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Active aging and disaster risk reduction: Examining the contributions of older adults in community disaster risk management

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Abstract

Older adults are potentially valuable members of a disaster risk reduction (DRR) process, but such potential is rarely explored. Therefore, this study aims to explore the nature of elderly participation in DRR and the underlying determinants and barriers to their participation. A mixed-methods design is used to integrate quantitative survey data from 160 older participants with qualitative data obtained through in-depth interviews. The target population comprised older adults living in the Mae Suai municipality in Chiang Rai, Thailand. Survey items included older adults' social roles in disasters, disaster experience, and engagement or willingness to participate in disaster risk reduction activities. Most of the elderly residents were found to be engaged in various community activities, mostly as non-leader members. Of the sample population, 20.6% were participating in some form of leadership activities. In terms of leadership activities, they made suggestions on how to prepare for disasters, coordinated communities in normal times, gathered residents to raise issues, and endeavored to communicate with the municipality. This shows how the elderly are able to play a central role in community disaster prevention activities as leaders across a diversity of organizations. Furthermore, they assisted in times of disaster, communicated with the municipality, cooked and distributed meals, and visited evacuation centers. There is a need for DRR strategies that are inclusive of older adults and consider aging as an essential variable of analysis. Rather than viewing older adults as passive victims who require support and assistance, a positive approach to aging could position older adults as agents of disaster preparedness and response—older adults as change agents rather than recipients of aid. This study highlights the importance of ensuring older adults are recognized to maximize their personal, family, and community participation in reducing disaster risks. The active recognition and inclusion of older adults into DRR strategies will enable the development of a more resilient community. In future research, there is a need to investigate more extensive data at the regional level and analyze the long-term adaptation strategies of aging societies.

Keywords: Active aging, Chiang Rai Province, disaster risk reduction (DRR), older adults, Thailand.

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1. Introduction

The growing share of older adults worldwide presents several challenges for different sectors, but one that is not commonly thought about is the way that the elderly are affected and how they handle natural and man-made disasters and humanitarian aid delivery [1]. As life expectancy rises worldwide and as birth rates decline in many nations, most countries, Thailand included, have experienced a transition to aging societies.

According to Boyer et al. [2], the elderly are extremely vulnerable in disaster situations due to their health status in terms of chronic illnesses, frail mobility, deficient mobility and physiologic distress. Older adults may rely on medications, medical equipment or help from a caregiver, which may be difficult to accommodate in a disaster response. Another overarching point that is highlighted in the surveyed literature is that older adults may suffer significant vulnerabilities in disaster situations due to some of the characteristic challenges faced by older adults. However, older adults also have capacities and resources that may be of vital importance to society and their local communities.

Over time, older adults have developed life experience and wisdom derived from it, in addition to established relationships with family, friends, and the local community [3]. The experience of life gives older adults a sense of meaning and life skills that they can adapt, while the relationships in their life can provide social support. These strengths make older adults skilled planners and resourceful, adaptable actors both before, during, and after a disaster strikes.

An aging society typically refers to a population where a significant percentage is elderly. The United Nations often uses specific thresholds, like 7% or 10% of the population being 65 or older. For an aged community, it might be a more localized term, maybe referring to a community where a higher proportion of residents are elderly. The exact percentage could vary by country. Japan, for example, has a high elderly population, so their definition is different from Thailand's. The UN's definitions indicate that an aging society is when 7% are 65+, aged society at 14%, and a super-aged at 20%. As such, by any of these definitions, Thailand has surpassed the thresholds Yodsuban and Nuntaboot [4], and by 2040, close to one-third of all Thais or approximately 17 million people, will be aged over 65 years or over.

Advanced medical technology is allowing people to live longer and to have a better quality of life; nonetheless, the other side of this success has created unfortunate issues, such as challenges in dealing with the care of older adults. Older people also have strong emotional and psychological responses to disasters [4]. Fear, anxiety, depression, and post-traumatic stress disorder are common reactions among older persons in the wake of a disaster [5]. These psychological impacts are frequently compounded by the disruption of social support mechanisms, isolation and loss.

Additionally, many older adults, especially a significant number of low-income elderly persons, often do not have the financial resources to relocate or remodel their households for disaster resilience [6]. Moreover, loss of extended families increases the social isolation of older adults and disrupts informal caregiving networks. Therefore, studies have shown that during disasters, older adults stay home in disasters, even when they are advised to evacuate.

In Thailand, from 2000 to 2019, Thailand witnessed 146 major natural disasters, which killed an average of 138 people annually and incurred $7.7 billion in losses [7]. Disaster occurrences vary from floods and earthquakes Muttarak and Pothisiri [8] to forest fires, crop burning, and related air pollution (especially in the northern provinces of Chiang Rai, Chiang Mai, and Lampang). One of the most severe disasters is the Great Flood in 2011, which affected 64 out of 77 provinces, including the capital of Bangkok [4]. Approximately 5.2 million households, or 16 million people, were affected. As such, the frequency of occurrence of disasters has reiterated the need for specific disaster preparedness mechanisms and policies for older persons [4, 9]. At the same time, older adults have played an important role in disaster preparedness, response, and recovery.

