

RESEARCH ARTICLE

How can urban environments support dementia risk reduction? A qualitative study

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Abstract

Objective: Interventions to reduce the risk of cognitive decline and dementia largely focus on individual-level strategies. To maximize risk reduction, it is also necessary to consider the environment. With the majority of older people living in cities, we explored how urban environments could support risk reduction.

Materials and Methods: In our qualitative study, we conducted semi-structured interviews with community members aged ≥ 65 years and stakeholders, all living in Leipzig, Germany. Interview guides were informed by the framework on modifiable risk factors for dementia of the Lancet Commission on Dementia Prevention, Intervention, and Care. Interviews were audio-recorded, verbatim-transcribed, and thematically analysed.

Results: Community members ($n = 10$) were $M = 73.7$ ($SD = 6.0$) years old and 50% were women. Stakeholders ($n = 10$) were aged 39–72 years, and 70% were women. Stakeholders' fields included architecture, cultural/arts education, environmental sciences, geriatrics, health policy, information and technology, philosophy, psychology, public health, and urban sociology. Across interviews with both older individuals and stakeholders, three main themes were identified: (i) social participation and inclusion (emphasizing social contacts, social housing, inter-generationality, neighbourhood assistance, information and orientation, digital and technological literacy, lifelong learning, co-creation/co-design), (ii) proximity and accessibility (emphasizing proximity and reachability, mobility, affordability, access to health care, access to cultural events, public toilets), (iii) local recreation and wellbeing (emphasizing safety in traffic, security, cleanliness and environmental protection, urban greenery, climate change and heat waves, outdoor physical activity).

Discussion: The design of urban environments holds large potential to create favourable conditions for community-dwelling individuals to practice lifestyles that promote brain health. Public policy should involve community members in co-creating such environments.

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KEYWORDS

city, dementia, environment, prevention, qualitative study, risk reduction, urban

Key points

- When asked about how urban environments could support dementia risk reduction, older community members and stakeholders referred to three main themes, namely: social participation and inclusion, proximity and accessibility, and local recreation and wellbeing
- Research findings highlight the need for policy makers to involve community members in co-creating urban environments that promote brain health

1 | INTRODUCTION

In 2050, more than one in five humans will be 60 years or older, more than double the number as of today.¹ Moreover, over two thirds of the global population will be living in cities.² These demographic developments imply grand challenges for healthcare systems and societies. Population ageing is driven by declining birth rates, but mainly by gains in life expectancy, which is currently seen in almost every country in the world. Directly related to population ageing is the dramatic rise in the number of people living with dementia.³ While currently over 50 million people are living with dementia, this number is expected to increase to more than 152 million by 2050.⁴ Dementia is already the main cause of disability and dependency among older individuals, and it comes with a high burden for everyone involved: patients, relatives, caregivers, and societies, with associated costs being equivalent to 1% of the gross world product per year.^{5,6} The aforementioned epidemiological situation around dementia is also the result of a lack of effective treatment, let alone cure.

The good news is that there is substantial room for improvement with regards to dementia risk reduction. A growing body of literature highlights the enormous potential for dementia prevention if certain modifiable risk factors were addressed. In fact, the Lancet Commission on Dementia Prevention, Intervention and Care estimated that 40% of all cases of dementia in high-income countries (HIC) and 50% in low- and middle-income countries (LMIC) could be prevented or at least delayed if the following 12 risk factors were eliminated: low education in early life, hearing loss, traumatic brain injury, hypertension, obesity, alcohol consumption above 21 units a week in midlife, diabetes mellitus, depression, physical inactivity, smoking, social isolation and exposure to air pollution in later life.⁷ The mounting evidence has led the World Health Organization (WHO) to issue guidelines on risk reduction for cognitive decline and dementia that recommend a set of healthy lifestyle behaviours in this regard.⁸

Increasingly, studies are focusing on translating the knowledge on risk factors into interventions aiming at preserving or improving cognitive function and thereby delaying or even preventing dementia.⁹ Whilst initially such studies usually focused on single risk factors, an increasing amount of randomized-controlled trials now investigate the effectiveness of complex lifestyle interventions,

that is simultaneously addressing multiple modifiable risk factors for cognitive decline and dementia in individuals at increased risk for dementia and/or in preclinical or prodromal dementia stages. The pioneer study, the Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER), was able to show a significant benefit of a multi-domain lifestyle intervention on cognitive function over 2 years.¹⁰ Other lifestyle-based trials from Europe, namely the French Multi-domain Alzheimer Preventive Trial and the Dutch Prevention of Dementia by Intensive Vascular Care trial have been less conclusive, but suggested benefits for cognitive function in specific subgroups of participants with increased risk for dementia.^{11–13} Within the World-Wide FINGERS initiative, there are currently lifestyle trials underway in over 40 countries.⁹

Lifestyle trials against cognitive decline and dementia are currently focused on bringing about behavioural changes in individuals. Thus, they operate on the micro level (the individual) or meso level (the individual's social network). Therefore, there may be limits to the effects on cognitive function that can be achieved as another level is disregarded, namely the macro level, that is the larger environment in which the individual lives. The contextual environment concerns socio-cultural, technological, ecological, political, and economic aspects, and it has been long established through the framework of the social ecological model of health that these play an important role in health promotion strategies.¹⁴ The social ecological perspective emphasizes the interaction between the individual, the community, the social, built and political environment in health outcomes.¹⁴ The social ecological approach argues for creating environments and policies that make it convenient, attractive and economical to make healthy choices.¹⁵ Creating and providing environmental conditions that promote lifestyles to optimise brain health in addition to individual interventions, that is taking a holistic approach, could increase the benefits for cognitive function and lead to larger and more sustainable effects. However, such a holistic perspective is fairly new in the evolving concept of brain health.¹⁶

Only in recent years, researchers started to investigate environmental impacts on dementia development, with air and noise pollution^{17–19} and the built and green environment^{20–22} being considered as potential factors. For example, Liu et al. identified over 26,000 incident dementia cases and the same number of controls

from health insurance claims in older Taiwanese citizens and linked it to environmental measures: odds for dementia were lower in environments with more playgrounds, sports venues and community centers.²² Wu et al. investigated environmental aspects and dementia risk in the HIC-cohort Cognitive Function and Ageing Study (CFAS II) from the UK as well as in the LMIC-cohort 10/66 study: living far from daily amenities was associated with higher odds for dementia in both studies, while living far from lifestyle and healthcare amenities was associated with increased odds of dementia only in the 10/66 study, and living far from public parks with lower odds of dementia in CFAS II.²³ Epidemiological findings have yet to be translated into risk reduction interventions. Taking a broader view, global initiatives encouraged by the WHO have led to a framework of age-friendly cities.^{24,25} Against this background, our specific aim was to explore how urban environments could enhance lifestyles that promote brain health and may in turn reduce the risk of cognitive decline and dementia (I) from the perspective of community-dwelling older individuals and (II) based on expert views of stakeholders from a range of diverse fields. The identification of themes could inform policy and public health interventions for dementia risk reduction in urban environments.

