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ARTICLE

Emergency Language Services in Linguistically Diverse Regions: Toward Inclusive Language Policy in Disaster Management in Garzê, China

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ABSTRACT

In multiethnic, multilingual, and hazard-prone regions, language is not only a medium of communication, but a critical determinant of inclusion and survival during emergencies. This study examines the intersection of language policy and emergency governance in the Garzê Tibetan Autonomous Prefecture in China, where linguistic diversity—primarily Tibetan, Mandarin Chinese, and the Sichuan dialect—poses challenges for effective disaster response. Drawing on a mixed-methods design comprising 13 focus group interviews (N = 125), ethnographic field notes, and a large-scale survey (N = 4137), the research identifies how generational, occupational, and ethnolinguistic factors shape linguistic accessibility and exacerbate risk during crises. The findings demonstrate the absence of an emergency language policy that accounts for the sociolinguistic realities on the ground, particularly the needs of elderly monolingual Tibetan speakers and the linguistic limitations of external rescue teams and volunteers. By bridging sociolinguistic theory with disaster management frameworks, this study calls for a paradigm shift toward linguistically inclusive emergency planning that recognizes

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language as a core element of risk communication. It proposes a multilayered policy response encompassing the institutionalization of language accessibility, human and technological capacity-building, cross-sector coordination, resource allocation, and cultural integration. Beyond immediate practice, the study underscores the need for further research on AI-mediated language tools and participatory policy design, ensuring that emergency language services not only overcome communication barriers, but also promote equity, trust, and resilience in multilingual, high-risk contexts.

Keywords: Language Policy; Linguistically Diverse Region; Language Barriers; Emergency Language Services (ELS); ELS Needs; Garzê

1. Introduction

Effective communication during emergencies is critical for the safety and well-being of residents in multilingual areas. However, such areas may encounter difficulties in providing adequate emergency language services (ELS) to ensure smooth communication, especially in remote hazard-prone regions. Research [1, 2] has demonstrated that language barriers in the form of misunderstandings, misinterpretations, or inability to convey ideas, thoughts, or information impede timely access to critical information and services, rendering the population more vulnerable and aggravating the impact of disasters. Furthermore, when multiple hazards such as earthquakes, wildfires, and landslides occur in the same area, ELS could face more complex situations. To develop targeted language strategies and provide language services accessible to both rescuers and the local population in an emergency, a thorough understanding of the ELS needs is imperative. While existing studies have explored crisis translation [3, 4] and the vulnerabilities faced by minorities in disaster contexts [2, 5], comprehensive field studies exploring ELS needs in multiethnic, multilingual, and hazard-prone environments are scarce to the authors' knowledge. This study aims to address this gap by investigating ELS needs within such a complex environment—Garzê Tibetan Autonomous Prefecture (abbreviated as Garzê) in China.

To ground this research, a literature review was conducted on three key areas: the conceptualization of ELS, the specific challenges of multiethnic, multilingual, and hazard-prone environments, and existing approaches to identifying ELS needs. This review situates the study within current scholarship and underscores the urgency of advancing ELS research in contexts such as Garzê.

1.1. Conceptualization of ELS

ELS plays a vital role in disaster management by facilitating effective communication. It emphasizes the timely and accurate exchange of information to mitigate risks, minimize harm, and protect vulnerable populations [6–9]. In diverse communities, culturally and linguistically appropriate communication is essential for ensuring that emergency management strategies are inclusive and effective. Failure to provide adequate language services can lead to unequal emergency responses and poorer outcomes [10]. Coombs [11, 12] also argued that clear, accessible communication, customized to different linguistic groups, is critical for effective crisis management and maintaining public trust.

Several key theories underpin the conceptualization of ELS. Risk Communication Theory is foundational in understanding how information about potential risks and emergencies is communicated to the public [13–15]. It emphasizes the importance of delivering clear, accurate, and timely messages to reduce public uncertainty and facilitate informed decision-making during crises [7]. In the context of ELS, this theory underscores the need for language services to ensure that emergency alerts, warnings, and safety instructions are not only linguistically accessible but also effectively communicate risk and protective actions to diverse populations.

Critical sociolinguistics examines how language, power, and society intersect, highlighting how language ideologies, such as linguistic capital and language hierarchies, influence emergency responses. Bourdieu [16] defines linguistic capital as the value given to specific linguistic practices, which can affect access to resources in emergencies. In crisis situations, official communication in a dominant language may marginalize speakers of other languages, leading to delayed or misinterpreted information [17, 18]. Language hierarchies, where certain languages hold more social, political,

or economic power, further exacerbate inequalities in emergency situations. Speakers of lower-status languages may struggle with communication, resulting in unequal distribution of aid[19, 20]. Cultural practices also play a significant role in shaping effective communication during crises. Trust in local institutions like temples or mosques can enhance the dissemination of information and coordination, overcoming linguistic barriers[21]. These institutions, rooted in cultural norms, promote collective responsibility and community resilience, which are essential for effective emergency responses[22, 23]. Therefore, critical sociolinguistics emphasizes the need to consider language ideologies and cultural practices in emergency response planning.

Disaster management theory, on the other hand, focuses on effectively managing emergency situations through planning, response, and recovery stages, with a central role for clear communication and coordination among agencies[24]. In this framework, ELS plays a role in ensuring that emergency messages are accessible to all, facilitating quick and coordinated action. Similarly, social justice and equity theories emphasize the fair distribution of resources and opportunities, particularly for marginalized groups during crises. These theories emphasize the need for emergency services to ensure that vulnerable populations are not excluded from critical information[25, 26]. ELS, therefore, must not only provide language access but also ensure that it is equitably distributed to those who need it most.

Intercultural communication theory examines variations in communicative practices across cultural boundaries and delineates strategies for adapting messages to diverse sociocultural contexts[27, 28]. This theory provides critical insights into ELS by emphasizing that culturally embedded norms, values, and expectations shape the interpretation of information. In emergency contexts, where rapid and accurate communication is paramount, cultural differences may influence how messages are decoded, potentially affecting response adherence and efficacy. ELS must, therefore, consider the context in which messages are received, ensuring that communication is both linguistically and culturally appropriate.

Together, these theories highlight the vital role of language in emergency management, emphasizing that ELS extends beyond translation to foster inclusivity, equity, and understanding. This study defines ELS across all emergency phases—planning, response, and recovery—prioritizing effective communication between responders and affected communities to enhance resilience, particularly in multiethnic, multilingual, and hazard-prone regions like Garzê.

1.2. Multiethnic, Multilingual, and Hazard-Prone Environments

Multiethnic and multilingual regions offer rich cultural and linguistic diversity, but this diversity can pose challenges in hazard-prone areas. Linguistic minorities may face barriers to accessing vital information for hazard preparedness, response, and recovery, potentially increasing their vulnerability[29]. In regions exposed to multiple hazards (e.g., earthquake, flood, landslide, & wildfire), the importance of ELS is even more pronounced. Such environments require adaptable language support systems (i.e., task-specific language supporting systems for smooth communication) capable of addressing various linguistic needs in different hazard situations[30]. Each type of hazard presents unique communication challenges, demanding comprehensive ELS strategies to ensure the safety and well-being of all residents. Conducting a detailed needs assessment for ELS in these regions is imperative to understand the specific language requirements of diverse communities and develop effective emergency response interventions.

