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EMERGENCY ACCESSIBILITY FOR ALL:

Evaluating inclusivity of emergency preparedness in Kazakhstan

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White Paper

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ABOUT AUTHOR

Aidana Tleuken is a researcher passionate about sustainable development, industrial symbiosis, and the circular economy. She is currently pursuing her PhD at the University of Twente (Netherlands), where she explores how to build more sustainable and interconnected industrial and urban ecosystems. In her work, Aidana combines quantitative and qualitative methods, including social network analysis, machine learning, and semantic text analysis. Her academic track record includes participation in around 30 scientific publications and conferences. Beyond academia, Aidana is actively involved in social and educational initiatives related to sustainability and inclusive urban planning. Her writings on women's safety and rights have been published in the books Adil Qala and the anthology Women in Central Asia.

ABOUT THE EUROPEAN UNION

The European Union is an economic and political union of 27 European countries. It is founded on the values of respect for human dignity, freedom, democracy, equality, the rule of law and respect for human rights, including the rights of persons belonging to minorities. It acts globally to promote sustainable development of societies, environment and economies, so that everyone can benefit.

ABOUT REPUBLICAN PUBLIC ASSOCIATION KORGAN-M

Korgan-M is a republican public association based in Kazakhstan that works to promote the development of an inclusive society in Kazakhstan and Central Asia. Its activities span social, environmental, educational, and legal fields, focusing on support for vulnerable groups and sustainable development. The organization implements projects on environmental education, climate change mitigation, and biodiversity conservation. It actively supports the socialization and employment of young people with disabilities and provides assistance to families raising children with disabilities. Korgan-M also carries out programs for the resocialization of former prisoners and supports women and children affected by domestic violence. Korgan-M is also involved in broader civic initiatives, including legal aid, cultural and educational outreach, youth policy development, and advocacy for the rights and interests of citizens and organizations. Through this comprehensive approach, Korgan-M plays a key role in building a more inclusive, just, and sustainable society in the region.

ABOUT IWPR

IWPR empowers local voices to drive change in countries in conflict, crisis and transition. Where hate speech and propaganda proliferate, and journalists and civic activists are under attack, IWPR promotes reliable information and public debate that makes a difference. With powerful new forms of disinformation driving social division, increasing digital security risks and escalating attacks on journalists, IWPR's mission to empower local voices is more important than ever. IWPR's core work is to strengthen the flow of credible, unbiased information, enabling journalists and civil society to inform, educate and mobilise communities. IWPR empowers societies to find their own solutions, by strengthening local capacity to report on and advocate for accountability, freedom of expression and human rights.

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EXECUTIVE SUMMARY

This white paper presents key findings from a study conducted across multiple regions to evaluate the accessibility and effectiveness of emergency preparedness and early warning systems for individuals with disabilities. The study aimed to understand how people with various disabilities – such as mobility, hearing, vision, and cognitive impairments – perceive emergency communication, assess their level of preparedness, and identify barriers to timely and effective evacuation. The survey explored multiple factors, including satisfaction with early warning information, the impact of training on preparedness, regional disparities in system accessibility, and preferred communication channels. Statistical analysis revealed significant differences in how different disability groups receive and interpret emergency alerts, emphasizing the need for more inclusive and accessible communication strategies. Findings highlight that individuals who received formal emergency training demonstrated higher confidence and preparedness levels, reinforcing the importance of targeted education programs. Additionally, regional differences were evident, with some areas providing more accessible early warning systems than others, pointing to the need for standardized policies and improvements in infrastructure. The study also identified key challenges in emergency communication, including gaps in multimodal alerts (such as audio, visual, and tactile signals), lack of familiarity with existing warning systems, and limited accessibility of emergency preparedness resources. Participants expressed a strong preference for customized, disability-specific communication methods to ensure that alerts are both timely and actionable. Interview findings revealed inconsistent emergency preparedness for persons with disabilities across Kazakhstan, with urban areas showing some progress but overall lacking inclusive infrastructure, adapted communication, and coordinated support. Cases from the 2019 Arys explosion to recent floods and preparedness gaps in regions like Shymkent and Aktau show the urgent need for accessible early warning systems, inclusive drills, and disability-sensitive emergency planning. Overall, the findings demonstrate the importance of inclusive design, user familiarity, tailored training, and multimodal communication. Implementing these principles can significantly enhance the safety and preparedness of individuals with disabilities, ensuring equitable access to life-saving emergency information.

1. INTRODUCTION AND BACKGROUND

Emergencies, whether natural disasters, fires, or other crises, disproportionately impact individuals with disabilities (Global Facility for Disaster Reduction and Recovery, 2017). These individuals often encounter unique challenges during such events, including difficulties in accessing timely and comprehensible emergency information, navigating safe evacuation routes, and securing appropriate temporary accommodations. The lack of inclusive emergency communication systems exacerbates these challenges, as they frequently fail to address the diverse needs of this population.

Research indicates that during disasters, people with disabilities face heightened risks due to physical, social, economic, and environmental barriers (United Nations Department of Economic and Social Affairs, n.d.). These barriers can impede their ability to receive and act upon emergency alerts, evacuate safely, and access necessary resources. For instance, standard emergency alerts may not be accessible to individuals with hearing or visual impairments, and evacuation routes may not accommodate those with mobility challenges. Moreover, emergency shelters often lack the necessary facilities to support individuals with specific needs, further endangering their well-being during crises.

The United Nations Convention on the Rights of Persons with Disabilities emphasizes the need for inclusive disaster risk reduction strategies that consider the unique vulnerabilities of individuals with disabilities (United Nations, 2006). Despite this, many emergency preparedness plans and early warning systems remain inadequately equipped to serve this demographic effectively (United Nations Department of Economic and Social Affairs, n.d.). This oversight not only violates the rights of individuals with disabilities but also undermines the overall efficacy of emergency response efforts.

1.1. KAZAKHSTAN AND ACCESSIBLE ENVIRONMENT FOR PEOPLE WITH REDUCED MOBILITY

Kazakhstan's primary disability legislation has been the Law on Social Protection of Persons with Disabilities, first adopted in 2005 (No. 39) and subsequently developed over the years into Social Code (Social Code of the Republic of Kazakhstan, 2023). This law establishes the legal rights of people with disabilities (PWDs) and mandates the government to create equal opportunities for their social inclusion.

Notably, it requires a «barrier-free» environment: public infrastructure must be made accessible. Local authorities are obliged to ensure PWDs have access to residential, public, and industrial buildings in accordance with national standards (Social Code of the Republic of Kazakhstan, 2023). If a facility cannot be fully adapted, alternative measures (coordinated with disability organizations) must be implemented to meet PWD needs. The law also guarantees PWDs access to information and communications on an equal basis. To enforce compliance, officials or businesses that fail to provide unimpeded access can face administrative penalties.

In 2015, Kazakhstan highlighted its commitment by ratifying the UN Convention on the Rights of Persons with Disabilities (CRPD) (Tyo, 2022). In 2019, the government approved a National Plan to Ensure the Rights and Improve Quality of Life of PWDs (2019–2025), which set targets for accessibility and inclusion (Tyo, 2022). These events reflect a strategic policy focus on disability rights.

Emergency management in Kazakhstan is governed by the Civil Protection Act (adopted 11 April 2014) (Committee on the Rights of Persons with Disabilities [CRPD], 2019). This act forms the legal basis of the State civil protection system (CPRD, 2019). It explicitly guarantees that all citizens, including persons with disabilities, have the right to receive advance warning of emergency situations, protection of life and health during emergencies, and compensation for any health or property damage caused by disasters (CPRD, 2019). This document ensures PWDs are not excluded from early warning or relief measures (CPRD, 2019).

For example, the law requires that emergency alerts and safety information reach everyone: telephone companies must assist in identifying caller locations and sending free SMS warnings to mobile phones in case of a threat or emergency. This provision is crucial for inclusive communication, as it enables people with hearing impairments to receive emergency warnings on an equal basis via text message.

In the past five years, Kazakhstan has taken further steps to make civil protection more inclusive. In 2020, a national Inclusion Council was established to advise on protecting the rights of PWDs in emergencies and climate-related disasters (Mager, 2024). Several forums – such as a 2024 international conference in Astana – have highlighted the need to include PWD representatives in disaster planning and response committees.

Chairperson of the Shyrak Association Tatyana Baklazhanskaya acknowledges that «insufficient accessible infrastructure, lack of rescue services' training, and absence of data on PWD needs exacerbate their situation in emergencies» (Mager, 2024). Consequently, the government introduced new standards and regulations in 2022–2024 to better protect PWDs during emergencies. For instance, in late 2024 the Ministry of Labor and Social Protection announced new standards guaranteeing the safety of PWDs in emergencies, including accessible emergency alert formats, disaster risk forecasting that accounts for vulnerable groups, and training programs for PWDs and their families on emergency preparedness (ORTCOM, 2024). The Vice Minister of Labor and Social Protection of Population of the Republic of Kazakhstan Askarbek Ertayev noted plans for «ensuring warning of persons with disabilities in emergencies based on accessible formats and tools» and developing response algorithms that consider PWD needs.