2 | MATERIALS AND METHODS

2.1 | Study design and approach

We conducted a cross-sectional qualitative study, which combined a bottom-up participatory and top-down stakeholder approach. The bottom-up approach involved older community-dwelling members as experts by own life experience. The top-down approach involved stakeholders from different fields relevant to ageing in an urban environment who were also advocates and/or participants in decision-making processes or local policies. All study participants underwent semi-structured interviews in order to collect data for reflexive thematic analysis based on a predominantly inductive, semantic, and realist approach.²⁶ In the inductive approach, themes are developed based on the content of the data. Semantic analysis refers to theme development reproducing the explicit content of the interviews. The realist approach focuses on reflecting the assumed reality as apparent from the collected data as described below.

2.2 | Ethics

The study was approved by the ethics committee of the Medical Faculty of the University of Leipzig, Germany (ethical vote ID 233/20-ek) and was conducted in accordance with the Declaration of Helsinki.²⁷ All participants were informed about the study aims and provided written informed consent. The results of the study are reported according to the Standards for Reporting Qualitative Research guidelines.²⁸

2.3 | Study setting and participants

The study was conducted in the setting and context of Leipzig, a city in Germany with about 600,000 inhabitants. Leipzig is among the 10 largest urban areas in Germany. The proportion of Leipzig's older population (i.e. age 65 years and older) is 31.2%, which is projected to increase to 38.0% by 2030.²⁹

Recruitment was based on purposeful sampling. Purposeful sampling is a selective sampling technique used in qualitative research to recruit study participants with in-depth insight on the topic under investigation.³⁰ For the recruitment of the community-dwelling group, we applied criterion-based sampling, that is we pre-defined criteria to recruit older individuals with lived experience of living in the city. For the stakeholder group, we applied a maximum variation sampling strategy to achieve a sample covering a diverse range of disciplines relevant to the topic under investigation. Inclusion criteria for community-dwelling members were being 65 years or older, having lived in Leipzig for at least five years, and not having a dementia diagnosis (as self-reported). Despite dementia risk reduction being important across the lifespan, we decided to focus on individuals at least 65 years of age as they can draw on the experiences from earlier life stages and are knowledgeable of the needs that become more relevant with increasing age. Potential participants were recruited through study brochures that were distributed in public spaces across all city districts. Participants were enrolled on a rolling basis, ensuring balance in key sociodemographic variables until a sample size of 10 was reached.

Potential participants for the stakeholder group were searched and identified through professional social networks (e.g. LinkedIn, XING) and then contacted. Inclusion criteria were having an occupational background in a field relevant to the research topic, and having worked in Leipzig for at least 5 years. Again, stakeholder group participants were enrolled on a rolling basis to ensure coverage of a diverse range of disciplines until a sample size of 10 was reached.

2.4 | Data collection

A semi-structured interview guide was developed based on evidence relating to 12 modifiable health and lifestyle factors for risk of cognitive decline and dementia as outlined in the framework of the Lancet commission on dementia prevention, intervention, and care.⁷ A preliminary version was pilot-tested ($n = 3$) and discussed between the authors and pilot participants. The guide started with an introductory part that comprised an open question about what study participants considered healthy ageing and what they knew about lifestyles for dementia risk reduction. Based on this initial exchange, interviewers would then supplement participants' knowledge by providing an overview of the 12 modifiable health and lifestyle risk factors for cognitive decline and dementia, if needed. This ensured a similar level of understanding and knowledge among all participants as a foundation for the subsequent main interview around the lead question "How can urban environments support dementia risk reduction?". The interview

guide included a range of open-ended follow-up questions with regards to the different dementia risk factors, and interviewers asked additional *ad hoc* questions when appropriate. In addition, a short standardized questionnaire was used to collect data on key sociodemographic characteristics (age, sex, education). Information on school and vocational education was assessed and classified into low, middle and high level of education according to the Comparative Analysis of Social Mobility in Industrial Nations classification of education.³¹ The interviews were conducted over the telephone between July and October 2020. The duration of the interviews was between 60 and 90 min. All interviews were audio-recorded. The two interviewers (Rosa Siemensmeyer, Felix Müller) had a background in social science and medicine, respectively. They were trained for interviewing by a senior social science researcher from the institute.

2.5 | Data analysis

Analysis was based on verbatim-transcribed data. Transcription, with all personal identifiers removed, was conducted by an external, commissioned transcription bureau. Transcripts were checked back against the audio recording by the interviewers to confirm reliability. Two researchers (Rosa Siemensmeyer, Felix Müller) independently first read and re-read all transcripts and then started to code the data utilizing the software package MAXQDA in order to identify common themes. Using MAXQDA, keywords were identified that represented recurring themes, and keyword searches helped to map relating paragraphs. In this way, a preliminary coding/theme framework was iteratively developed, and subsequently applied to every transcript. The process was continuously discussed between Rosa Siemensmeyer, Felix Müller, and Susanne Röhr to consider emerging themes, recognize recurring patterns, to subsequently map and condense themes, and, eventually, to reach a consensus on the themes after all transcripts were thoroughly analysed. Saturation was defined as inductive thematic saturation, that is the point in the analysis process at which no new codes/themes would emerge and redundancy was present.³² The reflexive and iterative process, as described in Tobin and Begley,³³ was rigorously implemented during the data analysis.

3 | RESULTS

3.1 | Study participants

The community-dwelling group comprised $n = 10$ older individuals living in Leipzig. They were $M = 73.7$ ($SD = 6.0$, range = 66–85) years old, 50% were women, and the educational level was middle for 40% and high for 60%. The stakeholder group included $n = 10$ experts in the age range of 39–73 years, 70% were women and all had a high level of education. Experts' fields included architecture, cultural/arts education, environmental sciences, geriatrics, health policy, information and technology (IT), philosophy, health psychology, public health, and urban sociology.

3.2 | Main themes

Across interviews, both older community-dwelling individuals and stakeholders commonly referred to what we summarized as three main themes with regards to promoting dementia risk reduction in the urban environment: (1) social participation and inclusion, (2) proximity and accessibility and (3) local recreation and well-being. Additionally, subthemes were categorized under each main theme. Table 1 provides an overview of main and subthemes alongside exemplary quotes. Figure 1 provides a thematic map that emphasizes the overlap and interconnection between the themes.

3.3 | Social participation and inclusion

One of the most discussed and highlighted theme emerged around social participation and inclusivity, emphasizing social contacts, social housing, neighbourhood assistance, intergenerationality, information and orientation, digital and technological literacy, lifelong learning, and co-creation/co-design.

