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Spatial Needs for Healthcare Access During Disasters in Informal Settings for Older Adults With Disabilities

RESEARCH

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ABSTRACT

Older adults with disabilities and their caregivers require certain spatial conditions that allow them to carry out protective actions and healthcare access during disasters. This study aims to identify these spatial needs in the first few hours of an emergency within informal settings. For this purpose, a case study methodology with several phases was applied. The first phase focused on case definition through a literature review and case studies selection in the Metropolitan District of Quito-Ecuador. Phase two centered on spatial audits and collecting quotes and experiences from older adults with disabilities and their caregivers, conducted through focus groups. The third phase analyzed quantitative and qualitative data, generating three thematic categories: autonomous, support-driven, and institutional response access needs to healthcare. Findings highlight that special attention should be paid to the relationship between spatial conditions and individual or group behaviors during disasters, as these can exacerbate vulnerable outcomes for older adults.

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INTRODUCTION AND THEORETICAL FRAMEWORK

During disasters—especially those characterized by short-notice timing, such as earthquakes—the health and life of persons with disabilities and their families or caregivers are at much risk, resulting in higher mortality and morbidity rates than those for the remaining population. For instance, during the 2011 earthquake in Japan, the mortality rate among persons with disabilities was double that among the general population. Similar data were obtained from disasters in Haiti and Indonesia (Aldrich and Benson 2008; United Nations Office for Disaster Risk Reduction 2016). Additionally, when Hurricane Katrina hit the US in 2005, many wheelchair users drowned in their beds and chairs, even inside specialized care facilities (Millin, Jenkins, and Kirsch 2006). Previous studies have also indicated that the percentage of persons with disabilities who can be evacuated in an emergency is only 20% in the case of a sudden or short-notice disaster. If there was a generous evacuation time, this percentage could increase to 38% (United Nations Office for Disaster Risk Reduction 2023).

Faced with this problem, the United Nations Convention on the Rights of Persons with Disabilities and the Sendai Framework for Disaster Risk Reduction assert the implementation of inclusive policies and strategies for reducing disaster risk, recognizing the unique needs of vulnerable populations. Among their recommendations are universal design and accessibility that provide safe and autonomous conditions for the usage of built environments, products, and services to all. It is important to note that public transportation and vehicular mobility tend to collapse during the first few hours following a disaster; thus, mobility generally depends on existing pedestrian pathways, making universal accessibility even more critical (Gurkan Solmaz and Turgut 2019; Gürkan Solmaz and Turgut 2015). Therefore, when the main objective is to provide fast and effective assistance to victims, universal access conditions should be deeply understood and fulfilled in health systems for daily-life healthcare and health response during disasters (Panamerican Health Organization n.d.; 2024).

Poor health outcomes among persons with disabilities living in underprivileged and informal contexts are of particular concern. In such contexts, the barriers to mobility and access to healthcare are multiple and of different types: physical, cultural, social, etc. This has been previously studied, where significant challenges, such as the need for universal design in health facility construction and recovery (Redwood-Campbell and Abrahams 2017), elimination of mobility barriers (Aryankhesal, Pakjouei, and Kamali 2017; Chaiyachati et al. 2018), policies and guidance regarding inclusive evacuation needs (Johnson, Ling, and Mcbee 2018), accessible internal conditions of primary healthcare facilities (Freitas Marques et al. 2018), inclusive information and communication (Hipper et al. 2018), and universal accessibility for disaster risk reduction in hospitals have been indicated (Panamerican Health Organization 2018).

