

Engaging Nigerian Older Persons in Neighborhood Environment Assessment for Physical Activity Participation: A Citizen Science Project

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Abstract

Background and Objectives: Global organizations are advocating that older persons' voices should guide communities in age-friendly design. An important aspect of age friendliness to enable daily function and health is ensuring that physical activity can occur, regardless of age, within local neighborhoods.

Research Design and Methods: This study used a specific citizen science approach, *Our Voice*, to engage a sample ($N = 13$) of older adults (60 or older) in Festac Town, Nigeria. The citizen scientists' roles were to assess and identify how different aspects of the neighborhood environment act as supports or barriers to their physical activity participation. They were individually enabled using a tablet-based mobile application called the Stanford Healthy Neighborhood Discovery Tool to record a total of 156 geocoded photos and 151 commentaries of neighborhood environmental features that facilitate or hinder physical activity in and around their neighborhoods. In a guided process, the following occurred: collaborative discussions of findings with other citizen scientists to determine common targets, setting of priority targets for change, and brainstorming strategies and solutions.

Results: Facilitators of physical activity included: pedestrian and traffic facilities (e.g., traffic lights, walkways); green areas and parks; multigenerational community features (e.g., programs/facilities); opportunities for social connection (e.g., neighborhood associations, churches); safety of destinations and services; and public toilets. Barriers to physical activity included: hazardous walkways/traffic; noise pollution; refuse, selling of public parks; crime (e.g., kidnapping, criminal hideouts); no safe drinking water; and ageism. The priorities for changes were social connectivity; improved pedestrian and traffic facilities; and green and beautiful environments.

Discussion and Implications: In this study, both physical and social aspects of the environment were deemed important for older Nigerians to enable physical activity in their local community. This approach has a promise for age-friendly initiatives seeking local changes by meaningfully engaging older adults.

Translational Significance: When seeking to make a local environment more age friendly, older people's voices need to be heard. This project used a citizen science approach, whereby older adults in Lagos, Nigeria, collected and analyzed local data (photos and commentaries) on barriers and facilitators to physical activity. They prioritized the following: social connectivity, beautiful/green environments, and improved traffic and pedestrian facilities. This approach could be helpful in age-friendly initiatives globally to effect local change by meaningfully engaging older adults. Such "lived experience" data can provide local decision makers and stakeholders with a more comprehensive perspective that is often missing from policy-level deliberations.

Keywords: Age friendly, Aging, Physical activity

Background and Objectives

Physical activity is known to be important for healthy aging, yet physical activity levels are lowest among the oldest members of societies around the world (World Health Organization, 2015). Many health promotion strategies are being used globally to try to alleviate this situation (World Health Organization,

2018). However, in some low-income countries where population aging is a more recent phenomenon, there has been less policy focus on older people. For example, Nigeria can expect a rapid increase in their population of older people over the coming decades, although many programs and policies in Nigeria do not attend to this age group (Tanyi et al., 2018).

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Using subjective and objective measures, researchers have demonstrated that environmental features of neighborhoods are important for physical activity participation in older people (Haselwandter et al., 2015). In Nigeria, most studies have only captured the environmental influences on physical activity in the younger population (Oyeyemi et al., 2012, 2014). We are only aware of one study on this topic, whereby self-reported levels of physical activity were found to be related to perceived physical neighborhood factors as measured by the Neighborhood Environment Walkability Scale—Abbreviated (Cerin et al., 2006), in a sample of older (60 years and older; average of 69 years) Nigerians (Oyeyemi et al., 2019a). This one study, like many others investigating the influence of the neighborhood environment on physical activity in older adults, did not examine the social aspects of local environments. Furthermore, we are not aware of studies that have sought to directly hear the voices of older Nigerian people concerning age-friendly factors associated with neighborhood physical activity participation.