Kazakhstan's building and urban planning regulations are also in the process of achieving accessible environment. A national building standard (SN RK 3.06.2011) was introduced on the accessibility of buildings and structures for people with reduced mobility, alongside a Code of Practice (SP RK 3.06-02-2012) on designing buildings with regard to accessibility for PWD (SP RK 3.06-101-2012, 2019). National building codes and urban planning norms are incorporating universal design principles over the last decade, aligning with European accessibility standards, although currently around 80% of facilities are inaccessible for people with disabilities, and 20% are only partially accessible (Kopzhassarova, 2021).

In practice, enforcement has been challenging – in 2020 a monitoring found only 1 of 24 newly constructed public buildings in one region was fully accessible

(Kopzhassarova, 2021), indicating gaps in compliance. Local authorities in different regions of Kazakhstan have developed a roadmap on better implementation of these standards, with increased inspections and penalties for non-compliance (Vecher.kz, 2024).

1.2. DISABILITY DEMOGRAPHICS IN KAZAKHSTAN

As of the early 2020s, Kazakhstan has roughly 700,000 registered persons with disabilities, constituting about 3.7% of the total population (Sabitova et al., 2020). Official data from January 2021 counted 696,000 PWDs (Kopzhassarova, 2021). Nationally, the gender split among PWDs skews slightly male: about 56% are men and 44% women (Kopzhassarova, 2021). This is unusual compared to some countries, as, for example, in many European countries (Finland, Denmark, Slovenia, Netherlands, Serbia, etc.) the number of males with disabilities has not been higher than those of females in 2022 (Eurostat, 2024). Such a gap in Kazakhstan may be due to occupational injuries or underreporting of women with disabilities. In terms of age, the vast majority (over 85%) of PWDs in Kazakhstan are adults (over 18), though there are also tens of thousands of children with disabilities receiving services (Kopzhassarova, 2021). Urban-rural distribution is nearly even – roughly half of PWDs live in cities and half in rural areas. This is an important statistic for emergency planners, as it means disability-inclusive preparedness must address both urban and rural environments. For example, Almaty, the largest city, alone is home to about 60,000 PWDs (Vecher.kz, 2024), while Mangystau has around 17,000 PWDs.

There is a significant rural-urban gap in access to information. A 2020 rapid assessment in southern Kazakhstan found that rural persons with disabilities were significantly less aware of emergency health information (like COVID-19 precautions) than urban PWDs (Sabitova et al., 2020). Every third (35.6%) rural respondent did not have adequate knowledge of the situation, compared to every fourth urban respondent (25.8%) (Sabitova et al., 2020).
Different types of disabilities require adapted information signals under their needs. For example, people with hearing impairments will not hear a siren warning of an emergency, and people with mental disabilities need information tailored to their needs to understand what is happening and what to do (Mager, 2024). The effectiveness of emergency warning systems varies between urban

and rural areas globally, impacting accessibility, especially for people with disabilities (UNICEF, 2022). The UN's New Urban Agenda highlights the need for inclusive infrastructure to improve community resilience and safety (UNICEF, 2022). To ensure effective communication during emergencies, a combination of notification methods is often more successful than relying on a single approach (UNICEF, 2022; U.S. Department of Justice, n.d.).

1.3. ACCESSIBILITY IN EMERGENCY SITUATIONS

An accessible environment in emergency situations is crucial to ensure that people with disabilities have equal access to protection and assistance (Alexander & Sagramola, 2014). This involves providing equal access to services and humanitarian aid, removing physical and systemic barriers, and incorporating universal design principles into programming, policies, and post-emergency reconstruction. Accessibility should be considered a core component of disaster risk management and humanitarian action, emphasizing the importance of the usability and operability of items and equipment distributed to persons with disabilities.

Accessibility is not a static feature; it requires periodic assessments to identify potential damages or evolving needs (UNICEF, 2022). Rapid assessments should include disability-related questions, and organizations of persons with disabilities (OPDs) should be actively involved in reviewing assessment forms. Training plays a crucial role in ensuring that people with disabilities can safely evacuate during emergencies. It not only equips emergency personnel with the knowledge and sensitivity needed to address the specific needs of individuals with disabilities but also empowers people with disabilities and their families to be better prepared for crisis situations (Alexander & Sagramola, 2014).

The type of disability and the warning system used during an emergency are closely interconnected, as different disabilities require tailored methods to ensure that critical information is delivered in a timely and accessible manner (Alexander & Sagramola, 2014; UNICEF, 2022; U.S. Department of Justice, n.d.). Recognizing these varying needs is essential for creating inclusive emergency response plans that safeguard everyone, regardless of their abilities.

Individuals who are deaf or hard of hearing may not notice traditional audible alerts such as radio broadcasts, television warnings, or sirens (Alexander & Sagramola, 2014; UNICEF, 2022). Similarly, individuals who are blind or have low vision may be unable to perceive visual cues, making audible alerts crucial for their safety (UNICEF, 2022; U.S. Department of Justice, n.d.). People with cognitive disabilities also face unique challenges, as complex instructions or excessive information during emergencies can lead to confusion or distress (Alexander & Sagramola, 2014; UNICEF, 2022).

1.4. PURPOSE OF THE STUDY

This research aims to examine the effectiveness of accessible environments in supporting people with disabilities during emergency situations in Kazakhstan, with a focus on their experiences and the challenges they face. First, we aim to assess perceptions of early warning information by evaluating how people in Kazakhstan from different regions with different types of disabilities perceive the accessibility of early warning information. Second, we aim to examine the role of training and familiarity by analyzing how training, familiarity with emergency systems, and regional factors influence preparedness levels and satisfaction with emergency response mechanisms. Third, we aim to identify strategies to enhance the inclusivity and effectiveness of emergency preparedness and response programs, ensuring diverse needs of individuals with disabilities specific to Kazakhstani context. Thus, we aim to provide evidence-based recommendations for policymakers, emergency planners, and community organizations that can effectively serve all community members, regardless of their physical or cognitive abilities.

2. METHODOLOGY

2.1. PURPOSE OF THE STUDY

To assess the accessibility and effectiveness of early warning systems for individuals with disabilities, a 26-question survey was designed and administered. The survey covered several important areas including disability type, familiarity with early warning systems, perceived accessibility of information, training and preparedness, challenges during evacuation. Thus, respondents were asked to self-identify their disability category, including hearing impairment, vision impairment, mobility limitations, cognitive or mental disabilities, and other conditions. Questions also collected information about respondents' prior knowledge and awareness of existing emergency communication and alert mechanisms. Participants rated their experiences in receiving and understanding emergency alerts, identifying any barriers to access. The survey explored whether individuals had received formal training on emergency preparedness and how this affected their ability to respond to an evacuation scenario. Open-ended and multiple-choice questions addressed the specific obstacles respondents encountered when evacuating during past emergencies. Thus, the survey was carefully structured to include quantitative and qualitative questions, ensuring that both statistical trends and personal experiences could be analyzed. The survey questions can be found in the Appendix.

2.2. DATA COLLECTION

2.2.1. SURVEY

A total of 437 individuals participated in the survey, representing a diverse overview of individuals with various disabilities. To enhance geographic representativeness, data were collected from multiple regions to understand how accessibility and preparedness to emergency varied across different locations. Efforts were made to include participants from both urban and rural areas, recognizing that emergency response infrastructure and accessibility might differ based on the location. Participants were recruited through various channels, including disability advocacy organizations, social media outreach, and direct invitations sent via email and community networks. Thus, the study aimed to capture a wide spectrum of experiences. The survey was anonymous, and participants were informed that their responses would be used solely for research purposes.

2.2.2. INTERVIEW

The research involved direct, face-to-face interviews with individuals possessing diverse types and degrees of disabilities, as well as with caregivers and leaders of disability-focused organizations across five selected regions of Kazakhstan: Turkestan, West Kazakhstan, Mangystau, Shymkent. Participants included those with visual impairments, mobility restrictions, complex multi-disabilities, and representatives of advocacy and caregiving communities. Additionally, to ensure ethical research practices, informed consent was obtained from all respondents before participation. Selection criteria aimed to ensure representativeness across urban and rural contexts, disability types, and varying experiences with emergency situations. All interviews were recorded and transcribed. An inductive thematic analysis approach was utilized, enabling themes to emerge organically from the data. Initially, data was coded according to broad thematic categories guided by the interview questionnaire: Experiences during emergency situations; Accessibility and quality of infrastructure; Availability and responsiveness of emergency services; Accessibility, usability, and inclusivity of early warning systems; Readiness and support provided by organizations; Inclusion in preparedness planning and communication effectiveness.