Many elderly people have strong ties with their communities, possessing a wealth of experience and knowledge, often becoming leaders and sources of guidance during disaster [10, 11]. As such, the authors' research has identified several important factors that contribute to the enhanced resilience of elderly populations in facing disasters. These include 'active aging' (AA) or 'elder-friendly' Alley et al. [12], which is a mechanism that engages the elderly in health programs, social and economic activities, and a mental attitude in which they "take charge of their own lives" [13, 14].

Furthermore, local governments and other community-based organizations have designed and implemented various programs to encourage elderly participation and engagement in disaster preparedness and response [15]. In Japan, the Silver Disaster Volunteers program helps to train “anyone over the age of 60 who wants to assist their local community in dark times” in areas such as “administration of temporary shelters, first aid and emergency distribution of food [10, 16]. In the United States, Senior Corps program recruits volunteer elderly “experience corps” who “teach emergency safety at schools, run disaster response drills in their community and recruit and train other volunteers [17].

Strong social networks for older adults have also fared better during and after disasters [17, 18]. Family, neighbors, and community organizations can all provide crucial support, helping seniors access necessary resources, providing emotional support, and helping ensure they are quickly evacuated when needed. Older adults also retain rich knowledge of past disasters, traditional survival skills, and community histories. These then get incorporated into disaster education efforts in schools and communities, potentially strengthening disaster preparedness and intergenerational learning.

Disaster education programs that target elderly resiliency have shown that they can reduce risk. The Plan Canicule project in France offers educational workshops to prepare seniors for disasters. At the same time, the Université du Temps Libre (UTL) provides elderly training on emergency management, risk prevention, and disaster preparedness. Such disaster preparedness programs allow older adults to gain access to basic survival skills, including learning how to use life-saving tools, preparing emergency survival kits, and organizing community disaster networks.

Policymakers and community leaders can promote resiliency of the elderly to disasters through the use of disaster preparedness frameworks that address elderly vulnerabilities and capacities. One important policy recommendation is to increase the access of elder populations to disaster response networks. Emergency shelters, disaster recovery centers, and disaster relief programs should also ensure that elderly needs are factored into their design. These include wheelchair-accessible facilities, medical care, and age-appropriate accommodation. Social media groups are also a proven resource [19].

For greater empowerment of older adults and strengthened resilience in communities, it is important to involve older adults in planning processes. Older adults can engage in emergency drills, risk assessment committees, and volunteer response teams [16]. Encouraging the development of family and community-level emergency response plans that target elderly members can reduce their vulnerability during a disaster. Community-based efforts such as neighborhood buddy systems can also be instituted to prevent social isolation and to provide the needed support.

Public awareness campaigns should be designed for older adults. Interactive training, accessible informational materials, and culturally appropriate messaging may help to raise the preparedness levels of older persons. Mobile applications, emergency alert systems, and telemedicine services can greatly aid elderly safety during disasters. Governments and NGOs must invest in accessible and user-friendly digital platforms that provide real-time disaster updates, evacuation routes, and health monitoring services for the elderly.

While Thailand other countries are frequently and severely affected by disasters, it therefore becomes necessary to recognize each country's vulnerabilities and resiliencies of older adults. Older adults may be more vulnerable to the effects of disasters due to physical, psychological and economic disadvantages. However, they may also have an increased ability to prepare and recover from disasters through life skills, social networks and resilience. By incorporating policies into disaster management frameworks that increase the protection of older adults, vulnerabilities can be reduced by increasing accessibility, increasing community engagement, and increasing education initiatives. Simultaneously, older adults can make vital contributions. However, it may be necessary for further research to be conducted to further focus on innovative solutions, such as technology and intergenerational disaster education Su et al. [20] to increase elderly resilience during disasters.

Therefore, this study provides an overview of research on the role of the elderly in disaster risk reduction (DRR). It introduces the study that aims to better understand the role of the elderly in DRR through a case study of the Mae Suai Subdistrict Municipality in Thailand's far northern mountain province of Chiang Rai. The content represents the scope of the study and the deployment model. It contributes to disaster preparedness, response, and recovery.

2. Literature Review

2.1. Global Disaster Risk and the Elderly

Attributed to climate change, environmental degradation, and urbanization, accelerations of global disaster severity and frequency have been noted [21]. Moreover, disaster events are unequally problematic in vulnerable populations, such as older adults, due to the increased health burden from chronic health conditions, social isolation and physical frailty [22, 23]. Disaster risk is continuously being shaped and can be broadly categorized into three general areas. These include natural, man-made, and emerging disasters.