Garzê Tibetan Autonomous Prefecture, located in the western mountainous region of Sichuan Province in China, serves as an ideal case study due to its complex linguistic, cultural, and hazard profile. The region is home to 41 ethnic groups, with a majority Tibetan population, and is characterized by diverse languages, including Mandarin Chinese, Tibetan, Yi, Qiang, and various regional dialects. The geographical and geological features of Garzê contribute to the high frequency of hazards such as earthquakes, landslides, debris flows, and seasonal floods[31]. The region's linguistic diversity and susceptibility to multiple hazards make it a compelling case for investigating the ELS needs to improve emergency communication and response.

Furthermore, while Garzê has implemented policies emphasizing bilingual education in Chinese and Tibetan, questions remain about whether its current language services are adequate to meet the demands of major disasters. The region's challenging geography requires small, precise rescue teams that would benefit from accurate multilingual

communication during critical response periods. Effective communication between rescue teams, volunteers, and disaster victims in their native languages could enhance survival rates and improve overall disaster response effectiveness [32]. Therefore, Garzê has been chosen as the location for our field investigation into ELS needs.

1.3. Identification of ELS Needs

Identifying ELS needs involves a structured approach that takes into account the linguistic, cultural, and situational factors influencing communication during emergencies. For instance, Yin [33] proposed a comprehensive ELS Needs Identification Model, categorizing needs by event type, recipient characteristics, environmental factors, emergency management processes, communication channels, and language content. This model emphasizes the importance of ensuring that ELS is accessible, acceptable, adaptable, and aligned with the expectations of service recipients. Additionally, the model highlights the role of emergency responders' language proficiency as a critical factor influencing the effectiveness of ELS. Given that this research is a case study centered on the ELS needs in Garzê, Yin's model serves as a guide for crafting interview questions and designing survey items that are both comprehensive and targeted, but the focus of this study is not only on the responders' language proficiency, but also on the potential affected populations' language use.

Moreover, local resources such as interpreters, cultural mediators, and community organizations can facilitate communication during emergencies. For instance, during disasters, local interpreters who understand both the language and cultural context of the affected population can provide crucial information to non-native speakers, facilitating communication effectively. Cultural mediators can also play a critical role by bridging cultural gaps, ensuring that emergency messages are not only understood but also culturally sensitive, which can improve compliance and trust in the community [34]. Furthermore, community organizations, such as local non-profits or grassroots groups, can serve as trusted channels for disseminating information, enhancing community engagement, and increasing resilience in hazard-prone areas [35, 36]. Thus, existing community ELS practices in Garzê were another concern of our investigation while identifying ELS needs.

1.4. Research Questions

Existing theories and models of ELS emphasize a multifaceted approach to understanding and addressing language needs in emergencies. Investigating ELS needs in Garzê extends this theoretical foundation by providing a practical application in a real-world setting. Yet, the literature reveals a lack of empirical field studies. To address this gap, the present study poses three research questions:

RQ1: What is the current state of language use and barriers encountered during emergency management in Garzê?

RQ2: What established ELS practices are currently implemented to mitigate language barriers?

RQ3: What are the specific ELS needs that should inform policy development for effective emergency management in Garzê's multiethnic, multilingual, and hazard-prone context?

2. Materials and Methods

2.1. Research Design

This is a mixed-methods study aimed at learning about the ELS needs in multiethnic, multilingual, and hazard-prone environments with Garzê as the case for investigation. The qualitative component involved focus group interviews with representatives selected in collaboration with local officials from educational and emergency bureaus at both the county and prefecture levels in Garzê. The quantitative component was conducted after each focus group interview, with the interviewees assisting in distributing the survey QR code to others through the social media WeChat.

2.2. Participants

A purposeful sampling approach was employed in this study. The researchers collaborated with local officials from the educational and emergency departments at both county and prefecture levels in Garzê. With their support, 13 focus group interviews were conducted, involving 125 participants. These participants completed the survey and subsequently facilitated its wider distribution through a snowball sampling technique. Participation was entirely voluntary, and a total of 4,137 individuals successfully completed the survey. The demographic profile of the participants is shown in **Table 1** and **Table 2**.

Table 1. Profile of focus interview groups.

No.	Village/ County/City	Participants	No. of Participants
1	Kangding City	officials from the Garzê Emergency Management Bureau, the Education Department, the Language Committee, the Ethnic & Religious Affairs Committee, the Youth League Prefectural Committee, the Healthcare Commission, the Foreign Affairs Department, and the Comprehensive Search & Rescue Team	18
2	Xinduqiao Town, Kangding City	officials from the local government branches, monks, and villagers	9
3	Jiawa Town, Litang County	officials from the local government branches, monks, pupils, and villagers	9
4	Batang County	officials from the County-Level Emergency Management Bureau, the Education Department, the Healthcare Committee, the Ethnic & Religious Affairs Committee, the Firefighting Team, the Youth League Committee, and Zequhuo Village	15
5	Rulong Town, Xinlong County	officials from the local government branches and villagers	8
6	Quge Village, Rulong Town	officials from the local government branches and villagers	8
7	Xinlong County	officials from the local government branches, the County-Level Healthcare Committee, the Firefighting Team, the Ethnic & Religious Affairs Committee, and the Youth League Committee, as well as villagers	11
8	Dege County	officials from the local government branches, the County-Level Youth League Committee, the Weather Bureau, the Public Security Bureau, the Firefighting Team, the Education Bureau, the Emergency Management Bureau, the Ethnic & Religious Affairs Committee, the Forestry & Grassland Bureau, the Healthcare Commission, the Natural Resources Bureau, the Transportation Bureau, and the Water Conservancy Bureau	13
9	Baiya Town, Dege County	officials from the local government branches and villagers	5
10	Derong County	officials from the local government branches, the County-Level Emergency Management Bureau, the Firefighting Team, the Ethnic & Religious Bureau, the Public Security Bureau, the Youth League Committee, the Healthcare Bureau, the Forestry & Grassland Bureau, and the Education Bureau	11
11	Sun Valley Town, Derong County	officials from the local government branches and villagers	7
12	Garzê County	officials from the local government branches	6
13	Daocheng County	officials from the local government branches	5
Total			125

Table 2. Profile of survey participants.

Category	Sub-Category	No. of Participants	Percentage
Gender	Male	1823	44.07%
	Female	2314	55.93%
Age	Below 18	2031	49.09%
	18–35	944	22.82%
	36–45	667	16.12%
	46–55	292	7.06%
	56–60	108	2.61%
	Above 60	95	2.30%

Table 2. *Cont.*

Category	Sub-Category	No. of Participants	Percentage
Ethnicity	Han	128	3.09%
	Tibetan	3967	95.89%
	Yi	23	0.56%
	Qiang	7	0.17%
	Others	12	0.29%
Occupation	Full-time rescue worker	42	1.02%
	Prefecture government staff	22	0.53%
	County and municipal staff	258	6.24%
	Township and town government staff	113	2.73%
	Emergency volunteer	17	0.41%
	Educator	172	4.16%
	Student	1983	47.93%
	Village cadre	149	3.60%
	Villager	956	23.11%
	Temple staff	9	0.22%
	Monk	15	0.36%
	Others	401	9.69%
Education	Primary school	1014	24.51%
	Junior high school	1889	45.66%
	Senior high school	199	4.81%
	College diploma	357	8.63%
	Bachelor's degree	310	7.49%
	Master's degree	11	0.27%
	Doctor's degree	4	0.10%
	Others	353	8.53%

2.3. Instruments

The research instruments comprised a focus interview guide and a survey. The focus interview guide was in Mandarin Chinese, as most target interviewees were expected to be proficient in the language. For the few participants who might not be proficient in Mandarin Chinese, such as some villagers, local officials provided on-site interpreting assistance. Conversely, the survey was available in both Chinese and Tibetan to accommodate self-administration by participants.

