban ecosystem services as the values and benefits that urban residents may gain from ecosystems located within a city. Vegetation in urban green spaces regulates climate by mitigating high temperatures during hot conditions through shading and evapotranspiration (Aram et al., 2019). Trees filter air pollutants (Grote et al., 2016; Janhäll, 2015) and buffer noise (Van Renterghem et al., 2015), and unsealed open spaces mitigate flooding (Prudencio and Null, 2018; Venkataramanan et al., 2019). These ecosystem regulation services may prevent urban residents from negative health outcome effects and serve to promote healthy behaviour through the provision of cultural ecosystem services (Kabisch et al., 2017; Markevych et al., 2017). Cultural ecosystem services provided by urban green spaces such as parks, cemeteries, allotment and urban gardens, urban forests and other spaces include offering a location to recreate, play sports, relax, enjoy and learn from nature and meet with friends and family, thus increasing social cohesion.

With demographic change and the aging of societies, particularly in developed countries, urban green spaces and the ecosystem services they provide may be of particular importance for older people (WHO Regional Office for Europe, 2016). In Germany, the share of the population aged 65 years and older increased from 15.8% in 1997 to 21.4% in 2017 (Statistisches Bundesamt, 2018). In addition to the aging of the population, demographic change comes with individualization processes, particularly in cities. The number of households has been increasing due to significantly higher numbers of small – mainly one-person – households, including people of older age groups (Mahne, K. et al., 2017).

An increasing challenge among older people, particularly those living in one-person households, is social isolation. A lack of social connections (O'Brien, 2014) may result in severe health outcome effects (Cornwell, E.Y., Waite, 2009; Steptoe et al., 2013). When entering retirement, older people leave their place of work and thus lose a crucial place for interpersonal encounters and social networks. The risk of the death of partners and friends is higher in older age than in younger age (Misoch, 2017). Offering places of encounter within a city, such as public urban green spaces, may counteract the social isolation of older people. In addition, older people have been found to closely relate the physical accessibility of their neighbourhood with social components, such as knowing their neighbours and feelings of familiarity (Menec et al., 2011; Van Dijk et al., 2015). These findings suggest that social integration could serve as a prerequisite for older people to visit nearby public spaces, such as urban parks.

Urban green spaces are important parts of an age-friendly urban environment (O Brien 2014) and provide a number of health benefits, particularly for older people (Kabisch et al., 2017). Urban parks provide space for recreational, physical and social activities (Kawachi and Berkman, 2001; Levinger et al., 2019). The presence of green spaces in a neighbourhood motivates older people to be more physically active (Mytton et al., 2012; Sugiyama and Thompson, 2007; Takano et al., 2002), with positive impacts on cardiovascular health (Astell-Burt et al., 2016) and mental health (Lee and Lee, 2019; Thompson Coon et al., 2011), particularly as part of community-based programmes (Barton et al., 2012) and through the integral provision of opportunities for social interaction (Aspinall et al., 2010). Despite the numerous studies on the health impacts of urban green space, limited research has been conducted on the connection between older people's actual use of urban green spaces,

their motivation and the role of social integration in the neighbourhood (Gibson, 2018). Given that demographic changes will impact urban societies within cities that often lack sufficient and equally distributed public green space, the issue of older people's motivation to visit public green spaces is becoming more salient. In the context of environmental justice, urban green space distribution and availability by different population groups are often analysed at the macro level of a total city and its districts to identify the potential unjust distribution of urban green spaces (Kabisch et al., 2016; Rigolon, 2016). An approach that combines a distributive dimension with social dimensions of justice is provided by (Low, 2013). Accordingly, a *procedural justice dimension* relates to the integration of all affected population groups in planning and decision-making processes of public space, and an *interactional justice dimension* relates to the quality of interpersonal relations and interactions in a public space without, e.g., discriminant behaviour (Low, 2013). Recently, this framework of socio-environmental justice was further elaborated, such as in the "ecological model of environmental justice for recreation" by Rigolon et al. (2019).

In the present study, we use the city of Berlin as a case study and aim to identify sociodemographic factors and factors of social integration that promote the use of urban green spaces by older people. We look beyond solely distributive factors of green space availability and explore additional interactional justice components. These interactional justice components might be important for motivating park use and thus contribute to a better self-estimated health condition. The approach to interactional justice for older people is twofold: First, as the possibility for older people to enjoy parks as a non-discriminant environment when they become frailer because health issues can restrict older people's park use in cases of insufficient facilities and equipment, e.g., benches and toilets (Alidoust and Bosman, 2015). Second, because social connectedness can be considered a prerequisite for older people to visit public spaces at all, especially when affected by frailty, we include patterns of social integration in the dimension of interactional justice. By combining our empirical findings with existing research on environmental justice, especially on procedural justice that we did not include in our empirical research, we develop a framework that considers all three dimensions of environmental justice.