Natural disasters such as floods, wildfires, cyclones, and earthquakes pose severe threats to the elderly, often exacerbating pre-existing health conditions and limiting their ability to evacuate. Catastrophic floods in South Asia have displaced millions of people, limiting older adults' access to health care and social services [24]. Wildfires in California and Australia have exacerbated respiratory conditions for older people with lung disease [25]. In Turkey and Syria, following the earthquakes in 2023, older adults were disproportionately likely to be trapped in homes that collapsed because they were less mobile [26].

Besides natural hazards, human-induced disasters, such as wars, industrial accidents, and environmental pollution, also pose significant risks to older populations. In Ukraine and Gaza, military invasions, Bayram et al. [25], have displaced millions of civilians, Balikuddembe et al. [26], cutting elderly refugees off from medical services and aggravating existing health problems [27]. Environmental disasters also threaten older adults' human security, as demonstrated by Thailand's 2022 oil spill, which compromised the local economy, particularly older people depending on fishing and tourism [28].

Emerging disasters such as pandemics and cyber disruptions challenge aging demographics. The COVID-19 pandemic was devastating to older adults, that saw higher fatality rates due to weaker immune systems. More recent cases of disease outbreaks such as monkeypox, raise the question of preparedness for future pandemics for aging populations [28]. Cybersecurity threats against healthcare infrastructure may disrupt elderly care services, Okafor et al. [29], exposing them to medical vulnerabilities and financial risk [30]. Older people are among the most vulnerable populations in disaster situations, and a reduction in this vulnerability will require that disaster risk management include strategies for preparing the elderly, such as community-based support, appropriate health care, and resilient infrastructure [4].

Researchers deciphering the variables that affect individuals, families and communities are considered to be in a better position to take action that can enhance the preparation of the communities against disasters [31]. With this enhanced understanding, working with communities will enable the development of a targeted risk reduction measure that will in turn, improve response to potential challenges pertaining to disasters. Therefore, the key factors affecting disaster risk can be said to be as expressed in Equation 1.

Risk = Hazard (H) x Vulnerability (V) / Capacity (C) (1)

2.2. Community-Based Disaster Risk Management (CBDRM)

CBDRM is an approach that prioritizes local participation in disaster preparedness, response, and recovery [32]. Since communities experience disaster risks firsthand, they are best positioned to develop context-specific strategies that enhance resilience. While external agencies such as governments and NGOs provide support, local ownership of disaster management ensures more sustainable and effective outcomes.

2.2.1. CBDRM Objectives

The primary goal of CBDRM is to reduce vulnerability and enhance resilience through proactive risk management [33]. Its key objectives include minimizing disaster risks by moving from a reactive model (waiting for external aid) to a proactive approach that strengthens self-protection. Moreover, CBDRM builds local capacity by training communities in risk assessment, emergency preparedness, and disaster response to enhance self-reliance.

CBDRM is also focused on fostering a preventive culture where awareness campaigns and preparedness drills are used to encourage long-term risk reduction. It is additionally used in supporting sustainable development, where the prevention of economic loss and infrastructure damage reduces the reliance on government relief efforts. Finally, CBDEM ensures community well-being by strengthening social networks to protect vulnerable groups, including children, older adults, and persons with disabilities.

2.2.2. Balancing Community Participation and External Support

CBDRM is effective when community leadership is combined with external expertise and resources. There are two primary levels of involvement. These include community-led initiatives where locals lead disaster risk management efforts, including awareness campaigns and emergency preparedness programs. The second level is collaborative partnerships where governments and NGOs support local initiatives by providing funding, technical knowledge, and policy guidance.

2.2.3. Core Processes of CBDRM

CBDRM follows a structured approach to identify and mitigate disaster risks. These include:

- Awareness and Education: Educating communities through schools, local media, and public forums ensures widespread disaster preparedness.
- Risk Assessment: Combining scientific data and traditional knowledge to analyze environmental hazards.
- Capacity Building: Training residents in first aid, rescue operations, and disaster response while establishing community response teams.
- Planning and Implementation: Developing evacuation plans, disaster-resistant infrastructure, and sustainable land-use practices.
- Recovery and Resilience: Rebuilding affected areas with more substantial infrastructure, financial recovery programs, and psychological support.

2.2.4. Stages of CBDRM

CBDRM unfolds in three critical phases. These are:

1. Pre-Disaster (Prevention and Preparedness): Identifying hazard-prone areas, conducting emergency drills, and establishing communication networks.
2. During Disaster (Response and Relief): Activating evacuation plans, rescue operations, and medical assistance while ensuring effective coordination.
3. Post-Disaster (Recovery and Development): Rebuilding infrastructure, rehabilitating affected areas, and integrating disaster prevention into development plans.

