Exploring emotions in relation to neighborhood environmental characteristics among older adults with low socioeconomic position: A qualitative study using walk-along interviews

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ABSTRACT

Cities are challenged to provide older adults with high-quality neighborhoods that foster their mental health. Older adults with low socioeconomic position (SEP) are at risk for poor mental health, but research in this group is scarce. The neighborhood may have an impact on older

adults' mental health through the elicitation of emotions. Qualitative on-site research can provide detailed and context-sensitive information on the experienced emotions. The aim of this walk-along study was to identify which emotions older adults with low SEP experience when they walk in their neighborhood and the physical and social neighborhood environmental characteristics that influence these emotions. Twenty-four older adults with low SEP were interviewed and content analysis was performed using NVivo 12 software. Participants experienced various positive emotions (e.g., calmness) in green and blue spaces, spaces with historical buildings, and open spaces. They experienced negative emotions (e.g., frustration) in spaces with heavy traffic and crime, paths with uneven surfaces, and areas with a lack of services, infrastructure and maintenance. The presence of public transport, renovations, graffiti, and cultural diversity evoked mixed emotions. Insights from this study could be used to develop specific hypotheses in quantitative studies and by urban planners and policy makers when (re-)designing neighborhoods.

1. Introduction

The rapid increase in the proportion of older adults (aged 65 years and older) is impacting human society (United Nations, 2018; World Health Organization, 2018). Worldwide, the proportion of older adults will increase from 10% to 16% between 2022 and 2050 (United Nations, 2022). Population ageing implies that in developed countries, a quarter of the residents in many cities will be older adults by 2050 (OECD, 2015; Salmistu & Kotval, 2023). This evolution challenges existing structures in cities, especially since ageing is associated with poorer health (Salmistu & Kotval, 2023; World Health Organization, 2018).

While the disability and mortality burdens of most diseases have decreased over the past three decades, the burden of common mental disorders (i.e., depression, anxiety and substance use

disorders) has increased (Rehm & Shield, 2019). The increase in the prevalence of mental health problems is a major policy concern globally with huge financial implications (Frankish, Boyce, & Horton, 2018; Wu et al., 2021). Worldwide, approximately 15% of older adults suffer from a mental disorder (World Health Organization, 2017b). According to the 2018 health survey, respectively 6% and 9% of Belgian older men and women suffer from a depressive disorder (Drieskens et al., 2018). Further, socioeconomic inequalities in mental health are a public health issue (Domènech-Abella et al., 2018; Kivimäki et al., 2020; Schmitz & Brandt, 2019; Wang, Feng, & Pearce, 2022). Socioeconomic position (SEP) can be measured at the individual level (e.g., educational level) and neighborhood level (e.g., living in a low income neighborhood). Both types of measures have been linked to mental health outcomes (Barnett et al., 2018; Drieskens et al., 2018; World Health Organization, 2013). For example, among Belgian older adults, the prevalence of depressive disorders and major depression is 5% and 2% respectively in the highest educated individuals compared to 15% and 8% in the lowest educated (Drieskens et al., 2018). In addition, living in low-income neighborhoods is related to depression, anxiety, stress, and lower subjective well-being (Barnett et al., 2018; Martínez, 2021; Martínez, Estrada, & Prada, 2019; Van Cauwenberg et al., 2022; Wen, Hawkley, & Cacioppo, 2006). Efforts to enhance mental health in older adults, especially older adults with low SEP, are justified and necessary (World Health Organization, 2017b).

Enhancing mental health requires a comprehensive understanding of influencing factors that encompass both individual (e.g., physical health), as well as environmental characteristics (World Health Organization, 2013). There is a growing understanding that cities can have a broad impact on health through the way they are planned and designed (Martínez, 2021). This is especially relevant for older adults given that they tend to spend a substantial amount of time within their neighborhoods (Buffel et al., 2012). The mental health outcomes of older

adults with low SEP can be particularly influenced by their neighborhood environment because limited transportation options in low SEP neighborhoods (and not having access to a car) make them more dependent on neighborhood resources such as shops (Giles-Corti et al., 2016).

Neighborhood environments may influence emotions which could influence long term mental health outcomes through repeated experience of these emotions (Lachowycz & Jones, 2013; Lorenc et al., 2012). For example, experiencing negative emotions (e.g., anxiety) has been linked to higher risk of depression (Gilbert, 2015; Gross & Jazaieri, 2014). Meanwhile, experiencing positive emotions (e.g. joy) has been associated with well-being (Fredrickson, 2000). Moreover, neighborhood environments may influence emotions (e.g., fear of falling) which could influence long term mental health outcomes through behavioral responses to these emotions (e.g., reduced levels of outdoor mobility) (Plaut et al., 2021; Rico & Curcio, 2022).

A qualitative approach with walk-along interviews is a promising method to investigate how neighborhood environmental characteristics influence mental health through the elicitation of emotions. During walk-along interviews, researchers walk with individual participants on outings in their neighborhood (Carpiano, 2009). By asking questions, listening and observing, researchers can actively explore participants' streams of emotions as they move through, and interact with, their physical and social environment (Kusenbach, 2018). A few previous studies have used walk-along interviews to examine the link between environmental characteristics and mental health outcomes among older adults (Juvani, Isola, & Kyngäs, 2005; Veitch et al., 2020). One such study has previously been conducted in Belgium, but they did not exclusively focus on older adults (Lauwers et al., 2021). These studies did yield in-depth information and new insights about the physical and social neighborhood characteristics influencing older adults' mental health. However, they did not focus

specifically on older adults with low SEP, who are at increased risk for mental health issues and frequently live in disadvantaged neighborhoods (Domènech-Abella et al., 2018; Robinette, Charles, & Gruenewald, 2017; Ross & Mirowsky, 2001; Schmitz & Brandt, 2019).