2. Materials and methods

2.1 Case study

Berlin is the capital of Germany and the country's largest city. The city area spans more than 891.1km² and had a population of 3,644,826 inhabitants in 2018. Almost 20% of the population are between 50 and 65 years of age, and another 20% of Berlin's inhabitants are aged 65 years and older (21.4% Germany-wide, Statistisches Bundesamt, 2018). The population has increased by nearly 10% in the last eight years (3,326,000 in 2011), and the official population prognosis suggests a further increase in the total city population of up to 3,828,000 by 2030 (Senatsverwaltung für Stadtentwicklung, 2016). The mean age in Berlin was 42.9 years in 2014 and is expected to grow to 44.3 years in 2030. The increase in mean age is expected to be a result of the disproportionate increase in older people, particularly a 62% increase in those aged 80 and older (to 263,000 people by 2030). More than 675,200 inhabitants in 2018 were foreign, defined as people of exclusively foreign or unknown nationality and stateless people. The population with a migration background was 518,839 in June 2018.

Berlin is a green city, with almost 40% of the city's area consisting of natural spaces, including urban green spaces (33%), including forests, parks, allotments and cemeteries, and water areas (6.7%). These spaces are very heterogeneously distributed across the city, with high shares of urban green spaces in the southwestern and southeastern parts of the city. The suburban areas close to the city border are connected to the high shares of urban forest, while other areas consist of agricultural land. Berlin contains more than 2,500 parks and public green spaces that amount to approximately 5,000 ha (SenUVK, 2019).

2.2 Data

We use data from a quantitative questionnaire survey that was conducted in 2018 in Berlin as part of the research project "Superdiversity and ageing cities?". Building on previously conducted qualitative research (see Haacke et al., 2019), a questionnaire was developed and distributed among people aged 50 years and older throughout the city of Berlin. We set the lower limit of our survey sample at age 50 because our preliminary qualitative research showed that older migrants are likely to feel they are part of the older generation in their 50s, which is earlier than people without a migrant background do. Berlin is a culturally diverse city with significant shares of people with non-German backgrounds. To enable their participation, the German questionnaire was translated into seven languages: Arabic, Bosnian, English, Polish, Russian, Turkish and Vietnamese. Pre-tests with bilingual older people were conducted to ensure coherent meaning throughout the different language versions. Research suggests that people from ethnic minority groups tend to participate in surveys at below-average rates (Feskens et al., 2006), and with increasing age, their willingness to answer questionnaires declines (Motel-Klingebiel et al., 2019). Questionnaires were thus pro-actively distributed in social and cultural meeting places, counselling centres and neighbourhood institutions for older people in general and for those of different cultures. Contacts to institutions were established during an earlier qualitative phase of the research project, which resulted in increased trust in the survey. Additionally, we provided an online version of the questionnaire that was distributed through mailing lists of initiatives, political interest groups and associations of and for older people.

To assess the value of urban green spaces for older people, respondents were asked about the general perception of public urban green spaces within their neighbourhood and how often they visited them. In particular, we asked how the respondents agreed with the statement, "In my residential area, there are enough parks and public green spaces" (fully agree – agree – partly – disagree – strongly disagree). Visitation frequency was assessed with the question, "How often do you use the parks and public green spaces in your neighbourhood? ((nearly) daily – 1-3x per week – 1-3x per month – rarely more than 1x per month – never), and the accessibility of green spaces was assessed with the question, "Are the parks and green areas accessible and easily to reach by foot?" (Yes – with constraints – no).

The questionnaire included questions regarding the respondents' social networks, asking about their agreement with the following three statements: (1) "One of my family members (e.g., partner, child, grandchild or any other relative) lives in my neighbourhood". (2) "Recently, I have met with one of my neighbours." (3) "I have friends and/or acquaintances who live in my neighbourhood".

To assess the participants' health, the respondents were asked to self-rate their state of health (very good – good – depends – rather bad – bad). We included the following sociodemographic variables in our analysis: gender (female – male – other), age (year of birth), migration background (country of

birth), marital status (married – single – divorced – living separated – widowed – civil union (same sex) – in partnership – in same-sex partnership), and housing status (alone – with partner – with children – with grandchildren – with own parents – with friends – other). Respondents were asked to indicate the postal code zone of their residential area.

Urban green space data are based on land use data extracted from the Urban and Environment Information System provided by Berlin's Senate Department for Urban Development and Housing (SENURBAN, 2019). Public urban green space is calculated as the total sum and as the percentage of public green space, including urban parks, urban forests, allotment gardens, and cemeteries, as a percentage of the total area in a sub-district.

2.3 Data analysis

Data were analysed using descriptive statistics and chi-square tests to identify statistically significant differences between the respondents' visitation patterns of urban green spaces, demographic characteristics, health status and social network components.