2.2.5. Strengthening Community Resilience

Finally, CBDRM empowers communities by integrating local knowledge with scientific disaster management strategies. Residents enhance their preparedness, minimize risks, and build long-term resilience through active participation. By engaging all community members including vulnerable groups, CBDRM ensures that disaster management efforts are inclusive, effective, and sustainable.

2.3. Active aging (AA): A Holistic Framework for Disaster Resilience

As Thailand enters into an aged society, AA has become an essential framework to improve disaster resilience of older adults, with the WHO [34] defining ‘active aging’ (AA) as the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age.' Active Aging also emphasizes the positive, active role undertaken by older adults and dispels stereotypes that older adults are passive, unable to care for themselves, or a burden to society and Roberts [35]. Active Aging represents a view of older adults as contributors to resilient communities rather than recipients of care and assistance, which is a valuable asset for older adults in communities with frequent disasters, such as Chiang Rai, Thailand.

The essence of AA is captured by three interdependent pillars: health, security and participation [36]. Health extends beyond physical well-being to include preventive care and mental resilience, ensuring older adults can manage chronic conditions effectively. Security, in this context, translates to economic independence and the possibility to use available

services when and if desired rather than dependence on them. Participation is perhaps the most radical pillar of AA. It demands social involvement and calls for possibilities for older adults to be engaged and active members of society, e.g., in volunteering, civic or family roles, and inter-generational knowledge transfer. In other words, this aspect can be considered as a prerequisite for social inclusion. Finally, all three pillars connect and support each other as it is easier to keep healthy if financially independent

2.3.1. Active aging in Disaster Resilience

In Japan's Tohoku earthquake recovery, older residents were key in guiding evacuations and managing resources through their lived experience [37]. Similarly, Thailand's CBDRM initiatives have highlighted the role of older adults in risk assessments and post-disaster recovery, with elders acting as mentors and storytellers, preserving community resilience [23].

However, realizing this potential requires addressing systemic barriers—personal factors such as education, income, and gender shape access to resources. Higher educational attainment enhances disaster preparedness, while economic disparities can limit access to healthcare and safe housing [8]. Gender further influences experiences: Women, who typically serve as primary caregivers, face more significant financial and health vulnerabilities, whereas men often prioritize financial planning over well-being.

Beyond individual challenges, structural barriers also hinder AA in disaster resilience. The lack of age-friendly infrastructure, such as wheelchair-accessible pathways and emergency alert systems, increases risks during emergencies [38]. In Chiang Rai, uneven terrain and inadequate disaster signage pose additional hazards [39]. Another critical yet overlooked factor is embodied capital—the cultural knowledge and social networks that older adults contribute, such as traditional disaster-coping mechanisms and leadership roles [40].

2.3.2. Bridging the Gaps: Policy and Future Directions

Thailand's AA and other similar policies align with other frameworks, including the Sendai Framework for Disaster Risk Reduction (2015–2030), which calls for intersectoral collaboration [41]. The implementation at the grassroots level has, however, been uneven, stemming from the fragmented collection of survey and assessment data and the lack of sustained funding. To fill these gaps, AA must be promoted through a lifelong approach. Early education on health, financial literacy, and disaster preparedness can help build resilience over the lifespan. Work for the elderly should also be incentivized through policies prolonging opportunities for older adults. This can be seen through New Zealand's "SuperSeniors" Niamsawaeng [42], where the government partners with businesses to retain their aging workforce along with social participation.

Active aging reconfigures the view of growing old as a process of continued contribution rather than constraint. By addressing both personal and structural barriers to the integration of health, security, and participation, Thailand can enhance the contribution of its aging population. In turn, communities become more resilient to disasters. In this way, rather than aging being a societal constraint, governments can harness the full potential of their aging population, turning demographics from a challenge to the economy into a strategic advantage.

2.4. Disaster Risk Management in Mae Suai Municipality, Chiang Rai

Mae Suai Municipality lies within Chiang Rai Province, where a tropical climate beckons the Suai and Lao Rivers running through it. Located 457 meters above sea level, the area covers approximately 1.2 square kilometers which unfortunately encounters numerous natural disasters that affect the lives and property of the people of the area. From these natural disasters, the local government assesses and analyzes the area at risk of natural disasters according to the frequency and severity of the events that occur [43].

The most commonly occurring hazards in Mae Suai are flooding and landslides due to the region's low-lying plains, often frequented by seasonal floods. Additionally, due to active fault lines throughout the area, earthquakes are frequent, with the main active faults in the area are known as the Mae Chan Fault and Phayao Fault [44]. Fire hazards are also frequent due to the nature of the wooden construction and the density of the local villages. Therefore, historical records and risk assessments help the municipality rank these hazards, facilitating the development of targeted disaster response strategies.

In terms of earthquake threats, Chiang Rai Province has experienced several earthquakes, with the strongest occurring on May 5, 2014, when a 6.3 magnitude earthquake struck Mae Lao District at a depth of seven kilometers [45]. This earthquake was one of the strongest to ever hit Thailand. It resulted in one fatality, left 100 people injured, and caused significant destruction to structures in the province. Due to the high local geological instability, the seismic risk in the region has remained high, and local authorities must continue to monitor and prepare for potential earthquake-related events.