2.3.1. Focus Interview Instrument

The focus interview guide was divided into different sections, each tailored to specific participant groups, ensuring that data collection was focused and relevant to the needs and responsibilities of each group. Each section targeted distinct groups involved in emergency management and language service provision. For example, the section for the Garzê Prefecture Emergency Management Bureau included questions related to: a) Language barriers encountered in emergency management operations; b) The content and methods used to address the emergency language service needs; c) The scale and capabilities of the ELS team; and d) the availability of bilingual training for emergency management personnel.

Similar sections were provided for other relevant stakeholders, such as the Education Bureau, Ethnic and Religious Affairs Bureau, Youth League Committee, Health Commission, Foreign Affairs Bureau, Comprehensive Rescue Teams, and local emergency management departments.

These sections aimed to collect detailed information on how each group addresses language barriers, the available resources, and any gaps in the existing language service provisions. The data allowed for a comprehensive understanding of the language service infrastructure and its effectiveness in responding to emergencies.

In addition to the stakeholder-specific sections, the focus interview guide included a section for interviews with local community members. This section focuses on the experiences of residents with language barriers throughout the various stages of disaster management, including disaster prevention, emergency response, and post-disaster reconstruction. Community members were asked to provide insights into the extent and types of language needs during emergencies, the scale and capabilities of the ELS teams

they interacted with, and the availability and effectiveness of language education in local educational institutions.

The guide was designed with flexibility, allowing it to be easily adapted to the unique needs of different participant groups. This flexibility was crucial for encouraging open and honest discussions regarding the challenges, needs, and opportunities related to ELS in Garzê.

2.3.2. Survey Instrument

The second instrument employed in this study was a structured survey distributed via the Wenjuanxing platform. This survey was organized into four sections. The first section provided an introduction outlining the research objectives, scope, potential risks, significance, privacy protections, and consent procedures. This ensured that participants were fully informed before voluntarily engaging in the study.

The second section comprised six items capturing essential demographic information, including gender, age, ethnicity, occupation, educational background, and residential location. These variables were crucial for contextualizing language use within the region's socio-economic landscape. For instance, the data facilitated the identification of linguistic trends across different age cohorts and occupational sectors.

The third section included six items assessing language use and proficiency. Respondents were evaluated on their listening, speaking, reading, and writing abilities in Tibetan, Mandarin Chinese, Sichuan dialect, and other regional minority languages. Additionally, this section incorporated self-reported proficiency levels and explored participants' language-learning experiences and exposure to different linguistic environments.

The fourth section consisted of five items examining participants' disaster-related knowledge and their use of language in emergency contexts. The purpose of this section was to get insights into the population's access to disaster knowledge and their choice of language for emergency communication.

To ensure the validity and reliability of the data, the research instruments underwent a pre-testing phase within the research team and two doctoral students. This process allowed for the refinement of questions and ensured that the focus interview guide and the survey would capture the information needed to address the research objectives. Feedback from the pre-test was incorporated into the final version of the instruments to improve clarity and relevance.

2.4. Data Collection and Analyses

The research data were collected through 13 focus group interviews, field notes, and a survey. The resulting minutes and notes (36,585 Chinese characters) were subjected to a thematic content analysis. Initially, the first, second, and third authors conducted a manual analysis, engaging in collaborative close reading and iterative discussion to achieve consensus on the emergent themes. To further ensure the reliability and accuracy of the thematic extraction, the AI tool DeepSeek was subsequently employed to independently identify potential themes. The final themes were determined by triangulating the results of both the manual analysis and the AI-generated outputs.

Meanwhile, the survey was distributed by sharing a QR code produced through the Wenjuanxing platform with the interviewees at the end of each meeting, who were encouraged to disseminate the code further. Through the combined efforts of the research team and the interviewees, a total of 4,408 questionnaires were distributed, resulting in 4,137 valid responses (93.8% response rate). The survey data were initially analyzed using the Wenjuanxing platform's built-in statistical tools to generate descriptive analytics. Then, the data were exported to a spreadsheet application (Microsoft Excel) for advanced inferential analyses. Following that, three distinct multiple regression models were constructed using a stepwise method to identify predictors of language proficiency outcomes. In these models, Mandarin proficiency, Sichuan dialect proficiency, and Tibetan proficiency were each operationalized as dependent variables, while sociodemographic factors (e.g., age, education, occupations, ethnicity) and language-related variables (e.g., Tibetan dialects, preferred communication language with rescuers), and knowledge variables (e.g., disaster knowledge, emergency rescue knowledge) served as independent predictors. This approach enabled a systematic exploration of how individual factors influence language proficiency in the studied multilingual, hazard-prone environment so that ELS needs can be identified.

3. Results

3.1. Qualitative Data Analysis Results

Once the minutes of the focus group interviews and field notes were ready, a qualitative data analysis was con-

ducted to extract key themes and sub-themes. The results are presented in alignment with the three research questions.

To address RQ1 (the current state of language use and barriers in emergency management in Garzê) and RQ2 (the established ELS practices currently implemented to mitigate language barriers), the analysis revealed that Tibetan is the predominant language in Garzê, encompassing multiple dialects such as Kham, Amdo, as well as localized variants. In addition, other languages spoken in the region include Mandarin, the Sichuan dialect, and indigenous languages such as Yi and Naxi. The specific language barriers, established ELS practices, and identified gaps are summarized in **Table 3**.

Table 3. Language barriers, existing solutions, and identified gaps.

Language Barriers	Existing Solutions	Identified Gaps
Limited Mandarin proficiency among older populations (50+ years), who primarily use local dialects or Tibetan	- Implement the "Small Hand in Big Hand" program, where children teach parents Mandarin. - Deploy bilingual village cadres and volunteers.	- Insufficient bilingual volunteers in remote areas. - Limited funding for language training.
Regional dialect variations (e.g., Minyak, Quyugue) obstruct cross-area communication	- Use standardized Tibetan (Kham dialect) for emergency broadcasts. - Employ local guides and translators.	- Absence of dialect-specific translation tools. - Lack of consistent dialect mapping for emergency communication.
Technical terminology (e.g., disaster alerts, medical terms) is lost in translation	- Develop simplified bilingual glossaries. - Engage village "knowledgeable persons" to disseminate information.	- No standardized bilingual emergency terminology database. - Inadequate training in technical terms.
Low Mandarin proficiency among rural and religious communities	- Establish monastic management committees with bilingual staff. - Promote Mandarin learning through school-based programs.	- Monks receive little to no Mandarin language training. - Weak adoption of Mandarin in religious settings.
Communication challenges between external rescue teams and non-local personnel	- Recruit local bilingual rescue personnel. - Allocate translators before disasters occur.	- No centralized translator database. - Limited cross-regional language coordination.
Limited literacy in Tibetan and Chinese among older populations	- Utilize oral broadcasts via village loudspeakers. - Implement visual aids (e.g., posters, instructional videos).	- Emergency broadcasts have poor coverage in remote areas. - Lack of audiovisual emergency materials in local dialects.
Language barriers faced by tourists and foreign visitors	- Train tourism personnel in basic English and Mandarin. - Recommend the use of translation apps.	- No multilingual emergency hotline available. - Translation apps lack compatibility with regional dialects.