An application of Bonferroni-corrected Pearson chi-square tests and a calculation of adjusted standardized residuals according to Sharpe (Sharpe, 2013) were used to identify significant differences in park use frequency and different age and health status categories. The statistical significance threshold was set at $p<.05$ (McCormack et al., 2014; Stewart et al., 2018). The aim was to identify whether park visitor patterns are different according to health status and variables that indicate social inclusion in local networks. Building on preliminary research, we assumed that social inclusion impacts the likelihood that older people will actively participate in outdoor activity (see Chaudhury, Campo, Michael, & Mahmood, 2016). To analyse whether official public green space is significantly different compared to perceived urban green space categories in the neighbourhood, a non-parametric Kruskal-Wallis test was performed, which may be used when assumptions of parametric tests (such as an analysis of variance – ANOVA) are not met. All data analyses were conducted with SPSS data files using IBM SPSS Statistics 24.

Spatial data visualization was performed with ArcMap 10.5. Maps were created that use the postal code as a spatial delineation for city neighbourhoods.

3. Results

After the exclusion of missing values, our sample included 506 questionnaires (318 online and 188 paper). The average age of respondents was 69 years, comprising an age range from 50 to 93 years. A total of 67.2% of the respondents were female. A total of 85.6% of the participants were born in Germany, and 12.5% were born in another country. Our participants were in generally good health, as 54.8% rated their health as very good or good and only 9.7% rated it as rather bad or bad. Of the respondents, 47.4% were divorced, widowed or single, and 46.6% lived alone (see table 1).

Table 1. Sociodemographic characteristics of the sample

Variable	Category	Percentage	Variable	Category	Percentage
Gender	Female	67.2 %	**Housing status**	Living alone	46.6 %
	Male	32.8 %		Living with someone	53.4 %
Age	< 65	24.9 %	**Health status**	Very good	9.5 %
	65-75	49.7 %		Good	45.9 %

	75 and older	25.5 %		Depends	32.7 %
				Rather bad/bad	9.8 %
Migration background	German born	85.6 %	**Marital status**	Married	43.1 %
	Foreign born	12.5 %		Divorced	19.6 %
				Widowed	15.2 %
				Single	12.3 %

Concerning social integration, over 60% of our respondents had friends who lived in the neighbourhood, and another 60% of the respondents had recently met with their neighbours. Of our respondents, 43.3% had family in the vicinity, and 72.9% stated that they had recently met with their family (see figure 2).

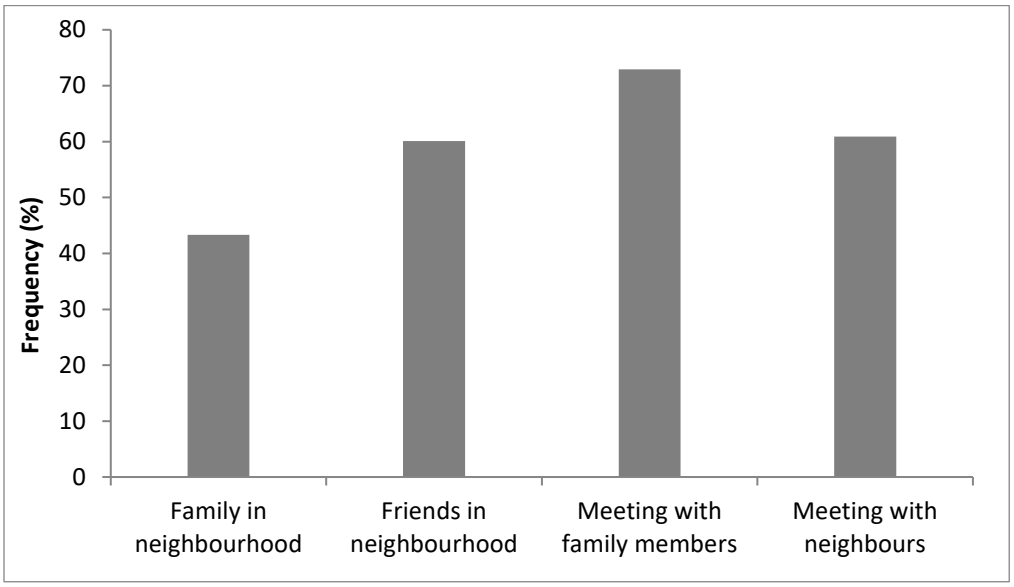

Figure 1. Sample integration in social networks

3.1 Green space use and perception

A total of 24.9% of the older people in our sample visited urban green spaces daily, and another 31.2% used green spaces 1-3 times per week. Only 22.9% of respondents indicated that they never used urban green space or used them less than once per month. Most of the respondents noted that they strongly agreed that there was enough public green space within their neighbourhood, and over 80% considered the parks in their neighbourhood accessible (figure 3).