In response, Mae Suai Municipality handles its disaster risk management in accordance to Thailand's National Disaster Prevention and Mitigation Plan (2021-2027) [46]. The purpose of this DRR strategy is to alleviate disaster risks while securing community resilience in a 7-step process. These include analysis of past disaster incidents, hazard assessment, vulnerability assessment, community capacity assessment, impact assessment, risk management plan, and DRR plan revision [47]. In this way, Mae Suai is able to improve its disaster risk reduction plan by incorporating DRR steps into the local governance.

A crucial aspect of Mae Suai's disaster management involves community-led initiatives. The municipality actively engages residents in disaster preparedness training programs conducted by external agencies such as the Department of Disaster Prevention and Mitigation in Chiang Rai. These programs equip community leaders and volunteers with essential skills in first aid, emergency response, and evacuation procedures. One notable example of community-driven disaster preparedness is in Village 14, Ban Den Phu Wiang, where a local herbal medicine club has repurposed a five-rai area into a multi-functional space. This area serves as an herbal learning center, a refuge point during disasters, and a hub for

coordinating relief efforts. Positioned on high ground and near a main road, it provides an ideal safe zone for the community in times of crisis.

Moreover, Mae Suai's disaster risk reduction efforts acknowledge vulnerable groups' unique challenges, such as the elderly and people with disabilities. While these groups are disproportionately affected by disasters, they also play a crucial role in raising awareness and preserving indigenous knowledge related to disaster preparedness. Their insights contribute to local resilience by integrating traditional wisdom with modern risk management practices.

2.5. Related Research: Older Adults in Disaster Management

The evolving role of older adults in disaster management has been increasingly recognized within Disaster Risk Reduction (DRR) and Community-Based Disaster Risk Management (CBDRM) frameworks. These approaches emphasize proactive adaptation and community-based solutions, shifting the perception of older adults from passive recipients of aid to active contributors in disaster preparedness, response, and recovery.

2.5.1. The Role of Older Adults in Disaster Preparedness and Recovery

Research demonstrates that integrating older adults into risk mapping, emergency planning, and preparedness training enhances community resilience. The Ibasho model in Japan illustrates how elders are regarded as cultural and knowledge assets [48]. Willcox participates in disaster preparedness activities such as evacuation planning and emergency kit preparation [49]. Similarly, intergenerational disaster simulations foster collective learning, where older adults share historical disaster knowledge with younger generations.

Social capital and trust within communities significantly impact survival rates during disaster response, with strong communal bonds ensuring rapid response for older adults, particularly those with mobility challenges. The importance of age-friendly emergency shelters with accessibility features is critical in ensuring safety for older populations [23].

Following a disaster, older adults frequently transition into volunteer and advisory roles, guiding infrastructure rebuilding and providing emotional support within their communities. For instance, post-2011 Tohoku earthquake case studies highlight how older adults managed community shelters and participated in rebuilding initiatives, reinforcing their role in fostering long-term disaster recovery.

2.5.2. Factors Influencing Older Adults' Participation

The extent of older adults' involvement in disaster risk reduction is shaped by multiple factors, including knowledge, skills, and community support [50]. Studies in Thailand show that prior disaster experience correlates with greater disaster literacy, enabling older adults to advise on risk mitigation strategies. However, participation levels vary due to educational and economic disparities, with older individuals of higher socioeconomic status demonstrating greater preparedness and risk awareness.

Community inclusivity in disaster planning is another determining factor. Tailored training programs designed with older adults' physical and cognitive abilities in mind significantly increase their confidence in leading disaster drills and preparedness initiatives [51]. Conversely, exclusion from decision-making processes results in vulnerabilities being overlooked, leading to inadequate post-disaster recovery policies [52].

2.5.3. Older Adult Disaster Resilience

2.5.3.1. Enabling Conditions

Family, community, and institutional support are crucial in facilitating older adults' participation in disaster risk management, as previous research has underscored the critical nature of strong family networks that enable rapid evacuations and provide psychological support during disasters. Furthermore, local government support, such as funding community-based training centers, enhances elder engagement in disaster coordination roles.

Infrastructure accessibility remains fundamental to elder-led disaster resilience. Age-friendly urban design, including barrier-free pathways, emergency shelters with medical stations, and real-time alert systems, ensures that older adults can participate effectively in disaster risk reduction [39]. The post-2011 Tohoku earthquake reforms demonstrate the impact of integrating elder perspectives into disaster planning, improving earthquake-resistant housing and accessible transit systems [49].