2.3. DATA ANALYSIS

To examine key relationships between disability status, awareness of early warning systems, and evacuation outcomes, a series of statistical tests were conducted. Most of them used Chi-Square tests, a non-parametric statistical method used to determine whether there are significant associations between categorical variables. It assesses if observed frequencies differ from expected frequencies under the assumption of independence. The Chi-Square test is applicable when analyzing relationships between two or more categorical variables, such as disability type and satisfaction with emergency information, especially when sample sizes are large and data are presented in contingency tables (McHugh, 2013). Additionally, the Kruskal-Wallis Test was applied to assess differences in perceived accessibility of information and preparedness levels across different disability categories and regional groups. The Kruskal-Wallis Test is a non-parametric statistical test used to compare two or more independent groups to determine if there are statistically significant differences between them. It is particularly useful when dealing with ordinal data or non-normally distributed continuous data (Glen, 2023). By employing these non-parametric tests, the analysis accounted for the fact that the survey data did not necessarily follow a normal distribution. This ensured robust and reliable statistical insights despite potential variations in response patterns. In addition to quantitative analysis, qualitative responses from open-ended questions were categorized thematically to identify recurring challenges and common barriers faced by individuals with disabilities during emergency evacuations. Thus, a mixed-methods approach was used to comprehensively understand the accessibility of early warning systems.

2.4. LIMITATIONS

While the study successfully gathered a diverse dataset, several limitations must be acknowledged. One key limitation is self-reporting bias, as responses rely on individuals' recollections, which may be influenced by memory recall issues or personal biases. Additionally, those who are more aware and engaged in emergency preparedness may have been more likely to participate, potentially skewing results toward individuals already familiar with early warning systems. Another challenge is the uneven regional response rates. Some areas had higher participation than others, which may limit the generalizability of the findings, particularly for regions with lower representation. Variations in emergency preparedness infrastructure across different regions could also contribute to inconsistencies in the results. The study's scope regarding disability categories presents another limitation. While a range of disabilities was considered, the nuances within each category may not have been fully captured. Individual accessibility needs, such as the specific assistive technologies required, were not deeply analyzed, potentially leaving gaps in understanding. Potential selection bias is also a concern. Individuals with prior negative experiences related to emergency preparedness may have been more motivated to participate, potentially amplifying negative perceptions. Conversely, those without past emergency encounters may have provided less detailed responses, affecting certain analytical insights. Despite these limitations, the study provides valuable findings into the accessibility of early warning systems for individuals with disabilities. The findings could serve as a foundation for future research and policy recommendations aimed at improving emergency preparedness and fostering greater inclusivity.

3. SURVEY FINDINGS AND ANALYSIS

This section presents an analysis of the survey data, focusing on the following areas: accessibility and satisfaction with early warning systems, the impact of familiarity and training on preparedness, regional disparities, and the relationship between information access and evacuation challenges. These areas were found important during literature review, which is why they were studied in the context of Kazakhstani experience.

3.1.1. GENERAL FINDINGS

Of the respondents, 41% are from West Kazakhstan, 30.9% from Turkestan, 18.8% from Mangystau, and 9.4% from Shymkent (see Figure 1). Regarding disability groups, 24.9% belong to Group I, while Group II and III each represent 35.2% of respondents (see Figure 2). As illustrated in Figure 3, the majority of respondents experience musculoskeletal disorders. Figure 4 indicates that most respondents reside in private houses. Figure 5 identifies primary challenges during emergencies as the inability to self-evacuate, absence or malfunctioning of assistive devices, and delayed emergency notifications.

Figure 6 demonstrates that when asked about their familiarity with local early warning systems, most respondents described their knowledge as either «good» or indicated uncertainty («don't know»). According to Figure 7, the majority of respondents expressed satisfaction (either fully or partially) with the quality of information received through the early warning system. Additionally, Figure 8 reveals that most respondents experience no issues regarding access to emergency-related information. Figure 9 indicates that about half of the respondents receive timely notifications of potential emergencies, whereas approximately 20% do not.

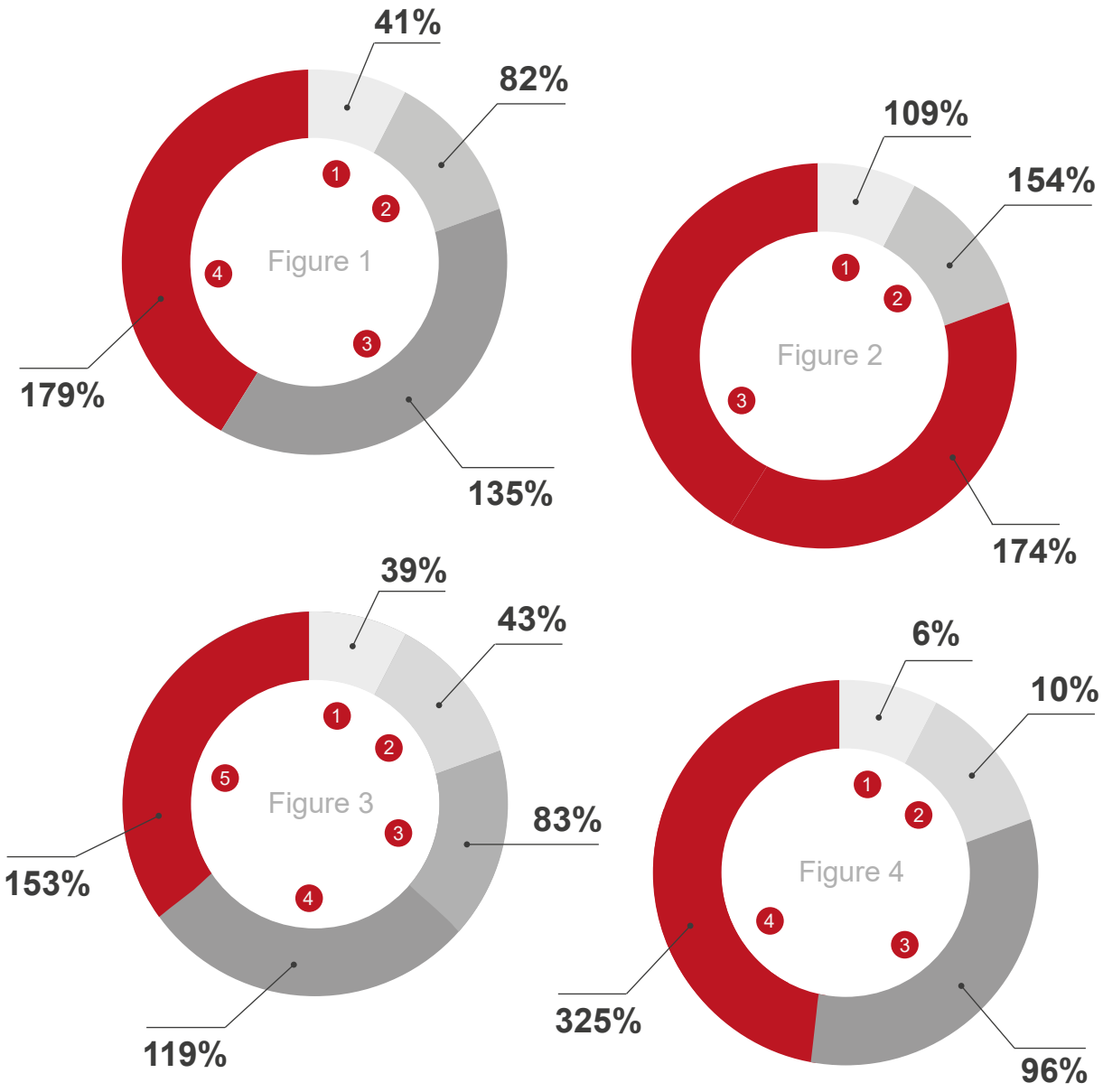
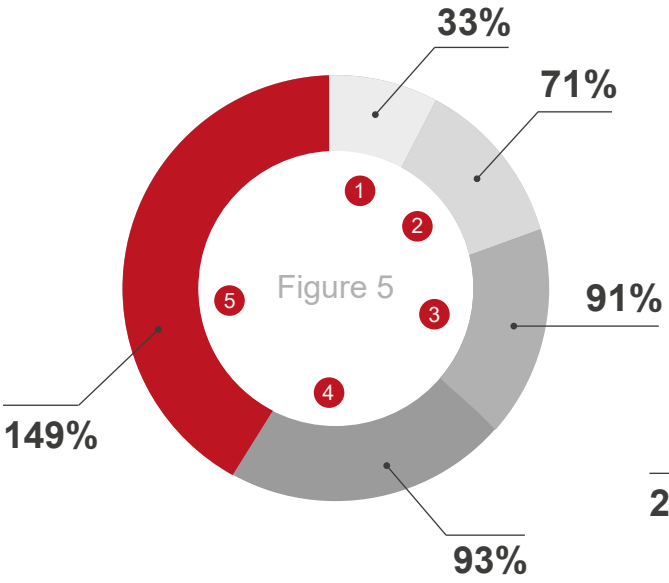