The findings presented in **Table 3** outline significant linguistic challenges in emergency response within Garzê. A key issue is the widespread reliance on local dialects and Tibetan among older populations and rural communities, which impedes Mandarin-based communication efforts. While community-driven initiatives, such as the "Small Hand in Big Hand" program and bilingual village cadres and volunteers as translators, aim to bridge these gaps, the shortage of qualified volunteers and inadequate funding for language training remain obstacles. Additionally, regional dialect variations further complicate cross-area communication, as there is no standardized mapping of dialects for emergency purposes.

Technical terminology related to disaster response and medical emergencies is often lost in translation due to the lack of a standardized bilingual terminology database. Although simplified bilingual glossaries and village "knowledgeable persons" help address this issue, these measures are insufficient without comprehensive training programs. Furthermore, rural religious communities exhibit low Mandarin proficiency, making it difficult to ensure effective emergency communication. Limited literacy among older populations exacerbates this problem, requiring alternative communica-

tion methods such as oral broadcasts and visual aids.

Another challenge is the communication gap between local and non-local emergency response teams. While recruiting bilingual personnel is a potential solution, the absence of a centralized translator database and limited cross-regional coordination hinders efficiency. Similarly, tourists and foreign visitors face linguistic barriers during emergencies, with no dedicated multilingual hotline available, and existing translation apps lacking dialect compatibility. These findings underscore the need for systematic policy interventions, enhanced technological solutions, and sustained funding to address language barriers in emergency management.

To address RQ3 (the specific ELS needs that should inform policy development for effective emergency management in Garzê), **Table 4** outlines the identified themes, sub-themes, and illustrative examples of ELS needs, as derived from the qualitative data analysis.

Table 4. Themes, sub-themes, and examples of specific ELS needs in Garzê.

Themes	Sub-Themes	Examples
Language Training	Bilingual Workforce Development	- Train rescue teams in both Tibetan dialects and Mandarin. - Integrate technical terminology into Tibetan language training programs.
	Community Literacy Programs	- Expand the "Small Hand in Big Hand" initiative to include emergency-related vocabulary. - Establish farmers' night schools to teach basic Mandarin.
Technology Integration	Translation Tools	- Develop dialect-specific translation applications (e.g., Kham Tibetan, Minyak).
	Communication Infrastructure	- Extend emergency broadcast coverage to remote villages. - Deploy offline translation devices in areas with poor network coverage.
Policy & Coordination	Standardized Protocols	- Create a unified Tibetan-Mandarin Chinese emergency terminology database. - Mandate bilingual contingency plans at the county level.
	Cross-Department Collaboration	- Establish prefecture-level task forces for language services in emergencies. - Strengthen collaboration between the Ethnic & Religious Affairs Committee and the Emergency Management Bureau to enhance emergency coordination in religious sites.
Resource Allocation	Funding for Local Solutions	- Allocate funding for the development of dialect-specific training materials. - Subsidize the recruitment and training of bilingual volunteers.
	Equipment & Personnel	- Equip rescue teams with translation devices. - Employ Tibetan linguists in medical and technical emergency response teams.
Cultural Sensitivity	Religious & Ethnic Inclusion	- Train monks in emergency-related terminology. - Involve monasteries in disaster preparedness drills to enhance community response.
	Community Engagement	- Use Kangba Satellite TV to disseminate culturally relevant emergency broadcasts. - Collaborate with local social media influencers to raise disaster awareness.
Special Populations	Elderly & Disabled Individuals	- Assign bilingual caregivers to support elderly and vulnerable groups. - Develop sign language and flag semaphore translation protocols for individuals with hearing impairments.
	Tourists & Migrant Workers	- Distribute multilingual emergency guides at key tourist locations. - Provide hospitality sector staff with training in emergency communication.

The thematic analysis revealed six interconnected themes that collectively address the ELS needs critical to effective emergency management in Garzê. These themes are: Language Training, Technology Integration, Policy & Coordination, Resource Allocation, Cultural Sensitivity, and Special Populations.

To begin with, Language Training emerged as foundational. Specifically, the need to develop a bilingual workforce—focusing on rescue teams proficient in both Tibetan dialects and Mandarin—was strongly emphasized. In parallel, community-based literacy programs were identified as vital, particularly those enhancing basic language skills

pertinent to emergency contexts.

Building upon language competencies, Technology Integration plays a complementary role. The analysis pointed to the importance of developing dialect-specific translation tools and expanding emergency broadcast services. Furthermore, the deployment of offline translation devices was highlighted to ensure accessibility in remote and network-limited areas.

In addition, Policy & Coordination surfaced as essential for institutionalizing language support. The findings advocate for standardized bilingual protocols, such as a Tibetan-Mandarin emergency terminology database and mandated county-level contingency plans. Equally important is fostering cross-department collaboration, particularly between ethnic, religious, and emergency management bodies.

Complementary to policy efforts, Resource Allocation was recognized as a practical necessity. Specifically, allocating funds for the creation of localized training materials and supporting the recruitment of bilingual volunteers were identified. Moreover, equipping rescue teams with translation devices and integrating linguistic personnel into emergency response units were seen as crucial.

Another key theme is Cultural Sensitivity, which underscores the need to incorporate religious and ethnic considerations. For instance, involving monasteries in disaster preparedness activities and utilizing local media platforms to disseminate culturally appropriate information were highlighted as effective strategies.

Lastly, attention was directed to Special Populations. Addressing the needs of vulnerable groups—including the elderly, disabled, tourists, and migrant workers—requires assigning bilingual caregivers, developing sign language protocols, and providing multilingual emergency guidance in public spaces.

Taken together, these six themes illustrate that overcoming language barriers in Garzê's emergency management demands a multi-dimensional approach.

3.2. Quantitative Data Analysis Results

Once the survey data were collected, the quantitative analysis was conducted and the results are presented as follows.