Lastly, public-private partnerships further strengthen elder-led resilience efforts. In Zimbabwe, collaborations between NGOs and local governments enabled older adults to lead agricultural recovery initiatives following droughts, combining traditional knowledge with modern disaster preparedness strategies [23]. These models illustrate the potential of structured institutional support in transforming older adults from vulnerable groups into active disaster resilience architects.

2.6. Research Gap Statement

Existing studies have already pointed out that older adults can contribute to disaster risk reduction. However, the challenges and contributions of older adults regarding local disasters have not been thoroughly examined in cases of natural disasters in Chiang Rai, Thailand. The blending of the concept of Active Aging (AA) and community disaster resilience work, particularly how personal, structural, and cultural factors influence and shape the participation of elders, has not gained a place in the current discourse. While national policies promote the participation of older adults in disaster preparedness activities, these policies are not effectively translated into the practice of disaster risk reduction (DRR) at the grassroots level due to limited access to training for older adults and ineffective resource allocation. Therefore, this study fills these gaps by exploring the experiences, barriers, and enabling factors that influence the role of older adults in DRR in the case of Mae

Suai Municipality, Chiang Rai Province.

2.7. Research Objective and Research Questions

Research Objective:

To examine how older adults contribute to community-based DRR in Chiang Rai, Thailand, and to identify the factors that block or facilitate their participation in disaster preparedness, response, and recovery.

Research Questions:

RQ1: What roles do older adults play in disaster preparedness, response and post disaster recovery in Chiang Rai?

RQ2: What individual, structural and organizational factors shape their capacity to become disaster resilient?

RQ3: How can AA principles be implemented within the community disaster management to facilitate greater participation of the older adult population?

RQ4: What policy recommendations can be suggested to help bolster elder-led disaster resilience efforts?

This study is based on the conceptual framework linking disaster risk reduction, community-based disaster risk management, and the AA paradigm. This study sheds light on the roles, challenges, and enabling conditions of older adults' participation in resilience during disasters and inspires more inclusive and practical disaster risk management efforts in Thailand.

3. Research Methodology

This study employs a multi-method research design integrating quantitative and qualitative approaches to investigate the roles of older adults in disaster risk reduction (DRR) within the Mae Suai Subdistrict, Chiang Rai Province, Thailand. The methodological framework ensures alignment with three core objectives: (1) analyzing the roles of older adults in community disaster management, (2) identifying personal, environmental, motivational, and supportive factors influencing their participation, and (3) examining conditions correlating with their effectiveness.

3.1. Research Design and Units of Analysis

The study adopts a mixed-methods sequential design, where quantitative data from 160 older adults (aged 60+) inform broader patterns, while qualitative insights from 10 key informants, including elderly community leaders, local officials, and NGO representatives, provide contextual depth. The quantitative phase focuses on individual-level variables, utilizing stratified sampling across 17 villages to ensure geographic representation. The qualitative phase employs purposive sampling to select participants with direct disaster management experience, ensuring rich, case-specific narratives.

3.1.1. Site Selection

The Mae Suai Subdistrict was chosen due to its high seismic risk from the active Phayao Fault and its history of community-led disaster responses following the 2014 earthquake. Criteria for selection included:

- Historical relevance: Repeated exposure to earthquakes and documented community resilience strategies.
- Data accessibility: Availability of local disaster management plans, volunteer networks, and historical records.
- Elder engagement: Demonstrated leadership roles of older adults in risk assessment, emergency coordination, and post-disaster recovery.

3.2. Data Collection and Instrumentation

A structured 5-section questionnaire was used to collect the quantitative data. This included a section on:

- Demographics: Age, gender, education, and socioeconomic status.
- Risk perception: Self-reported vulnerability to earthquakes and prior disaster exposure.
- Motivational factors: Knowledge, skills, and community participation in disaster preparedness.
- Support systems: Family, community, infrastructure, and institutional support.
- Roles in disaster phases: Pre-disaster preparedness, emergency response, and post-disaster recovery.

The questionnaire underwent rigorous validation, including content validity checks by three experts (IOC > 0.5) and reliability testing (Cronbach's $\alpha = 0.76–0.86$). A pilot study with 30 older adults in a neighboring subdistrict confirmed instrument clarity and cultural appropriateness.

Qualitative data were gathered using focus group discussions and in-depth interviews. Semi-structured interview guides explored participants' lived experiences, community roles, and institutional challenges. Interviews were recorded after each participant's consent, with anonymization to protect participant identities.

3.3. Ethical Considerations

The study adhered to ethical protocols approved by Mahidol University's Institutional Review Board (No. 2023/065.2104). Key principles included:

- Informed consent: Participants were briefed on research goals, voluntary participation, and withdrawal rights.
- Confidentiality: Identifiable data were anonymized, and raw records were securely stored and later destroyed.
- Beneficence: Interviews were scheduled at participants' convenience to minimize disruption, and findings were shared with communities to inform future disaster policies.