Previous studies have also shown that developing countries account for around 89% of deaths resulting from disasters, even when only 26% of disasters occur in such countries (International Red Cross Federation 2022; Pantano 2015; United Nations 2011). This has to do, in part, with the large presence of informal or self-constructed territories where stigma, poverty, and poor habitat conditions exacerbate exclusion and risk (Blaikie et al. 2014; Cannon 1994; Cortes Lara 2019; Cutter, Mitchell, and Scott 2000; Mileti 1999; Segura 2010; United Nations Department of Economic and Social Affairs 2019; Wisner, Gaillard, and Kelman 2012b), preventing people from accessing healthcare by themselves, creating dependency, and impeding them from meeting the environment they should face in case of a disaster (Bantis et al. 2017). In addition, in developing countries, approximately 15–20% of the underprivileged population is estimated to have some disabilities (United Nations Office for Disaster Risk Reduction 2023; Vicepresidencia Ecuador 2012). Given the lack of inclusive education systems, low levels of social participation, and barriers to their mobility (Mitra, Posarac, and Vick 2013), poor health outcomes for this demographic exist (Chaiyachati et al. 2018; Hunt et al. 2015; Nunnerley et al. 2015; Skøt et al. 2016; Stough and Kang 2015; United Nations Office for Disaster Risk Reduction 2023). This problem remains understudied and under-consulted, primarily within developing countries (Hipper et al. 2018).

The discourse on promoting inclusive disaster risk reduction relies on theoretical or conceptual perspectives, such as the social model of disability, the capability approach, and the human rights model of disability. The social model positions disability as the result of social attitudes and stigma, cultural and physical barriers that impede the interaction between persons with disabilities and the environment (Oliver 1990; Oliver and Barnes 2012; Levitt 2017). This model

diverges from the medical perspective of disability as a form of physical impairment and argues that the types of limitations that individuals face in daily life and during disasters result from societal barriers, not from their health conditions (Arneson 1993; Hunt et al. 2015). On the other hand, the capability approach relates to an individual's ability to use resources for purposes the person deems essential, being individual-centered rather than resource-centered (Hemingway and Priestley 2006). This approach claims that the actions people aim for and need to carry with efficacy are part of their right to be independent and autonomous. Furthermore, the human rights model of disability claims the inherent dignity of the human being, placing individuals in the center stage of all decisions affecting their lives and locating the problem in societal factors, similar to the social model (Lawson and Beckett 2021; Quinn et al. 2002).

These conceptual models are consistent with theories about disasters and self-protection, which are of particular importance for promoting inclusive disaster risk reduction (Kahe et al. 2018; Marceron and Rohrbeck 2019; McDermott, Martin, and Gardner 2016; Pertiwi, Llewellyn, and Villeneuve 2019; Rogers 1975; Ton et al. 2018; Wisner, Gaillard, and Kelman 2012a), not only for persons with disabilities but also for their families, caregivers, and the community who face increased levels of risk in their eagerness to support them in case of disaster, especially within environments characterized by stigma, exclusion, and lack of access to public facilities that are typically utilized for evacuation and relief areas (Brand and Nicholson 2016; Chaiyachati et al. 2018; Grassman, Whitaker, and Larsson 2009; Gülgün et al. 2016; Rogero 2009; Van Willigen et al. 2002; Wakui et al. 2017; Zuo, Zhou, and Lin 2015). These models on disability promote the elimination of defenseless and resource-needed stereotypes, the dependency reduction of individuals on institutions, and the development of more efficient health and emergency systems for persons with disabilities and similar demographics.

In addition, the disaster risk reduction needs of persons with disabilities should become part of the urgent agendas of all societies for many reasons. First, the threat of climate change increases with the frequency and intensity of disasters (Maarten and Van 2006), resulting in injuries, deaths, mental health problems (Ridel et al. 2018), and saturating or collapsing health and emergency systems. Second, the effects of disasters raise vulnerability for at-risk populations (Morris, Hayward, and Otero 2018) and increase inequalities and damages that further reduce the opportunities to access health and sanitation services for several population groups. Third, many societies, especially in developed countries, are aging, which is associated with an increase in the presence of disabilities (Tatsuki 2013; World Health Organization and World Bank 2011).

To address the existing gap for inclusive disaster risk reduction, we conducted three case studies of neighborhoods with informal or self-construction characteristics in the Metropolitan District of Quito, Ecuador, a city highly exposed to disaster risk due to its geographic location and tectonic complexity and subjected to various threats such as telluric movements, floods, and several active volcanoes (Banco Interamericano de Desarrollo, División de Medio Ambiente, Desarrollo Rural y Administración de Riesgos por Desastres 2018; Servicio Nacional de Gestión de Riesgos y Emergencias 2018; Toulkeridis, Cabrera, and Speck 2013). With the three case studies, we aimed to identify, categorize, and understand the spatial conditions required for accessing healthcare during the first few hours of a short-notice disaster for older adults with disabilities within informal settings where vulnerability and exclusion intersect, drawing on the social model, the capability approach and the human rights model on disability.