Figure 10 highlights smartphones as the most convenient method for respondents to receive emergency information. Figure 11 reveals that respondents generally perceive the early warning system as accessible or partially accessible for various types of disabilities. However, Figure 12 indicates that while most respondents find the notifications clear (fully or partially), around 9% consider them unclear. According to Figure 13, approximately 45% of respondents feel well-informed about actions to take during emergencies, whereas roughly 20% have no such knowledge. Figure 14 presents striking statistics: over 70% of respondents faced difficulties evacuating during emergencies.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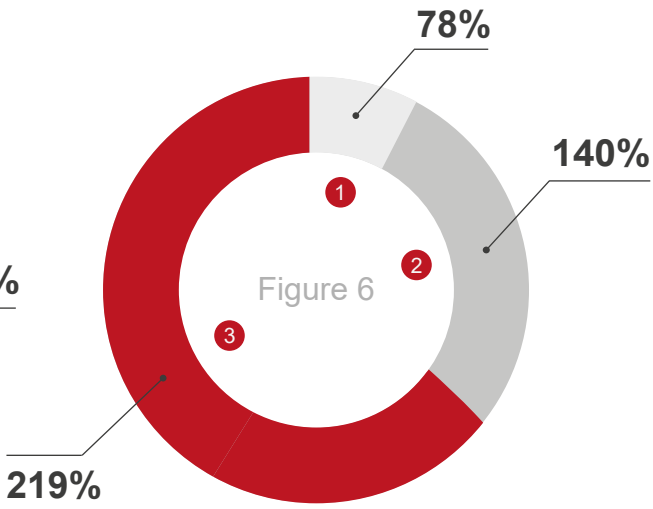
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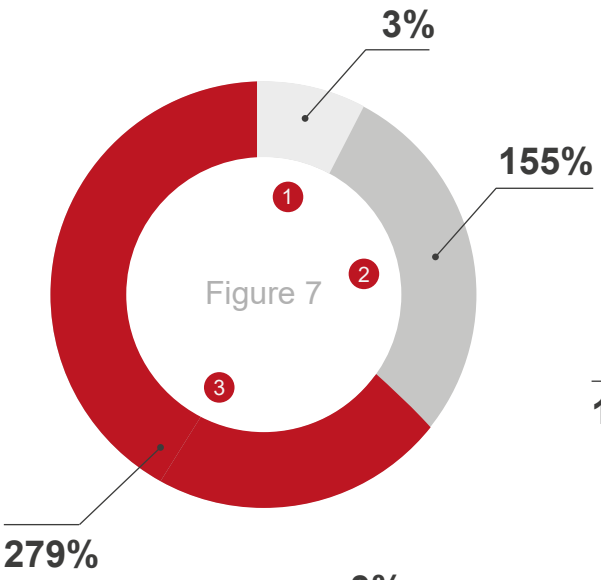
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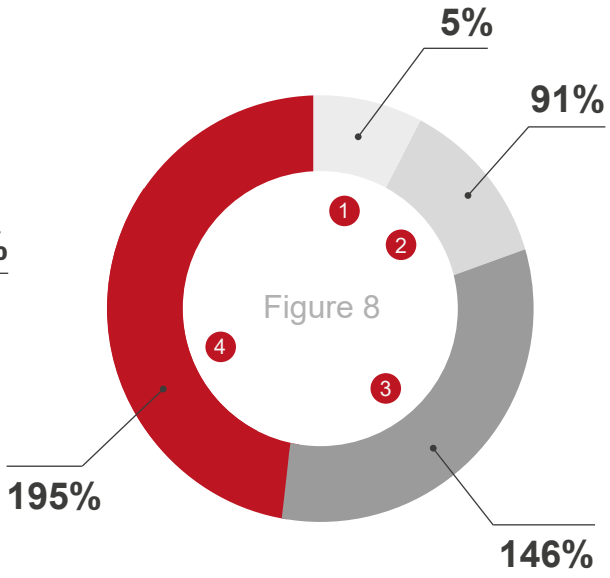
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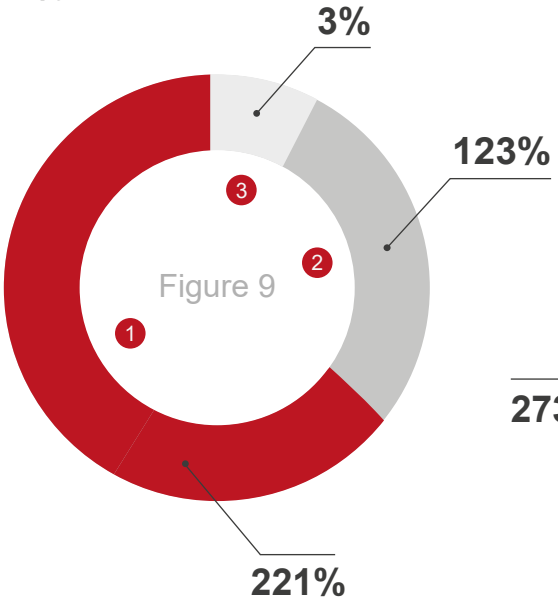
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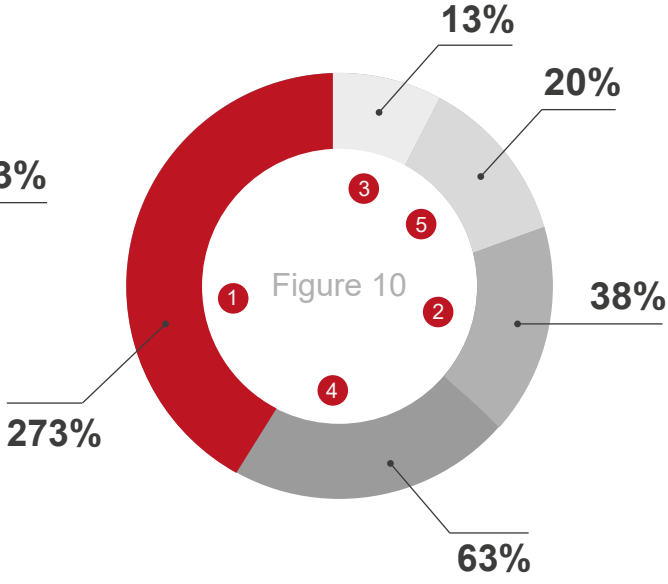
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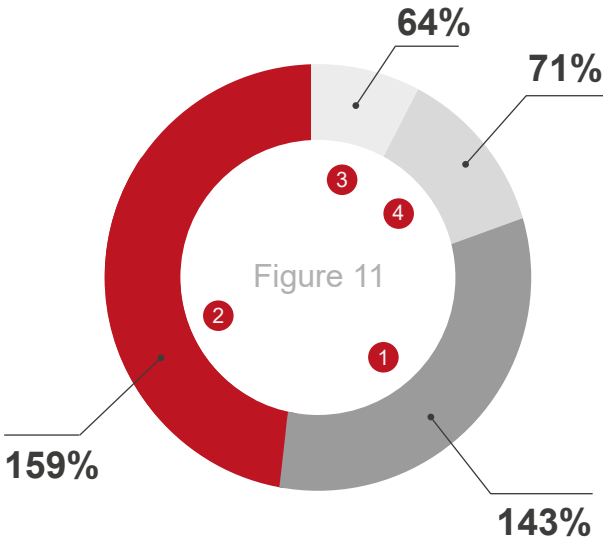
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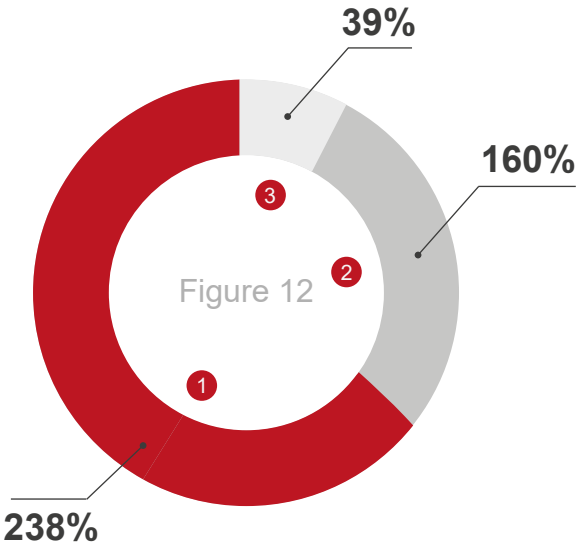
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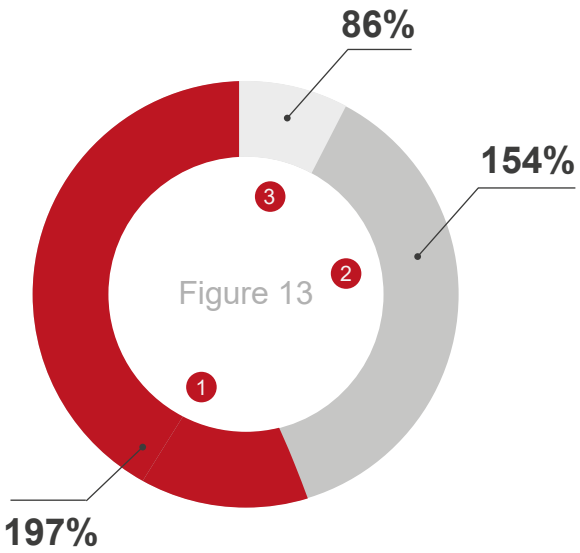
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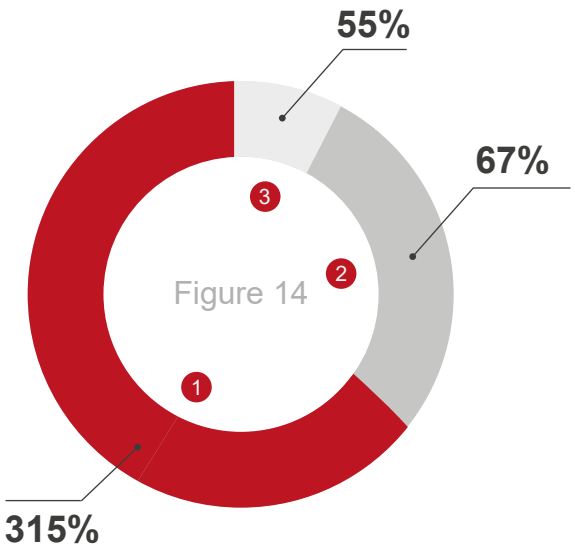
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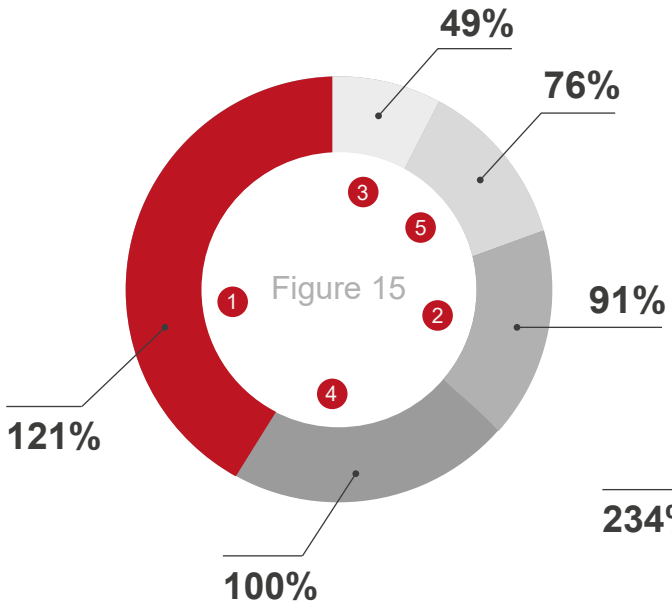
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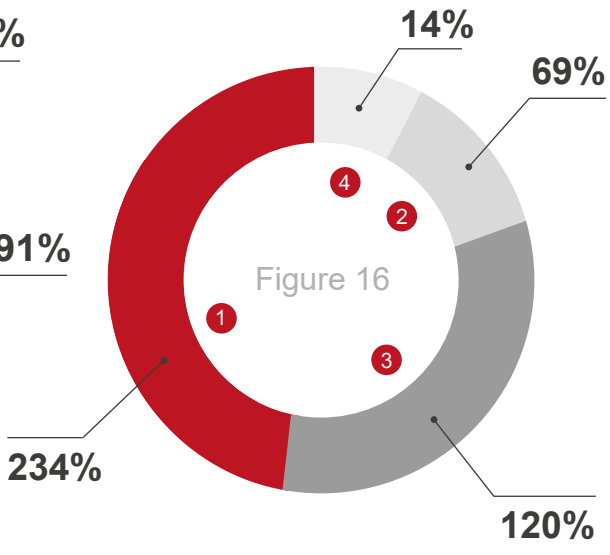
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Figure 15 identifies key evacuation-related problems as lack of transportation and failure to receive necessary notifications. Figure 16 suggests that respondents overwhelmingly support the idea of step-by-step emergency instructions tailored for individuals with disabilities. Moreover, Figure 17 demonstrates that most respondents feel their specific needs and health conditions are appropriately considered by emergency response personnel during evacuations. Approximately 70% of respondents reported receiving emergency procedure training, as seen in Figure 18. Interestingly, Figure 19 shows a nearly equal distribution of responses regarding awareness of the nearest temporary accommodation points in emergencies. Table 1 presents the age distribution of respondents, highlighting that the majority were between 35 and 61 years old.

