Brief communication: Towards inclusive risk management

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Abstract. People with disabilities face heightened vulnerability during disasters, yet they remain underrepresented in risk management planning and response. This brief communication highlights findings from a pilot study in Tyrol, Austria, which assessed flood exposure and disaster preparedness in facilities serving people with disabilities. Spatial analysis revealed significant exposure to flood hazards, while qualitative interviews uncovered critical gaps in risk awareness, preparedness, and

10   inclusive planning. The study underscores the urgent need for disability-inclusive disaster risk management, calling for accessible information, targeted preparedness measures, and the integration of disability perspectives into emergency planning to enhance resilience for all.

1 Introduction

According to the WHO (2023), approximately 1.3 billion people globally—one in six individuals—experience a significant

15   disability, making them the largest minority worldwide (UN DESA, 2024). The United Nations Convention on the Rights of Persons with Disabilities (UN CRPD, 2007) defines persons with disabilities as those with long-term physical, mental, intellectual, or sensory impairments, as well as chronic illnesses, which—when interacting with various barriers—may hinder full and effective participation in society on an equal basis with others. The global commitment to "leave no one behind" was articulated in the 2030 Agenda for Sustainable Development, the UN CRPD (2007), and the EU Disability Strategy (EC,

20   2021), which further emphasizes socially just, inclusive, and sustainable transitions in Europe. However, progress in implementing these key conventions and agreements remains slow, and significant inequalities persist for people with disabilities worldwide.

Thereby people with disabilities are at a particular risk during hazard events and emergency situations. For example, a row for studies in different contexts underlined that people with disabilities are significantly more often among fatalities related to

25   flood events (e.g., Petrucci 2022). The Sendai Framework for Disaster Risk Reduction (SFDRR) 2015–2030 (UNISDR, 2015) emphasizes the necessity of inclusive disaster risk management, explicitly advocating for the engagement of persons with disabilities in all disaster risk reduction (DRR) processes and especially in Priority 4 'Enhancing disaster preparedness for effective response, and to «Build Back Better» in recovery, rehabilitation and reconstruction. It underscores the importance of accessibility and the elimination of discrimination to ensure effective participation of all societal groups. Stough and Kang

30   (2015) evaluated the SFDRR's implications for persons with disabilities, underlining the importance of accessibility, inclusion,

and universal design in disaster risk reduction strategies. They also highlighted that the disability-related concepts in the SFDRR should serve as key guiding principles in the field.

However, as we argue in this commentary, people with disabilities remain persistently overlooked in disaster risk management, necessitating a fundamental shift toward inclusive risk management practices—especially in light of climate-change-related

35 increase in hazards and risks (IPCC, 2022). Bennett (2020) assessed the implementation of the SFDRR's priorities with regard to people with disabilities, highlighting the need for enhanced disaster preparedness and a greater consideration of intersectional vulnerabilities. Villeneuve et al. (2021) propose a person-centered capability framework for Disability Inclusive Disaster Risk Reduction (DIDRR), emphasizing the importance of recognizing and enhancing the specific capabilities of individuals with disabilities in disaster contexts. The framework advocates for targeted, context-sensitive actions that address

40 systemic barriers, empower individuals, and foster inclusive practices in the DRR process, particularly during emergency situations.

To substantiate our argument, we use a pilot study from the alpine state of Tyrol, Austria. It analysed proneness towards flood events of facilities for people with disabilities and analysed awareness levels and preparedness—among both disability facilities, organisations and support networks as well as representatives of disaster risk management and emergency

45 responders.

2 Method and results

2.1 Case study Tyrol in Austria

The United Nations criticized Austria for lacking an inclusive, human rights-based disaster strategy (Amt der Tiroler Landesregierung, 2024). The National Action Plan on Disability (NAP) 2022-2030 aims to implement the UN CRPD in

50 Austria, with a focus on strengthening federal cooperation and enhancing the participation of persons with disabilities (BMSGPK, 2022). Section 1.7 "Persons with Disabilities and Crisis Situations", specifically addresses inclusive disaster protection.