MATERIALS AND METHODS

Figure 1 collects and represents the activities and methods applied in the study and the relationships among them.

PROBLEM DEFINITION AND CASE STUDY SELECTION

This work forms part of a doctoral study concerning inclusive disaster risk management within informal settings (Pacheco Barzallo, Fariña, and Álvarez de Andrés 2022a; 2022b) that used a case study methodology, allowing the collection of qualitative and quantitative data through the thorough observation of the spatial characteristics across the cases (Alpi and Evans 2019). The case studies were selected to identify the most explicit representations of the problem, facilitating their evaluation and interpretation. Thus, three variables were defined for the case

selection: (1) being self-produced or informal territories, (2) being in high-risk areas of Quito, and (3) having the openness of territory leaders, older adults with disabilities, and their families for the research. Three neighborhoods were selected: Case A–Atucucho, Case B–Carapungo, and Case C–Auqui de Monjas. In this article, we focus on the findings about the spatial needs and the characteristics of the built environment. Other results will be published elsewhere.

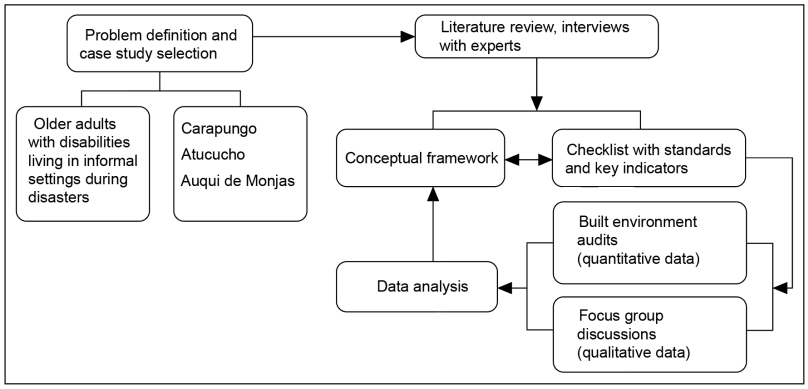


Figure 1 Activities and methods approach.

LITERATURE REVIEW, INTERVIEWS, AND CONSTRUCTION OF INDICATORS

The case study methodology was applied through three different phases. Phase 1 examined various documents, including technical standards such as ISO 21542 Standard on the Accessibility and Usability of the Built Environment and existing scientific literature, which were systematically reviewed. Also, in this phase, unstructured interviews with experts on disaster risk management in the health sector were conducted. With the inputs collected from these two activities, the conceptual framework for the study was established, and an instrument or checklist containing a set of spatial standards regarding universal accessibility and disaster risk reduction in the built environment was constructed. The checklist includes a total of 60 standards to observe the built environment, which were aggregated into nine key indicators for providing inclusive access to healthcare during disasters:

1. Spatial conditions required in road axes for universally accessible pedestrian mobility: this indicator measures universal accessibility and disaster risk reduction standards on streets, signage, and sidewalks regarding their materiality, slope, and the availability of ramps and handrails where needed, among other things.
2. Spatial conditions required for accessible green and public spaces: this indicator observes public open spaces and their entrances, nearby pedestrian crossings, internal sidewalks, and internal signage for their availability and accessibility standards.
3. Spatial conditions required for accessible entrances to facilities: this indicator features how universal accessibility standards are observed in the main entrances to hospitals, health centers, or similar facilities.
4. Availability of healthcare institutions inside the exposed territory: this indicator shows whether a healthcare institution exists within each neighborhood or case study to help the local population in case of disaster.
5. The health center's close location in relation to the dwellings in the territory: this indicator measures the proximity of dwellings to health centers, facilitating quick access to health services.
6. The close location of a hospital in relation to the affected territory: this indicator examines whether a healthcare institution exists near each case study so people can quickly reach it in case of disaster. The measure of close location was defined as within the neighborhood or surrounding neighborhoods.
7. Street permeability between the affected territory and the broader urban network: this indicator assesses to what extent the road network of the territory of the cases connects with the city or broader road networks to allow escaping or evacuation in case of disaster.
8. Lighting services are provided along all pedestrian and vehicular axes: this indicator checks the length of roads with lighting services.
9. Availability of visual and auditive disaster alarms: this indicator investigates if alarms exist to inform the population in case of disaster.