There is a scarcity of qualitative on-site research which offers the advantage of providing more in-depth insights, which can be valuable for informing understudied topics (Padeiro et al., 2022). Further, many of the studies described above did not include physical as well as social environmental characteristics, which is important as the physical and social cluster of age-friendly cities are highly interwoven (Guite, Clark, & Ackrill, 2006; Lauwers et al., 2020; World Health Organization, 2017a). Previous studies on the association between environmental characteristics and mental health have also mainly focused on broad concepts such as well-being rather than specific emotions which may influence long term mental health outcomes (Lachowycz & Jones, 2013; Lorenc et al., 2012). To conclude, more qualitative research about the link between the physical and social neighborhood environment and emotions among older adults with low SEP is warranted.

The aim of this qualitative study was to identify the emotions experienced by older adults with low SEP while walking through their neighborhood. Additionally, we aimed to explore how these emotions were influenced by physical and social neighborhood environmental characteristics.

We first present a literature review on initiatives aimed at creating age-friendly cities. Additionally, we provide a review of studies that examine the relationships between urban physical and social neighborhood environmental characteristics and mental health outcomes.

2. Literature review

As a result of population ageing and urbanization, there is growing interest in initiatives aimed at creating age-friendly cities. Multilateral organizations acknowledge the important role of city design and planning in older adults' health and various frameworks for age-friendly cities have been used in the literature (Buffel, Phillipson, & Scharf, 2012; Novek & Menec, 2014; Salmistu & Kotval, 2023). In the "Healthy Cities" initiative of the United Nations, cities are mentioned as important actors to resolve inequalities in health (World Health Organization, 2016). Additionally, member states of the United Nations adopted the Sustainable Development Goals (SDG's), with the aim to foster inclusive and sustainable cities. The WHO age-friendly cities concept proposes eight domains to recognize and tackle obstacles to the well-being and participation of older adults. In the WHO European region, the eight age-friendly cities domains were adapted to the Europe-specific context and categorized into three clusters: the physical environment (outdoor environments, transport and mobility, and housing), social environment (social participation, social inclusion and non-discrimination, and civic engagement and employment), and municipal services (community and health services, and communication and information) (World Health Organization, 2017a; Salmistu & Kotval, 2023).

Changes to the neighborhood environment have the potential to impact older adults' mental health. These changes do not require older adults to use personal resources (such as time or money) and are called "low-agency interventions" (Adams et al., 2016). Implementing low-agency interventions to establish age-friendly neighborhoods, aligns with one of the goals set by the WHO: enhancing the health of older adults, particularly those who are most vulnerable (World Health Organization, 2017a).

Research has already shown that the physical environment may impact mental health. Noise exposure, air pollution, poor maintenance, and traffic have been associated with poor mental health (Guite, Clark, & Ackrill, 2006; Lauwers et al., 2021; Ouis, 2001; Pelgrims et al., 2021).

Availability of green and blue spaces, benches to sit, proximity of neighborhood services, and cleanliness may benefit mental health (Cottagiri et al., 2022; Gascon et al., 2017; Juvani, Isola, & Kyngäs, 2005; Lauwers et al., 2021; McDougall et al., 2021; Ottoni et al., 2016; Pun, Manjourides, & Suh, 2018; Sugiyama et al., 2008; Yue, Yang, & Van Dyck, 2022). The positive impact of green and blue spaces on mental health can be explained by the Stress Recovery Theory (SRT) and the Attention Restoration Theory (ART). According to the SRT, nature is the natural habitat of humans, and, therefore, contact with nature reduces stress. ART states that nature has restorative properties, such as 'being away' (i.e., being mentally away from routine) (Kaplan & Kaplan, 1989). A recent nationwide study in Belgium found that mood disorder medication sales in urban settings was lower in environments with higher levels of green space coverage (e.g., woodland, gardens) (Aerts et al., 2022).

Social environmental characteristics, such as neighborhood ties, neighborhood safety, and familiarity with the neighborhood, are also believed to influence mental health (Juvani, Isola, & Kyngäs, 2005; Lauwers et al., 2021; Miao, Wu, & Zeng, 2022; Van Cauwenberg et al., 2022). Perceived unsafety from crime can negatively impact mental health (Barnett et al., 2018; Lorenc et al., 2012). A previous longitudinal study in older adults in Belgium found higher baseline levels of perceived safety from crime to be related to higher levels of mental health-related quality of life at baseline and three years later (Van Cauwenberg et al., 2022).

Targeting environmental characteristics may be important to optimize older adults' mental health. However, there are relatively few studies investigating the association between environmental characteristics and mental health that have focused specifically on older adults, resulting in limited recommendations for targeted strategies for this age group. Moreover, despite the fact that older adults with low SEP are at higher risk of mental health problems and may be more susceptible to environmental characteristics, they are an understudied group. Furthermore, few studies have been conducted in Europe. Research in Europe is needed

because neighborhood environments and cultures differ across the globe, and the key factors that contribute to the mental well-being of older adults need to be adapted to what is most relevant in the local context. However, combining the results of all these separate studies will help to develop more global recommendations in the future and to learn which key factors can be transferred from one context/country to another (Jagroep et al., 2023; World Health Organization, 2015). Importantly, most previous studies did not take place within participants' own neighborhoods which can have a substantial impact on their mental health, and familiarity with the neighborhood could impact older adults' emotions (Bornioli, Parkhurst, & Morgan, 2018).