A key challenge remains the lack of data on affected individuals and their specific requirements, which hinders the provision of targeted assistance. To address this issue, efforts are underway to establish a more comprehensive data foundation.

55 Simultaneously, an accessible emergency call and warning system will be implemented to ensure equal access to critical information. Additionally, persons with disabilities and their organizations will be integrated into crisis response teams and disaster planning processes to ensure that their requirements are adequately considered (BMSGPK, 2022). Furthermore, the NAP promotes knowledge exchange between civil protection authorities and disability organizations to refine existing measures. Technical innovations, such as the introduction of a crisis situation register, are also intended to optimize crisis

60 management. The overarching goal of these initiatives is to enhance the resilience and safety of persons with disabilities in emergency situations (BMSGPK, 2022).

The Tyrolean Action Plan (TAP) seeks to implement the UN CRPD at the regional level. It emphasizes that people with disabilities face particular challenges in disaster situations and that existing crisis plans do not take them sufficiently into account (Amt der Tiroler Landesregierung, 2024). The aim is to provide equal emergency care through barrier-free warning systems, suitable equipment and training for emergency services. To this end, civil protection and disability organisations should work closely together, plans should be regularly updated and persons with disabilities should be more strongly involved in prevention to ensure that they are not overlooked. Implementation will be carried out gradually until 2030 and includes specific measures in the areas of planning, alerting, evacuation, and accommodation. These measures are based on a participatory process involving the civilian population and are structured according to short-, medium- and long-term timeframes. In the long-term, the objective is to achieve genuine, equal participation (Amt der Tiroler Landesregierung, 2024).

Disaster risk management in Tyrol is based on the Tyrolean Crisis and Disaster Management Act (TKKMG), which addresses all coordinated measures in the areas of prevention, preparedness, response, and recovery after the event. The TKKMG categorizes disasters as local, cross-municipal, or cross-district damaging events, thereby delineating the responsibilities of municipalities, district administrations, and the provincial government. Mayors are responsible for drawing up municipal disaster management plans, while district administrations and the provincial government are required to draft corresponding plans for large-scale events. These plans include a comprehensive analysis of local conditions, potential hazards, warning and alert systems, evacuation measures, and available resources (TKKMG, 2024). The specific structure of these plans is regulated in the Disaster Protection Plan Ordinance. However, as this ordinance is not publicly accessible, no reliable information is available regarding its actual content.

Tyrol's disaster protection plans do not include specific provisions for people with disabilities, despite legal requirements (TKKMG, 2024). The Tyrolean Action Plan acknowledges this shortcoming and calls for legal adjustments as well as the regular inclusion of people with disabilities (Amt der Tiroler Landesregierung, 2024). Yet, reliable data on the inclusion of people with disabilities in disaster risk management in Tyrol remain insufficient. The 2022 microcensus supplementary survey provides only limited insights, as it does not account for residents of facilities for people with disabilities (Schuller et al., 2024).

River floods and torrent floods represent two primary types of flood hazards in mountain regions, each requiring distinct hazard mapping approaches due to their specific characteristics.

2.2 Methods

The first step included the identification of workspace and residential facilities of people with disabilities in the state of Tyrol by the analysis of public available institutions and their locations.

A spatial analysis was conducted to assess the exposure of residential and workplace facilities for individuals with disabilities in flood-prone areas of Tyrol, as delineated by the hazard maps for river and torrential flooding, as well as the modelled flood hazard zones (BML, 2025). In Austria three different sources on flood hazard maps are available. Hazard mapping for torrent

floods, including debris flows, is conducted at the local scale (1:2000 to 1:10,000) by the Austrian Service for Torrent and Avalanche Control (WLV). These maps delineate areas affected by design events with a return period of 150 years. The Federal Water Engineering Administration (BWV) provides the hazard maps for river flooding, primarily considering events of a return period of 100 years. The third source of hazard information is based on flood modeling, which accounts for 1-in-30

100   (HQ30), 1-in-100 (HQ100), and 1-in-300 (HQ 300) year flood events to meet the requirements of the EU Floods Directive 2007/60/EC (EC, 2007).