DATA COLLECTION THROUGH AUDITS OF THE BUILT ENVIRONMENT AND FOCUS GROUP DISCUSSIONS

Phase 2 involved in-depth audits of the built environment and focus group discussions (FGDs). The audits observed the daily-life spatial conditions of the territories of the cases where a disaster could occur. This was achieved using the observation instrument or checklist designed in Phase 1. The data collection was achieved by walking, in each case, through all streets, alleys, public spaces, and the main entrances to existing health facilities. During the audits, each standard from the checklist was observed and received either a value of 100 if the standard was met or 0 if it was not; all standards observed measured the same, and no weight was granted. In this way, we calculated the percentage to what extent the universal accessibility and disaster risk reduction standards were met within the built environment of each case study.

On the other hand, FGDs allowed us to collect perspectives and experiences regarding healthcare access during emergencies for older adults with disabilities and their caregivers. The participation of the people in FGDs was achieved with the help of the community leaders of each case study, who sent an open invitation to participate in the discussion through their community social networks. Focus group discussions were held in the community houses of each case, where neighbors converged to attend different activities; FGDs were programmed within the same schedules when neighbors typically attend communal activities, and pedestrian mobility assistance was planned for all sessions.

The FGDs engaged 49 participants, including 27 with physical, visual, and hearing disabilities; there were no blind or deaf people, only people with partial disabilities participated, and the rest were family members, caregivers, or neighbors. Eight participants required assistive devices such as wheelchairs for their daily lives, and when necessary, different communication channels, verbal or written, were used during the FGDs. Moreover, some participants who had difficulties hearing during the group conversations were interviewed individually. Neither photographs were taken nor were the participants asked for personal or health information; the discussion specifically addressed the spatial conditions of their neighborhoods. All FGD participants were informed about the objective and scope of the study and signed an informed consent letter, which was read and printed to all older adults and their caregivers before initiating the discussions.

The questions for FGDs referred to the participants' perceptions of the built environment within their neighborhood, addressing each of the key indicators obtained in Phase 1; for example, they were asked to comment about the conditions of road axes and the mobility challenges faced in daily life or during emergencies. These data were collected with audio and notes.

DATA ANALYSIS

Finally, in Phase 3, qualitative and quantitative results were analyzed. Quantitative data were aggregated within each key indicator and expressed as percentages. Qualitative data was transcribed for analysis within a code structure obtained inductively, with codes developed based on what was found from the data. Five initial codes were generated focusing on identifying strategical approaches for healthcare access during emergencies and following an individual-centered and not resource-centered perspective, being consistent with the capability approach (Hemingway and Priestley 2006) and the social model of disability (Levitt 2017; Oliver 1990; Oliver and Barnes 2012); subsequently, these codes were regrouped and yielded three thematic categories for interpreting spatial needs: spatial needs for autonomous access to healthcare, spatial needs for support-driven access to healthcare, and spatial needs for institutional response access.

LIMITATIONS

This study acknowledges its inherent limitations. Given the impossibility of observing actual disasters happening in real-time, we selected cases categorized as vulnerable to emergencies, such as tremors, earthquakes, landslides, and fires. Second, to broadly understand spatial needs, it was necessary to observe the internal conditions of dwellings and health facilities; however, this study only observed the main entrances of such structures. Third, the lack of contact information for older adults with disabilities complicated the organization and definition of the number of participants for the FGDs; therefore, the sessions were organized with the people who attended the community invitation. Finally, as this topic remains understudied, it

was challenging to identify previous methodologies to study the problem and list the inclusive spatial standards for observing the cases. As a result, mixed data collection techniques were used with reference to international technical standards for auditing the cases. Admittedly, this methodology needs further polishing.