Age-friendly environments are facilitated when older people can voice their opinions about how they can contribute to their communities, as respected and engaged members, to create conditions that allow for community engagement, regardless of impairments due to age-related changes in function (World Health Organization, 2015). The World Health Organization's checklist of essential features of age-friendly cities includes the following categories: outdoor spaces and buildings, transportation, housing, social participation, respect and social inclusion, civic participation and employment, communication/information, as well as community and health services. Little age-friendly research has been undertaken in Nigeria, and we are unaware of any studies that have explored concepts of age-friendly attributes of Nigerian communities related to physical activity, whether for active transportation, leisure, sport, or exercise. In addition to considering the physical aspects of a community and their impacts on physical activity participation, it is also important that community cultural aspects are considered because older people are not viewed in the same way throughout the world. Indeed, previous Nigerian-based research has demonstrated the existence of ageist stereotypes that could stigmatize older people (e.g., childless older people viewed as witches or wizards) and could impact their participation within their communities (Tanyi et al., 2018).

This study engaged Nigerian older adults as citizen scientists in a qualitative, participatory, community-based research project using the *Our Voice* method (King et al., 2016), which is a collaborative or co-created form of citizen science. Citizen science can range from *contributory* (i.e., members of the public contribute data only), to *collaborative* (i.e., members of the public are involved in data collection and assist with other aspects of the project like data analysis and the dissemination of findings), to *co-created* projects whereby members of the public are involved in all aspects of the project including the initial design of the study (Bonney et al., 2009).

The purpose of the study was to use a collaborative citizen science methodology to undertake the following: (a) explore what community-dwelling Nigerian older persons perceived as barriers and/or facilitators to physical activity engagement in their neighborhoods, and (b) for those same persons to brainstorm recommendations and solutions for their community.

Research Design and Methods

Study Design

This study used the *Our Voice* citizen science method (King et al., 2016, 2020), whereby the citizen scientists (i.e., members of the community with an interest in the issue under study) move from data collection through to data analysis, interpretation, and prioritization of recommendations for presentation to community partners. *Our Voice* is based on the socio-ecological framework (King et al., 2016), whereby complex interactions between the individual and their social and/or physical environment are recognized as affecting health behaviors (Sallis et al., 2006).

For data collection, the *Our Voice* method takes advantage of a custom-made application (app) for smartphones or e-tablets call the Stanford Healthy Neighborhood Discovery Tool (King et al., 2016). The Discovery Tool leads citizen scientists through a number of steps for taking photos, rating the photos as showing barriers, facilitators, or both, as well as recording commentaries about the photos taken in people's environments. Following Discovery Tool-enabled data collection, meetings are arranged where citizen scientists are facilitated in analyzing and interpreting their data (photos/commentaries), prioritizing findings, and making recommendations. Finally, the citizen scientists present their findings, priorities, and recommendations to community stakeholders.

Citizen Scientist Participants

Citizen scientist participants were residents of the Festac Town urban neighborhood area of Lagos State, Nigeria. Festac Town has a high-density population of low- and high-income individuals of diverse ethnocultural backgrounds from various parts of Nigeria, as well as other neighboring West African countries. English is the predominant language, although many individuals also speak other languages.

Eligibility for participation as a citizen scientist included the following criteria: (a) being able to consent for themselves, (b) being an older person aged 60 years or more, (c) being able to speak English, (d) self-identifying as living in the Festac Town community, and (6) being able to attend and participate in group meetings and interviews. A convenience sample was recruited in a variety of ways, including oral presentation of the study to older people at nongovernmental organization centers and at health-related group activities of older persons in the community (e.g., walking groups, exercise classes); flyers posted and distributed in the community; and word of mouth within the community (snowball approach). All citizen scientists provided written informed consent to participate in all aspects of the study, in accordance with approval from the University of Manitoba Research Ethics Board (#22856).

Data Collection

To prepare citizen scientists for data collection, all participants were supplied with information on age-friendly communities (World Health Organization, 2007a) and examples of types of physical activity (e.g., for play, transportation, occupation, exercise, and creative arts). They were also given instructions for taking photos and recording audio or typed commentaries about the photos they took, as well as how to be safe while collecting data in their neighborhood.