Due to the limited research on the inclusion of people with disabilities in Austrian disaster risk management, an exploratory research approach was adopted. This employed expert interviews with a semi-structured format to provide in-depth insights. Experts were defined as individuals with specialized role knowledge. The study included interviews with two representatives

105   from disaster management, four employees in disability service facilities, and one researcher specialized in the field. The interviews were transcribed and coded using MAXQDA. They were analyzed through qualitative content analysis following Kuckartz (2018). This approach enables a systematic and transparent analysis, capturing both existing structures and new insights through deductive and inductive categorization (Kuckartz, 2018). In addition to the interviews, four protocols documenting the implementation processes of the Tyrolean Action Plan were also analyzed (Amt der Tiroler Landesregierung,

110   2024).

2.3 Results

In the study area we identified 84 workplace facilities and 74 residential facilities of people with disabilities.

2.3.1   Results of exposure to floods

A total of 31 work facilities and 23 residential facilities for people with disabilities are located, at least partially, in flood-prone

115   areas. A differentiated analysis reveals that three work facilities are situated in areas of high hazards (HQ30), while twelve work facilities and twelve residential facilities are located in areas of moderate hazard (HQ100). Figure 1 presents selected sections of Hall in Tirol and Schwaz, highlighting residential and work facilities at risk within the flood zone. Approximately 102 people with disabilities live in the exposed residential facilities and 140 people with disabilities are employed in those workplaces. The majority of facilities fall into the low-hazard zone (HQ300), including 15 work facilities and eleven residential

120   facilities.

2.3.2   Results of analysis of flood risk awareness and preparedness

Awareness and sensitization of the population are crucial for an appropriate and effective response to disasters. Experts note that there is a lack of societal awareness regarding flood risk (expert in disaster risk management). In facilities for people with disabilities, there is often a lack of awareness of exposure to natural hazards such as flooding (experts in disability matters),

125   even though publicly accessible flood maps provide this information. While fire protection measures are well-established, interviews revealed that facility managers were not aware of the flood risks to their facilities. Although Lebenshilfe Tyrol has

a risk management team, the hazard and exposure situation of individual locations is only partially known and is not centrally documented (expert in disability matters). Systematically recording this data would be essential for effective flood protection and preparedness.

130 A significant challenge for people with disabilities is the limited accessibility of information on natural hazard risks, as such information is often not presented in accessible formats. For example, while the Water Information System Austria (WISA) map offers crucial data on flood risks, its website is not fully accessible (BML, 2025). As the document analysis showed, the Austrian Civil Protection Association's information is not available in accessible formats and fail to account for the requirements of people with disabilities, thereby hindering their participation in disaster preparedness measures. According to

135 the Global Survey Report, many individuals criticize the lack of accessible information, which reduces risk awareness and complicates participation in protective measures (Gvetadze et al., 2023). As a result, the perspectives of people with disabilities are often overlooked in disaster management planning.

Another important issue in this context is the special requirements for inclusive early warning systems. Historically, these systems have relied on acoustic signals, such as sirens, which are not accessible to all. There is an urgent need to design early

140 warning systems that effectively reach all individuals and clearly communicate necessary actions. Currently, the AT Alert mobile phone warning system is being tested as a more accessible alternative (Amt der Tiroler Landesregierung, 2024).

Additional studies reveal that reliable data on people with disabilities in disaster risk management in Tyrol remain insufficient. However, the 2022 microcensus supplementary survey provides only limited insights, as residents of facilities for people with disabilities are not included (Schuller et al., 2024). To overcome this lack of data, a voluntary emergency register enables self-

145 registration but is viewed critically due to data protection concerns (expert in disaster risk management Tyrol). Nevertheless, such a register could facilitate more targeted resource allocation during disasters (Member of the Austrian Disability Council).

In general our pilot study highlights once again that people with disabilities remain underrepresented in emergency response organizations (Gabel and Schobert, 2024). Legal barriers, such as health suitability requirements, contribute to this exclusion. People with disabilities can actively contribute to disaster response, provided that accessible frameworks are in place (expert

150 in disability inclusive disaster risk reduction). However, preparedness materials and training programs are often not fully accessible. Neighborhood assistance plays a key role but requires coordinated state support (expert in disaster risk management Tyrol).