3. Methods

3.1. Participant recruitment

Participants aged 65 years or older were recruited by purposeful convenience sampling in five neighborhoods in the city of Ghent, Belgium. The five poorest neighborhoods (i.e., the lowest median incomes) were selected: Muide-Meulestede-Afrikalaan, Rabot-Blaisantvest, Nieuw Gent-UZ, Bloemekenswijk and Sluizeken-Tolhuis-Ham (Statbel, 2019). The neighborhoods are situated between two and six kilometers from the city center, and 50 to 70 percent of the population are of non-Belgian origin, which is a high percentage compared to the average in Ghent. In each neighborhood, multiple local organizations, such as local service centers and social restaurants (social restaurants serve a fresh meal daily at a reduced rate), who interact with older adults with low SEP were contacted. Suitable methods of recruitment were discussed with the individual organizations. Posters and folders with information about the study were provided. Older adults could contact the researchers directly via the information

provided on the posters and folders or through the organizations' contacts. Moreover, researchers participated in activities offered by these organizations to help build trust and provide an opportunity for potential participants to talk to the researchers (e.g., if they wanted additional information). Furthermore, researchers regularly visited the various organizations to recruit older adults. Inclusion criteria were: aged 65 years or older, living in one of the selected neighborhoods in Ghent, be able to move around independently for at least 20 minutes in their neighborhood on foot or with aid (e.g., walker, crutches, wheelchair, mobility scooter), speak Dutch, English or French, and have a low individual level SEP based on education. Older adults who did not live in one of the five poorest neighborhoods or had a college or university degree were excluded. When inclusion criteria were met, an appointment was scheduled for a visit at home for data collection. Data collection was performed by two trained researchers from March until July 2022. It involved an interview-administered questionnaire followed by a walk-along interview. In total, both interviews took approximately 90 minutes to complete. Participants were recruited until data saturation was achieved. The study was approved by the ethical committee from the University Hospital of Ghent (January 28, 2022, reference number BC-11224). All participants gave informed consent in written form at the start of the study.

3.2. Interview-based questionnaire

The interview-based questionnaire assessed demographics, self-rated physical, mental and social health, physical activity levels, use of public open spaces (e.g., streets, parks, and squares) and current emotional states.

3.2.1. Demographics

Demographic items included age (in years), social housing (yes or no), years lived in the neighborhood, country of birth, marital status (married, widowed, divorced, living alone or never been married, living together), educational level (no diploma or certificate, primary education, vocational lower secondary, technical lower secondary, general lower secondary, vocational higher secondary, technical higher secondary, general higher secondary), living situation (living alone, living together with spouse or partner, living together with spouse or partner and children, living together with acquaintances or friends, living in a residential care center or assisted living, other), and (former) main occupation (the profession they performed for the longest period).

3.2.2. Self-rated physical, mental and social health

Participants were asked to rate their (1) physical, (2) mental and (3) social health using five response options (very good/good/moderate/bad/very bad). Responses were dichotomized into two categories: (1) very bad or bad (coded poor) and (2) moderate, good or very good (coded good).

3.2.3. Physical activity levels and use of public open spaces

The International Physical Activity Questionnaire (IPAQ; www.ipaq.ki.se), adapted for use in older adults, was used to assess walking levels over the last seven days (Van Holle et al., 2014). Participants were asked on how many days they walked for transport or recreation (two separate questions). The average duration of walking on these days was also assessed. Frequency and average duration were multiplied to obtain weekly minutes of walking for transportation and recreation.

Participants were also asked on how many days they had visited a park, square or other public open space during the past month.

3.2.4. Current emotional states

Current emotional states were measured by eight items assessing to what extent the participant had felt sad, worried, enthusiastic, stressed, attentive, happy, scared and calm during the past week, using a 5-point rating scale. Response options were: very slightly or not at all, a little, moderately, quite a bit, and extremely. One of the main reasons for questioning emotions was to get the participants to start talking about their emotions so that they would be more comfortable talking about their emotions during the walk-along interview. Two categories were created: (1) very slightly or not at all and a little and (2) moderately, quite a bit, and extremely. These questions were based on the Positive and Negative Affect Scale (PANAS-scale) (Watson, Clark, & Tellegen, 1988).

3.3. Walk-along interviews

Walk-along interviews involved a walk from the participants home to a nearby public open space, in the public open space, and back home (public open spaces were chosen by the researcher to obtain as much variety as possible in public open spaces). In one half of the interviews the participant chose the route from his/her house to the nearby public open space. The participant and researcher walked back to the house of the participant through a different route chosen by the researcher. In the other half of the interviews the researcher chose the route to the public open space and the participant chose the route back to his/her house. This strategy was applied to observe a range of physical and social neighborhood environmental characteristics with different amenities and qualities along the routes, however we did not

count the exact number of public open spaces that were visited. An interview guide was developed specifically for this study (see Table 1). The guide contained main and sub-questions about the experienced emotions and how these were influenced by physical and social neighborhood environmental characteristics. Before the walk-along interview started, participants were asked to provide some examples of emotions they usually experience while walking in their neighborhood. The researcher also gave some examples of possible emotions that could be influenced by neighborhood environmental characteristics (e.g., joy, relaxation, sadness). Participants were informed that the interviews would be audio recorded and the routes would be filmed with a GoPro Hero9-camera worn by the researcher in order to link the emotions to neighborhood environmental characteristics. The participant and researcher walked side by side during the interview at the participants' pace (average duration=43 minutes).