3.3.1 | Social contact

The need for social connectedness was strongly stressed, and worry of social isolation and loneliness were recurrent themes, with some older community-dwelling individuals voicing difficulties to stay connected with others.

"What possibilities are there? How to know who else feels that way? I could not find a solution for myself. Within a 500 m radius, there are probably several who sit at home, being sad, saying no one talks to me, no one is here." (community group, 78, female)

"What people need to stay cognitively healthy in old age are stimulation, encounters, and contacts—the opposite of isolation and being alone." (stakeholder group, urban sociology, female)

3.3.2 | Social housing

Participants voiced the relevance of apartment blocks with inhabitants of mixed ages and opportunities to meet each other.

"I would advocate, if new apartment houses are being built, that there are common rooms where you can go, have a family party or you just know, oh, I can go down there to play or to talk." (community group, 78, female)

TABLE 1 Results of thematic analysis of qualitative in-depth interviews with older community-dwelling individuals (n = 10) and stakeholders (n = 10) from the city of Leipzig, Germany, exploring the question “How can urban environments promote dementia risk reduction?”

Theme	Subtheme	Quotes of community-dwelling individuals	Quotes of stakeholders
Social participation and inclusion	Social contact	What possibilities are there? How to know who else feels that way? I could not find a solution for myself. Within a 500 m radius, there are probably several who sit at home, being sad, saying no one talks to me, no one is here. (78, female)	What people need to stay cognitively healthy in old age are stimulation, encounters, and contacts – the opposite of isolation and being alone. (urban sociology, female)
		You lose touch. It's hard to stay connected. Especially, if you move, you lose touch. (74, male).	It's faster in the city. You have to create interactions artificially. There really has to be energy from outside that people can find to each other, otherwise the city is too anonymous. (environmental sciences, male)
		The loneliness is difficult. And that wasn't the case before. People used to live here from the beginning until they died. There is this mobility now, people going places. In my environment, there is no one anymore, who I know. (73, female).	
	Social housing	I would advocate, if new apartment houses are being built, that there are common rooms where you can go, have a family party or you just know, oh, I can go down there to play or to talk. (78, female)	Cities need to focus on the increasing single households. (health psychology, female)
		There is this nice older couple living in the block. If you meet them on the bench, you can talk nicely, but it takes a long time until you meet again. So somehow you would have to build up such a small network in the house. (85, female)	Social life should be happening in the stairwells and entrance halls. Home should not start behind the apartment door, but much earlier. Especially, a lively ground floor is really important for communication in urban apartment blocks. Stairwells are meeting spaces. If they would be designed to allow people to sit and meet, they could greatly enhance social contacts. (architecture, female)
			City planners should design mixed areas, i.e. mixed ages, socially mixed. And not favour segregation. Cross-generational housing, with care services, but also with technological innovations. (urban sociology, female)
	Neighbourhood assistance	Usually, my daughter always brought heavy groceries, but she broke her foot and she cannot come. And then I took advantage of the offer in the house that heavy things like water or potatoes could be brought to me. I turn to the neighbours and get help. (79, female)	I believe that a good neighbourhood is where you know the people, where you help each other, where you just meet each other. I think that makes a huge difference. In an emergency, I can call someone who can support me. People keep an eye on each other. (philosophy, female)
			For a sustainable future, we have to go back from the very strong individualization to a little more common sense, a more common good-oriented approach. (geriatrics, male)
	Intergenerationality	We now have singing for young and old in our club. We also do handicrafts together, creative design, we also do Christmas parties together, a sports festival for young and old. We've been doing this for many years. Working for young and old across generations has always been a part of our club. (70, female)	Smaller residential buildings, six to eight families. And mixed, young and old together. When Ms. Lehmann lives on the ground floor and others are at work, she accepts the deliveries. And the young people in the house can support the older ones with physically difficult things. (senior work, male)
		I do not know whether it can be the point when you are old, you only deal with old people. I want	This effect of self-efficacy: you can contribute something, you can explain something to a

(Continues)

TABLE 1 (Continued)

Theme	Subtheme	Quotes of community-dwelling individuals	Quotes of stakeholders
		my surroundings to be mixed up a bit. (76, male)	child, you can convey knowledge, and you can provide assistance. (philosophy, female)
		I think it would be a way to bring older people and children together to read stories, play games with the kids. Having community rooms and developing concepts for them – I think older people would be very pleased to get involved. (78, female)	There is this intergenerational work with primary school. I am thinking of a project in which older people and kids are paired in tandems to create theatre plays. Works fantastic. (cultural/arts education, female)
	Information and orientation	Now is the time, I would say, a transition period, when old people have not yet mastered the technology. And you should actually pay attention to that, because they say that everything is on the internet. Not all old people have internet. (70, female)	The digital way is not enough. It is very important that information is available in community centers. And it is important that, for example, telephone access is also there. (health policy, male)
		I don't have internet, and that is burdensome. Many offers can only be accessed via the internet. And then I might miss a lot of information, because I have no internet and also no smartphone. (79, female)	If you consider where older people actually go, it's obviously the doctor, and for some that's parish – that's where you have to meet them. Providing information on leisure activities, especially at the doctor's. (health policy, male)
		Anyone who does not come out of their apartment, does not get any information about Leipzig. (76, male)	Clear signage is important, so that I can easily find certain things like a toilet. I think clarity is also important. Because older people find it harder to find their way around. So it takes longer. (geriatrics, male)
		Information offered by analogue media is too little. Those who only use analogue have a hard time. (67, male)	
	Digital and technological literacy	I need a contact point for computer questions. (73, female)	What strikes me is that cashless payment is extremely difficult for many older people. They get their pin out of their wallet and so on. So if they had a smartphone with their fingerprint... They could also check in with the phone on the train. That is not a question of money at all. Many retirees only have a minimum pension, but now almost everyone over 70 has a smartphone. (public health, female)
		We have offers for mobile phone courses and computer courses in our citizens' association. They are always full. Because a lot of seniors are given smartphones and computers, and then don't get along with them. (70, female)	I think it is essential for this technology that there is a lot of advice. And that advice is given as often as necessary. And not just once. Because if the technology is not used, it is pointless. So at this point, one thinks economically in the short term, but not economically in the long term. (geriatrics, male)
		There is a ticket that is inexpensive, which you can only buy if you have an app on your mobile phone. Otherwise you cannot buy this ticket at all. Well, things like that cause older people being excluded. (78, female)	
		There are always people who have inhibitions to seek help. And then of course they are cut off. They then depend on the daily newspaper and television. (74, male)	
		When older people move with the times, then they are better able to stay in touch with their grandchildren, great-grandchildren. (66, male)	
	Lifelong learning	All your life you have to inform yourself about new things and accept them or at least to look at	I Believe that the best way to learn is to do things that you are interested in. This is also what