3.2.1. Descriptive Analysis Results

Language Barriers in Mandarin, Sichuan Dialect, and Tibetan Use

Although more than ten different languages and dialects are spoken in Garzê, the most widely used ones are Mandarin Chinese, the Sichuan dialect of Chinese, and Tibetan. Other regional ethnic languages such as Muya, Daofu, Guiqiong and Jiarong are less spoken. Only 529 (12.8%) of the total participants can communicate with one or more of these languages. And out of them 528 (99.8%) people can also use one or more of the more popular three languages. Only one person is monolingual and communicates with others in Jiarong. The three languages with higher popularity are listed below in order of the proportion of the participants who can communicate in them: Tibetan > Mandarin Chinese > the Sichuan dialect of Chinese. The figures are as follows: 2,779 participants, or 67.2% of the total, were able to communicate fluently in Tibetan. Among the remaining participants, 290 (7%) did not understand Tibetan at all, and 1,068 (25.8%) could understand basic Tibetan and communicate orally. Thus, 32.8% of participants faced communication barriers in Tibetan. Of the Tibetan speakers, 75.4% spoke the Khams dialect, while 24.6% spoke the Amdo or Ü-Tsang Tibetan. Therefore, Khams can be considered the predominant Tibetan dialect in Garzê.

Regarding Mandarin Chinese, 2,543 individuals, or 61.5% of the total participants, were able to use it for communication. In contrast, 274 participants (6.6%) were unable to understand it, and 1,320 participants (31.9%) could only engage in basic oral communication using simple Mandarin Chinese words. Thus, 38.5% of the participants experienced communication difficulties in Mandarin Chinese.

As for the Sichuan Dialect of Chinese, the third most commonly used language, it was spoken fluently by 1,786 individuals, representing 43.2% of the participants. However, 1,936 (46.8%) participants could only communicate orally with basic words in the Sichuan Dialect, and 415 (10%) participants could not understand it at all. Thus, 56.8% of the participants encountered communication problems in the Sichuan Dialect of Chinese.

In summary, despite the widespread use of Tibetan, Mandarin Chinese, and the Sichuan dialect of Chinese, language barriers still exist. A significant portion of speakers

in each language reports experiencing difficulties in communication, with the Sichuan dialect showing the highest challenges, followed by Mandarin Chinese, and then Tibetan. This highlights the ELS needs in the prefecture to enhance effective communication in an emergency setting.

Generational Proficiency Variations in Mandarin, Sichuan Dialect, and Tibetan

There are generational differences in the use of Mandarin Chinese, the Sichuan dialect of Chinese, and Tibetan. These differences are particularly evident when considering 35 years of age as the dividing line for Mandarin Chinese proficiency.

Among participants who can communicate fluently in Mandarin Chinese, 69.4% are aged 35 or younger, whereas only 41% are over the age of 35. The highest proficiency is observed in individuals under 18 years of age, with 71.3% of this group able to communicate without barriers. This is followed by the 18–35 age group, where 65.3% can communicate barriers-free in Mandarin Chinese.

In contrast, the proportion of individuals over 35 who can communicate without barriers in Mandarin decreases significantly, with the following breakdown by age group: 36–45 years of age: 46.9%, 46–55 years of age: 37.1%, 56–60 years of age: 33.4%, and over 60 years of age: 21%. Details of these generational differences are presented in **Table 5**.

Table 5. Mandarin Chinese proficiency across different age groups.

Age Group (No. of Participants)	Don't Understand Mandarin	Understand Basic Mandarin and Conduct Simple Verbal Communication	Certain Reading and Writing Capability	Understand News and Programs in Mandarin; Fluent in Communication in Mandarin	Mother Tongue is Mandarin
	No. of Participants (%)	No. of Participants (%)	No. of Participants (%)	No. of Participants (%)	No. of Participants (%)
Under 18 (2031)	78 (3.8%)	504 (24.8%)	504 (24.8%)	768 (37.8%)	177 (8.7%)
18–35 (944)	39 (4.1%)	288 (30.5%)	169 (17.9%)	360 (38.1%)	88 (9.3%)
36–45 (667)	65 (9.7%)	289 (43.3%)	125 (18.7%)	142 (21.3%)	46 (6.9%)
46–55 (292)	41 (14.0%)	143 (49.0%)	44 (15.1%)	58 (19.9%)	6 (2.1%)
56–60 (108)	21 (19.4%)	51 (47.2%)	19 (17.6%)	15 (13.9%)	2 (1.9%)
Over 60 (95)	30 (31.6%)	45 (47.4%)	10 (10.5%)	6 (6.3%)	4 (4.2%)
Total	274 (9.3%)	1,320 (44.3%)	871 (29.3%)	1,349 (45.4%)	323 (10.9%)
Over 35 (1162)	157 (13.5%)	528 (45.4%)	198 (17.0%)	221 (19.0%)	58 (5.0%)
At or under 35 (2975)	117 (3.9%)	792 (26.6%)	673 (22.6%)	1,128 (37.9%)	265 (8.9%)

In the use of the Sichuan dialect of Chinese, the highest proportion of participants who can communicate barrier-free (i.e., without difficulties in communication when people who speak different native languages attempt to interact with one another) is in the 18–35 age group, accounting for 55.9% of that population. In contrast, less than half of the participants in the other age groups can communicate without barriers. The proportions are as follows: 36–45 (47.5%), 46–55 (38.4%), under 18 (38.4%), 56–60 (27.8%), and over 60 (20%). Details are shown in **Table 6**.

Regarding the use of Tibetan, the proportion of people across all age groups who can communicate without barriers exceeds 50%. The proportions, ordered by age group, are as follows: over 60 (82.1%), under 18 (72.1%), 56–60 (67.7%), 36–45 (66.7%), 46–55 (65.1%), and 18–35 (56.1%). Details are shown in **Table 7**.

In summary, generational variations impact language proficiency, with younger individuals generally demonstrating higher levels of understanding and communication in Mandarin Chinese and the Sichuan dialect of Chinese. While the proportion of older individuals encountering communication barriers increases with age concerning these two languages. In contrast, Tibetan shows a comparatively consistent ability to communicate without barriers across all age groups, exceeding 50%, although minor differences still exist.

Table 6. Sichuan dialect of Chinese proficiency across different age groups.

Age Group (No. of Participants)	Do not Understand Sichuan Dialect	Understand Basic Sichuan Dialect and Conduct Simple Verbal Communication	Proficient in Using Sichuan Dialect	Mother Tongue is Sichuan Dialect
	No. of Participants (%)	No. of Participants (%)	No. of Participants (%)	No. of Participants (%)
Under 18 (2031)	187 (9.2%)	1064 (52.4%)	545 (26.8%)	235 (11.6%)
18–35 (944)	41 (4.3%)	375 (39.7%)	369 (39.1%)	159 (16.8%)
36–45 (667)	71 (10.6%)	279 (41.8%)	198 (29.7%)	119 (17.8%)
46–55 (292)	52 (17.8%)	128 (43.8%)	70 (24.0%)	42 (14.4%)
56–60 (108)	31 (28.7%)	47 (43.5%)	19 (17.6%)	11 (10.2%)
Over 60 (95)	33 (34.7%)	43 (45.3%)	14 (14.7%)	5 (5.3%)
Total	415 (10.0%)	1,936 (46.8%)	1,215 (29.4%)	571 (13.8%)
Over 35 (1162)	187 (16.1%)	497 (42.8%)	301 (25.9%)	177 (15.2%)
At or under 35 (2975)	228 (7.7%)	1439 (48.4%)	914 (30.7%)	394 (13.2%)

Table 7. Tibetan proficiency across different age groups.

