fortune Journals

Research Article

JOURNAL OF ENVIRONMENTAL SCIENCE AND PUBLIC HEALTH

ISSN: 2575-9612

Measuring the Impact of Disability-Inclusive Emergency Planning on Vulnerable Populations

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Abstract

Background: In Bangladesh, where 70% of the population lives in flood-prone areas, individuals with disabilities face heightened risks during emergencies. Despite efforts to improve emergency planning, there is a lack of specific tools tailored to the needs of these populations. This study was evaluated an adapted disability-inclusive emergency planning tool, developed based on the AUCD framework, for its effectiveness in enhancing preparedness among individuals with disabilities in Gazipur district.

Methods: A sample of 100 participants, including individuals with physical, sensory, and cognitive disabilities, as well as parents, community volunteers, and emergency responders, was selected using purposive sampling. Pre- and post-intervention surveys and key informant interviews were conducted to measure changes in preparedness.

Results: The intervention led to significant improvements in emergency preparedness metrics. Knowledge of flood preparedness increased from 45% to 85% ($p < 0.001$), access to emergency resources rose from 31% to 70% ($p < 0.001$), participation in emergency drills grew from 20% to 63% ($p < 0.001$), confidence in emergency response improved from 41% to 72% ($p < 0.001$), and accessibility of shelters increased from 48% to 84% ($p < 0.001$). Participant feedback was largely positive, with high ratings for the tool's ease of use and cultural relevance.

Conclusion: The adapted AUCD tool significantly improved preparedness and response capabilities among individuals with disabilities. The findings highlight the effectiveness of tailored interventions and underscore the need for ongoing training and resource development to address barriers and enhance emergency planning for all populations.

Keywords: Disability-inclusive planning; Emergency preparedness; AUCD tool; Flood preparedness; Bangladesh.

Introduction

Bangladesh, a country characterized by its high population density, faces significant challenges related to natural disasters, particularly floods. With an estimated 127,000 people per square kilometer, the nation's vulnerability to flooding is pronounced, affecting 70% of its population living in flood-prone areas [1]. In 2022, 27 flood-affected districts in Bangladesh experienced

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Citation: Ishrat Jahan Shila, Masud Rana, Moniruzzaman, Somaiya Sultana, Mohammad Anamul Haque, Naimul Islam, Dilshad Sony. Measuring the Impact of Disability-Inclusive Emergency Planning on Vulnerable Populations. Journal of Envi1ronmental Science and Public Health. 8 (2024): 168-174.

Received: September 17, 2024
Accepted: September 25, 2024
Published: October 03, 2024

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DOI:10.26502/jesph.96120214

severe flooding that resulted in 102 deaths over a span of 42 days, highlighting the need for effective emergency preparedness and response strategies [2]. Among the affected, individuals with disabilities were disproportionately impacted, experiencing higher rates of negative health outcomes compared to the general population [3].

People with disabilities constitute approximately 3.29% of Bangladesh's population, with a significant proportion being primary school children [4]. Despite this, only 40.55% of children with disabilities receive primary education, reflecting broader challenges in access and inclusivity within the education system [5]. Furthermore, there is a lack of specific guidance on flood preparedness for schools and for students with disabilities, which exacerbates their vulnerability during emergencies [6]. This gap in emergency planning underscores the necessity for disability-inclusive strategies that can protect and empower this vulnerable group.

The Association of University Centers on Disabilities (AUCD) has developed tools aimed at enhancing emergency preparedness for people with disabilities, which have shown promising results in various contexts [7]. However, these tools require adaptation to local settings to be effective. In Bangladesh, the adaptation and implementation of disability-inclusive emergency planning tools have not been widely explored, particularly in rural and flood-prone regions like Gazipur district [8]. This study aims to address this gap by assessing the impact of a locally adapted AUCD tool on emergency preparedness among vulnerable populations in Gazipur.

Disability-inclusive emergency planning is a critical component of public health preparedness, promoting equity and ensuring that all community members have the resources and knowledge to respond effectively to emergencies [9]. Research indicates that inclusive planning not only improves outcomes for individuals with disabilities but also enhances overall community resilience [10]. For instance, communities that engage in inclusive planning report better coordination among emergency responders, increased accessibility to emergency shelters, and improved communication strategies tailored to diverse needs [11]. Despite these benefits, there remains a lack of implementation in many low- and middle-income countries, including Bangladesh [12].

The barriers to implementing disability-inclusive emergency planning in Bangladesh are multifaceted, including limited awareness, inadequate training for emergency responders, and a lack of accessible infrastructure [13]. Additionally, cultural attitudes towards disability often result in the marginalization of people with disabilities in disaster response efforts [14]. Addressing these barriers requires a comprehensive approach that involves not only the adaptation of tools but also community education and advocacy [15].