RESULTS

The results obtained from the case studies help us identify the spatial needs that allow older adults with disabilities to access healthcare during disasters. Drawing on the social, the capability approach, and the human rights models on disability, we focus on what persons with disabilities and their caregivers are able to do in case of disaster or the actions they need to carry to protect themselves or their relatives rather than on the available resources for their protection. The results analyzed with this perspective claim the inherent dignity of individuals, who should be able to make all decisions affecting their health, both in daily life and during disasters, without worrying about the barriers to their well-being that society creates.

Table 1 shows the quantitative results obtained from spatial audits where 100% represents the best situation, and 0% represents the worst situation for each key indicator in each case study. As we can see, the most urgent spatial needs are related to accessible pedestrian mobility (Indicator 1), as only 28% of road axes in Case A, 46% in Case B, and 27% in Case C were universally accessible, meaning that the vast majority of streets lacked good materiality conditions, minimum dimensions for the circulation of all people, or that they presented repetitive barriers as steps along sidewalks. It should be mentioned that several streets did not have sidewalks, representing a significant barrier to pedestrian mobility. Similar findings were obtained in public spaces (Indicator 2), where only 27% of green and public space was safe and accessible in Case A, 47% in Case B, and 42% in Case C due to bad quality of the materiality of internal roads, the absence of ramps and accessible signage, the presence of walls or other barriers to access, among others. The results obtained from the observation of entrances to health facilities (Indicator 3) show that only 41% of entrances in Case A, 51% in Case B, and 33% in Case C are accessible to all; these results are particularly worrisome even outside disaster scenarios as persons with disabilities face several barriers to enter the places where they need to receive health assistance. In Case C, this problem is even more relevant as it did not have any internal health institution or a close location with a hospital to attend to affected people in case of disaster (Indicators 4, 5, and 6). Street permeability with a broader urban area (Indicator 7) and availability of disaster alarms (Indicator 9) were the most worrying indicators in all cases, as only 4% of streets in Case A, 9% in Case B, and 10% in Case C were connected to the broader urban network, meaning that large areas of the territories do not have escape points. No case had any alarms for communication in case of disaster. In cases A and B, lighting services were available along 100% of pedestrian and vehicular axes, reducing to 50% in Case C (Indicator 8).

Table 1 Comparative results between case studies.

INDICATOR NUMBER	SPATIAL NEEDS OBSERVED	CASE A	CASE B	CASE C
1	Spatial conditions required in road axes for universal accessible pedestrian mobility	28%	46%	27%
2	Spatial conditions required for accessible green and public space	27%	47%	42%
3	Spatial conditions required for accessible entrances to facilities	41%	51%	33%
4	Availability of healthcare institution inside the exposed territory	100%	100%	0%
5	Close location of the health center in relation to the dwellings in the territory (Reference distance of 200 m or 0.12 miles)	100%	100%	0%
6	Close location of a hospital in relation to the affected territory	100%	100%	0%
7	Street permeability between the affected territory and broader urban network	4%	9%	10%
8	Lighting services along all pedestrian and vehicular axes	100%	100%	50%
9	Availability of visual and auditive disaster alarms	0%	0%	0%

These spatial conditions observed in real-life settings can help us interpret spatial needs during disasters. We start from the disaster premise that what does not work correctly in normality will not work well in times of crisis; it could only get worse (Expert interviewed, September 30, 2019*)*. Following this idea, spatial needs are exposed within a strategic conceptual structure resulting from qualitative data coding and interpretation. We argue that spatial needs are essential in performing different strategies: autonomous access to healthcare, support-driven access, and institutional response access.