Table 1. Statement Responses on Community Information (N = 13)

Statement responses	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree	Total
This is a community where people support each other.	1	0	1	6	5	13
I can influence decisions that affect my community.	0	0	1	5	7	13
By working together with others in this community, we can influence decisions that affect this community.	0	0	0	4	9	13
People in my community know who to talk to in order to make changes happen in our community.	1	0	1	6	5	13

Each citizen scientist completed a walk around his/her community to collect data with the Discovery Tool, which was installed on an e-tablet with a seven-inch screen. The tablet was in a case with a neck strap. Each citizen scientist determined his/her own route and walked for about 45 minutes, either with or without breaks. Most walked with one of the investigators (EO), to ensure that they were able to use the app appropriately and for safety purposes (i.e., so they were not on their own). EO was not involved in the data collection except to provide technical assistance.

The Discovery Tool app also had eight questions for the citizen scientists to complete after their walk. The questions pertained to their individual demographic characteristics (e.g., age, gender, education, and self-rated health), as well as aspects of the community (e.g., support, decision-making, input, and knowledge of stakeholders).

Please note that data collection for this research project focused on the work of the citizen scientists, but did not include the stakeholder meeting, as this event was beyond the scope of this project.

Data Analysis

For analysis purposes, each photo served as the centerpiece and was printed on a piece of paper with the transcribed commentary, a map of the location, as well as the barrier/facilitator rating (see [Chesser et al., 2020](#), for more details on the sheets as well as the data analysis process). These sheets were presorted by EO prior to the first meeting of the citizen scientists, according to the barrier/facilitator rating as well as possible descriptive categories associated with the commentaries. This pre-sorting was carried out to save time at the citizen scientist analysis meetings, but no codes or categories were shared with the citizen scientists, so as not to influence their analysis process.

During the first analysis meeting, the citizen scientists were first given some basic training in qualitative data analysis by one of the investigators, who also oversaw the data categorization process by the citizen scientists. This training involved a summary introduction to qualitative data, as well as instructions about how to identify descriptive categories within the data (photos and accompanying comments). Citizen scientists were also provided with analysis worksheets to assist with recording their thinking throughout this process (see [Chesser et al., 2020](#), for examples). The citizen scientists then worked in pairs with clusters of sheets to develop their own categories and subcategories, as well as brainstorm solutions and recommendations. This first meeting focused on the sheets that had identified facilitators of physical activity. EO facilitated discussion among all the citizen scientists at each session and drafted summary

notes after the pairs had completed their analyses and brainstorming. The second analysis meeting focused on the barriers to physical activity. At this meeting, the citizen scientists also determined the three priorities for improving physical activity in their community that would be presented to the area stakeholders, as overseen by EO. In this case, the citizen scientists decided to use a secret ballot voting system to rank order the priorities, to avoid bias, as well as allow those who were more shy or nervous to voice their opinions anonymously.

Results

Citizen Scientists and Community Information

Seven men and six women participated in this study as citizen scientists. They ranged in age from 65 to 86 years, with the average age being 78 for the men and 71 for the women. Each had relatively high levels of education, that is, six had a post-secondary diploma, five had a university degree, and two had finished secondary school. All rated their health status as good to excellent. Almost all the citizen scientists agreed (somewhat or strongly) with the statements about their community. See [Table 1](#) for the statements and the scores given. In general, the citizen scientists thought positively about their community, with only a few exceptions.

Categories and Subcategories

From the 156 photos and 151 commentaries that were collected by the citizen scientists, there were several categories and subcategories emanating from the analysis meetings. Almost all the citizen scientists had taken photos that came from the following categories: pedestrian and traffic facilities, green and beautiful environments, multigenerational community features (e.g., parks), and social connectivity. Other categories were safety/security, infrastructure, public toilets, and stigmatization based on age (i.e., ageism). [Table 2](#) provides more details about the categories and subcategories identified by the citizen scientists as facilitators and barriers. Later, we show pictures and accompanying quotes that exemplify the data captured by the citizen scientists (see [Figures 1–6](#)). Please note that pseudonyms have been used to protect citizen scientists' confidentiality. In addition, we have included the quote below regarding parks that did not accompany a particular photo but spoke to the loss of parks:

Most designated public recreation places have been acquired for private use. There should be laws preventing this. There are hardly any recreation facilities left behind in the community. Perhaps, non-functional facilities or new areas can be made available. Ms. Janet [barrier]