Improving knowledge about disaster preparedness is essential for strengthening long-term self-help capacities. Inclusive, data-driven disaster risk management remains a key challenge for Tyrol. The integration of people with disabilities, accessible

155 information dissemination, and the establishment of robust legal frameworks must be consistently advanced to ensure safety and participation for all.
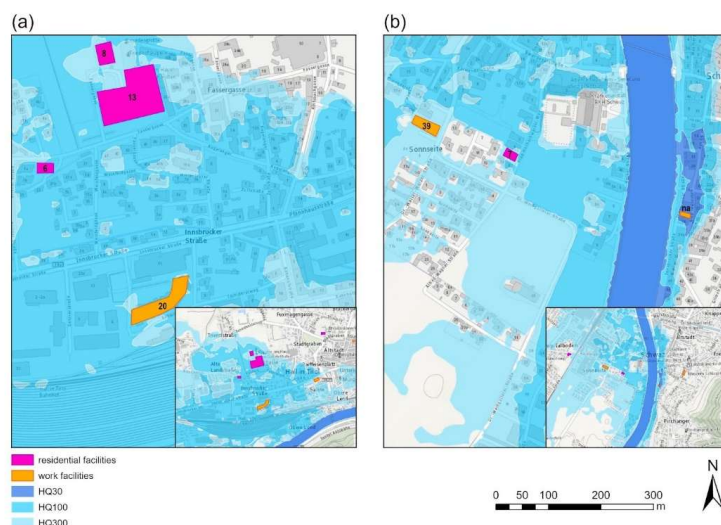
Figure 1: Residential and work facilities for people with disabilities exposed to flood risk in (a) Hall in Tirol and (b) Schwaz. Figures indicate the number of people with disabilities in the facilities, data basis: data.gv.at and basemap.at

3 Results

As the UN DESA (2019) has noted: "Sustainable development for all can only be attained if persons with disabilities are equally included as both agents and beneficiaries as countries strive for a sustainable future." When it comes to risk management, as the case study in this article has shown, people with disabilities remain overlooked.

The study underscores significant gaps in inclusive disaster risk management in Tyrol, particularly in risk awareness, preparedness, and data accessibility which are needed to be addressed for inclusive disaster risk management and aims to enhance the resilience and safety of people with disabilities. Based on the analysis of identified barriers, five key recommendations emerge: (1), Raising public awareness about flood risk and the specific requirements of people with disabilities is essential. This can be achieved through workshops, accessible public awareness campaigns, and joint exercises involving emergency response organizations and the community. (2) Enhancing self-help capacities of people with disabilities is critical. This includes the provision of accessible informational materials, inclusive first aid training, and the removal of barriers in early warning systems and evacuation processes (Gabel and Schobert, 2024). (3) Improving data collection to enable targeted planning and assistance, such as through emergency registries that include facilities serving people with disabilities, while ensuring the protection of sensitive data is central. (4) Ensuring accessible disaster risk communication, e.g., preparedness information, which should be available in easy language and across various media formats. (5) Promoting the inclusion of people with disabilities in emergency response organizations as a key measure to leverage their resources, promote

diversity, and reduce biases (Gabel and Schobert, 2024). Implementing these measures can foster individual safety but also to contribute to a more inclusive society as a whole.

Implementing effective inclusive risk management remains inherently complicate and challenging due to the diverse nature of disabilities, each requiring tailored measures and responses. However, adopting an inclusive approach not only addresses the

180 specific requirements of people with disabilities but also strengthens the resilience of other vulnerable groups. These groups include older adults, individuals with temporary illnesses or injuries, those with mobility impairments, pregnant women, and children and young people along with their families. By fostering a comprehensive and inclusive risk management strategy, communities can enhance overall preparedness and ensure that no one is disproportionately affected during damaging natural hazards events.

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Data availability: The flooding areas are available via data.gv.at and are publicly accessible. The data of the disabled facilities are not publicly accessible due to data protection.

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190 190 T.B.-H. and M.K.; writing

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