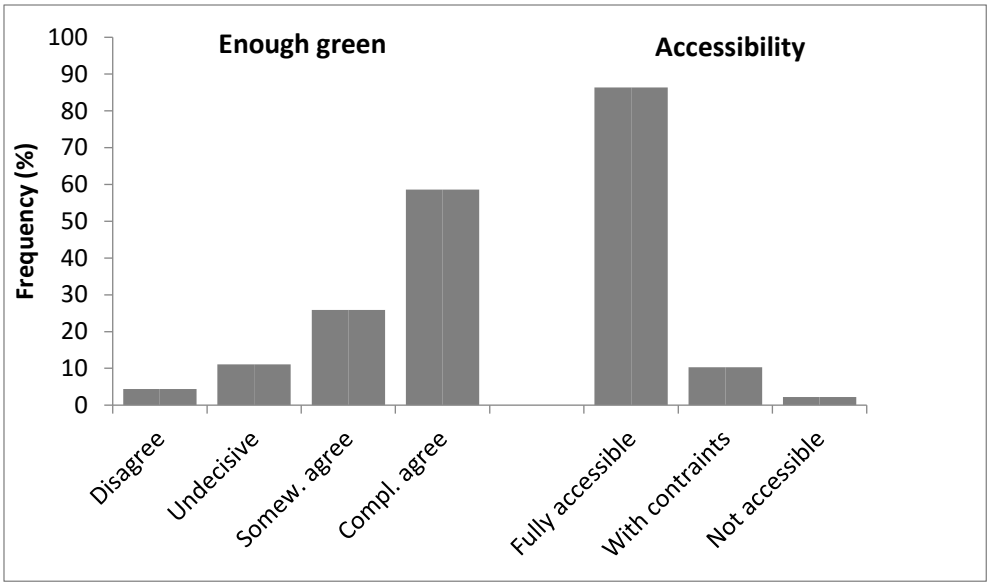

Figure 2. Sample's perception of parks in the neighbourhood: Distribution and accessibility

The respondents' estimation of the quantity of green space in their neighbourhood, i.e., their assessment of whether there was enough public green space within their neighbourhood reflects the actual distribution of urban green space in the city. No significant difference between the estimated green space and the actual green space was revealed by Kruskal-Wallis tests (p=0.247). Figure 4 shows the distribution of public urban green space in the city of Berlin.

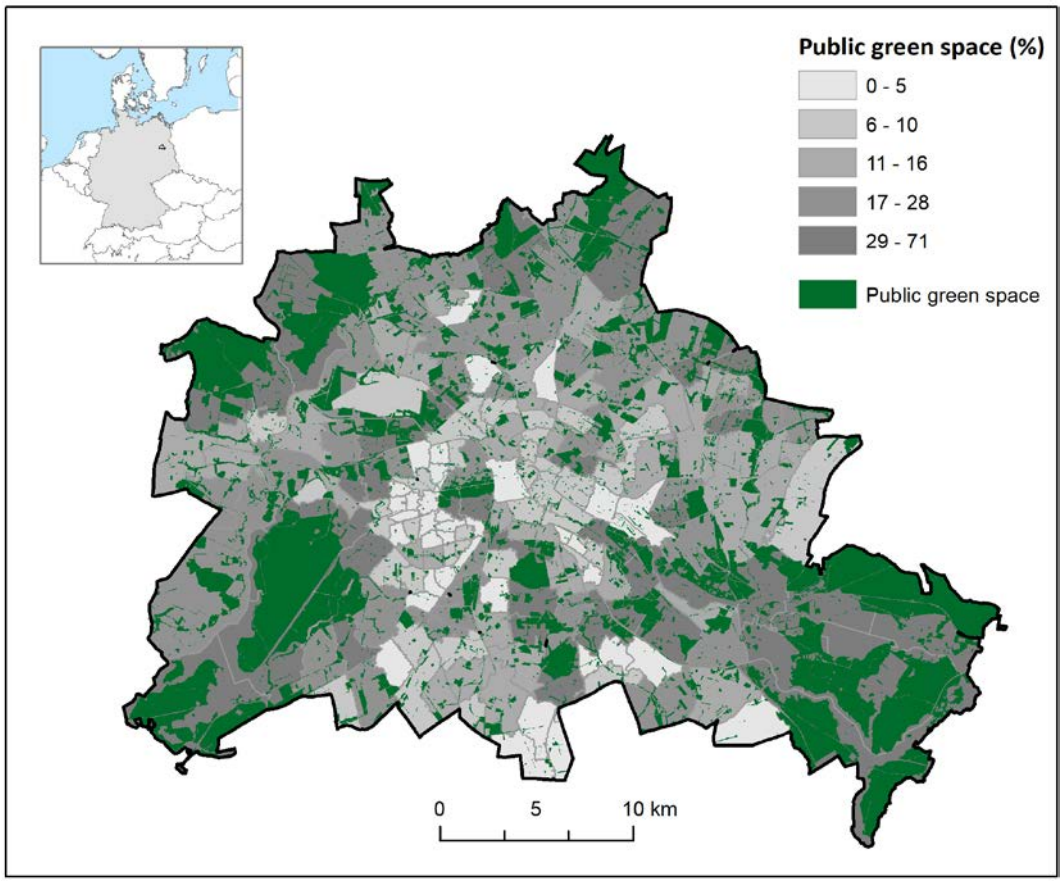

Figure 3. Spatial distribution of public urban green space in Berlin (quantiles)