3.4. Data Analysis

Quantitative analysis utilized SPSS for descriptive statistics (frequencies, means) and multiple regression to model relationships between variables. Outliers were addressed using boxplot analysis, ensuring robust model fit (VIF < 5).

Qualitative analysis followed by thematic content analysis. Transcripts were coded inductively to identify patterns in roles, challenges, and community dynamics. Triangulation with quantitative findings enhanced interpretive validity.

3.5. Integration of Findings

Results from both methods were synthesized to provide a holistic understanding of elder-led disaster resilience. Quantitative data highlighted statistical trends in participation barriers, while qualitative narratives contextualized these patterns, emphasizing the interplay of cultural respect, infrastructure accessibility, and intergenerational collaboration.

This methodological synergy addresses the research objectives and offers actionable insights for policymakers aiming to leverage older adults' expertise in disaster-vulnerable regions.

4. Results

4.1. General Information on the Elderly

The elderly participants in this study were predominantly female (55.6%). The majority were between the ages of 66 and 70 (36.2%). Most participants' highest level of education was primary education (55.0%). Additionally, the majority (79.4%) were not involved in social organizations or held official community positions (Table 1).

Table 1.
Demographics of the elderly participants (*n*=160).

Personal factors	Participants	%
Gender		
Male	71	44.4
Female	89	55.6
Age		
60-65	55	34.4
66-70	58	36.2
71-75	47	29.4
Educational level		
Never studied	66	41.2
Primary	88	55.0
Lower secondary	3	1.9
Higher secondary/Vocational certificate	1	0.6
Associate degree/Vocational certificate	1	0.6
Bachelor's degree	1	0.6
Higher than a bachelor's degree	-	-
Social status (after 60 years old)		
Not a social group member	127	79.4
Being a member of a group or having a social position	33	20.6

4.2. Insights from In-depth Interviews with the Elderly

Interviews with elderly individuals involved in their communities revealed that those who were well-accepted and engaged in community activities tended to lead a good quality of life and were physically healthy. Most were female, aged 64-81 years, with primary-level education. Their hometowns were in Mae Suai Municipality, Chiang Rai Province.

Before retirement, most worked in agriculture or government service, maintaining the same profession throughout their careers. Some were municipal firefighters, trained in disaster management, and had firsthand experience dealing with natural disasters such as earthquakes, wildfires, floods, and landslides.

After retirement, some held social leadership roles, such as village committee members, senior citizens' club presidents, or women's group leaders. Many leveraged their expertise to contribute to community resilience and disaster risk reduction.
Key Quotes from Interviewees:

1. *"Before, I was a teacher. After retiring, the community nominated me as the senior citizens' club president."*
2. – (A01, 81 years old, Female, Bachelor's Degree, President of Senior Citizens' Club)
3. *"Currently, I still work in agriculture while also serving as the president of the women's group in Mae Suai Municipality."*
4. – (A04, 76 years old, Female, Bachelor's Degree, President of Women's Group & Senior Committee Member)
5. *"In the past, I was a village head (Moo 11). I worked closely with the community and the government, especially in disaster risk reduction activities."*
6. – (A03, 64 years old, Female, Bachelor's Degree, Village Committee Member & Civil Defense Volunteer)

4.2.1. Government and Private Sector Officials in the Municipality

The majority of government and private sector officials in Mae Suai Municipality were female. The oldest participant in this 10-member interview group was 48 years old, while the youngest was 32 years old. Most held a bachelor's degree,

with some attaining a master's degree. It should be noted that these individuals are outside the main survey group and are not included in Table 1's demographics.

Many participants had over 10 years of experience working in Mae Suai Municipality, primarily in public administration, emergency response, and disaster risk reduction. Some worked as emergency medical personnel, security system technicians (CCTV monitoring), or volunteer rescue workers.

These professionals were crucial in coordinating disaster response efforts and ensuring rapid and effective assistance during community emergencies.

Key Quotes from Interviewees:

1. *"I have worked with the community for a long time. Even though I was not born here, I have served in Mae Suai for 15 years, with 9 years in disaster prevention and mitigation. This experience has given me a deep understanding of the community and its risk factors."*
2. – (B01, Female, Master's Degree, Head of General Administration, Mae Suai Municipality)
3. *"I specialize in technical repairs and emergency rescue operations. Every time an emergency arises, I am among the first responders."*
4. – (B02, Male, Vocational Diploma, Emergency Medical Technician & CCTV System Operator)

Table 2.
Roles of older adults in disaster management (*n*=160).