Age Group (No. of Participants)	Do not Understand Tibetan	Understand Basic Tibetan and Conduct Simple Verbal Communication	Certain Reading and Writing Capability	Understand Tibetan News and Programs; Fluent in Communication in Tibetan	Mother Tongue is Tibetan
	No. of Participants (%)	No. of Participants (%)	No. of Participants (%)	No. of Participants (%)	No. of Participants (%)
Under 18 (2031)	90 (4.4%)	477 (23.5%)	286 (14.1%)	117 (5.8%)	1061 (52.2%)
18–35 (944)	123 (13.0%)	292 (30.9%)	86 (9.1%)	63 (6.7%)	380 (40.3%)
36–45 (667)	48 (7.2%)	174 (26.1%)	78 (11.7%)	45 (6.7%)	322 (48.3%)
46–55 (292)	22 (7.5%)	80 (27.4%)	39 (13.4%)	28 (9.6%)	123 (42.1%)
56–60 (108)	4 (3.7%)	31 (28.7%)	11 (10.2%)	6 (5.6%)	56 (51.9%)
Over 60 (95)	3 (3.2%)	14 (14.7%)	7 (7.4%)	6 (6.3%)	65 (68.4%)
Total	290 (7.0%)	1,068 (25.8%)	507 (12.3%)	265 (6.4%)	2007 (48.5%)
Over 35 (1162)	77 (6.6%)	299 (25.7%)	135 (11.6%)	85 (7.3%)	566 (48.7%)
At or under 35 (2975)	213 (7.2%)	769 (25.8%)	372 (12.5%)	180 (6.1%)	1441 (48.4%)

Barrier-Free Rates between Emergency Personnel and At-Risk Populations

The emergency personnel in Garzê consisted of command and dispatch personnel, on-site rescue and coordination service staff, and temple staff. The command and dispatch personnel, including officials and staff at the prefecture, county, and township levels, totaled 383 out of the 4,137 responders. The other two groups, the on-site rescue and coordination staff and temple staff, comprised 217 individuals. While the at-risk populations including villagers, temple practitioners, students, educators, and other personnel, totaled 3,537 individuals.

Among the command and dispatch personnel, 81.7% could communicate without barriers in the Sichuan dialect of Chinese, followed by 77.5% in Mandarin, and 46.4% in Tibetan.

For the on-site rescue and coordination service staff, 64.1% were able to communicate without barriers in Tibetan, 54.4% in Mandarin, and 49.8% in the Sichuan dialect of Chinese.

Whereas among the at-risk populations, the highest proportion, 69.6%, could communicate barrier-free in Tibetan. This was followed by Mandarin, with 60.2%, while only 38.6% could do so in the Sichuan dialect. Notably, the survey responders included a significant number of secondary school students and educators. When excluding these groups, the percentage of those able to communicate barrier-free in Mandarin dropped to 37.5%, with minimal change in the

proportions for Tibetan and the Sichuan dialect. Detailed results are presented in **Table 8**.

After a major emergency, effective communication among these three groups is a crucial factor influencing the success of rescue operations. According to the survey results, the barrier-free communication rates among individuals in Mandarin Chinese, the Sichuan dialect of Chinese, and Tibetan vary among the three groups.

Barrier-free communication rate is the proportion of two groups involved in communication who are able to directly communicate in a given language or dialect. This rate serves as a quantitative measure of the effectiveness of communication between these groups. According to the barrel law, the capacity of a barrel is determined not by its longest stave but by its shortest one. Similarly, the barrier-free communication rate is determined by the group with the lower proportion of individuals able to communicate without barriers. Therefore, the barrier-free communication rates for the three groups mentioned above can be listed as shown in **Table 9**.

Table 8. Communication barriers across different groups.

Language	Barrier Status	Command & Dispatch Personnel (383)	On-Site Rescue & Coordination Staff (217)	At-Risk Populations (Including Students and Educators) (3537)	At-Risk Populations (Excluding Students and Educators) (1357)
		No. of Participants (%)	No. of Participants (%)	No. of Participants (%)	No. of Participants (%)
Mandarin Chinese	Barrier-free	297 (77.5%)	118 (54.4%)	2,129 (60.2%)	509 (37.5%)
	With barriers	86 (22.5%)	99 (45.6%)	1,408 (39.8%)	848 (62.5%)
Sichuan Dialect of Chinese	Barrier-free	313 (81.7%)	108 (49.8%)	1,365 (38.6%)	425 (31.3%)
	With barriers	70 (18.3%)	109 (50.2%)	2,172 (61.4%)	932 (68.7%)
Tibetan	Barrier-free	178 (46.4%)	139 (64.1%)	2,461 (69.6%)	892 (65.7%)
	With barriers	205 (53.5%)	78 (35.9%)	1,076 (30.4%)	465 (34.3%)

Table 9. Barrier-free communication rates across different interactions.

Language or Dialect	Interaction	Barrier-Free Communication Rates
Mandarin Chinese	Command and Dispatch Personnel – On-Site Rescue and Coordination Staff	54.40%
	On-Site Rescue and Coordination Staff – At-risk Populations (Including Students and Educators)	54.40%
	On-Site Rescue and Coordination Staff – At-risk Populations (Excluding Students and Educators)	37.50%
Sichuan Dialect of Chinese	Command and Dispatch Personnel – On-Site Rescue and Coordination Staff	49.80%
	On-Site Rescue and Coordination Staff – At-risk Populations (Including Students and Educators)	38.60%
	On-Site Rescue and Coordination Staff – At-risk Populations (Excluding Students and Educators)	31.30%
Tibetan	Command and Dispatch Personnel – On-Site Rescue and Coordination Staff	46.40%
	On-Site Rescue and Coordination Staff – At-risk Populations (Including Students and Educators)	64.10%
	On-Site Rescue and Coordination Staff – At-risk Populations (Excluding Students and Educators)	64.10%

Table 9 shows that there are notable differences in the barrier-free communication rates among the three groups: command and dispatch personnel, on-site rescue and coordination staff, and at-risk populations. Among interactions

between these groups, Tibetan has the highest barrier-free communication rate. Mandarin follows, slightly surpassing the Sichuan dialect of Chinese.

3.2.2. Multiple Regression Analysis Results

To learn about the factors influencing the proficiency of languages that impact the communication effectiveness during emergencies, three regression analyses were conducted. The results are illustrated in **Table 10**, **Table 11**, and **Table 12**.

The stepwise regression model for Mandarin proficiency ($R^2 = 0.574$, Adjusted $R^2 = 0.327$, $F(14, 4122) = 144.62$, $p < 0.001$) identified 14 significant predictors. Key findings include: i) Sichuan dialect proficiency (Beta = 0.325, $p < 0.001$) emerged as the strongest positive predictor, followed by Tibetan proficiency (Beta = 0.135, $p < 0.001$) and number of languages spoken (Beta = 0.108, $p < 0.001$). ii) Age (Beta = −0.144, $p < 0.001$) showed a significant negative association with Mandarin proficiency. iii) Occupational predictors such as villager (Beta = −0.075, $p < 0.001$) and educator (Beta = 0.087, $p = 0.004$) also contributed significantly. iv). All predictors exhibited acceptable multicollinearity (VIF < 4).