Table 2 contains comparisons between the frequency of urban green space visits, including 126 respondents who used urban green spaces daily, 158 respondents who used green spaces 1-3 times per week, 101 respondents who used green spaces 1-3 times per month, and 116 respondents who used urban green spaces less than once per month or never (Table 2). Older people who visited urban green spaces nearly daily were significantly more likely to be married, to have friends that live in the neighbourhood and to have met a neighbour recently. Older people who visited urban green space less than once per month or hardly ever were less likely to be in self-estimated good health than those visiting green spaces more often; they were more likely to be divorced and to assess their health status as rather bad or bad. We found no significant difference in green space visitation patterns by age group, gender, migration background or housing status (living alone or with someone). More than 70% of older people who used urban parks nearly daily estimated that they had enough urban green in their neighbourhood, and 91.2% of the frequent users considered these spaces to be easily accessible (see figure 3).

Table 2. Characteristics of the sample by park visitation patterns

Variable	Category	Nearly daily (n=126)	1-3 times per week (n=158)	1-3 times per month (n=101)	Less than once per month or hardly ever (n=116)	p-value*
Socio-demographics						
Gender	Female	66.7%	65.8%	61.4%	73.3%	.306
Age	<64	26.2%	22.8%	29.7%	22.4%	
	65-74	49.2%	51.3%	49.5%	47.4%	
	75 and older	24.6%	25.9%	20.8%	30.2%	.716
Migration background	Born in Germany	80.0%	74.0%	76.8%	79.6%	.617
Family status	Married	**54.8%**	39.1%	36.5%	41.6%	
	Divorced	25.4%	35.1%	**50.0%**	36.3%	
	Widowed	13.5%	18.5%	9.4%	19.5%	
	Single	6.3%	7.3%	4.2%	2.7%	**.007**
Living alone	Yes	40.5%	45.6%	48.5%	54.3%	.182
Health status	Very good	10.5%	11.2%	12.2%	4.4%	
	Good	50.8%	50.0%	48.0%	38.1%	
	Depends	33.9%	27.6%	32.7%	40.7%	
	Rather bad/bad	4.8%	11.2%	7.1%	**16.8%**	**.019**
Interactional justice dimension						
Someone in family lives in neighbourhood	Yes	48.4%	48.7%	39.6%	35.3%	.080
Friends live in neighbourhood	Yes	**68.3%**	64.6%	57.4%	49.1%	**.012**
Meeting a family member recently	Yes	76.2%	72.2%	75.2%	71.6%	.802
Meeting neighbours recently	Yes	**71.4%**	60.8%	64.4%	49.1%	**.004**

Distributive justice dimension						
Perception – enough public green space in neighbourhood	Disagree	2.4%	2.5%	3.0%	10.6%	
	Indecisive	4.8%	7.6%	14.1%	20.4%	
	Somew. agree	21.6%	22.3%	32.3%	30.1%	
	Compl. agree	**71.2%**	67.5%	50.5%	38.9%	**.000**
Perception – accessibility of parks	Fully accessible	**91.2%**	94.3%	86.0%	74.6%	**.000**

*p value based on chi-square test.

4. Discussion

We used the results of a comprehensive dataset of park visitation patterns, sociodemographic characteristics, and social networks for older people in Berlin to identify the potential health and social integration patterns that may contribute to the frequency of urban green space use. We found that those who visited green spaces in their neighbourhood on a daily basis had a better perceived health status and seemed to be more integrated in social networks than those who visited green space hardly ever. The social integration of those frequent park users is indicated by most of them being married and having more friends and close neighbours around them. Obviously, social networks play a major role in urban park visitation by older people. The importance of social integration for the physical and mental health of older people has been shown by a number of other studies (Chen et al., 2015; Paul et al., 2006; Stanley et al., 2010). Lee & Lee (2019) reported that elderly populations experienced less stress and fewer depression symptoms in environments with higher levels of urban greenery. Other studies showed significant relations between social contact and community well-being, particularly in urban green space environments (Maller et al., 2006). Improvements in mental health may occur particularly when social contact and social interaction are formed and maintained in urban green spaces (Teo et al., 2013).

Building on our empirical findings as well as preliminary studies, we develop in the following a framework on how the three dimensions of socio-environmental justice – distributive, interactional and procedural justice – may contribute to a just provision of ecosystem services and social cohesion in the context of planning for age-friendly and just cities (figure 4).

4.1 Distributive justice

Within the ecosystem service concept, distributive justice can be regarded as the fair allocation and availability of urban green and related ecosystem services. A number of studies have addressed the distributive dimension of green spaces through urban green availability analyses for different age groups (Barbosa et al., 2007; Giles-Corti et al., 2005; Kabisch et al., 2016; Kabisch and Haase, 2014; Schipperijn et al., 2010; Van Cauwenberg et al., 2012). In these studies, distance threshold values were used to assess green space availability from residential areas. This relates to the provision of space for recreation and of important regulating ecosystem services such as air cooling or noise buffering, which might be important services to prevent negative health outcomes, particularly among older people (Kabisch et al., 2017).