TABLE 1 (Continued)

Theme	Subtheme	Quotes of community-dwelling individuals	Quotes of stakeholders
		them. Otherwise, you get left behind and isolated, then you can no longer cope and no longer understand the world. Lifelong learning is an absolute prerequisite. (67, male) For mental health and also for my confidence, so I say: I can do that too. (85, female) Continued education always plays a big role for me. It's extremely important. And if you want, you can learn well into old age. Really learn for life. I have just noticed this with my travel groups. So almost all of them, when I went on a trip to the USA, had attended English courses" (74, male) They took the libraries from us — we protested. Now there is a book bus, but only once a month. It's not enough. (70, female)	keeps you fit. I just think it's important to stay open and remain interested. (cultural/arts education, female) Cooking and nutrition are a subject that can make a huge difference. Courses in this regard would be good. But what other course? Dance. Yes, dancing is an excellent form of dementia prevention. (geriatrics, male)
	Co-creation and co-design	Our district would have been permanently switched off from train access. So a friend of my husband and him had the idea to establish a bus route - they have achieved that. (78, female) Well, if gardening tools would be available publicly, then I would like to tick off a bed or use a gripper when walking through the park and pick up rubbish. I think people pay more attention to things if they are part of it. (78, female)	It depends very much on what options I have to participate — political influence, but also how I can help to shape my neighbourhood. (philosophy, female) When it comes to open spaces, residents should be asked what they want to do in their city. (architecture, female) Older people, especially the very old, like younger people, tend to be underrepresented when it comes to political decisions. Of course, that could be improved. (geriatrics, male) As far as possibilities of political involvement are concerned, there is a senior advisory council in Leipzig. In itself a very good instrument, but advisory boards have no decision-making powers. In this respect, this form of participation is not true participation. (health psychology, female)
Proximity and accessibility	Proximity and reachability	Here, there is nothing. We have a long way to go for shopping. As a pedestrian, it is quite a long walk. We need means of transport. (66, male)	Everything a person needs should be within 15 minutes by foot. The workplace, the school, the daycare center, the supermarket, the pharmacy, the park, the library. It is also sustainable, because, of course, it severely restricts traffic movement and so on. It makes a huge contribution to people's wellbeing, to physical and mental health. So maybe that would be a vision to develop. A fifteen-minute city. I think that would be a good vision for older people, I think it can be a good vision for all people. (philosophy, female)
	Mobility	What would be important are minor repairs or help. If the curtain rod falls down or if the top of the cupboard needs to be cleaned. So after two or three years it sticks up there, especially in the kitchen. (73, female) For me, most important is that I can get to where I need to go using local transport. (78, female) Contact with others, participation in social life, in cultural life — that is not possible without public transportation" (74, male)	I personally would promote small-scale shop structures and not giant discounters that are way too anonymous. (architecture, female) First of all, mobility must be affordable. There need to be senior tickets or appropriate means of transport that are discounted. And the frequency of the means of transport is important. (philosophy, female)

(Continues)

TABLE 1 (Continued)

Theme	Subtheme	Quotes of community-dwelling individuals	Quotes of stakeholders
		I think immediately of mental health when I ride a bike. Always look, react accordingly so that there are no collisions. (85, female)	
		It is a challenge to ride a bike in this city, many of my friends who do not live in the city, they do not understand that I still cycle. But I know my ways and I can always find a parking space for my bike. I ride my bike as long as possible. (78, female)	
		I would say that I don't cycle into the city because there are no continuous cycle paths where I feel safe. It's all just partial routes and then there are none, where I really feel insecure or I am afraid of the behaviour of the car drivers and therefore, as an older person, I don't ride into the city. (78, female)	
		It's not so easy with the bus or with the tram, because you have to climb so high to get in. Some have a flat entry, some don't. (79, female)	
	Affordability	For a computer course, you pay 25 euros or 30 euros or 70 euros. Or the senior citizens' association, they have very nice things, but it costs. I haven't been there because it costs a lot of money. (73, female)	When the money is just enough for the rent and for basic food, then many withdraw. Simply because nothing is possible anymore. (health policy, female)
		Tickets are getting too expensive, opera and such, very expensive. (70, female)	Cultural institutions could make rest ticket contingents available for free for people with low incomes. (cultural/arts education, female)
		Leipzig is expensive. It is simply too expensive. (76, male)	
	Access to health care	What naturally plays a role is the medical infrastructure. Yes, the family doctor around the corner and one of those for emergencies, good clinics nearby. Quickly reachable. (74, male)	There are now a lot of medical centers. This has increased more rapidly in recent years. I think that's very good. You often find houses where several specialties are together, and where there is also a pharmacy—all supplies in one house. (IT, male)
		There is this structure of specialist medical centres. It used to be called polyclinics. This focus is really good. (67, male)	
		It would be ideal if there were car parks, where you drive into the underground car park and then upstairs you're with your doctor. (85, female)	
	Cultural events	A good concert is good for you. You leave it uplifted. It gives courage. (85, female)	If an older person plays in a theatre group or also with dancing: you have so much social contact and that is actually what ensures you stay awake and alive, because you have to adjust and react flexibly and create something together. So that really goes beyond what is required, for example, in a crossword puzzles. (cultural/arts education, female)
		I've never looked at cultural events from the point of view that they should be especially suitable for older people. On the contrary, I actually regret that many cultural things in Leipzig are surprisingly not noticed by the younger generation. (74, male)	Often there is also the problem with empty buildings in cities. You could use them for self-organized citizens' ateliers. So it is a kind of meeting point and at the same time a kind of opportunity to work artistically. Especially, if you don't have the money to do it in regular art school. (cultural/arts education, female)

TABLE 1 (Continued)