By incorporating both quantitative and qualitative data, the research aims to provide a nuanced understanding of the tool's impact on knowledge, accessibility, and confidence in emergency preparedness [16]. The findings will inform future efforts to scale up disability-inclusive planning in other flood-prone areas of Bangladesh, contributing to broader goals of public health and disaster resilience [17].

Ultimately, this research seeks to ensure that disability-inclusive emergency planning is not just a theoretical concept but a practical reality that protects vulnerable populations in times of crisis [18]. By engaging stakeholders, including people with disabilities, their families, community volunteers, and professional emergency planners, the study promotes a collaborative approach to building safer, more inclusive communities [19]. The results of this study are expected to contribute to the development of targeted training programs and advocacy efforts that enhance the capacity of local communities to respond effectively to natural disasters [20].

Materials and Methods

This study employed a mixed-methods design, incorporating both quantitative and qualitative approaches to assess the impact of disability-inclusive emergency planning on vulnerable populations in the Gazipur district, Bangladesh. The study was conducted over a one-year period from 2022 to 2023.

Study Population and Sample Size

The study targeted a sample size of 100 participants, including individuals with disabilities, parents, community volunteers, and professional emergency planners and responders. Participants were selected through purposive sampling to ensure a diverse representation of disabilities, including physical, sensory (hearing/visual), and cognitive disabilities. The inclusion criteria were individuals residing in the Gazipur district, and willing to participate in the study. Exclusion criteria included individuals with severe cognitive or communication impairments that prevented them from providing informed consent or participating in interviews without a guardian or representative, and people with disabilities currently experiencing a medical emergency or acute health crisis that would impede their participation. Additionally, individuals who had already received similar training on disability-inclusive emergency planning within the past year and those who did not reside in the Gazipur district were excluded from the study.

Study Setting

The study was conducted in the Gazipur district, an area prone to frequent flooding, making it a critical region for assessing emergency preparedness. The setting included various community spaces, schools, and local government offices involved in emergency planning and response.

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Data Collection Methods

Literature Review: A comprehensive literature review was conducted to gather existing data on disability-inclusive emergency planning tools and their effectiveness. This review helped to identify gaps in current practices and informed the adaptation of the AUCD tool for the Bangladeshi context.

Key Informant Interviews: Semi-structured interviews were conducted with key stakeholders, including:

- Individuals with disabilities and their caregivers.
- Community volunteers and professional emergency planners.
- School administrators and local government officials involved in disaster response.

These interviews aimed to gather insights into the challenges faced by people with disabilities during emergencies and to collect feedback on the existing emergency planning practices.

Tool Adaptation: The AUCD (Association of University Centers on Disabilities) tool was adapted to fit the cultural and contextual needs of the Bangladeshi community. The adaptation process involved translating the tool into Bengali and modifying it to address local emergency scenarios, such as flooding.

Beta Testing: The adapted tool was beta-tested with a small group of 20 participants, including individuals with disabilities, parents, and emergency responders. Feedback from this phase was used to make further refinements to the tool.

Training and Implementation: Participants received training on using the adapted tool through workshops facilitated by local trainers, with oversight and guidance from AUCD experts. The training focused on enhancing knowledge and skills in flood preparedness, emergency response strategies, and the specific needs of individuals with disabilities.

Data Analysis

Quantitative Data Analysis: Quantitative data were collected through pre- and post-intervention surveys measuring knowledge, accessibility, and confidence in emergency preparedness. Data were analyzed using SPSS (25) software, employing descriptive and inferential statistics, including paired t-tests to compare pre- and post-intervention results. Statistical significance was set at $p < 0.05$.

Qualitative Data Analysis: Qualitative data from key informant interviews were analyzed thematically using SPSS (25) to assist with coding and organizing qualitative data. Key themes related to barriers, facilitators, and the perceived impact of the disability-inclusive planning tool were identified and reported.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of a relevant local institution. Informed consent was obtained from all participants, ensuring their right to confidentiality, voluntary participation, and the ability to withdraw from the study at any time without any repercussions. All data were anonymized and stored securely to protect participant privacy.

Outcome Measures

The primary outcome measures included:

- Changes in knowledge and preparedness for flood emergencies among participants.
- Improved access to emergency resources and shelters for individuals with disabilities.
- Feedback on the usability and effectiveness of the adapted AUCD tool.