SPATIAL NEEDS FOR AUTONOMOUS ACCESS TO HEALTHCARE

The first strategy is autonomy for self-protection and self-efficacy. It is the only strategy individuals can implement from the first few seconds of a short-notice disaster to care for their health and life through self-protection actions such as holding on to fixed elements, escaping from risky areas, and finding safe ones. The spatial needs required to favor this strategy start with the physical conditions of the buildings where people are when a disaster begins, the connections of the buildings with their surroundings, the availability of close, safe public areas, close primary healthcare or other safety facilities, and the logistic means to access them through universally accessible streets and sidewalks. Unluckily, within the territories of the case studies, several of these needs are missing or vaguely satisfied.

During disasters when mobility intensely depends on pedestrian means, universal accessibility becomes necessary for evacuation and survival until reaching safe areas. The results of Indicators 1 and 2, shown in Table 1, help us interpret that autonomy could be blocked during a disaster for older adults with disabilities for evacuating and accessing healthcare if needed for many reasons. In the first instance, the location of the territories studied near streams generates large slopes on streets and sidewalks; second, health institutions could not be accessed with autonomy due to the barriers in their entrances; third, pedestrian means such as streets, sidewalks, and pedestrian crossings lack minimum dimensions, handrails, inclusive signage, have loose pieces, holes, and irregular materiality; moreover, signaling along the routes is insufficient and not very readable, not even risky areas can be identified.

The results obtained from the observation of the built environment imply that older adults with disabilities encounter redundant barriers to their autonomy, generating a dependency that would intensify during disasters, meaning that their lives could depend on the willingness and eagerness of other people to help. Therefore, for older adults living alone or lacking social ties, the spatial conditions further reduce their possibilities for survival; furthermore, the conditions of the built environment have a worrying implication as these may influence the perception of older adults' capabilities for self-protection in case of disasters. During the focus groups, it could be identified that it is too hard for older adults with disabilities to imagine facing disaster situations by themselves; they have built a fatalist perception regarding their self-protection capability within the built environment, as described by one participant.

> … in those cases, you get scared and do not know how to get out or where to go… in my case, it is not paved, and I must walk quite a bit for everything… it becomes pure mud, it would be chaos in the event of an earthquake, I do not know if I could get out… (Older adult, Case A) (Pacheco Barzallo, Fariña, and Álvarez de Andrés 2022b)

SPATIAL NEEDS FOR SUPPORT-DRIVEN ACCESS TO HEALTHCARE

The second strategy, that of formal or informal support, considers actions that can be taken by caregivers, family members, specialized personnel, or communities to provide fast healthcare access. Particularly within informal settings such as those from the case studies, the care-providing role becomes even more pressing and, during emergencies, could be crucial for the survival of older adults as their autonomy is reduced or blocked due to the conditions of the built environment, social stigma, and beliefs. The spatial needs required to make this strategy effective during disasters include close health facilities, close public spaces for meeting with others and sharing relief actions, basic services, trained personnel inside the territory, and logistic means.

In all cases, the most urgent spatial needs regard accessible green and public places due to either scarcity of parks or communal spaces or the few repetitive barriers present in their

surrounding and internal sidewalks, as shown in Table 1, Indicator 2. While walking around the territory of all three cases, several parks could not be accessed due to existent walls around their perimeter, doors, and even padlocks. In addition, there is an urban tendency to construct big and enclosed housing complexes that block access to their common areas, limiting free mobility and reducing the availability of safe open areas for the community. This set of spatial conditions not only reduces autonomy for older adults with disabilities to evacuate and meet with others but could also demotivate caregivers and the community from acting as a support during disasters as the risk to their own health and life increases and the barriers to this purpose may be perceived as too complex to manage, as mentioned by the participants.

> ...before 2010, the community had a project to locate these people -people with disabilities- and find out where they are, but there were difficulties due to the lack of resources. Approximately since 2010, the Ministry of Economic and Social Inclusion started a new program to locate them and has data about them, but only to involve them in neighborhood activities, not for anything else... (Older adult, Case A)

> ...the neighborhood committee coordinates actions with some associations and pertinent institutions; they can help them – older adults-... (Older adult, Case B)

Added to these spatial conditions is that although the neighbors know that several health professionals live in their neighborhood, they do not know each other and have never taken collective preventive measures for disasters, even less about inclusion strategies. Therefore, they do not consider community action with older adults with disabilities; instead, they perceive that this responsibility corresponds to specialized institutions. These ideas reflect that the community is unaware of the states of loneliness of older adults, not only about their health conditions, and therefore ignores that the community itself is their closest social tie in case of emergency.