Table 1

Interview guide

Main questions
What do you experience at this place?
What / how do you feel right now?
What influences your feeling? / You say it is (e.g., very clean) here, can you tell me how this affects you when you walk here?
Are there things in the environment that influence your feeling?
Can you explain a little more about the feeling you are experiencing?
How strong is this feeling?
You say it is very (e.g., busy) here and in the other public space you said it was very (e.g., calm). Do you experience a different feeling here?
Sub-questions
Do you always experience this feeling in this place?
Do you also walk here in the evening or when it is dark? If this is not the case, why is this?
Do you also experience this feeling in other places?
Do you still experience this feeling?
Does this feeling have an effect on whether or not to visit this place?
Does this feeling have an effect on what you do in this place?
How could this public open space be improved so that you feel better when you walk here?
Do you also experience this feeling when you walk here with other people?
Do you experience any other feelings?
Are there other things in the environment that influence your feeling?
What are your reasons for visiting this place?
Do you feel you are answering differently because this is an interview?
Are there any other places nearby that we didn't walk to that make you feel good or bad? If this is the case, how come you feel this way in that place?

3.4. Data analysis

Data from the interview-based questionnaires were analyzed using IMB SPSS version 28.0 and descriptive statistics were calculated. The walk-along audio recordings were transcribed verbatim, pseudonymized and entered into NVivo 12 for analysis. Qualitative content analysis, a technique in which categories present in textual data are identified by following a systematic coding process, was performed. The unit of analysis was utterance, which could be a part of a sentence, a sentence, or a paragraph. All transcripts were read several times to achieve immersion. The data were reduced by coding the utterances, and then categorized by

combining codes that belonged together. Initial categories were determined based on the following key concepts: emotions, physical and social environmental factors, and type of public open space. Different subcategories were created under these categories based on the content of the data (Hsieh & Shannon, 2005). During analysis, (sub-)categories were adapted due to new content and the category 'influence on behavior' was added. The analysis was done in an inductive manner and not based on an existing framework (e.g., the WHO age-friendly city concept). Two researchers coded independently (JVC and NJ) to enhance the reliability of the analysis. When a factor was mentioned by less than 25%, between 25% and 50%, between 50% and 75%, and more than 75% of participants, it was stated in the results as being reported by "few", "some", "many" and "almost all" participants respectively.

In October 2022, we invited three participants to take part in a member check to assess the validity of the findings (Koelsch, 2013). The qualitative themes were presented and participants were asked if the researcher had accurately reflected their experiences. A number of items were added based on this. For example, in the infrastructure section, besides footpaths and bicycle paths that were not well separated from each other, a lack of traffic signs that caused dangerous situations was added.

4. Results

4.1. Sample characteristics

The sample included 24 older adults (13 female), ranging in age from 66 to 89 years and the mean age was 77 years (see Table 2). Three quarters of the participants lived alone, 67% lived in social housing and 42% had a private garden. More than half of the participants had no diploma (8%) or a diploma of primary education (46%). Regarding current emotional states,

311 46%, 67% and 58% of participants reported to have felt at least moderately sad, worried and
312 nervous in the past week, respectively.

Table 2

Sample characteristics (n = 24)

Socio-demographics	
Sex (% female)	54.0
Age in years (M ± SD)	76.8 ± 7.0
Living alone (%)	75.0
Social housing (%)	66.7
Private garden (%)	41.7
Educational level (%)	
No diploma	8.3
Primary education	45.8
Lower secondary education	29.2
Higher secondary education	16.7
Health (% very bad or bad)	
Poor physical health	12.5
Poor mental health	8.3
Poor social health	12.5
Physical activity (Med, Q1 – Q3, min/week)	
Walking for transportation	77.5, 15.0 – 232.5
Walking for recreation	0.0, 0.0 –135.0
Use of public open spaces (M ± SD, days/month)	
Park	2.2 ± 1.9
Square	2.5 ± 1.8
Other POS	1.6 ± 1.2
Current emotional states (% moderately, quite a bit or extremely)	
Sad	45.8
Worried	66.7
Enthusiastic	58.3
Nervous	58.3
Attentive	70.8
Happy	62.5
Scared	8.3
Calm	87.5

M = mean, SD = standard deviation, Med = median, Q1 = quartile 1, Q3 = quartile 3.

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314 ## 4.2. Emotions experienced during the walk-along interviews

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316 Participants experienced a variety of emotions while walking in their neighborhood. Almost

317 all participants discussed the emotions ‘relaxation’ or ‘calmness’. Other emotions that

participants experienced frequently were regret, annoyance or frustration, fear, happiness and sadness. It was not always easy for participants to explain exactly which emotion they experienced. They often described their emotions as 'I feel positive here' or 'I feel negative here'. We coded this as positive and negative emotions. The results are summarized in Figure 1. Characteristics linked to positive emotions are shown with a plus sign, and characteristics linked to negative emotions with a minus sign. Some characteristics evoked positive or negative emotions, depending on the participant, and are shown in the figure with a plus-minus sign.