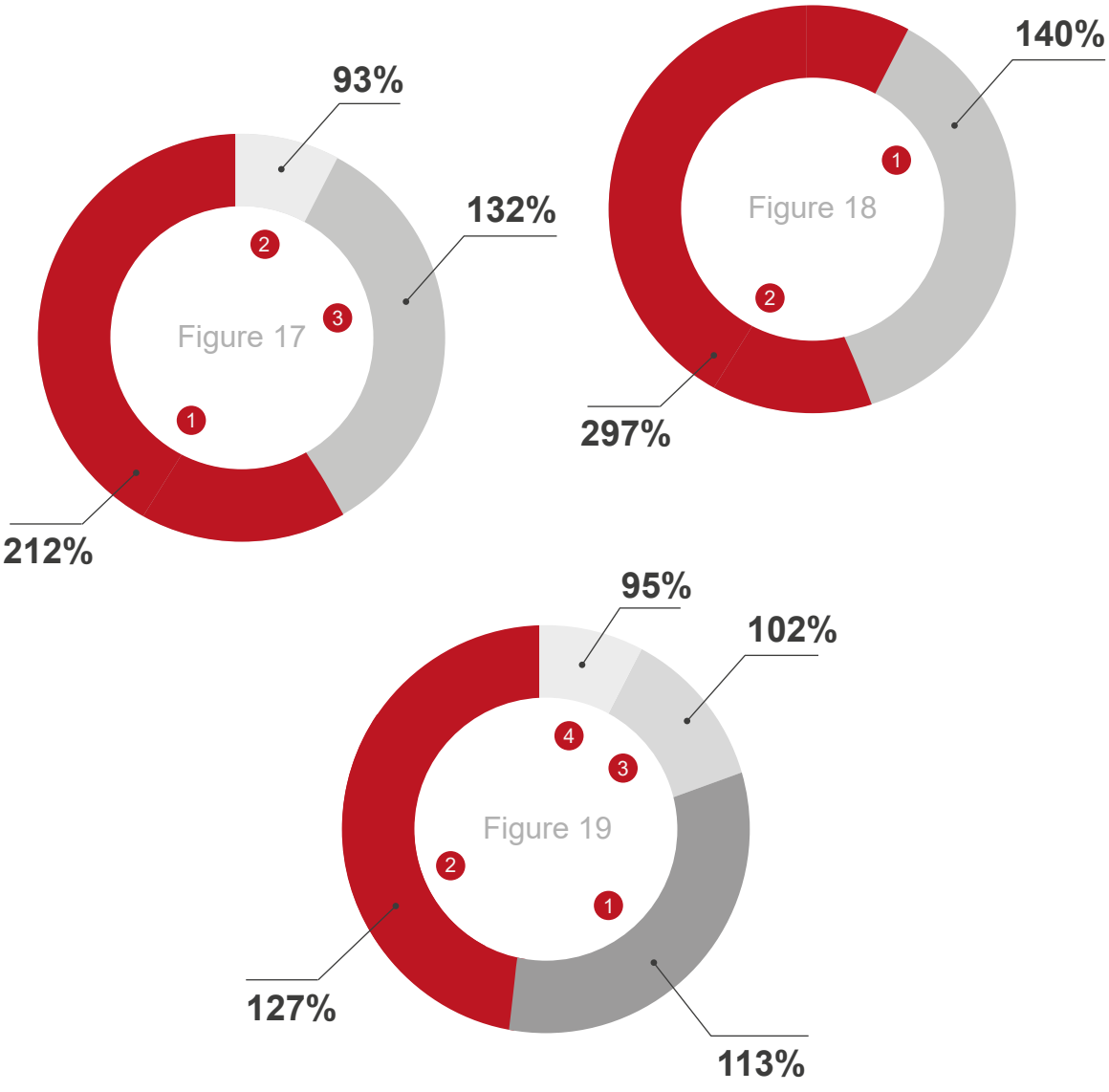

TABLE 1. AGE OF RESPONDENTS.