Theme	Subtheme	Quotes of community-dwelling individuals	Quotes of stakeholders
	Public toilets	In the city, toilets are important. If possible, without steps. (70, female)	When I listen to music or deal with art, it speaks to a lot of different senses, to my emotions. To my cognition. I think it all adds up to a certain amount of mental flexibility. And just prevents from routines. If you only move in routines, then you are not training your mental abilities sufficiently. (philosophy, female) Actually the biggest obstacle to mobility is if you don't know where to pee when you're on the move. (public health, female) Clear signage is important. That I can easily find certain things like a toilet. (geriatrics, male). Public toilet guides: when they arrive in a city, they need a toilet very quickly. (public health, female)
Local recreation and wellbeing	Safety in traffic	I would say that I don't cycle into the city because there are no continuous cycle paths where I feel safe. It's all just partial routes and I really feel absolutely insecure or am afraid of the behaviour of the car drivers and therefore, as an elderly person, I don't ride into the city. (78, female)	Not only bike lanes, but also footpaths that are easy to roll over and walk on. (health psychology, female)
		Maybe if in the future build trams or buses in such a way that the driver doesn't have to come and lower a ramp to get on. Because often, you know, this is the reason why I don't go into town with the walker. This is way too much of a fuss. (73, female)	Wide enough sidewalks that one can move around easily with walking aids. (architecture, female) A great challenge are bad bike paths, because you only dare to cycle if you can cycle safely. (architecture, female)
	Security (after dark)	I don't go out a night and I don't go to the theatre in the evening any more. I now go on Sunday mornings. (79, female)	Sometimes streets don't work so much through street lighting, but simply through illuminated shop windows or offices on the ground floor. It is also important that these ground floors are not completely sealed off from the street space. Because they contribute to this feeling, that there are people, too. (architecture, female)
		So I would have doubts if I would cycle through the park in the evening or go on foot. Somehow you always have a strange feeling. And the bad thing is that I know that I am no longer able to defend myself. (76, male)	We discussed the height of hedges with the city. All should be visible and safe. (health policy, female)
		I feel like I'm night blind. And the streets are so badly lit, too. And then I would be afraid that I fall. That's why I don't go out at night anymore. (79, female)	We need to advise older people on safety in everyday life. That begins at the apartment door. So when the doorbell rings, what should I do? But also protect against handbag theft or street crime. (IT, male) Only five to six percent of all crime is committed against old people. That means, the subjective feeling or the subjective fear of becoming a victim of crime is much larger than it is represented in numbers. (IT, male) By the way, it's a very interesting story about camera surveillance in public spaces. I haven't met a senior who is against it. (IT, male)
	Cleanliness and environmental protection	I think a cycle path network would encourage many, not just older people, to cycle and to leave their cars behind and thus make our city more environmentally friendly. (79, female)	Cleanliness is a very, very big issue, which a lot of senior citizens are very consciously aware of. It goes from dog poop, to somehow deposited garbage, to graffiti. It is simply an issue that

(Continues)

TABLE 1 (Continued)

Theme	Subtheme	Quotes of community-dwelling individuals	Quotes of stakeholders
		Mental health always means health of the environment and vice versa. It is absolutely clear that I feel comfortable in a healthy, clean environment. (74, male)	moves many seniors very much. (health policy, female)
		How comfortable do I feel in a city where I constantly have to walk past weeds and where rubbish lies in the streets? How is this supposed to create a sense of wellbeing? Some don't care what it looks like, I do care. (74, male)	
		It already starts with the wastebaskets, which are not always emptied, even in the parks. And then there is dog poo everywhere. So that's not clean for me. (66, male)	
		But the worst thing for me is that we don't have waste containers at many bus stops where cigarette butts can be disposed. Every cigarette butt pollutes 40 L of groundwater. (78, female)	
	Public gardening	It would be great if there were tools or something in a public space so that older people could be involved in maintenance work in the park. I think I wouldn't be the only one, there would certainly be a whole lot of people who want to do something for their environment and for their neighbourhood. (78, female)	If you want to preserve this whole environment, you must include senior citizens in district development. For example, when it comes to maintaining green spaces, but also developing green spaces, you could start a survey and ask which types of flowers to be planted etc. That seems very banal, but it's a big factor for wellbeing. (health policy, male)
		You could have a senior park or mini park in every part of the city. And then there is a call for what seniors want to plant. Or we could discuss with the city planning department, which areas we could turn into parks. (79, female)	
		There are beds here free of plants or withered or whatever. I asked the gardeners: "Would I have permission to plant flower seeds here?" "No, you are not allowed to do that." I think people pay more attention to things, if you are part of it. (78, female)	
	Urban greenery	We will be grateful for every tree we have. It has so much effect, not only is it calming, but we also get oxygen. And that is so important, especially for big cities. You can't have enough green. (76, male)	Whenever someone sees an element of nature, it has a calming effect. I think it has a very positive effect on mental health. (architecture, female)
		I would say: not always a new shopping center, but a new park or something. (79, female)	From my experience, older people are especially interested when animals are involved, for example, an animal shelter, that offers to go for a walk with animals, is gladly accepted. There is social contact through animals. (environmental sciences, male)
		You can meet people there, go for a walk. (66, female)	
		But you would also need seating, maybe little pavillons, where you can rest, watch the young people. In the shade. (73, female)	
		The brain definitely needs oxygen. That's important for everyone. Oxygen and recreation and no noise pollution in that sense. Look into the green, watch animals or feed animals, if you are allowed to. And that's where you get to know people. Some still have a dog. They are more communicative with each other, the dog friends. (70, female)	

TABLE 1 (Continued)

Theme	Subtheme	Quotes of community-dwelling individuals	Quotes of stakeholders
		Where does a person rest? Where there are trees. Where there are a couple of benches. Where you can watch and see something. And of course, where you also feel safe. (76, male)	
		Green spaces in the city should be preserved. It would be ideal if you don't have long distances to green areas nearby. (76, male)	
	Climate change and heat waves	I can't live normally when it's so hot. This is no fun. I then sit in a dark room where everything is sealed so that it doesn't get so hot. And I have over 50° on my balcony, I cannot use it. (73, female)	With climate change, if I now walk in 36° on a paved street, with no tree far and wide, it is totally exhausting. And of course the older I am, the more exhausting the heat becomes. Trees provide shade and so on. (architecture, female)
		It worries me that I might soon be living in a steppe. And there is no more water. It's too warm for me, too. When it's always like 30, 32°. That's when I don't feel good. I can't go on my balcony, then I can't use it. Then I have to stay in my apartment and that kind of makes me sick. (79, female)	There must be cold air streams or cold air corridors in the city so that it can cool down again at night. And in a certain way, the air is filtered differently. (architecture, female)
	Outdoor physical activity	Well, always keep moving. I go for a lot of walks and bike a lot. I keep myself mentally fit." (69, male).	Older people need ways where they can go for a walk without falling. (urban sociology, female)
			You can do exercises on the park bench. We could foster urban development that invites to move. There are outdoor fitness spaces in Leipzig. But that's far too little. And most don't know them either. (public health, female)
			Paths could be curved instead of being straight. You would have a completely different way of moving in the park than you have along the edges of houses. I am challenged to move differently. (architecture, female)

Abbreviation: IT, information and technology.

"City planners should design mixed areas, i.e. mixed ages, socially mixed. And not favour segregation. Cross-generational housing, with care services, but also with technological innovations." (stakeholder group, urban sociology, female)

and kids are paired in tandems to create theatre plays. Works fantastic." (stakeholder group, cultural/arts education, female)

3.3.3 | Intergenerationality

In line with favouring social housing of mixed age groups, opportunities to engage across generations, especially with children, were emphasized.