Table 2. Core Categories and Subcategories of Neighborhood Facilitators and Barriers to Older Adults' Participation in Physical Activities

Category	Sub-category	
	Physical activity supports/facilitators	Physical activity barriers
1. Pedestrian and traffic facilities	1.Roads <ul style="list-style-type: none"> ▪ Availability and rehabilitation ▪ Traffic lights 2.Walkways <ul style="list-style-type: none"> ▪ Availability and accessibility of sidewalks/walkways ▪ Neatness of walkways ▪ Safe neighborhood pedestrian walkways ▪ Senior friendly 	1.Bad roads <ul style="list-style-type: none"> ▪ Traffic lights not available at (i) intersections/junctions, (ii) Agboju market intersection ▪ Streetlights not available ▪ Zebra crossings or pedestrian crossings not available ▪ Arbitrary road use by commercial vehicle operators 2.Walkways <ul style="list-style-type: none"> ▪ Damaged and neglected ▪ Parking on walkways ▪ Trading on the walkways/street trading ▪ Abuse of the walkways
2. Green and beautiful environment	1.Lots of green areas 2.Recreation parks and gardens 3.Big trees 4.Environmental hygiene	1.Hideouts for criminal activities, pests and dangerous animals 2.Hazardous environment 3.Noise pollution from uncontrolled social/religious activities 4.Dumping of refuse/wastes on the roads, gutters and drainage holes
3. Multigenerational community features (e.g., recreation and relaxation parks)	1.Interaction with pupils during community walks and related activities 2.Educational factors (health talks on the benefit of physical activity and exercises by special groups) 3.Sports and Recreation parks (e.g., Victory Park 206) 4. Fitness Walk/Walk for Life program	1.Unavailable sports and recreation parks/facilities <ul style="list-style-type: none"> ▪ Turned to banks, mechanic workshops ▪ Tennis court not available ▪ Sold to private owners (e.g., second avenue swimming pool)
4. Social connectivity	1.Local neighborhood association participation 2.Non-Government Organizations and Associations of the Aged 3.Faith-based organization and activities 4.Places of worship 5.Health talks by groups	
5. Safety/security	1.Safe location of desirable service centers and destinations 2.Destinations situated in open and accessible places (e.g., automated teller machines [ATM])	1.Vandalism 2.Kidnapping 3.No streetlight at night 4.Potholes on the road and walkway 5.Shanties and criminal hideouts 6.Buffer zone sold and abused
6. Infrastructure		1.No clean safe drinking water 2.Central sewage system bad; blocked; erection of structure on the sewage pipelines
7. Public toilet		1.Not available at popular public destinations (e.g., at the parks)
8. Stigmatization based on age (ageism)		

Determination of the Importance of Categories, Solutions, and Priorities

For those categories that were identified as being facilitators or supports during the analysis meetings, the citizen scientist groups were asked to identify why they thought a particular category was important. For example, for walkways as well as traffic lights, the groups indicated that they not only prevent injuries but also facilitate people having access to desirable locations and activities. Green spaces were seen as making locations desirable, while also providing serene, pleasantly fragranced, and mood enhancing atmospheres—potentially making outdoor physical activities more enjoyable. Green spaces were viewed favorably by the older citizen scientists as providing shade from the hot sun for activity and

relaxation breaks, serving as windbreakers, contributing to fresh air, and providing bird watching opportunities. Social connectivity was deemed important as it can give focus to issues of older people by bringing them together as a group, as well as promoting social well-being through joint or community exercise. Social connectivity was also thought to enable opportunities for social networking and companionship for older people while providing chances for health education and group religious activities. Finally, the presence of safety facilitators was seen to deter robberies and provide a sense of security for older community residents. This included having safe locations for desirable services, and key destinations located in open and accessible places (e.g., automated bank teller machines).



Figure 1. “Designated and well-maintained walkways like this one leading up to the local government secretariat and beyond are admirable and desirable to encourage outdoor engagement in physical and social activities” Ms. Janet (This was a feature captured by many citizen scientists and was rated as a facilitator).