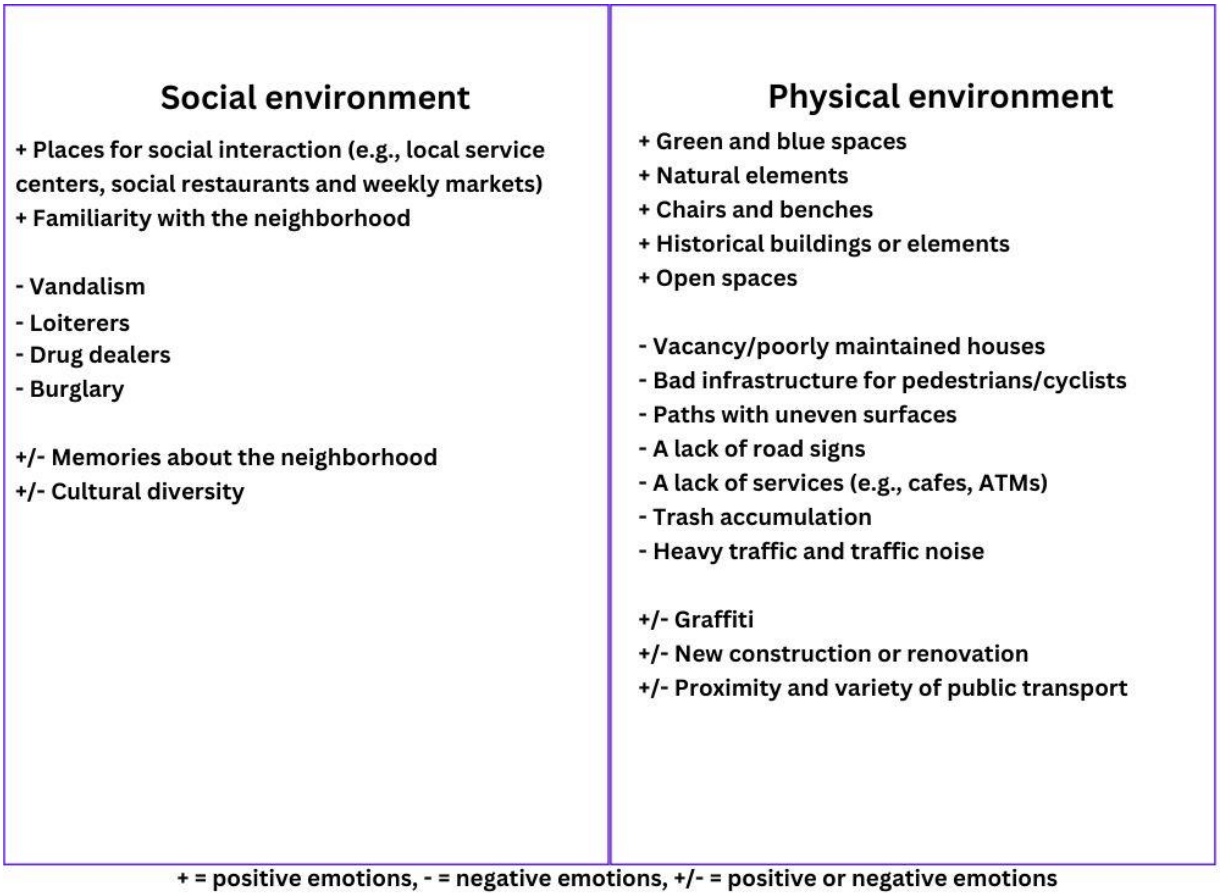

Figure 1: Social and physical neighborhood environmental characteristics discussed by participants to positively or negatively influence their emotions.

4.3. Physical neighborhood environmental characteristics influencing emotions

4.3.1. Green and blue spaces

The presence of green spaces (e.g., parks), blue spaces (e.g., areas along canals) and natural elements (e.g., plants in front yards) were perceived as positive by almost all participants. They felt relaxed, calm and happy in these places and enjoyed looking at the flowers, listening to the birds, walking in nature and sitting on a bench. Some participants mentioned that green spaces helped them to take their mind off things.

Man, 78 years: *"I feel satisfied and happy here. You hear the birds chirping, the weather is good."*

The importance of green and blue spaces to be physically active was mentioned by some participants. Being physically active was linked to positive emotions such as relaxing. The presence of chairs or benches in parks led to positive emotions and enhanced their park experiences because they were able to take a break during a walk, talk to people, and enjoy the view which encouraged them to stay longer in the park and experience positive emotions related to green spaces (Figure 2).

Woman, 66 years: *"You come across many green spaces. […] People are busy enough already and there you can take a breather, relax. […] Yes, it is relaxing, if you have beautiful places to walk".*

Figure 2: Chairs led to positive emotions and enhanced park experiences (Own work).

4.3.2. Neighborhood services

Many participants said that there was a lack of services in their neighborhood such as cafes, shops, ATMs, banks and parking spaces which evoked negative emotions including annoyance, sadness, and loneliness.

Woman, 71 years: *"What do we have left… yes, a butcher and two bakeries. For example a clothing store, a fish shop, we don't have all that anymore. Compared to the old days… yes a grocery store on the street corner and the supermarket. We still have that. But otherwise, not much more, compared to the past. Yes, I think that's a pity."*

Some participants felt positive about the proximity and variety of public transport options in their neighborhood. Few participants felt negative about the lack of public transport (e.g., buses, trams).

4.3.3. Neighborhood infrastructure

A few participants mentioned a lack of good infrastructure for pedestrians and cyclists. This included footpaths and bicycle paths that were not well separated from each other and a lack of road signs, which created dangerous situations. This evoked feelings of annoyance, frustration and insecurity. The presence of walking paths with uneven surfaces meant that participants had to pay more attention while walking to avoid falling and injuries and, as a result, their enjoyment was reduced. The accumulation of trash in public open spaces evoked negative emotions such as annoyance, frustration and regret of poor maintenance and upkeep. The lack of benches in public open spaces was linked to negative emotions such as disappointment because they were not able to take a break during a walk or enjoy the view.

Figure 3: Trash was related to negative emotions such as annoyance, frustration, and regret (Own work).