"I do not know whether that can be the point when you are old, you only deal with old people. I want my surroundings to be mixed up a bit." (community group, 76, male)

"There is this intergenerational work with primary school. I am thinking of a project in which older people

3.3.4 | Neighbourhood assistance

Older community-dwelling individuals stated how important it is for them to receive support from neighbours, if needed.

"Usually, my daughter always brought heavy groceries, but she broke her foot and she couldn't come. And then I took advantage of the offer in the house that heavy things like water or potatoes could be brought to me. I turn to the neighbours and get help." (community group, 79, female)

"I believe that a good neighbourhood is where you know the people, where you help each other, where you just meet each other. I think that makes a huge

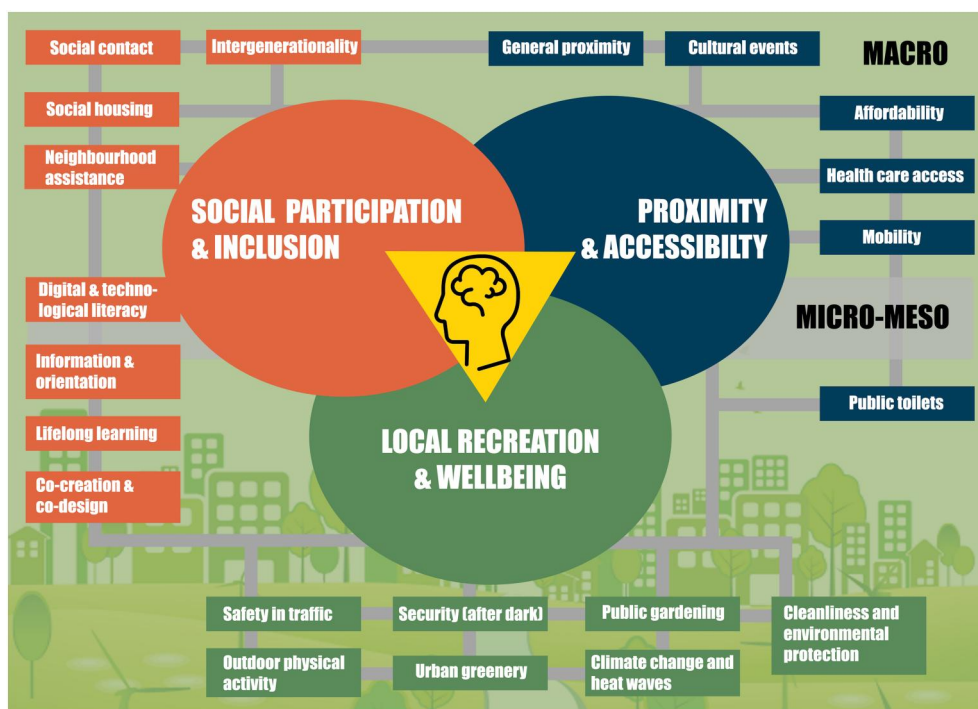


FIGURE 1 Thematic map of themes and subthemes identified in qualitative semi-structured interviews with 10 community-dwelling older individuals and 10 stakeholders on the question ‘How can urban environments support dementia risk reduction?’, conducted in Leipzig, Germany

difference. In an emergency, I can call someone who can support me. People keep an eye on each other.” (stakeholder group, philosophy, female)

3.3.5 | Information and orientation

Having reliable sources of information of what is happening in and around the city was considered pivotal, while it was clearly voiced that digital information is not sufficient.

“I don’t have internet, and that is burdensome. Many offers can only be accessed via the internet. And then I might miss a lot of information, because I have no internet and also no smartphone.” (community group, 79, female)

“The digital way is not enough. It is very important that information is available in community centers. And it is important that, for example, telephone access is also there.” (stakeholder group, IT, male)

3.3.6 | Digital and technological literacy

In line with access to information, there was a clear expression of a need to be able to use modern devices.

“We have offers for mobile phone courses and computer courses in our citizens’ association. They are always full. Because a lot of seniors are given smartphones and computers and then don’t get along with them.” (community group, 70, female)

“I think it is essential for this technology that there is a lot of advice. And that advice is given as often as necessary. And not just once. Because if the technology is not used, it is pointless. So at this point, one thinks economically in the short term, but not economically in the long term.” (stakeholder group, geriatrics, male)

3.3.7 | Lifelong learning

Older individuals stressed the importance of being able to learn, have access to books and courses in order to keep up with modern developments.

“All your life you have to inform yourself about new things and accept them or at least to look at them. Otherwise you get left behind and isolated, then you can no longer cope and no longer understand the world. Lifelong learning is absolute prerequisite.” (community group, 67, male)

"I believe that the best way to learn is to do things that you are interested in. This is also what keeps you fit. I just think it's important to stay open and remain interested." (stakeholder group, cultural/arts education, female)

3.3.8 | Co-creation and co-design

There was a strong desire to be able to participate in community development.

"Well, if gardening tools would be available publicly, then I would like to tick off a bed or use a gripper when walking through the park and pick up rubbish. I think people pay more attention to things if they are part of it." (community group, 78, female)

"When it comes to open spaces, residents should be asked what they want to do in their city." (stakeholder group, architecture, female)

3.4 | Proximity and accessibility

Within urban environments, community-dwelling older individuals as well as stakeholders stressed the importance of proximity and accessibility to be able to participate, remain socially included, and master daily life tasks. In particular, proximity of and access to means of transport, health care services, necessities of daily life, community (particularly cultural) events as well as public toilets and seating were relevant subthemes, with emphasis on minimization of physical barriers.

3.4.1 | Proximity and reachability

Possibilities to easily reach relevant facilities, such as grocery stores, medical services, recreational areas, or train/bus stations, constituted a key need for autonomy and functionality.

"Here, there is nothing. We have a long way to go for shopping. As a pedestrian, it is quite a long walk. We need means of transport." (community group, 66, male)

"Everything a person needs should be within fifteen minutes on foot. The workplace, the school, the daycare center, the supermarket, the pharmacy, the park, the library. It is also sustainable, because, of course, it severely restricts traffic movement and so on. It makes a huge contribution to people's wellbeing, to physical and mental health. So maybe that would be a vision to develop. A fifteen-minute city. I think that would be a

good vision for older people, I think it can be a good vision for all people." (stakeholder group, philosophy, female)

3.4.2 | Cultural events

Community-dwelling older individuals voiced the relevance of being able to participate in cultural events, especially as a means to socially connect and as a source of joy and wellbeing.

"A good concert is good for you. You leave it uplifted. It gives courage." (community group, 85, female)

"If an older person plays in a theater group or also with dancing: you have so much social contact and that is actually what ensures you stay awake and alive, because you have to adjust and react flexibly and create something together. So that really goes beyond what is required, for example, in a crossword puzzles." (stakeholder, cultural/arts educator, female)

3.4.3 | Affordability

While there was a clear need to be able to participate in lifelong learning or to visit cultural events, it was simultaneously stressed that it must be affordable, especially with regards to small pension schemes.