Our findings showed that 82% of older people in Berlin perceived that there was enough green space in their neighbourhood and that the green spaces were mostly accessible. This result indicates that

older people are aware of the potential public spaces around their residential homes, despite their possible limited mobility and increasing frailty compared to younger and middle-aged population groups. However, the frequency of green space and park visitation patterns differed by health status and integration in social networks (Table 2). We conclude that there is a need to look beyond distributive patterns to understand older people's use of green spaces.

4.2 Interactional justice

The dimension of interactional justice addresses different groups' needs and preferences to enjoy a fair and non-discriminant environment. Accordingly, for older people who experience bodily constraints and frailty that translate into a specific health status, the physical environment in urban parks may have discriminating or non-inviting impacts and may lead to non-use or avoidance of urban parks (Alidoust and Bosman, 2015). Our results indicate that older people who consider their health status to be rather bad visit parks significantly less often than people who feel that they are in good health. Better health enables people to be active and engage with society (Chaudhury et al., 2017). Good health is thus a prerequisite to visit and benefit from green spaces. However, the reverse is also true: going outside, spending time in public green spaces and being active have been found to increase perceived health among older people (Acree et al., 2006).

Accordingly, urban parks should be designed and equipped to attract people of all ages with respect to their specific (health-related) needs. Here, interactional justice is linked to distributive justice because the availability of inclusive design elements in urban green spaces and ensuring ease of access through pedestrian-friendly local street networks and public transport systems regarded as distributive aspects are a precondition for age-related interactional justice (O'Brien, 2014). The inclusive design of urban green spaces such as parks relates to a number of particular infrastructure elements and facilities, including pleasant vegetation, trees for shade, age-convenient benches, toilets, shelters from extreme weather situations (e.g., heat) and paved trails for older people (Arnberger et al., 2017; Aspinall et al., 2010; Knight et al., 2018). Ottoni et al. (2016) highlighted that benches are particularly needed to motivate older people to visit parks. Benches should be designed so that older people can sit comfortably with adapting height and shape to adjust for potential physical limitations. Gibson (2018) highlighted that benches should allow older people to rise from the bench on their own – with arm and back rests – and be installed in a way that allows people to cluster in order to enable social interaction.

In addition, safety is an important neighbourhood characteristic that was considered to be a prerequisite for older people's use of urban green spaces (Alidoust and Bosman, 2015; O'Brien, 2014). Safety may be ensured through an inclusive urban design that considers the safe interaction of diverse user groups, e.g., pedestrians and cyclists (Knight et al., 2018) and protection from nuisances as well as potential adaptations to the physical built environment to ensure that disabled people can cross roads safely or even access a park with ramps instead of steps (O'Brien, 2014).

In addition to health-related reasons, the frequency of park use by older people in our study also differed by their level of social integration, which is further linked to interactional justice. We found a clear relationship between indicators of social integration and park use, with those visiting parks more often having more social contacts in their neighbourhood. Preliminary research found social networks to be important to older people for engagement in activities (Chaudhury et al., 2016; Levasseur et al., 2015; Yung, Conejos, & Chan, 2016) as well as better health among older people (Alidoust & Bosman, 2015; Levasseur et al., 2017). Knight et al. (2018) showed that older people

mostly visit parks with others, particularly with their partners. Accordingly, our results showed that most of the older people who frequently used parks were married. This finding suggests that social integration is a precondition for older people to visit parks at all. The most vulnerable group of older people, namely, the very old and frail, might not feel safe to visit parks alone. In this case, a lack of integration in social networks can become the decisive barrier that prevents park visitation from the start, regardless of how age-equipped green spaces are.

Maas et al. (2009) found that elderly people feel less lonely in neighbourhoods with high levels of urban green space. Alidoust and Bosman (2015) showed that a close neighbourhood environment with green spaces can be considered a particular arena for fostering social ties between older people and enable an experience of neighbourliness (Alidoust & Bosman, 2015; Knight et al., 2018). In this sense, urban green spaces can be regarded as "spaces of encounter" (Piekut and Valentine, 2017; Valentine, 2008), which are important to enable social contacts, to meet other people and to engage with strangers (Neal, Bennett, Jones, Cochrane, & Mohan, 2015; Peters, 2010; Peters, Elands & Bujis, 2010). In turn, a lack of accessible public spaces (again, as a link to distributive justice) prevents older people from socializing with their local friends and neighbours (White et al., 2010).

As such, parks and green spaces may prevent social isolation by promoting a sense of place in public areas that are positively associated with improved mental health (Thompson et al., 2016) and improved feelings of community among older people. Providing safe spaces for people to meet and socialize together with the provision of social community programmes that encourage elderly people to go out (Knight et al., 2018) and visit friends and neighbours have been shown to be effective strategies in promoting and increasing physical activity patterns (Chaudhury et al., 2016). Because older people may regard social contacts in the neighbourhood as a prerequisite for park visitation, community programmes may also involve other spaces of encounter, such as neighbourhood cafés, libraries or community gardens.