4.3.4. Traffic

Many participants experienced negative emotions such as stress and frustration due to heavy traffic. Some participants mentioned they had to be more attentive and felt insecure in some streets due to traffic and they avoided busy streets with heavy traffic. In addition, traffic noise caused annoyance and stress, making it hard to relax. The absence of traffic noise was linked to feeling relaxed and participants appreciated the calmness in quiet streets with little traffic.

Woman, 68 years: *"Here you see trees, here you see some nature. On the street you see houses, hear noise, cars that are annoying. No, there is nothing pleasant about that."*

Some participants were annoyed by the violation of traffic rules by others, including speeding, ignoring stop signs or electric scooters that drive on footpaths.

Man, 81 years: *"Here I still feel reasonable. But during the weekend, they race here with their cars. And that annoys me. This is a parking. People live here. This is not a race circuit."*

Figure 4: Heavy traffic was related to negative emotions such as stress and frustration (Own work).

4.3.5. New construction or renovations

Most participants experienced positive emotions related to new constructions or renovations in their neighborhood. The reconstruction of roads and bridges to promote traffic flow and sidewalk renovations to eliminate unevenness was experienced as positive.

On the other hand, some participants experienced negative emotions such as annoyance, frustration and sadness related to new construction or renovations mostly due to the slow progress of the work and the construction waste. The disappearance of greenery and open spaces to make way for new construction was often perceived negatively by participants.

Man, 77 years: *"It is a pity, on the one hand, in fact, I think it is a pity. Our green corner. This used to be a square. For those people who live here, they could have a view all the way*

to the water. And that is all gone with the new construction. Yes, that is a pity. Another piece of greenery we lost."

4.3.6. Neighborhood design and maintenance

Historical buildings and lots of open spaces were perceived as positive aspects of neighborhood design. These were linked to emotions such as relaxation and seemed to contribute positively to mental well-being.

Man, 77 years: *"I enjoy the breeze along the water even more. That does good, an open view, yes, that does good. […] The open view also gives a calm impression."*

A source of negative emotions, such as annoyance, was the presence of vacant or poorly maintained houses.

Man, 81 years: *"Many apartments are empty. It takes so long… it takes three to four years for them to renovate these apartments and let other people live in them. That annoys me a bit."*

Few participants did not like the graffiti in their neighborhood. They saw it as a form of vandalism or a failed attempt to brighten up their neighborhood. In contrary, graffiti was perceived as positive by few participants who enjoyed watching the beautiful art, especially the bright colors.

Woman, 72 years: *"Yes, I like it. The graffiti in Nieuw Gent, I think it is amazing. Some people say oh no all those bright colors and I say nice, a bit of color in the neighborhood. […] I think it is an added value. A little more color."*

4.4. Social neighborhood environmental characteristics influencing emotions

4.4.1. Neighborhood security

Participants mentioned security problems with loiterers, drug dealers, vandalism and burglary. This evoked negative emotions such as being scared or angry which negatively affected their mental well-being. Due to these security problems some participants avoided passing by some places or were scared to go out during the evening or night.

Man, 81 years: *"It used to be cozy here, we all sat outside here. We sat here for a while, the people who lived on the first floor brought a table and chairs downstairs and we sat here playing cards. Or someone was knitting here. It used to be cozy here. Now, no one dares to go outside anymore. Because it's here… because those dealers are all around here."*

A few participants even avoided going to the parks in their neighborhood because loiterers caused feelings of lack of safety.

Woman, 71 years: *"I would not come here. No. It may be even during the day, no. My daughters totally forbade me. Just because it is daytime, that does not mean that nothing can happen. […] yes, I am scared of that. […] It is a pity that they hang out here, those loiterers."*

4.4.2. Cultural diversity

Few participants experienced positive emotions related to cultural diversity in their neighborhood. They appreciated contact with neighbors from different cultural backgrounds and the diversity in the neighborhood.

Woman, 87 years: *"Because I know the neighborhood, because I know where you can go and where not, but you can still go anywhere here. Although the culture has changed a lot, lots of*

foreigners. But no problem because I have to say, honestly, if I am walking and they are sitting in their doorway, everyone says hello and I say hello."

Conversely, some participants experienced negative emotions such as annoyance and fear related to cultural diversity and experienced difficulties coping with different cultures. For example, they indicated that people with a migration background made a lot of noise, which annoys them. There was intolerance and a lack of trust towards other cultures resulting in participants' avoidance of certain public open spaces.

Woman, 71 years: *"There are a lot of foreigners here. That is, well, not positive either. […] But sometimes I am afraid, when I see foreigners, I am sorry to say, but I don't trust them."*

4.4.3. Memories and familiarity with the neighborhood

Many participants talked about positive memories while walking in their neighborhood. They felt attached to specific places such as the school where they went to during childhood, the house they grew up in, or their former workspace. During the walk, participants paused to look at those specific places and talked about their memories which evoked positive emotions such as happiness and relaxation.

Woman, 71 years: *"But the memory, where I used to live with my parents, the same street I used to live with my kids, that brings back all the memories, that's positive."*

On the other hand, some memories evoked negative emotions such as sadness and loneliness, often due to changes in their neighborhood. They mentioned, for example, the loss of social contact due to the death or moving of friends, fewer organized activities and more drug dealers compared to the past.

Familiarity with the neighborhood provided some participants with positive feelings including happiness because they were close to their home and they enjoyed living in the neighborhood and talking to local residents passing by on the street.