"For a computer course, you pay 25 euros or 30 euros or 70 euros. Or this senior citizens' association, they offer very nice things, but it costs. I haven't been there, because it costs a lot of money." (community group, 73, female)

"Cultural institutions could make rest ticket contingents available for free for people with low incomes." (stakeholder group, cultural/arts education, female)

3.4.4 | Access to health care

Proximity to medical services was a prominent aspect.

"What naturally plays a role is the medical infrastructure. Yes, the family doctor around the corner and one of those for emergencies, good clinics nearby. Quickly reachable." (community group, 74, male)

"There are now a lot of medical centers. This has increased more rapidly in recent years. I think that's very good. You often find houses, where several specialties are together, and where there is also a

pharmacy - all supplies in one house." (stakeholder group, IT, male)

3.4.5 | Mobility

In line with the desire to have relevant facilities close to home, participants emphasized that mobility, that is being able to move around, be it through walking or cycling, or by using public transport, was a pivotal aspect of their brain health.

"Contact with others, participation in social life, in cultural life - that is not possible without public transportation." (community group, 74, male)

"I think immediately of mental health when I ride a bike. Always look around, react accordingly so that there are no collisions." (community group, 85, female)

3.4.6 | Public toilets

A barrier to moving around was whether public toilets are available and accessible. Public toilets on the way to and near intended destinations have been described as a prerequisite for engaging in out-of-home activities. In addition, it was considered important that public toilets are well signposted, easily accessible, clean and safe.

"In the city, toilets are important. If possible, without steps." (community group, 70, female)

"Actually the biggest obstacle to mobility is if you don't know where to pee when you're on the move." (stakeholder group, public health, female)

3.5 | Local recreation and wellbeing

The third theme evolved around opportunities for recreation and wellbeing in the city. Important subthemes included safety in traffic, security (after dark), public gardening, urban greenery, cleanliness and environmental protection, climate change and heat waves, as well as outdoor physical activity.

3.5.1 | Safety in traffic

Being able to safely use public transport, particularly when barrier-free, seemed to determine whether older community members felt comfortable to move and engage in activities.

"I would say that I don't cycle into the city because there are no continuous cycle paths where I feel safe. It's all just partial routes and I really feel absolutely insecure or am afraid of the behaviour of the car drivers and therefore, as an elderly person, I don't ride into the city." (community group, 78, female)

"Wide enough sidewalks that one can move around easily with walking aids." (stakeholder group, architecture, female)

3.5.2 | Security (after dark)

Another prerequisite for participation in out-of-home activities was the need to feel and to be safe, particularly with regards to threats of crime and at night.

"So I would have doubts if I would cycle through the park in the evening or go on foot. Somehow you always have a strange feeling. And the bad thing is that I know that I am no longer able to defend myself." (community member, 76, male)

"We need to advise older people on safety in everyday life. That begins at the apartment door. So when the doorbell rings, what should I do? But also protect against handbag theft or street crime." (stakeholder, IT, male)

3.5.3 | Public gardening

A recurrent theme was the desire to be involved in public gardening. Stakeholders corroborated a community-engaging approach in public greenery maintenance.

"It would be great if there were tools or something in a public space so that older people could be involved in maintenance work in the park. I think I wouldn't be the only one, there would certainly be a whole lot of people who want to do something for their environment and for their neighbourhood." (community group, 78, female)

"If you want to preserve this whole environment, you must include senior citizens in district development. For example, when it comes to maintaining green spaces, but also developing green spaces, you could start a survey and ask which types of flowers to plant etc. It seems very banal, but it's a big factor for wellbeing." (stakeholder group, health policy, female)

3.5.4 | Cleanliness and environmental protection

For remaining healthy and in good wellbeing, it was important to have both a safe and a clean environment.

"How comfortable do I feel in a city where I constantly have to walk past weeds and where rubbish lies in the streets? How is this supposed to create a sense of wellbeing? Some don't care what it looks like, I do care." (community group, 74, male)

"Cleanliness is a very, very big issue, which a lot of senior citizens are very consciously aware of. It goes from dog poop, to somewhere deposited garbage, to graffiti. It is simply an issue that moves many seniors very much." (stakeholder group, health policy, female)

3.5.5 | Urban greenery

Access to urban greenery was a big theme: for physical activity, for socialisation, for stress reduction, for recreation, for wellbeing, and for clean air.

"The brain definitely needs oxygen. That's important for everyone. Oxygen and recreation and no noise pollution in that sense. Look into the green, watch animals or feed animals, if you are allowed to. And that's where you get to know people. Some still have a dog. They are more communicative with each other, the dog friends." (community group, 70, female)

"Whenever someone sees an element of nature, it has a calming effect. I think it has a very positive effect on mental health." (stakeholder group, architecture, female)

3.5.6 | Climate change and heat waves

Participants voiced an increasing awareness of climate change, especially more frequent heat waves, impacting their lifestyles.

"I can't live normally when it's so hot. This is no fun. I then sit in a dark room, where everything is sealed so that it doesn't get so hot. And I have over 50° on my balcony, I cannot use it." (community group, 73, female)

"With climate change, if I now walk in 36° on a paved street, with no tree far and wide, it is totally

exhausting. And of course the older I am, the more exhausting the heat becomes. Trees provide shade and so on." (stakeholder group, architecture, female)

3.5.7 | Outdoor physical activity

With regards to physical activity, cycling and walking, that is being physically active outdoors, were recurrent themes for older community members.

"Well, always keep moving. I go for a lot of walks and bike a lot. I keep myself mentally fit." (community group, 69, male).

"You can do exercises on the park bench. We could foster urban development that invites to move. There are outdoor fitness spaces in Leipzig. But that's far too little. And most don't know them either." (stakeholder group, public health, female)

4 | DISCUSSION

We aimed at exploring how urban environments could support dementia risk reduction based on a qualitative study that combined a bottom-up participatory and a top-down stakeholder approach. The bottom-up approach involved older community-dwelling members as experts by life experience, while the top-down approach involved stakeholders from different fields relevant to ageing in an urban environment being advocates and/or participants in decision-making processes or local policies. Thematic analysis across both groups, older community members and stakeholders, identified three overlapping and interconnected main themes, under which subthemes were categorized: (i) social participation and inclusion (emphasizing social connectedness, social housing, neighbourhood assistance, intergenerationality, information and orientation, digital and technological literacy, lifelong learning, co-creation and co-design), (ii) proximity and accessibility (emphasizing proximity and reachability, mobility, affordability, access to health care, access to cultural events, public toilets), (iii) local recreation and wellbeing (emphasizing safety in traffic, security, cleanliness and environmental protection, urban greenery, climate change and heat waves, outdoor physical activity).