> ...disaster issues have not been discussed; what has been discussed is the need to coordinate with the National Risk Management Secretariat so that they attend to the neighborhood in the matter... (Older adult, Case A)

SPATIAL NEEDS FOR INSTITUTIONAL RESPONSE ACCESS

The last strategy, from which older adults with disabilities, their families, and the community have high expectations, is the response from specialized institutions that enter the affected territories to help and rescue people when internal capacities have been overwhelmed. The main spatial need for this strategy in all case studies is road and geographical disconnections with the urban network where rescuers, health and emergency resources, and all types of facilities are located. Table 1, Indicator 7 shows that in Case A, only 4% of streets are permeable with the rest of the city, 9% in Case B, and 10% in Case C, meaning that the majority of streets have no connection with broader urban areas or escape points in case of disaster. Several participants mentioned that during emergencies, the scarce access points that connect their neighborhood with the city are quickly blocked due to traffic or landslides, resulting in a low permeability that blocks people from leaving the affected zones to reach safer areas or health infrastructure. This primarily blocks the entrance of emergency response professionals, ambulances, or any other external resource. As shown in Table 1, Indicators 8 and 9, this problem is exacerbated by the dimensional deficiencies of internal streets, the lack of lighting services, which in Case C is available only along 50% of pedestrian and vehicular axes, and the total lack of visual and auditive disaster alarms which help maintain control and coordination among the response institutions such as military, police, and firefighters, inside the affected territories.

> ... we have stairways connecting with the only two streets that join the city; they are two streets but meet simultaneously. One of them is only for light vehicles and unsuitable for large vehicles such as ambulances" (Older adult, Case A).

The spatial needs of institutional response strategies must also be analyzed over time. This is because when external health services manage to enter the affected territories, a large part of their capacity and resources is already filled; many people might require urgent healthcare or have already died. Upon entering, response institutions must help those most likely to survive rather than looking for those trapped unless the rest of the community has already reached

the basic survival conditions. Therefore, the logistic and human resources will be more available to those most likely to survive and those who have provided information about their location or reached safe community areas. This means that spatial conditions that block autonomous access and demotivate support could further reduce access to institutional response aid for older adults who, in many cases, must face the disaster situation alone, with different healthcare needs, and without sufficiently recognizing the surrounding environment to escape, meet others or call for help.

> ...during the first 24 hours, rescuers prepare to enter the affected territories; upon entering, they act or react as the internal conditions allow and according to the available information provided by citizens or the community that has already initiated relief activities... (Expert interviewed)

> ...let's think of a disaster response institution, a delegation... We could try to have them – persons with disabilities – located and give them priority; however, why should the institution give them priority with respect to other people? To what extent would that be ethical or fair... To deal with the disaster, people making the decisions will have to take the actions that allow them to obtain the best possible results for the entire community at risk... (Expert interviewed).

DISCUSSION

The results obtained from the case studies provide evidence regarding the most urgent spatial needs that concern not only persons with disabilities and older adults but also their families, caregivers, communities, and health response systems in case of a disaster within informal territories. The results help us identify an essential gap between the unique needs of older adults with disabilities and disaster risk reduction strategies, which should be further studied, especially in developing countries. Our results align with calls made by international instruments such as the United Nations Convention on the Rights of Persons with Disabilities and the Sendai Framework for Disaster Risk Reduction, emphasizing how urgent universal accessibility and autonomy are during disasters (United Nations 2006; United Nations Office for Disaster Risk Reduction 2015), particularly for populations who suffer an intersection of disaster vulnerability as loneliness and health problems.