Age group	Number of responses
Between 35 and 61	249
More than 61 years old	88
Between 18 and 35	82
Less than 18	18

3.1.2. REGIONAL SPECIFICS

One of the hypotheses for regional specifics was to analyze if *citizens with disabilities living in the pilot regions of the project (Shymkent, Turkestan region, Mangystau region) tend to face a higher degree of vulnerability to emergency situations* due to limited access to information, insufficient infrastructure and lack of specialized support. The statistical analysis of correlation between region and evacuation difficulties (Q1 vs. Q16) reveals significant regional disparities in experiences of evacuation difficulties during emergencies, supporting the hypothesis that vulnerability varies across regions.
In Shymkent, residents reported disproportionately high challenges: 31.7% of respondents faced difficulties, indicating systemic issues such as inadequate infrastructure or limited access to information. In Turkestan a notable minority (23 respondents) encountered problems, suggesting localized gaps in preparedness. By contrast, in Mangystau majority reported no issues, implying stronger emergency systems.

Similarly, West Kazakhstan demonstrated majority experiencing no problems, pointing to relatively robust emergency protocols. These findings highlight Shymkent as urgently requiring interventions to address accessibility and information gaps.

Second hypothesis was: «The current early warning system in the regions does not sufficiently take into account the needs of citizens with disabilities, which reduces its effectiveness, as well as the state's implementation of guarantees to ensure the safety of persons with disabilities during emergencies, adopted upon ratification of the UN Convention on the Rights of Persons with Disabilities».

The analysis of correlation between region and satisfaction with the early warning system (Q1 vs. Q7, Q1 vs Q12) demonstrated a statistically significant relationship between region and satisfaction with early warning messages ($\chi^2 = 20.2148$, $p=0.0166$; $\chi^2 = 19.2228$, $p=0.0234$). Some regions reported comparatively higher satisfaction, while others showed discontent due to limited communication methods or lack of local-language adaptations. This finding supports the view that emergency alerts must be regionally customized to meet the linguistic and cultural needs of diverse populations. In Shymkent, dissatisfaction with the quality of emergency warning system information was notably high, with only 26.8% of respondents reporting satisfaction («Yes»), compared to 41.5% expressing dissatisfaction («No» or «Partially»).

Accessibility failures for people with disabilities were also most acute here, with 24.4% encountering inaccessible systems «very often». This suggests gaps in the system, such as a lack of multimodal alerts (e.g., visual, auditory, or tactile signals), which disproportionately endanger people with disabilities. Turkestan Region presented a more mixed picture. While satisfaction levels (48.5% «Yes») were present, 30 respondents still reported dissatisfaction, and 18% faced accessibility barriers «very often». This indicates that while the emergency systems may function adequately for the general population, it remains exclusionary for people with disabilities, particularly in rural areas. By contrast, Mangystau showed moderate progress, with accessibility issues aligning closely with expected frequencies. West Kazakhstan emerged as the most compliant region, with the highest satisfaction rates and fewer accessibility failures.

Another hypothesis included: «In regions where local authorities and public organizations actively interact with citizens with disabilities (Turkestan region), the level of awareness and preparedness for emergency situations is higher». A series of emergency preparedness trainings conducted in the Turkestan region, including in cities and towns such as Lenger, Aksukent, Kazygurt, Arys, Myrzakent, and Temirlan, demonstrates proactive collaboration between local emergency departments and public organizations working with persons with disabilities. These events, supported by the Eurasia Foundation and funded by USAID, focused on building behavioral skills for emergency situations caused by climate change, in alignment with Article 11 of the UN Convention on the Rights of Persons with Disabilities. The activities consistently engaged local volunteers and citizens with disabilities, indicating a structured and inclusive approach to raising awareness and readiness for emergencies (korgan_m.kz, 2024a–h). Statistical analysis of correlation between region and readiness/knowledge and training received (Q1 vs. Q15, Q1 vs Q22) reveals significant regional differences in emergency preparedness across Kazakhstan, supporting the hypothesis that the Turkestan region exhibits higher awareness and readiness for emergencies. Turkestan

emerged as a standout region, with a notably higher proportion of respondents reporting being «well-informed» about emergency procedures and fewer individuals lacking knowledge. This aligns with its above-average training participation, suggesting that Turkestan's training initiatives effectively translate into retained knowledge. It is also a region where local authorities and public organizations actively interact with citizens with disabilities, which is resulted in higher level of awareness and preparedness. In contrast, Shymkent showed a paradox: while it had the highest training rates relative to its population size, this did not correlate strongly with better knowledge outcomes, implying potential gaps in training quality. Meanwhile, West Kazakhstan and Mangystau lagged behind, with West Kazakhstan reporting the highest number of respondents lacking emergency knowledge and both regions showing below-expected training participation. Improving training accessibility in West Kazakhstan, addressing industrial-sector prioritization in Mangystau, and enhancing the practical effectiveness of programs in Shymkent is recommended.

The analysis has also revealed significant regional variations in how often residents encounter inaccessible or ineffective alert systems for people with disabilities (Q1 and Q12). In Shymkent, residents report disproportionately frequent challenges. This suggests gaps in accessibility infrastructure or heightened awareness and reporting in this city. The Turkestan region indicates average accessibility challenges compared to other regions. The Mangystau region shows lower frequent issues, with higher «never» responses. This could imply better regional accessibility measures, underreporting due to cultural factors, or less exposure to disability-specific infrastructure. Similarly, the West Kazakhstan region reports fewer frequent issues and more «rarely/never» responses, potentially reflecting better compliance with accessibility standards or less reliance on alert systems in rural areas.

3.1.3. OTHER CORRELATIONAL FINDINGS

3.1.3.1. Disability specifics

The survey revealed a statistically significant association between the type of disability and satisfaction with emergency alerts (Q3 vs. Q7) (χ^2, $p = 0.0163$). Notably, respondents with hearing impairments reported lower satisfaction levels unless the messages were specifically adapted to their needs, such as through visual or text-based formats. This finding demonstrates the necessity for emergency communication systems to employ multiple modalities to effectively reach diverse populations.

3.1.3.2. Importance of preparedness to emergencies

The survey indicated that familiarity with the early warning system strongly correlates with higher satisfaction levels (Q6 vs. Q7) ($p < 0.0001$). Individuals who understood how the system operates found the information more relevant and useful. This suggests that increasing public awareness and understanding of emergency systems can enhance the perceived value and effectiveness of the information disseminated.

Formal training was found to significantly boost awareness of appropriate actions during emergencies (Q22 vs. Q15) ($p < 0.0001$). Respondents who had received training were more likely to report that they «know what to do» in a crisis. This demonstrates the importance of targeted training programs in equipping individuals with the necessary skills and knowledge to respond effectively during emergencies.

A significant relationship ($p = 0.0252$) was observed between training and reported evacuation difficulties (Q22 vs. Q16). While training improves preparedness, it may also heighten awareness of potential hazards, leading trained individuals to report difficulties more readily. This finding suggests that training must be complemented with infrastructural and practical support to address the challenges identified, ensuring that individuals can effectively apply their training during actual emergencies.

The analysis revealed a highly significant link ($p < 0.0001$) between receiving training and awareness of the locations of temporary shelters during emergencies (Q22 vs. Q23). Those who underwent training were more likely to know where to find temporary accommodation, demonstrating that training can expand overall situational awareness and improve outcomes during evacuations.

3.1.3.3. Information Access Importance

Respondents who reported difficulties accessing information also faced a wider range of evacuation challenges (Q8 vs. Q17) ($p = 0.0228$). Barriers to receiving timely alerts or instructions can significantly hinder safe evacuation, highlighting the need for accessible communication channels that cater to diverse needs. A strong association ($p < 0.0001$) was found between difficulties in accessing information and delays in receiving alerts (Q8 vs. Q9). Individuals facing access challenges were less likely to receive timely notifications, showing the direct impact of communication barriers on emergency outcomes. The survey also revealed a significant correlation ($p < 0.0001$) between the type of disability and preferred notification methods (Q3 vs. Q10). For example, individuals with hearing impairments preferred text-based or smartphone notifications, while those with visual impairments relied more on audio signals.