Results

Table 1: Demographic Characteristics of Participants (N = 100)

Characteristic	Frequency (n)	Percentage (%)
Age Group (Years)		
<18	42	42
18-30	27	27
31-45	18	18
>45	13	13
Gender		
Male	57	57
Female	43	43
Disability Type		
Physical	39	39
Sensory (Hearing/Visual)	30	30
Cognitive	19	19
Multiple	12	12

Table 1 presents the demographic characteristics of the 100 participants in the study, highlighting their distribution across different age groups, gender, and types of disabilities. The majority of participants were under the age of 18, comprising 42% of the sample. Participants aged 18-30 made up 27%, those aged 31-45 accounted for 18%, and the remaining 13% were over the age of 45. This indicates a higher representation of younger individuals in the study. The gender distribution shows that 57% of the participants were male, while 43% were female. This suggests a slightly higher participation rate among males compared to females in the study. In terms of disability type, 39% of the participants had physical disabilities, making it the most common category. Sensory disabilities, including hearing and visual impairments, were

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reported by 30% of the participants. Cognitive disabilities were identified in 19% of the participants, while 12% reported having multiple types of disabilities.

Table 2 demonstrates the positive impact of disability-inclusive emergency planning on preparedness and response measures among the study participants (N = 100). The intervention significantly improved participants' knowledge of flood preparedness, increasing from 45.0% before the intervention to 85.0% after the intervention. Access to emergency resources also saw a marked improvement, rising from 31.0% to 70.0%, while participation in emergency drills increased substantially from 20.0% to 63.0%. Confidence in emergency response showed a notable enhancement, with 41.0% of participants feeling confident before the intervention compared to 72.0% after. Additionally, the accessibility of shelters improved significantly, from 48.0% before the intervention to 84.0% afterward. All these changes were statistically significant, with p-values of <0.001, indicating that the disability-inclusive emergency planning intervention was effective in enhancing the preparedness and response capabilities of participants, thus highlighting the importance of inclusive strategies in emergency planning for vulnerable populations.

Table 3 summarizes participant feedback on the adapted AUCD tool. Most found the tool user-friendly (50% agree, 20% strongly agree), while 10% disagreed and 5% strongly disagreed. The tool was deemed culturally relevant by 60% of participants (20% strongly agree), with 7% disagreeing and 3% strongly disagreeing. It was rated effective in knowledge transfer by 55% (25% strongly agree), with 6% disagreeing and 4% strongly disagreeing. Participants showed a high likelihood of recommending the tool (60% agree, 25% strongly agree), with 5% disagreeing and 2% strongly disagreeing. Overall, the feedback reflects a positive reception, confirming the tool's effectiveness and suitability for disability-inclusive emergency planning.

Table 4 highlights the main barriers to implementing disability-inclusive emergency planning among 100 participants. The most frequently reported barrier was a lack of awareness (41%), underscoring the need for better education and outreach. Limited accessibility of resources (35%) and funding constraints (30%) were also significant challenges, indicating gaps in both the availability and financial support for inclusive emergency measures. Insufficient training for responders (22%) and cultural/social barriers (16%) further illustrate the obstacles to effective implementation.

Discussion

The implementation of disability-inclusive emergency planning is crucial for ensuring that people with disabilities are adequately protected and supported during emergencies. The findings from our study, which evaluated the impact of an adapted AUCD tool on emergency preparedness, reveal significant improvements in knowledge, resource accessibility, and overall preparedness among participants. These results are consistent with and build upon findings from other studies in the field.

Our study demonstrated a notable increase in knowledge of flood preparedness and confidence in emergency response post-intervention. Participants' knowledge of flood

Table 2: Impact of Disability-Inclusive Emergency Planning on Preparedness and Response (N = 100)

Measure	Before Intervention	After Intervention	p-value
Knowledge of Flood Preparedness (%)	45	85	<0.001
Access to Emergency Resources (%)	31	70	<0.001
Participation in Emergency Drills (%)	20	63	<0.001
Confidence in Emergency Response (%)	41	72	<0.001
Accessibility of Shelters (%)	48	84	<0.001

Table 3: Feedback on the Adapted AUCD Tool (N = 100)

Feedback Aspect	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
Ease of Use	5	10	15	50	20
Cultural Relevance	3	7	10	60	20
Effectiveness in Knowledge Transfer	4	6	10	55	25
Likelihood to Recommend	2	5	8	60	25

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DOI:10.26502/jesph.96120214

Table 4: Barriers to Implementation of Disability-Inclusive Emergency Planning (N = 100)

Barrier	Frequency (n)	Percentage (%)
Lack of Awareness	41	41
Limited Accessibility of Resources	35	35
Insufficient Training for Responders	22	22
Cultural/Social Barriers	16	16
Funding and Resource Constraints	30	30

preparedness improved from 45% to 85%, and confidence in emergency response increased from 41% to 72%. These results are in line with findings from similar studies. For instance, a study by Schmid et al., found that targeted emergency preparedness training significantly improved knowledge and readiness among people with disabilities [21]. Schmid et al. emphasized that specialized training tailored to the needs of individuals with disabilities can lead to substantial gains in emergency preparedness and response capabilities.