As argued with the results, spatial means are essential for effectively accessing healthcare during disasters for all actors: individuals, families, communities, and institutions. Therefore, one of the first objectives of inclusive disaster risk reduction projects and policies should be to create spatial means that increase the autonomy of all people to move around and get to know their neighborhoods and communities. This would reduce dependency and motivate the development of self-protection actions and capabilities. It must be understood that if a person's autonomy can be strengthened daily, it may have the same effect during disasters; therefore, we emphasize that an inclusive disaster risk perspective should be individual-centered and align with theoretical frameworks such as the capability approach (Hemingway and Priestley 2006). In addition, it would be necessary for disaster risk management agendas to create community awareness about specific risk triggers for some demographics, such as loneliness in the case of older adults, and the importance of fostering encounters among all population groups by means such as inclusive public space. Delving into this idea, it should be mentioned that universal access to built environments and public space is a human right that fosters the use and enjoyment of space and encounters with communities, which, during disasters, may facilitate survival (Lawson and Beckett 2021).

Similar to autonomous actions, support-driven actions would be strengthened with inclusive spatial conditions in case of disaster as universal accessibility reduces dependency and could help mitigate risk rises for families or caregivers in territories similar to those studied here (Wakui et al. 2017). Not only are risk rises of importance, but also the perceptions and beliefs that people build from these environments. One of the fatal results of the lack of inclusive spaces has to do with the apathy and demotivation that communities may feel for helping others in case of a disaster because the problem may seem too big, the resources may seem very few, and the barriers could seem too many to be handled by the community. This idea needs to be further studied.

Our research also suggests that all types of mobilities, in coordination with relevant institutions, should be included in the plans for health response during disasters, which aligns with previous literature and particularly for pedestrian mobility (Gürkan Solmaz and Turgut 2015). The local levels of healthcare delivery need to be reinforced, encouraging the fulfillment of inclusive and universal accessibility standards in social and built environments. In this way, all people can explore the environment in which they live and identify the risks and barriers they must face. These daily experiences shape their behavior, execute daily life actions, and define their capabilities, a person can execute. In this sense, the relationship between individual and collective behaviors and spatial conditions needs further study. As we can note from the comments given by the participants, the perception of their autonomy and the support capacity from family members and the community is not positive and tends to be fatalistic as spatial conditions are not inclusive; therefore, dependency during disasters is reinforced and strengthens the expectations for disaster risk management based on institutional response. This is paradoxical as, from the spatial analysis of the case studies, we could see that institutional response has even more spatial barriers than the strategy of autonomous access to be effective; the institutions do not have the essential spatial means as a road network to access these informal or self-produced territories, and this reality may be similar in several neighborhoods and cities in developing countries exacerbating exclusion for older adults with disabilities (Mitra, Posarac, and Vick 2013). In this sense, we understand a great need to change the preference for disaster risk management based on institutional response and redefine institutions' role to coordinate and motivate inclusive policies and projects. This should also be further analyzed in different contexts.

It is necessary to deepen the study to better understand the needs of different types of disabilities and psychological and mental health conditions, as all these present unique characteristics that are likely to have different spatial needs during disasters. Also, it would be pertinent to test the methods for different age groups and identify particular concerns of each one. In our study, for the case of older adults with disabilities, loneliness is a major concern that interacts negatively with the spatial conditions of the territories for the survival of older adults, mainly due to the lack of pedestrian mobility means during disasters which exacerbate dependency (Gurkan Solmaz and Turgut 2019).

Further analyzing the methodology, we affirm that the different approaches to addressing the problem were challenging yet enriching. In contexts like those studied here, it may be difficult to obtain or collect data; indeed, more methodologies for the analysis of inclusion are needed to compare results among different contexts. From our experience, we affirm that the mix of quantitative and qualitative data may be beneficial in contexts where age and disability are still understood as merely health conditions. Measuring socially constructed issues such as the lack of universal accessibility and collecting testimonies about its implications may promote the move of society towards a model more coherent with the social and the capability approach that guided this research conceptually. It would be very enriching to test further and validate the method and some standards for observing the built environment in other contexts with various social and economic backgrounds.

Finally, we would like to mention that the case studies from this research were carefully selected due to their disaster risk conditions; however, they are a sample of what is happening in many territories in developing countries where several spatial needs still need to be fulfilled.

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The authors have no competing interests to declare.

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