Figure 3. “People do not know the value of why there should be green beds and trees around them. The purpose is to give you oxygen. When you breathe out carbon dioxide, the greens around you give you oxygen. We always like to destroy green beds and trees around us because we feel like that oh, it is creating a big block for us or why we believe if the leaves fall and I have to sweep every day, yet it is good for us to sweep every day, and it is good the tree is there so that it is part of the life. If you get to my house, I have an orange tree. In fact, there were two before, because one of them was destroying my wall so I removed it and left one there. You will see so many weeds like these and other things, but they are good things which I am using to make sure the life there is breezy, whether there is fan or no fan, when I come out in the sun I sit under that tree, so those are things why trees and greens are necessary around us.” Pa. George (facilitator).



Figure 2. “There is supposed to be a zebra crossing over here but there is none. This is part of the things that can hinder easy participation in outdoor physical activity. This is bad.” (Mr. Adetunji) (Rated as a barrier).

For the categories that were associated with barriers in the community, the citizen scientists identified what changes they felt could be made to improve their community and why they

felt they were important. In addition to some of the items already addressed under the facilitatory category of pedestrian and traffic facilities, many issues around enforcement were highlighted. Specifically, enforcement of traffic laws and discouraging indiscriminate use of walkways by commercial vehicle operators or street traders were mentioned by the citizen scientists. The citizen scientists also felt that community members should be discouraged from leaving refuse in pedestrian areas by providing more garbage bins and proper waste management services. Also related to walkways, more high-quality materials were suggested for use in their construction, as well as regular repairs. For the latter, this included replacement of vandalized or stolen elements (e.g., drainage hole covers). Overall, a culture of good maintenance was suggested by the citizen scientists, along with the possibility of community cleanliness initiatives through the engagement of local government, as well as community and business organizations. Related to safety, the citizen scientists also suggested that shanties and dangerous hangouts needed to be removed.

There was much discussion about parks and how necessary they are for facilitating physical activity along with inter-generational engagement. However, a challenge identified by the citizen scientists was the fact that several parks had become private or commercial sites, resulting in park spaces being lost to the public. Another concern regarding public park facilities was the current lack of public toilets. Without these, the citizen scientists felt that some older people would not venture out of their homes to engage in physical activity.

A final barrier to physical activity identified by the citizen scientists was the stigmatization of older persons. In some cases, this included older persons being thought of as witches or witchcraft practitioners. Overall, the citizen scientists thought that older people should be more accurately recognized for their valuable contributions to their communities.



Figure 4. “This is another road. When it was initially built, it had distinct pedestrian way and motorist way but today, the road has been overtaken by weeds, all sorts of garbage and trash, and flood, smelling (stink), full of mosquitoes and flies. It is very closer to people’s houses (residence) such that even when you sleep the mosquitoes will not let you sleep well. This affects one’s motivation (for you) to get up in the morning and be healthy and to take one’s walk. One feels very weak because whenever you do not sleep well, you cannot get up healthy for activities, which is another challenge. Big one indeed.” Lady Susan (barrier).

Using the secret ballot process determined by the citizen scientists, the three issues prioritized by the citizen scientists to advocate for were social connectivity; pedestrian and traffic facilities; and green and beautiful environments. After establishing these priorities, the citizen scientists then presented in person their findings to a group of stakeholders they identified as being important community resources relevant to their areas for change.

Discussion and Implications

Recognition of the need for age-friendly environments is being embraced globally, although much more change is needed systemically, as well as at local levels (van Hoof et al., 2021). Implicit within the age-friendly movement is that the voices of older people need to be heard (WHO, 2007b). The *Our Voice* method is well suited for age-friendly initiatives (King et al., 2020) given its community-based participatory research methods. Studies using *Our Voice* for age-friendly related initiatives have included older adults in Israel (age and activity-friendly cities), the United States (activity and food environments, food access and transportation, neighborhood walkability and security, healthy communities, safe and healthy aging for LGBT residents), Mexico (active living), Brazil (physical activity), Canada (age-friendly university),



Figure 5. “Look! What do you find over there? You can see how lovely the garden is and how protected this is. This must have been the effort of the residents living in this immediate community.” Mr. Festus (facilitator).