Similarly, the study by Morss et al., demonstrated that interventions designed to enhance preparedness among vulnerable populations, including those with disabilities, resulted in increased preparedness and response efficacy [22]. Morss et al. highlighted the importance of community-specific adaptations to training tools, which aligns with our adaptation of the AUCD tool to the Bangladeshi context. Our findings, therefore, support the notion that culturally and contextually adapted tools can enhance the effectiveness of emergency preparedness interventions.

Our study showed a significant improvement in access to emergency resources, from 31% before the intervention to 70% after. This is consistent with the work of Covington et al., who reported similar improvements in resource accessibility following the implementation of disability-inclusive emergency planning tools in the United States.23 Covington et al. emphasized that increased accessibility to emergency resources is crucial for people with disabilities and that effective planning can bridge significant gaps in resource availability.

In contrast, a study by Alazmani et al., found that while training improved some aspects of resource accessibility, many communities still faced persistent barriers due to systemic issues and lack of infrastructure [24]. This discrepancy highlights the ongoing challenges in ensuring that improvements in accessibility are uniformly experienced and suggests that while our intervention led to significant improvements, there may still be underlying issues that need to be addressed at a systemic level.

Our results also highlighted the importance of training for emergency responders, with 22% of participants identifying insufficient training as a barrier. This finding is supported by Jones et al., who found that enhanced training for emergency responders improved their preparedness to assist people with disabilities during crises [25]. Jones et al., stressed the need for continuous professional development and specialized training to ensure that responders are equipped to handle diverse needs effectively.

Conversely, a study by Lee et al., found that while training programs were beneficial, there was a lack of follow-up and refresher courses, leading to a decline in effectiveness over time [26]. This underscores the importance of not only implementing initial training but also ensuring ongoing education and evaluation to maintain high levels of preparedness and effectiveness.

The study identified cultural and social barriers as significant challenges to implementing disability-inclusive emergency planning. This finding aligns with research by Khan et al., who reported that cultural and social factors can impede the adoption of inclusive practices in emergency planning [27]. Khan et al. emphasized the need for culturally sensitive approaches and community engagement to overcome these barriers.

Similarly, Smith et al., highlighted that cultural attitudes and social norms can influence the effectiveness of emergency planning tools [28]. They found that involving local communities in the development and implementation of planning tools helped address cultural and social barriers, leading to more successful outcomes. Our study's adaptation of the AUCD tool to the local context aimed to address these barriers, and the positive feedback on cultural relevance supports the effectiveness of this approach.

Our study also revealed barriers such as lack of awareness (41%) and funding constraints (30%). These barriers are consistent with findings from Patel et al., who identified similar challenges in implementing disability-inclusive emergency planning in low-resource settings [29]. Patel et al. emphasized the need for increased awareness and dedicated funding to support the development and implementation of inclusive emergency planning initiatives.

A study by Williams et al., also highlighted that funding and resource limitations were significant obstacles to implementing effective emergency planning [30]. Williams et al. called for greater investment in emergency preparedness and suggested that addressing funding issues could lead to more robust and comprehensive planning efforts.

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Limitations of the study

The sample was drawn from a specific district (Gazipur), which may limit the generalizability of the findings to other regions with different socio-cultural and infrastructural contexts. Additionally, the reliance on self-reported data from surveys and interviews may introduce response bias, as participants may have provided socially desirable answers. The study's duration was limited to one year, which may not capture long-term impacts or sustainability of the intervention. Finally, while the adapted AUCD tool showed positive results, the study did not evaluate the tool's effectiveness in real emergency situations, which could provide further insights into its practical utility and limitations. To enhance the generalizability of the findings, future studies should include a larger and more diverse sample from multiple districts or regions.

Conclusion

The implementation of the adapted AUCD tool for disability-inclusive emergency planning in Gazipur district has demonstrated significant improvements in emergency preparedness among participants. The study revealed substantial gains in knowledge, access to resources, and confidence in responding to emergencies, indicating that tailored interventions can effectively enhance preparedness for individuals with disabilities. Feedback from participants on the tool's ease of use, cultural relevance, and effectiveness was overwhelmingly positive, underscoring the tool's suitability and impact. However, barriers such as lack of awareness, limited accessibility of resources, and funding constraints were identified as significant challenges that need addressing. These findings underscore the importance of contextually adapted tools and the need for comprehensive strategies to address the multifaceted barriers to effective disability-inclusive emergency planning. The study highlights the critical role of ongoing training, community engagement, and resource allocation in ensuring that emergency planning is inclusive and effective for all individuals, particularly those with disabilities.

Acknowledgment

I would like to express my sincere gratitude for the invaluable support and cooperation provided by the staff, participants, and my co-authors/colleagues who contributed to this study.

Financial support and sponsorship

No funding sources.

Conflicts of interest

There are no conflicts of interest.

Ethical approval

The study was approved by the Institutional Ethics Committee.

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