4.3 Procedural justice

To create age-friendly green spaces where older people feel comfortable and welcome, older people need to be included in the planning process through active participation. This phenomenon is of particular importance because planning urban open spaces such as urban green spaces is complex and needs to consider different aspects to fulfil the needs of different population groups (Astell-Burt et al., 2016). Procedural justice addresses the way to integrate the diversity of all potentially affected groups in the planning process to provide them with the arena to be able to actively articulate their needs (Low, 2013). Infrastructure elements and urban green space facilities, as outlined in section 4.2, may be provided through co-created comprehensive green space planning (Frantzeskaki and Kabisch, 2016; Lee et al., 2015). Older people's co-creation in urban planning is important not only to increase age awareness in planning (Loukaitou-Sideris et al., 2016) but also to build trust in local planning among older people. Participation in the planning process of, for example, a nearby park, may foster feelings of belonging and identification and, in turn, enhance park visitation and social cohesion. Access to parks or other green spaces is linked to the built environment, local street network, distribution of public transport stops, etc. Broader urban planning is needed that looks beyond thinking in planning silos (Raymond et al., 2017) and integrates a diversity of population groups in comprehensive urban planning to come to long-term strategic planning decisions. Thus far, older people are unlikely to be involved in planning processes (Fang et al., 2016). In addition, minority groups within older people, such as older migrants, were found to be reluctant to engage in participation processes. Here, disadvantaging age-related factors might intersect with migration-related factors, such as insufficient language skills (Low, 2013). Against the

backdrop of increasingly diverse populations, planning should be attentive to various, often less visible, disadvantaged groups.

In addition, some scholars have concerns that procedural injustices are often disguised as procedural justice by focusing on a "greater good", such as the aim of implementing sustainability or climate change action plans and strategies to improve the overall environmental condition of a neighbourhood or city district. This process can go against the needs and interests of the very local population, with the tacit intention to tame, co-opt or silence their voices while benefiting higher income groups or developers and even to evict lower status groups or vulnerable population groups. These processes have been discussed, e.g., as green gentrification, environmental or eco-gentrification (Anguelovski et al., 2016; Checker, 2011; Dooling, 2009). In the context of older people in urban areas where there already exist barriers such as lower participation among older people and migrants in public participation, planning and politics must carefully pay attention to making the voices of all affected people heard, not just those of the well-educated and well-connected who know how to set their interests on the political agenda (Novy and Colomb, 2013).

4.4 An integrated view of the three dimensions of justice for an age-friendly and just urban society

We understand the three dimensions of justice as interlocking systems that work best when all systems are considered alike. The availability of urban green and particular design elements (distributive justice dimension) is the prerequisite for people to identify green spaces and visit them. However, mere distribution is not enough, as spaces that are not accessible by older people fail to make visitors feel comfortable in the park, engage with others and come frequently (interactional justice dimension). To provide desirable facilities for all inhabitants, different groups have to be heard in planning processes, thus promoting procedural justice. Considering this, we understand distributive, interactional and procedural justice as interwoven dimensions that contribute equally and inseparably to the just provision of ecosystem services in ageing urban societies (see figure 4). With this, our understanding of the three dimensions of justice complements and further specifies the "ecological model of environmental justice for recreation" developed by Rigolon et al. (2019). These authors use the three dimensions of environmental justice and overlay them with additional environments containing a policy environment, physical environment, perceived environment, social environment, and individual factors. They highlight some overlaps of these environments with the justice dimensions, while our contribution here is that we position older people as part of vulnerable population groups at the centre of an exemplified application of our conceptual understanding of socio-environmental justice. Mirroring Day (2010), we believe that considering age, particularly older age groups and their demands, enriches socio-environmental justice theories. We argue that all dimensions and their interlinkages should be considered in socio-environmental justice discussions and specific recommendations, which also complement those provided by Kabisch and Haase (2014), should be determined. In particular, the present study enhances the understanding of interactional justice as proposed by Low (Low, 2013). The empirical findings of this study show that social integration and connectedness decisively impact the use of urban green spaces when considering the vulnerable group of older people. Therefore, patterns of social integration should be considered as components of interactional justice in ageing cities. Previous studies have called for the consideration of older individuals' recreational and social needs, including the availability and accessibility of basic amenities such as seating and clean restrooms, in future green space design and management (see e.g. Gibson, 2018; Knight et al., 2018). This suggestion is also of major importance in terms of health and well-being. Payne et al. (2005) highlighted the need to consider local parks among urban green spaces – particularly those located in walking distance – as a part of a viable

strategy for health promotion activities (such as physical activity) and disease prevention in older age groups.