4. INTERVIEW FINDINGS

The interview data revealed various levels of emergency preparedness and response as experienced by persons with disabilities in Kazakhstan regions. While some regions, especially urban centers, have begun to implement accessible infrastructure and responsive emergency services, these efforts remain fragmented and inconsistently applied. The findings illustrate a pressing need for more inclusive early warning systems, better coordination with disabled persons' organizations, and adapted infrastructure capable of meeting diverse needs during emergencies.

In the Turkestan Region, the memory of the 2019 Arys ammunition depot explosion emerges still large. Respondents described a complete lack of preparedness, with no warning signals, no accessible shelters, and no assistance from local institutions. Evacuation was chaotic and largely self-initiated. Many interviewees reported feeling abandoned, with survival dependent on neighbors and personal networks. Afterwards, recovery efforts were perceived to be uneven and inaccessible, worsening a sense of institutional neglect of people with disabilities. Participants emphasized the need for inclusive risk education, specialized assistive devices such as talking watches, and reliable support personnel trained to assist PwDs during crises.

The city of Shymkent also exhibited several weaknesses in terms of preparation of PwDs to emergency situations. Although no major emergencies were recalled by respondents, participants expressed concern over the absence of preparedness drills and accessible infrastructure. Many lacked access to specific taxi services (Invataxi) or basic mobility support, and feared that in the event of a real emergency, they would be left behind. Early warning information, while occasionally available through standard SMS, was not adapted for people with sensory disabilities. One of the frequently received recommendation was the establishment of accessible communication systems and community-based support mechanisms.

In West Kazakhstan, which includes the Atyrau area, experiences during the 2023 floods revealed both strengths and gaps. Respondents generally viewed the emergency response as well-coordinated, noting the availability of temporary shelter, food, medical support, and some infrastructure repair. However, deeper analysis exposed the limited accessibility of shelters, with few adapted toilets or mobility features, and insufficient support for children with complex disabilities. While some evacuation routes and services functioned well, others did not account for PwDs' specific needs. Participants called for universal design standards, improved transportation, and formal recognition of disability support services within emergency protocols.

Mangystau Region, particularly the city of Aktau, has not faced major emergencies in recent years. Many participants praised the region's relative accessibility, citing functional lifts, supportive local services, and the availability of special taxi («Invataxi»). Nonetheless, interviewees acknowledged that the absence of real emergency events may lead to a false sense of preparedness. Respondents were critical of the lack of inclusive emergency drills and expressed concern over the insufficient training of first responders in how to assist individuals with disabilities, especially those with visual or cognitive impairments. There was also mention of the need for more audio-visual alert systems and tactile infrastructure, particularly in traffic crossings and public facilities.

TABLE 2. Key issues, common findings, and recommended actions that are developed from the interview with people with disabilities about emergency preparedness

KEY ISSUES	COMMON FINDINGS ACROSS REGIONS	RECOMMENDED ACTIONS
Infrastructure accessibility	Evacuation facilities often lacked ramps, adapted toilets, and tactile guidance	Standardize inclusive design in public infrastructure
Early warning system adaptation	Predominantly sms-based, insufficiently adapted for sensory impairments	Implement multi-modal (voice, tactile) alerts
Medical and social assistance	Urban areas more prepared than rural; medical/social support often delayed	Strengthen rural emergency services and mobile units
Inclusive preparedness training	Almost absent, limited knowledge of emergency protocols among PwD	Regular inclusive training sessions and public drills
Community dependence	High reliance on informal networks due to inadequate institutional response	Formalize roles of local organizations and networks
Participation in planning	Pwds and advocacy groups rarely included in emergency preparedness planning	Ensure mandatory involvement of disability representatives

5. CONCLUSIONS AND RECOMMENDATIONS

To enhance the accessibility of training materials and methods, it is crucial to respond to the specific needs of participants with various disabilities.

Hearing-impaired individuals reported lower satisfaction with emergency alerts unless they were appropriately tailored through sign language interpretation or captioning. Moreover, while there's a significant reliance on smartphones, respondents also emphasized the necessity of low-tech solutions in rural areas with limited internet connectivity. To address these findings, training resources should be developed in multiple accessible formats, including large-print, braille, Easy-to-Read texts, captioned video modules, sign language interpretations, audio descriptions, and tactile demonstrations for those with visual impairments. In rural regions like Turkestan or West Kazakhstan, it is essential to complement digital tools with printed handouts, local radio broadcasts, and SMS-based alerts. Collaborating with local disability advocacy groups is also important for ensuring cultural appropriateness and clarity in training materials provided in Kazakh and Russian, and minority languages where applicable. Moreover, it is recommended that the relevant departments and researchers in Kazakhstan be tasked with identifying the underlying causes of PwDs gender disproportion, as understanding these factors is crucial for accurately assessing the scale and implications of the issue.

Ensuring physical accessibility of training venues is another key element. As many respondents struggle with inaccessible infrastructure during evacuations - 80% of public buildings remain inaccessible - it's important to adhere strictly to universal design principles.Training venues should be selected or retrofitted with ramps, wide doorways, handrails, accessible restrooms, proper lighting, and signage in braille or large print. Particularly in Shymkent, where dissatisfaction is high, compliance inspections and upgrades must be prioritized. Regional accessibility assessments involving local committees comprising individuals with disabilities, authorities, and planners can effectively audit training venues. Additionally, providing small grants or incentives for

rural community centers, especially in Turkestan or Mangystau, to add necessary accessibility features can greatly enhance participation. Offering flexible scheduling and mobile training units will ensure sessions reach rural populations who lack accessible transportation.

Personalization of training programs based on disability types has proven important for the respondents due to the significant relationship between disability type and satisfaction with emergency alerts. Specific training adaptations should be provided: for deaf or hard-of-hearing participants, training must include sign language interpreters, captions, and visual aids; for blind or low-vision individuals, audio instructions and tactile models illustrating evacuation routes; and for persons with cognitive disabilities, plain-language instructions, step-by-step demonstrations, and repetitive guidance. Region-specific adaptations, such as integrating training developed together with local NGOs, will further increase accessibility and effectiveness.

Integrating adaptive technologies and individualized learning strategies is crucial given the high smartphone usage contrasted by the rural-urban digital divide. Accessible mobile learning tools featuring text-to-speech, adjustable font sizes, contrast settings, and a library of sign language videos should be developed, along with offline versions for remote areas in West Kazakhstan. Additionally, individual coaching or small-group sessions, particularly for participants needing repetition due to cognitive or mental disabilities.

Evaluation and continuous improvement require establishing ongoing feedback mechanisms to identify and address emerging issues. Regular satisfaction surveys, simplified feedback forms, short phone surveys, and periodic focus groups enable the identification of barriers and refinement of training materials. Community awareness and engagement efforts must actively promote inclusive emergency preparedness, particularly in rural regions where timely information is less available. Finally, the study shows that positive results can be achieved in the case of collaboration of multiple stakeholders, including disability groups, government, NGOs.

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7. APPENDIX

Survey questions.

1. Тұрғылықты жеріңізді көрсетіңіз / Укажите регион Вашего проживания

1. Шымкент қ. / г. Шымкент
2. Түркістан облысы / Туркестанскаяобласть
3. Манғыстау облысы / Мангистаускаяобласть
4. Батыс Қазақстан облысы / Западно-Казахстанская область

2. Мүгедектік тобыңызды көрсетіңіз / Пожалуйста, укажите Вашу группу инвалидности

1. I топ / I группа
2. II топ / II группа
3. III топ / III группа

3. Мүгедектік түрін көрсетіңіз / Пожалуйста, укажите категорию Вашей инвалидности

1. Есту қабілеті бойынша / По слуху
2. Көру қабілеті бойынша / По зрению
3. Тірек-қимыл аппаратының бұзылуы / Нарушения опорно-двигательного аппарата
4. Ақыл-ой кемістігі / Ментальные нарушения
5. Другое

4. Тұрғын үй түрін көрсетіңіз / Укажите тип Вашего жилья

1. Көпқабатты үй / Многоквартирный дом
2. Жеке үй / Частный дом
3. Жатақхана / Общежитие
4. Другое

5. Төтенше жағдайлар кезінде қандай мәселелер туындайды (мысалы, табиғи апаттар, апаттар, өрттер)? / Какие проблемы вы испытываете во время чрезвычайных ситуаций (например, природные катастрофы, аварии, пожары)?