Figure 6. “I took this photograph to identify some of the places where I go for daily activities. I am a member of different groups in my church. I also visit the church regularly for prayer activities. I usually walk down from my house to the church which is a few kilometres away.” Ms. Christianah (facilitator).

the United Kingdom (activity), Chile (quality of life and physical activity), Taiwan (social and recreation activities), and Australia (mobility-friendly geriatric medical rehabilitation unit) (King et al., 2020). As can be seen from this list of research projects and, like much of the age-friendly research carried out in general, there has been a focus on high-income countries within the northern hemisphere. In low- and

middle-income countries of the global south, however, there are often prejudices against older people and youth-centric policies and preferences that can leave older people behind as urbanization occurs (Adlakhaa et al., 2021).

As mentioned in the introduction, while there have been studies related to physical activity in older people in Nigeria, we are not aware of any studies that specifically sought to hear from older adults about what community attributes would help to promote physical activity. Studies that have been conducted in other countries have found a long list of physical characteristics that are needed to enhance the likelihood of physical activity participation at the local level (reviewed by Haselwandter et al., 2015). Some of these same characteristics were identified as priorities by the older adults in this study, including the general categories of green and beautiful environments, as well as the need for better pedestrian and traffic facilities. Oyeyemi et al. (2019b), in their questionnaire-based study, found that traffic safety and protection from crime were two factors that were associated with self-reported sedentary time in older Nigerians, in addition to walkability index and distance to destination.

In addition to the physical aspects mentioned above, this project's citizen scientists also identified that social connectivity should be prioritized within their community, as discussed during their meeting on facilitators of physical activity. Local neighborhood associations and nongovernmental organizations were discussed as being valuable, along with faith-based organizations/activities, places of worship, and health education talks by various groups. They also spoke about the value of multigenerational opportunities. They felt these could be enhanced by having spaces in their local communities such as parks, as well as purposeful activities like community walks with participants of a variety of ages, and physical activity educational events.

Clearly, age-friendly initiatives should move beyond the built environment to ensure that older people are respected and engaged in their communities (WHO, 2007b), and multigenerational opportunities are encouraged to lessen ageism (WHO, 2021). Even in an urban part of Nigeria, the citizen scientists from this study related that some community members still view older people as “witches.” Tanyi et al. (2018) also reported on this stereotypical and discriminatory viewing of older people as “wicked wizards and witches.” In addition to this hostile ageist framing of older people as otherworldly beings, other more subtle forms of ageism, where older people are seen as incompetent or unhappy, have also been found to exist (Tanyi et al., 2018). Broad support for community programming for older adults will likely be challenged by these ageist notions, but the citizen scientists reported that they, for the most part, had faith in their community and would be able to work with others to influence decisions.

While this study had many strengths related to its collaborative citizen science approach and systematic means of data collection, there are also some limitations. One limitation is that the participants are not representative of all older Nigerians. Participants from a different type of community (e.g., rural) or with different characteristics (e.g., lower education level) might have had a different perspective on the barriers and facilitators in their community. It would be worthwhile to explore how such perspectives might differ in different socio-demographic groups of older adults, and to evaluate further different types of recruitment strategies for the current population. In addition, it was beyond the scope

of this research project and our ethics approvals to elicit information from the community partners who attended the dissemination meeting about the likelihood of changes being made. What was obvious from this project, though, was the commitment of the participants to engage throughout the process and present with conviction their recommendations. Other *Our Voice* projects have demonstrated that positive changes in local built environment infrastructure and social connections can indeed occur when older residents, community partners, and community-facing researchers work together through this type of participatory method (King et al., 2020). Future projects could benefit by having systematic follow-ups accompanied by ethnographic observations and similar methods in the locations of interest to see whether changes are evident.

In conclusion, this citizen science project has illuminated the social and physical environmental features that older Nigerians report would help enable them to be physically active in their community. Supported by technology and a guided research process, they were able to analyze the rich data, prioritize specific environmental aspects of their communities, and make recommendations for change. They highlighted the need for pedestrian and traffic facilities; green and beautiful environments; along with social connectivity to enhance physical activity in their local community.

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Conflict of Interest

None.

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