4.4.4. Social interactions

Participants mentioned several physical neighborhood factors that were important to create opportunities to interact with others. Weekly markets, social restaurants and local service centers were some examples of places participants liked to visit to meet with others. One participant mentioned that she started participating in different activities after the passing of her husband and that this had a positive effect on her mental wellbeing. These activities were considered a pleasant daytime activity. The restart of activities after the Covid pandemic was considered important to combat negative emotions such as loneliness.

Man, 80 years: *"Yes, of course it is nice to come here. Then you can do something like, for example, play billiards in my case. There is regularly something to do here in the local service center. I also come here to eat or dance sometimes, you name it."*

5. Discussion

We explored how neighborhood environmental characteristics may affect emotions of older adults with low SEP. While walking through their neighborhood, participants experienced a variety of emotions, including: relaxation or calmness, stress, regret, fear, annoyance or frustration, anxiety, happiness, and sadness. Our data analysis was performed in an inductive manner, which resulted in the division of environmental characteristics into two out of a total of three clusters of the WHO age-friendly cities concept, namely the physical and social environment (World Health Organization, 2017a). Some environmental characteristics (e.g., local service centers) that would fit into the third cluster of the age-friendly cities concept

(i.e., municipal services) were also mentioned by our participants, however, we chose to classify these characteristics under the physical or social environment depending on their meaning for our participants (e.g., local service centers as important places for social interactions were classified under 'social environment'). Thus, although our analysis was inductive, findings were consistent with the WHO age-friendly cities concept.

The inclusion of older adults with low SEP in research is important because they are more likely to spend time in their neighborhood and to experience a strong impact of the neighborhood environment on their mental health, but their views are rarely heard in decisions regarding their neighborhood (Buffel, Phillipson, & Scharf, 2012). This study extends previous research because it is the first study to explore how neighborhood environmental characteristics may affect emotions in older adults with low SEP in a Belgian context. Insights into how environmental characteristics influence emotions is important as emotions may influence long term mental health outcomes (Lachowycz & Jones, 2013; Lorenc et al., 2012; Plaut et al., 2021; Rico & Curcio, 2022). Novel insights from this Belgian study could be combined with research findings from other countries to maximize impact across countries and inform policy and practice globally.

Participants in this study talked about the direct and indirect (e.g., through outdoor mobility) influences of green and blue spaces on emotions. While walking through green and blue spaces, feeling relaxed or calm was mentioned frequently. Moreover, participants of the present study mentioned that being in or near green and blue spaces (e.g., parks, channels) helped to take their mind off things. They also felt relaxed, calm and happy in green spaces while listening to bird sounds. These benefits for mental health are described in the Stress Recovery Theory and Attention Restoration Theory (Kaplan & Kaplan, 1989). Also, participants mentioned the importance of parks as a setting to be physically active and the positive effect of outdoor mobility on relaxation (indirect influence). In a recent nationwide

study in Scotland, neighborhoods with higher blue space coverage had lower antidepressant medication prevalence among older adults (McDougall et al., 2021). Previous studies from Canada, China, and the United States also showed that availability of green spaces was associated with better mental health outcomes among older adults (Cottagiri et al., 2022; Pun, Manjourides, & Suh, 2018; Wang, Feng, & Pearce, 2022; Yue, Yang, & Van Dyck, 2022). In the present study, removal of green and open spaces to make way for new construction (e.g., buildings) was often perceived negatively which highlights the importance of preserving green and blue spaces in urban environments. This may be particularly important in disadvantaged neighborhoods, as older adults with lower SEP often have less access to health-related resources that can improve mental health, so local green and blue spaces may be of particular importance (Wang, Feng, & Pearce, 2022).

Besides green and blue spaces, participants also mentioned non-natural elements as restorative, such as historical buildings and familiar buildings. Literature confirms that restorative properties are not limited to green spaces (Bornioli, Parkhurst, & Morgan, 2018). Participants in this study also mentioned having fond memories of familiar buildings (e.g., parental house) resulting in the experience of positive emotions (e.g., happiness). Contrary, some memories evoked negative emotions (e.g., loneliness), often due to changes in the neighborhood (e.g., the moving of friends). This can be explained by the impact of the neighborhood on place attachment. Place attachment can be described as the emotional attachment people hold toward their environment and is linked to mental health (e.g., place attachment is associated with life satisfaction) (Lomas, Ayodeji, & Brown, 2021; Low & Altman, 1992). Place attachment is especially relevant for older adults due to accumulated memories from prolonged residence in the same neighborhood. Therefore, it is important to involve older adults in decision making about their neighborhood. Creating opportunities for

older adults with low SEP to play an active role may promote place attachment (Buffel et al., 2014; Phillipson, 2007).

The presence of paths with uneven surfaces caused negative emotions and in some cases this even resulted in participants avoiding certain outdoor environments (e.g., parks) because of a fear of falling. The results of this study are consistent with a study that investigated the role of environmental characteristics on US older adults' outdoor mobility. They found that feelings of a lack of safety due to paths with uneven surfaces resulted in less outdoor mobility in spaces that they would otherwise enjoy (Mahmood et al., 2012). Participants in the present study also experienced feelings of anxiety or fear of crime due to a lack of social safety (e.g., drug dealers), resulting in the avoidance of certain outdoor environments. In an exploratory study with older adults in Singapore, a sense of safety was a key characteristic that participants used to describe an age-friendly neighborhood (Bhuyan et al., 2020).