1. Өздігінен эвакуациялаудың мүмкін невозможстігі / Невозможность самостоятельной эвакуации
2. Көмекші құрылғылардың болмауы / бұзылуы/Отсутствие / поломки ассистивных устройств
3. Эвакуация жолдарының қол жетімсіздігі / Недоступность путей эвакуации
4. ТЖ туралы кеш хабарлау / Позднее оповещение о ЧС
5. Другое

6. Сіз өзіңіздің аймағыңыздағы ерте ескерту жүйесімен қаншалықты таныссыз? / Насколько хорошо вы знакомы с системой раннего оповещения в вашем регионе?

1. Өте жақсы / Очень хорошо
2. Жақсы /Х орошо
3. Таныс емеспін / Не знаком_а

7. Сіз ерте ескерту жүйесі арқылы алатын ақпараттың сапасына ризасыз ба? / Довольны ли вы качеством информации, которую вы получаете через систему раннего оповещения?

1. Иә / Да
2. Жоқ / Нет
3. Жартылай / Частично
4. Другое

8. Төтенше жағдай туралы ақпаратқа қол жеткізуде қиындықтар бар ма (мысалы, қажетті гаджеттердің/ қосымшалардың/ сервистердің болмауы)? / Есть ли у Вас сложности с доступом к информации о ЧС (например, отсутствие необходимых гаджетов/ приложений/ сервисов)?

1. Иә / да;
2. Жоқ / нет;
3. Другое

9. Мүмкін болатын төтенше жағдайлар туралы уақтылы ескертулер аласыз ба? / Получаете ли вы своевременные оповещения о возможных чрезвычайных ситуациях?

1. Иә / Да
2. Жоқ / Нет
3. Кейде / Иногда

10. Төтенше жағдай туралы ақпарат алудың қай әдісі сізге ыңғайлы? / Какой способ получения информации о ЧС для вас наиболее удобен?

1. Смартфон (SMS, қосымшалар) / Смартфон (SMS, приложения)
2. Теледидар / Телевизор
3. Радио
4. Интернет
5. Дыбыстық сигналдар / Звуковые сигналы
6. Другое

11. Сіздің ойыңызша, ерте ескерту жүйесі әртүрлі мүгедектігі бар адамдар үшін қол жетімді ме (мысалы, есту, көру, қозғалыс белсенділігі бұзылған)? / Как вы считаете, доступна ли система раннего оповещения для людей с различными видами инвалидности (например, с нарушением слуха, зрения, двигательной активности)?

1. Иә, толығымен қол жетімді / Да, полностью доступна
2. Жартылай қол жетімді / Частично доступна
3. Жоқ, мүлдем қол жетімді емес / Нет, совсем не доступна
4. Білмеймін / Не знаю

12. Сіз мүгедектігі бар адамдар үшін ескерту жүйесі қол жетімді емес немесе тиімсіз болатын жағдайларға қаншалықты жиі тап боласыз? / Как часто вы сталкиваетесь с ситуациями, когда система оповещения оказывается недоступной или неэффективной для людей с инвалидностью?

1. Өте жиі / Очень часто
2. Кейде / Иногда

3. Сирек / Редко
4. Ешқашан / Никогда

13. Төтенше жағдай туралы ескертулерді қай жолмен алуға болады?/ Каким способом Вам доступнее получать оповещения о чрезвычайных ситуациях?

1. SMS және дауыстық хабарламалар / SMS и голосовые сообщения
2. Дабыл сигналдары (дыбыстық) / Сигналы тревоги (звуковые)
3. Субтитрлері немесе ымдау тілі бар бейне / Видео с субтитрами или жестовой речью
4. Мобильді қосымшалар арқылы хабарландырулар / Уведомления через мобильные приложения
5. Другое

14. Хабарламалар сіздің жағдайыңызды ескере отырып, сіз үшін қаншалықты түсінікті және қол жетімді? / Если вы получаете уведомления, насколько они для вас понятны и доступны с учётом вашего состояния?

1. Толық түсінікті / Полностью понятны
2. Жартылай түсінікті / Частично понятны
3. Түсініксіз / Непонятны

15. Төтенше жағдайларда (мысалы, өрт, жер сілкінісі) қалай әрекет ету керектігін білесіз бе? / Знаете ли вы, как действовать в случае чрезвычайных ситуаций (например, при пожаре, землетрясении)?

1. Иә, мен жақсы білемін / Да, я хорошо осведомлён(а)
2. Менде негізгі білім бар, бірақ қосымша ақпарат қажет / Я имею базовые знания, но нужно больше информации
3. Жоқ, мұндай жағдайларда қалай әрекет ету керектігін білмеймін / Нет, не знаю, как действовать в таких ситуациях

16. Төтенше жағдайлар кезінде (мысалы, өрт, су тасқыны, жер сілкінісі) эвакуациялау кезінде қиындықтарға тап болдыңыз ба? / Сталкивались ли вы с трудностями при эвакуации в случае чрезвычайных ситуаций (например, при пожаре, наводнении, землетрясении)?

1. Иә, қиындықтарға тап болдым / Да, сталкивался(ась) с трудностями
2. Жоқ, ешқандай мәселелер болған жоқ / Нет, проблем не было
3. Кейде мәселелер туындайды, бірақ мен оны жеңе аламын / Иногда возникают проблемы, но я могу справиться

17. Эвакуация процесінде қандай проблемалар туындады? / Какие проблемы возникали в процессе эвакуации?

1. Көлік құралдарының болмауы / Отсутствие транспортных средств
2. Шығуларға немесе лифттерге қол жеткізудегі қиындықтар / Трудности с доступом к выходам или лифтам
3. Басқа тараптан көмектің жоқтығы / Отсутствие помощи со стороны
4. Қажетті хабарламаларды алу мүмкін еместігі / Невозможность получения необходимых уведомлений
5. Другое

18. Төтенше жағдайда Сізге қандай ақпарат немесе қолдау пайдалы болар еді? / Какая информация или поддержка была бы полезна для вас в случае экстренной ситуации?

1. Мүгедектігі бар адамдарға арналған қадамдық нұсқаулар / Пошаговые инструкции для людей с инвалидностью
2. Эвакуация бойынша оқыту курстары / Обучающие курсы по эвакуации
3. Консультацияларға арналған сенім телефоны / Горячая линия для консультаций
4. Другое

19. Төтенше жағдайда эвакуация кезінде қандай физикалық немесе психологиялық қиындықтарға тап болғаныңызды айтыңыз? / Расскажите, какие физические или психологические трудности вы испытываете при эвакуации в случае ЧС?

20. Сіздің ойыңызша,төтенше жағдай кезінде эвакуацияңызды және қауіпсіз аймақта болуыңызды не жеңілдетеді? / Что, по вашему мнению, могло бы облегчить вашу эвакуацию и нахождение в безопасной зоне в случае ЧС?

21. ТЖ қызметкерлері эвакуациялау кезінде сіздің қажеттіліктеріңіз бен денсаулық ерекшеліктеріңізді ескерілетінін сезесіз бе? / Чувствуете ли вы, что ваши потребности и особенности здоровья принимаются во внимание при эвакуации сотрудниками ЧС?

1. Иә / Да
2. Жоқ / Нет
3. Білмеймін / Не знаю

22. Сіз ТЖ кезіндегі іс-әрекеттер бойынша оқудан/ нұсқаудан өттіңіз бе? / Проходили ли Вы обучение/ инструктаж по действиям при ЧС?

1. Иә / Да
2. Жоқ / Нет

23. ТЖ кезінде халықты уақытша орналастырудың ең жақын пункті орналасқан ақпаратқа иесіз бе? / Владеете ли Вы информацией, где находится ближайший пункт временного размещения населения при ЧС?

1. Өте қолжетімді / Очень доступные
2. Қол жетімді, бірақ жақсартулар қажет / Доступные, но необходимы улучшения
3. Онша қол жетімді емес / Не очень доступные
4. Мүлдем қол жетімді емес / Совсем недоступные

24. Сіздің ойыңызша, мүгедектігі бар адамдар үшін ТЖ кезінде уақытша орналастыру пункттері қолайлы ма? / Как Вы считаете, доступны ли пункты временного размещения при ЧС для людей с инвалидностью?

25. Сіздің аймағыңыздағы мүгедектігі бар адамдар үшін қауіпсіздік пен эвакуацияны жақсарту бойынша қандай қосымша ұсыныстарыңыз бар? / Какие дополнительные предложения у вас есть по улучшению системы безопасности и эвакуации для людей с инвалидностью в вашем регионе?

26. Жасыңызды көрсетіңіз / Укажите Ваш возраст

1. 18 жасқа дейін/до 18 лет
2. 18 бен 35 жас аралығында/от 18 до 35 лет
3. 35 пен 61 жас аралығында/от 35 до 61 года
4. 61 жастан асқан/старше 61 года