The identified themes revealed a striking overlap with the eight domains that define age-friendly-cities in the WHO Age-friendly Cities Framework²⁴: community and health care, transportation, housing, social participation, outdoor spaces and buildings, respect and social inclusion, civic participation and employment, communication and information. This suggest that there is a rather general understanding—from community members as well as policy makers and other stakeholders—as to how urban environments should be designed and function in order to allow for a healthy lifestyle, which logically comprises lifestyles that improve brain health and hence

may reduce the risk of cognitive decline and dementia in later life. Importantly, the themes imply that the design and function of the urban environment is a prerequisite to being able to engage in and practice lifestyle behaviours that enhance brain health. Community members considered it extremely important to be able to socially participate and to lead an active life in the city. In contrast, social isolation and loneliness are highly prevalent among older individuals, particularly in urban areas,³⁴ with detrimental effects on cognitive function.^{35,36} Moreover, social isolation and loneliness are associated with health-risk behaviours, for example, physical inactivity and smoking, which in turn are risk factors for dementia.^{7,37} Social prescribing, that is leisure activity (nature-based, cultural or voluntary engagement, e.g.) on prescription, as well as co-production have shown to increase social participation of older individuals in urban areas.^{38,39} Finding ways to decrease or even prevent social isolation and loneliness in cities in the first place, through—as suggested here—mixed social housing and focusing on intergenerationality instead of segregation based on age groups could prove to be a more effective concept. Importantly, older community members made it clear that social participation can only succeed if certain needs are met: for example, not having access to a public toilet can be an easily overlooked barrier to participation. While research has shown that well designed, managed and maintained public toilets enhance positive and equal human participation in urban spaces.⁴⁰ This goes along with the prerequisite of feeling safe and secure when participating in activities outside of home, no matter the time of day, but especially after dark.⁴¹ For example, a review concluded that the perceived crime-related safety in neighbourhoods was associated with constrained physical activity in older adults.⁴² Moreover, social participation needs to be affordable. Despite being a high income country, the German pension system generates a medium level of poverty.⁴³ Therefore, prices for public transport, cultural events or continued learning, to name just a few examples, should generally be tailored to pension schemes. The above named examples illustrate the triangulation of the three identified themes: to remain cognitively healthy through recreation and fostering wellbeing, older individuals need to be able to socially participate, which can only work if they feel safe, secure, have the access and the means to do so. Urban model projects should therefore not only consider single environmental factors, but take a systematic approach inclusive of the individual's health and lifestyle profile. For individually tailored lifestyle interventions, in contrast, this implies the need to discuss the individuals' physical and social environment, that is identifying opportunities for participation in the community, barriers to participation and potential alternatives.

Our findings suggest that a priority for policy and decision makers should be to make urban environments more inclusive, especially given the ageing demographics, in order to maintain the physical and brain health of older citizens for as long as possible, and thus ensure ageing in place with maximum possible independence and quality of life.⁴⁴ While investing in age-friendly communities may seem costly at first sight, taking an approach that promotes brain health and reduces impairment is likely sustainable and cost-effective

in the longer term,⁴⁵ including savings achieved by avoiding premature institutionalisation.⁴⁶ It is well established that health promotion for older people has positive effects on health-related quality of life and decreases the burden of disease to non-communicable diseases.⁴⁷ Moreover, it needs to be stretched that a social ecological approach to brain health promotion would likely not only be beneficial to older individuals, but to all residents of urban areas, regardless of age, sex, education, social status or disability. This was a common view expressed by the stakeholders, supporting the notion that good public health favours health actions, that are universal, but with scale and intensity proportionate to level of disadvantage, thus promoting health equity.⁴⁸ However, the specific effects of brain health promotion taking a social ecological approach with regards to cognitive decline and dementia needs yet to be empirically established.

In light of global warming and subsequent climate change, the built urban environment will likely become a much more important consideration when it comes to brain health and health in general, wellbeing and quality of life. With higher temperatures and increased risk of heat waves in many regions of the world, older individuals will likely struggle more over prolonged periods of time and may be at increased risk for heat-induced ill-health and excess mortality.⁴⁹ In our study, we recorded concerns about excessive heat, changing climate and environmental pollution, with the importance of urban greenery and access to nature being stressed.

Overall, our study provides a unique mix of need-based perspectives from community-dwelling older individuals and expert views from stakeholders working in the field, which may provide ideas and encourage model projects in urban neighbourhoods. Above all, our results highlight the need for community-dwelling members to be involved in the co-creation and co-design of such urban model projects, to make sure that their voices are heard and their specific needs are met. Importantly, urban environments that promote lifestyle behaviours for good brain health may be particularly beneficial for marginalized and deprived community groups, which are usually hard to reach by individual-level interventions.^{50,51}

4.1 | Limitations

There may be a bias in the representation of community-dwelling members, through potentially having attracted individuals with a particular interest in dementia risk reduction strategies. Moreover, we were not able to recruit individuals with low levels of education nor individuals with an emigrational background. Therefore, themes may not cover the full range of views and should not be overinterpreted as to their generalizability. The community sample included individuals above 65 years of age. However, dementia risk reduction is important across the lifespan, with midlife being considered a particularly important stage. Though older individuals combine the lived experience of several life stages, individuals in midlife may have emphasized other aspects of the urban environment in relation to dementia risk reduction. Moreover, the

study took place in a single city of a high-income country, and different themes could emerge in different countries or settings. Additionally, although we felt that sufficient information was obtained as themes were recurrent, and thus saturation of the collected data was reached, there is a possibility that more themes could have emerged if a larger sample had been interviewed. Moreover, inductive thematic analysis is never entirely objective to the researchers' assumptions; however, we minimized such influence by independent conduction of analysis by two researchers and reflexive discussion of results including a third researcher.

4.2 | Conclusions

According to older community-dwelling members and stakeholders working in the field, urban environments hold large potential to create favourable conditions for the practice of lifestyles to promote brain health that could reduce the risk of cognitive decline and dementia. Our results suggest that urban environments should enhance social participation and inclusion, be accessible, safe, reachable and affordable and foster local recreation and wellbeing through greenery, opportunities for activity, and environmental protection. Our findings can inform researchers as well as policy makers, and particularly emphasize the need for community members to be involved, from the outset, in the design and implementation of better urban environments for better brain health.

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CONFLICT OF INTEREST

None.

AUTHOR'S CONTRIBUTIONS

Susanne Röhr designed the study and acquired funding. Susanne Röhr, Felix Müller, Rosa Siemensmeyer collected, analysed and interpreted data and wrote the manuscript. Francisca S. Rodriguez, Roman Romero-Ortuno and Steffi G. Riedel-Heller revised the manuscript for important intellectual content. All authors agree with the final version of the manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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