Participants in our study mentioned that distance to services evoked negative emotions such as annoyance which resulted in less outdoor mobility. Easy access to neighborhood services can promote outdoor mobility among older adults; being able to walk to these services provides an opportunity to be active and to use the neighborhood environment on a regular basis (Yen et al., 2014). Understanding how the neighborhood environment impacts outdoor mobility is important because outdoor mobility can support mental well-being (e.g., moving from one's home to other locations to maintain social ties) (Prohaska et al., 2011; Van Cauwenberg et al., 2012; Yen et al., 2014). In line with previous research from the Netherlands (Jagroep et al., 2023), our study shows that neighborhood services and activities were considered important to create opportunities for social interaction and combat loneliness. A lack of services (e.g., shops, ATMs) evoked negative emotions such as loneliness. Participants regularly compared the current situation with the past and commented that services are becoming scarcer. Services can support mental well-being by enhancing a sense

of belonging to a community and social aspects related to being involved in neighborhood activities, such as meeting friends for a coffee or talking to the shopkeeper (Mahmood et al., 2012).

A strength of the current study is its focus on older adults with low individual SEP who were living in disadvantaged neighborhoods. None of the participants had obtained a higher education and 67% lived in social housing. This population group is generally understudied while they can benefit greatly from improvements to their neighborhoods which often are of poorer quality. Moreover, older adults living in social housing often live in apartments with limited resources and therefore need sufficient high quality public open spaces (Chudyk et al., 2017; White et al., 2015). Walk-along interviews allowed us to obtain context-specific and detailed information and created a more egalitarian relationship between researcher and participant compared to traditional interviews (Carpiano, 2009; Kusenbach, 2018). Furthermore, the study was conducted in five different neighborhoods and we walked along two different routes per participant. This provided diversity in both physical and social neighborhood environmental characteristics. Finally, the walk-along interviews were completed in the participants' own neighborhood and therefore the emotions they described during the walk-along interviews were the emotions they are likely to experience on a regular basis, which may impact their mental health.

This study has some limitations. Given the qualitative nature of the study, quantitative relationships between environmental factors and emotions could not be assessed. The results from this study could serve as a basis to develop specific hypotheses to be tested in quantitative studies. In the future, quantitative studies, for example using virtual reality, could be conducted to examine the effects of environmental changes on emotions (e.g., to test the effect of different levels of greenery in a street on older adults' feelings of relaxation). Furthermore, since the context differs between cities and countries, findings of this study are

not necessarily generalizable to other contexts. It would be interesting to investigate whether our results apply to other seasons, weather conditions, and regions. The relatively small sample size restricted our ability to examine differences between men and women. A previous study that used walk-along interviews to examine environmental factors influencing walking for transport among older adults (n=57), found that issues related to familiarity and safety from crime were more frequently and intensively discussed by women (Van Cauwenberg et al., 2012). Future research could compare the emotions and the environmental influences on these emotions between men and women or between people aged 65 to 74 years and people aged 75 years and older. In this study, we did not further investigate the mixed results around public transport, renovations or new construction, graffiti, and cultural diversity. Future research could unpack some of these mixed results by examining contextual factors that may influence the mixed emotions.

Based on our results, the following policy intervention targets to promote mental health of older adults with low SEP can be identified: ensuring availability of green and blue spaces, ensuring availability of neighborhood services, improving connectivity, reducing neighborhood problems (e.g., trash accumulation), and investing in improvements (e.g., clearly separated footpaths and bicycle paths, the provision of benches). In line with previous research from the Netherlands (Jagroep et al., 2023), our study highlighted the importance of the presence of benches. For example, our study revealed that benches in green spaces (a relatively minor modification) may help to evoke relaxation and happiness. Moreover, the provision of benches may promote outdoor mobility, physical activity, the enjoyment of nature, and social contact among neighbors, which in turn may have a positive impact on mental health. Ensuring access to high-quality green spaces is an effective way to design an age-friendly city; however, the specific needs of older adults when designing green spaces are critical as their preferences are different to those from children and adolescents (Veitch et al.,

2022). This study also revealed the importance of providing sufficient neighborhood services which may improve mental well-being, and support older adults to continue to live independently in their neighborhood, which could reduce pressure on health systems (e.g., if they can go easily to neighborhood services for daily meals and information, this can ensure that they can live independently for longer). Previous research from Europe highlighted the importance of the provision of neighborhood services for older adults (Foglia, Parisi, & Pontarollo, 2023). We recommend that the provision of local services should be maintained. Urban planners, designers, governmental institutions and organizations that are in close contact with older adults with low SEP (e.g., local service centers) could work collaboratively with older adults to optimally (re-)design neighborhoods (Van Cauwenberg et al., 2022). For example, by using a community-engaged participatory approach such as the 'Our Voice four-step method', which has been applied in numerous environmental studies (Pedersen et al., 2022). (Re-)designing a neighborhood can be time-consuming and expensive, however it is critical as neighborhood improvements can benefit all age groups (Foglia, Parisi, & Pontarollo, 2023).

In conclusion, addressing the increase in mental health problems and inequalities in mental health should be a key policy priority. To accomplish this, insights into neighborhood environmental characteristics that may impact mental health are important. This qualitative on-site study enabled us to collect detailed information about neighborhood environmental characteristics evoking negative or positive emotions among older adults with low SEP. To minimize the experience of negative emotions and maximize the experience of positive emotions, neighborhoods should provide green and blue spaces, spaces with historical buildings, open spaces, and a variety of services and infrastructure. In addition, heavy traffic, paths with uneven surfaces, trash accumulation and crime should be minimized. The presence of public transport, renovations or new construction, graffiti, and cultural diversity evoked a

range of positive or negative emotions that varied among participants. Insights from this study could be used as a basis to develop specific hypotheses in future quantitative studies and by policymakers to inform their assessment of current policies and to guide future interventions.

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Declaration of interest

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