The model for Sichuan dialect proficiency ($R^2 = 0.275$, Adjusted $R^2 = 0.272$, $F(14, 4122) = 111.465$, $p < 0.001$) demonstrated: i) Mandarin proficiency (Beta = 0.357, $p < 0.001$) was the most influential positive predictor, highlighting bidirectional linguistic interdependence. ii) Occupational roles such as county and municipal staff (Beta = 0.131, $p < 0.001$) and educator (Beta = 0.114, $p < 0.001$) significantly enhanced Sichuan dialect proficiency. iii) Tibetan ethnicity (Beta = −0.085, $p < 0.001$) negatively predicted Sichuan dialect proficiency. iv) Multicollinearity was negligible (VIF < 2).

Table 10. Regression model 1: Mandarin proficiency as dependent variable.

Model	B	SE	Beta	*t*	*p*	VIF
(Constant)	1.532	0.116	-	13.194	0.000	-
Age	−0.128	0.017	−0.144	−7.727	0.000	2.128
Disasters knowledge	0.151	0.025	0.081	5.995	0.000	1.112
Ethnicity-Tibetan	−0.505	0.077	−0.091	−6.578	0.000	1.170
Number of languages spoken	0.166	0.021	0.108	8.016	0.000	1.111
Occupation-county and municipal staff	0.327	0.068	0.072	4.781	0.000	1.375
Occupation-educator	0.480	0.079	0.087	6.048	0.000	1.265
Occupation-emergency volunteer	0.527	0.224	0.031	2.356	0.019	1.031
Occupation-student	0.144	0.050	0.065	2.881	0.004	3.143
Occupation-township and town government staff	0.190	0.093	0.028	2.035	0.042	1.163
Occupation-villager	−0.196	0.047	−0.075	−4.138	0.000	2.000
Preferred communication language with rescuers-Mandarin	0.078	0.035	0.035	2.210	0.027	1.544
Preferred language for learning knowledge-Mandarin	0.199	0.035	0.089	5.598	0.000	1.552
Sichuan dialect proficiency		0.018	0.325	23.354	0.000	1.188
Tibetan proficiency	0.102	0.010	0.135	9.782	0.000	1.167

Table 11. Regression model 2: Sichuan dialect proficiency as dependent variable.

Model	B	SE	Beta	*t*	*p*	VIF
(Constant)	1.435	0.085	-	16.851	0.000	-
Emergency rescue knowledge	0.106	0.019	0.075	5.457	0.000	1.080
Ethnicity-Tibetan	−0.364	0.060	−0.085	−6.087	0.000	1.106
Gender	0.062	0.023	0.036	2.685	0.007	1.038
Mandarin proficiency	0.275	0.011	0.357	25.026	0.000	1.156
Number of languages spoken	0.076	0.017	0.064	4.606	0.000	1.100
Occupation-County and municipal staff	0.460	0.049	0.131	9.407	0.000	1.094
Occupation-Educator	0.485	0.059	0.114	8.278	0.000	1.069
Occupation-Others	0.122	0.039	0.042	3.102	0.002	1.056
Occupation-Township and town government staff	0.507	0.070	0.097	7.213	0.000	1.028
Occupation-Village cadre	0.302	0.061	0.066	4.919	0.000	1.025
Preferred communication language with rescuers-Sichuan dialect	0.288	0.045	0.097	6.438	0.000	1.294
Preferred language for learning knowledge-Other languages	0.347	0.088	0.053	3.957	0.000	1.014
Preferred language for learning knowledge-Sichuan dialect	0.159	0.047	0.052	3.412	0.001	1.298
Tibetan dialects-Other dialects	−0.059	0.024	−0.034	−2.488	0.013	1.046

Table 12. Regression model 3: Tibetan proficiency as dependent variable.

Model	B	SE	Beta	t	p	VIF
(Constant)	0.148	0.170		0.871	0.384	-
Age	0.163	0.024	0.138	6.678	0.000	2.142
Disasters knowledge	0.113	0.037	0.046	3.072	0.002	1.116
Ethnicity-Tibetan	1.803	0.117	0.245	15.362	0.000	1.278
Ethnicity-Yi	0.665	0.299	0.034	2.227	0.026	1.160
Mandarin proficiency	0.215	0.021	0.163	10.177	0.000	1.288
Number of languages spoken	0.253	0.030	0.124	8.291	0.000	1.120
Occupation-County and municipal staff	−0.590	0.100	−0.098	−5.928	0.000	1.363
Occupation-Educator	−0.405	0.116	−0.055	−3.486	0.000	1.264
Occupation-Monks	0.745	0.347	0.031	2.147	0.032	1.024
Occupation-Student	0.451	0.072	0.154	6.232	0.000	3.072
Occupation-Township and town government staff	−0.440	0.136	−0.049	−3.237	0.001	1.157
Occupation-Villager	0.280	0.069	0.081	4.047	0.000	2.003
Preferred language for learning knowledge-Mandarin	−0.329	0.047	−0.111	−6.987	0.000	1.282
Preferred language for learning knowledge-Sichuan dialect	−0.551	0.081	−0.104	−6.766	0.000	1.192
Tibetan dialects-Khams	0.262	0.043	0.089	6.107	0.000	1.074

The Tibetan proficiency model ($R^2 = 0.182$, Adjusted $R^2 = 0.179$, $F(15, 4121) = 60.949$, $p < 0.001$) revealed: i) Tibetan ethnicity (Beta = 0.245, $p < 0.001$) was the strongest predictor, underscoring ethnic identity's role in language retention. ii) Mandarin proficiency (Beta = 0.163, $p < 0.001$) and occupation-student (Beta = 0.154, $p < 0.001$) positively influenced Tibetan proficiency. iii) Occupation-county and municipal staff (Beta = −0.098, $p < 0.001$) and preference for Mandarin in learning knowledge (Beta = −0.111, $p < 0.001$) exhibited negative associations. iv) Multicollinearity remained within acceptable limits (VIF < 4).

3.3. Summary of Data Analysis Results

The qualitative and quantitative analyses highlight the critical need for ELS in Garzê during disasters. The region's linguistic diversity—encompassing Tibetan, the Sichuan dialect, and Mandarin Chinese—creates communication barriers across age groups and social roles. Qualitative findings indicate that older populations and external rescue teams encounter the most acute challenges, while the reliability of local multilingual intermediaries may be compromised in emergency contexts. Quantitative results corroborate these insights, revealing generational differences in communication proficiency and the prevalence of key languages. Regression analyses further elucidate the relationships among linguistic interdependence, ethnolinguistic identity, and occupational roles.

4. Discussion

The aforementioned findings underscore the necessity of external ELS support and the importance of designing equitable, multilingual emergency communication strategies to ensure effective response in disaster contexts.

4.1. Theoretical Implications

This study advances theoretical understanding of ELS in three key ways. First, it integrates disaster management theory[24] with sociolinguistic frameworks, demonstrating that effective crisis response requires not only logistical coordination but also linguistically inclusive communication strategies. Second, it extends intercultural communication theory[28] by illustrating how dialectal diversity within a single language (e.g., Tibetan's Khams vs. Amdo dialects) complicates message adaptation, even among shared ethnic groups. Third, the findings challenge assumptions in risk communication theory by revealing that linguistic accessibility alone is insufficient; cultural and generational nuances must also inform ELS design.