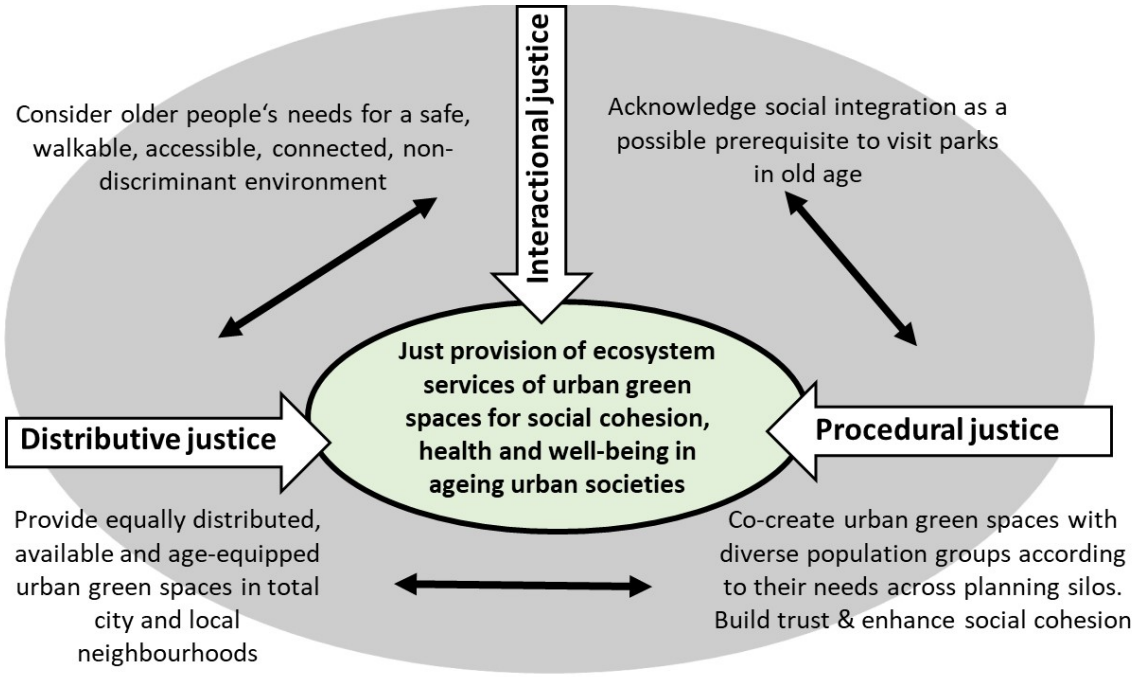

Figure 4. Contribution of the three dimensions of justice to an age-friendly and just urban society

4.5 Strengths and limitations

The survey provides insights into older people's park visitation patterns and encourages a holistic view of socio-environmental justice. While previous studies focus primarily on distributional justice at a macro- or total-city scale, the present study includes social network patterns such as neighbourhood relations that primarily occur on the micro scale. Thus, our study explored environmental justice in the case of older people. Older people have rarely been considered a vulnerable group (Day, 2010), despite their growing number and the severe constraints they might experience in the case of mobility loss.

Our study uses results from a questionnaire survey that was distributed in community centres and neighbourhood organizations in Berlin. Accordingly, very old and frail people, as well as people living in nursing homes, are certainly underrepresented. We may have also missed some important values and demands from older minority groups. Furthermore, snowball sampling in this survey does not allow statistical representativeness for all older people in Berlin but only for the 506 people surveyed. A further limitation is that we did not include questions on participatory justice in the survey.

5. Conclusion

We explored the patterns of older people's visitation of urban parks and green spaces in the city of Berlin. Older people who consider the provision of green spaces in their neighbourhood as sufficient and find them easily accessible have a greater likelihood of visiting them on a daily basis. Beyond the distributive dimension, our findings indicate that social inclusion is important for the use of parks.

Those who are in better health, who are married, who have friends living in the neighbourhood and who have a closer relationship to neighbours are more likely to visit parks frequently.

We proposed a framework of the three dimensions of socio-environmental justice in regard to ecosystem services provision, particularly the provision of recreational and social interaction opportunities. The integrated view of urban green spaces embedded in the social dimensions of a city extends our understanding of who truly benefits from urban green spaces such as parks and why. Social networks within the neighbourhood seem to play a major role here. Urban planning needs to consider both the physical and the social environment to be designed in a way that invites older people to visit them and to use them for recreational and social activities. In our framework, we provided specific advice on how this may be done effectively, including specific park infrastructure facilities, the integration of older people in planning processes and the establishment of community programmes.

Providing ecosystem services through the provision of urban green spaces in addition to enhancing social interaction underlines the umbrella view of a city as a socio-ecological system. This includes a mechanism for increasing social cohesion by enabling access to places for social interaction, which might be realized by offering incentives and community programmes to collaboratively undertake activities in urban green spaces. Here, the integration of the ecosystem services framework in urban planning may be an option that helps consider the important benefits that nature provides to people of different ages and cultures. To embrace all three dimensions of socio-environmental justice, planning units should make effort to work and think transdisciplinarily. Enriching the perspective of urban planners with the knowledge of community workers and health care sectors helps illustrate the needs of different groups of the population to create green, liveable cities for all – not just the older generation. In combination with the three dimensions of socio-environmental justice, a holistic approach to ecosystem and social services that looks at cities as socio-ecological systems may be most useful for planning just and sustainable cities.

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