The study also highlights the role of power dynamics in emergency communication. The dominance of Mandarin and Sichuan dialect among command personnel (77.5% and 81.7% barrier-free rates, respectively) versus Tibetan's prevalence among at-risk populations (69.6%) reflects institutional hierarchies. This aligns with Bourdieu's concept of linguistic capital, where responders' language preferences may inadvertently exclude vulnerable groups, reinforcing the need

for bidirectional communication models that prioritize local languages[16].

The bidirectional relationship between Mandarin and Sichuan dialect proficiencies (Beta = 0.325–0.357) aligns with Cummins' linguistic interdependence theory[37], positing that cognitive and cultural resources shared across languages enhance bilingual competence. This interdependence suggests that proficiency in one language may bolster comprehension of the other, a critical insight for multilingual disaster communication strategies. Meanwhile, the strong association between Tibetan ethnicity and Tibetan proficiency (Beta = 0.245) underscores Giles' ethnolinguistic vitality theory, which emphasizes identity-driven language retention. However, the negative impact of occupational roles (e.g., county and municipal staff: Beta = −0.098) on Tibetan proficiency reflects Bourdieu's linguistic capital framework, where dominant languages like Mandarin are prioritized in formal sectors, marginalizing minority languages in public discourse.

Age-related trends further reveal generational language shifts. The decline in Mandarin proficiency with age (Beta = -0.144) and the rise in Tibetan proficiency among older adults (Beta = 0.138) resonate with Fishman's language shift and maintenance theory, highlighting how younger generations adopt dominant languages for socioeconomic mobility, while older populations preserve heritage languages. These theoretical insights collectively underscore the need for disaster policies that recognize both linguistic diversity and power dynamics inherent in language use.

4.2. Practical Implications

The findings of this study also yield critical insights for policymakers and practitioners seeking to address linguistic barriers in emergency management, particularly in linguistically diverse regions such as Garzê. To operationalize these insights, a multilayered framework is proposed as follows.

Institutionalizing Language Accessibility in Policy

Emergency management frameworks must systematically embed linguistic inclusivity. This begins with 'linguistic mapping' to identify local language demographics, vulnerabilities, and resource gaps. Such data should inform mandatory multilingual training programs for first responders, ensuring proficiency in regionally dominant languages (e.g., Sichuan dialect, Tibetan) and culturally sensitive communication practices. Concurrently, funding allocations must prioritize real-time translation services and age- or literacy-adapted materials, such as pictographic guides and audio-visual aids, to accommodate older adults and non-literate populations. Community-led preparedness drills, co-designed with local stakeholders, can further contextualize protocols, enhancing their cultural relevance and practical efficacy.

Strengthening Human and Technological Capacity

Capacity-building efforts should focus on two interrelated domains: human resource development and technological innovation. Partnerships with universities and NGOs can cultivate networks of trained interpreters fluent in local dialects, while incentives for bilingual recruitment within emergency services would bolster institutional readiness. Technologically, AI-driven translation tools—tailored to regional dialects and rigorously validated for accuracy—offer scalable solutions for real-time communication. However, their utility in remote, connectivity-poor areas necessitates parallel investments in offline-capable mobile applications and durable printed materials (e.g., Tibetan-language manuals). This hybrid approach ensures redundancy, a critical feature in disaster-resilient systems.

Coordinating Cross-Sector Resources

Centralized emergency language support hubs could standardize linguistic resources—such as multilingual glossaries, interpreter registries, and communication protocols—across agencies, minimizing duplication and improving interoperability. Pre-disaster agreements with professional translation services are equally vital to prevent overreliance on affected communities during crises. Locally, leveraging existing social networks amplifies outreach efficacy. Educators (Beta = 0.114), local government staff (Beta = 0.131), and students (Beta = 0.154), identified in this study as high-influence mediators, should receive targeted training to serve as multilingual liaisons. Temples and community leaders, trusted for their cultural authority, can further bridge gaps between external responders and residents, fostering compliance with safety directives.

Adaptive Resource Allocation and Communication

Resource distribution must reflect both linguistic interdependence and ethnolinguistic identity. In rural areas, bilingual alerts leveraging the Mandarin-Sichuan dialect overlap (e.g., loudspeaker alerts in Sichuan dialect) can maxi-

mize reach, while Tibetan-language materials should dominate in ethnic enclaves to align with cultural identity. Communication channels should also adapt to generational divides: digital platforms (e.g., social media, mobile apps) suit younger, Mandarin-literate demographics, whereas older populations—often reliant on local dialects—require hyperlocal methods such as loudspeaker announcements or door-to-door outreach by community leaders.

Culturally Grounded Technological Integration

While AI tools enhance scalability, their deployment must be tempered by cultural sensitivity. Overreliance on Mandarin in Tibetan-majority areas risks alienating residents; instead, integrating local idioms and disaster-related terminology fosters trust. Human oversight remains indispensable to ensure cultural appropriateness, particularly in high-stakes scenarios. For instance, AI-generated translations should undergo validation by native speakers to avoid semantic or contextual errors.

4.3. Limitations and Future Research

While this study provides critical insights, self-reported language proficiency data and the exclusion of 10 Garzê counties limit generalizability. Future research should employ standardized language assessments and expand geographically. Moreover, the current survey sample exhibited a disproportionate representation of students, with 49% of participants being under 18 years of age, which may introduce bias into the findings. Future research would benefit from refining the sampling method to ensure a more representative and balanced participant pool.

5. Conclusions

This study reveals the need for linguistically inclusive emergency management in Garzê, where the coexistence of Tibetan spoken in multiple regional dialects, the Sichuan dialect, and Mandarin contributes to communication barriers during disaster response. The findings suggest that generational, occupational, and ethnolinguistic factors affect access to emergency information, disproportionately impacting vulnerable populations. By integrating sociolinguistic theory with disaster management frameworks, this research proposes a multilayered policy response. This response includes institutionalizing language accessibility, strengthening capacity-building, enhancing cross-sector coordination, ensuring equitable resource allocation, and promoting culturally informed communication strategies. Future research should expand sampling scope and explore the potential of AI-driven tools to support real-time multilingual crisis communication. Ultimately, advancing equitable, multilingual approaches is essential for effective disaster response and sustainable community resilience, reinforcing the imperative for an inclusive and participatory emergency language policy.

Author Contributions

Conceptualization, H.H., H.W., and X.L.; methodology, H.H., H.W., and X.L.; validation, H.H., H.W., X.L., Y.Z., Q.W., and H.W.; formal analysis, H.H., H.W., X.L., and Y.Z.; investigation, H.H., H.W., X.L., Y.Z., Q.W., H.W.; resources, H.W. and X.L.; data curation, H.H., H.W., and X.L.; writing—original draft preparation, H.H.; writing—review and editing, H.H., H.W., X.L., Y.Z., Q.W., and H.W.; project administration, H.W.; funding acquisition, H.W. and X.L. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

Ethical review and approval were waived for this study due to the fact that there is no institutional review board or ethics committee, but the study was formally approved by the National Language Service Corps of China.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author, Hongmei Han, upon

reasonable request.

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Conflicts of Interest

There is no potential conflict of interest.

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