Phase	Role Description	Mean	SD	Level
Pre-Disaster	1. Developing disaster response plans and community risk maps.	4.13	0.78	Very High
	2. Risk assessment and hazard prioritization	4.08	0.80	High
	3. Training on emergency communication tools and alert systems	4.00	0.75	High
	4. Collecting demographic, infrastructure, and historical disaster data	3.96	0.86	High
	5. First aid and rescue training	3.96	0.76	High
	6. Conducting evacuation drills and scenario simulations	3.94	0.84	High
During Disaster	7. Coordinating real-time alerts via loudspeakers, community radio, or evacuation hubs	4.03	0.81	Very High
	8. Partnering with government agencies for resource distribution and first aid	4.03	0.75	High
	9. Guiding neighbors to evacuation routes and safe zones	3.93	0.86	High
Post-Disaster	10. Leading infrastructure rebuilding and safety improvements	4.10	0.84	Very High
	11. Establishing livelihood programs and vocational groups	4.06	0.82	High
	12. Providing psychosocial support and counseling	4.01	0.82	High
	13. Sharing survival experiences to strengthen community resilience	4.00	0.80	High

4.3. Key Findings

4.3.1. Pre-Disaster Preparedness

Older adults demonstrated strong engagement in risk mapping (mean=4.13) and hazard prioritization (mean=4.08). Their historical knowledge of local vulnerabilities proved critical in updating community disaster plans. One participant emphasized:

"We may not join evacuation drills like younger members, but our experience in coordinating communication ensures everyone knows their role when disaster strikes." (A03, a community leader).

4.3.2. Emergency Response

During crises, elders excelled in real-time communication (mean = 4.03), using loudspeakers and community radio to relay alerts. Their collaboration with local authorities streamlined resource allocation, though challenges such as overlapping responsibilities among responders were noted.

4.3.3. Post-Disaster Recovery

Post-crisis, elders led infrastructure rebuilding (mean=4.10) and mental health initiatives (mean=4.01). A 68-year-old participant highlighted their role in economic recovery:

"After the 2014 earthquake, we formed vocational groups to help communities regain financial independence. This was not just about rebuilding homes—it was about rebuilding lives." (A05).

Older adults are pivotal across all disaster phases, leveraging experiential knowledge for risk assessment, crisis communication, and community healing. Their roles reflect a blend of technical coordination (e.g., hazard mapping) and emotional labor (e.g., psychosocial support), underscoring their multidimensional contributions to resilience.

5. Discussion

This study highlights the critical role of the elderly in disaster risk reduction (DRR) within the Maesuai Municipality. The findings reveal that elderly individuals actively engage in disaster preparedness, response, and recovery, drawing on their experiences and long-standing community ties. Their contributions range from leadership in local organizations to

hands-on involvement in emergency response efforts. However, despite their valuable role, several challenges hinder their full participation.

5.1. The Elderly as Key Contributors to Disaster Preparedness

The elderly participants in this study demonstrated significant involvement in disaster risk reduction (DRR) activities, mainly due to their lived experiences with past disasters. Many had previously held leadership roles in the community, such as village heads, disaster response trainers, and committee members. Their knowledge of local hazards and historical disaster events enabled them to provide crucial insights into effective risk mitigation strategies.

Furthermore, the elderly played a central role in community organizing. Many continued to lead social groups, including senior citizen clubs and women's associations, which served as disaster education and coordination platforms. Their leadership positions allowed them to advocate for disaster preparedness and mobilize resources for community resilience initiatives.

5.2. Challenges to Elderly Participation in DRR

Despite their active engagement, several barriers limited the full participation of the elderly in DRR efforts:

Physical Limitations – Aging affects mobility, endurance, and overall physical capacity, making it difficult for some elderly individuals to participate in physically demanding activities such as evacuation drills and emergency response operations.

Lack of Formal Training – Although elderly individuals possess a wealth of experiential knowledge, many lack formal training in modern disaster response techniques. This gap limits their ability to integrate into structured DRR programs effectively.

Technological Barriers – Many elderly participants reported difficulties using digital communication tools, which are increasingly essential for disaster alerts, coordination, and response planning.

Social and Institutional Constraints – The study found that formal disaster planning often overlooks the potential contributions of the elderly. As a result, they are not systematically included in official disaster response frameworks, reducing their opportunities to contribute meaningfully.

5.3. Older Adult DDR Enhancement

To maximize the contributions of older adult DRR, targeted policies and programs should be implemented:

Formalizing Elderly Roles in DRR – Local governments should establish structured roles for elderly individuals in disaster preparedness and response plans, ensuring their experience and expertise are effectively utilized.

Providing Tailored Training Programs – Offering workshops and training sessions for older adult participants can enhance their ability to engage in DRR activities. These programs should focus on practical disaster preparedness strategies and modern response techniques.

Improving Accessibility to Disaster Communication Tools – Simplified digital platforms and community-led programs can help bridge the technological gap and improve older adults' access to disaster-related information.

Fostering Intergenerational Collaboration – Encouraging collaboration between elderly individuals and younger community members can facilitate knowledge-sharing and strengthen overall disaster resilience.

The elderly are a vital yet often underutilized resource in disaster risk reduction. Their extensive experience, community leadership, and historical knowledge position them as key contributors to disaster preparedness and response. However, structural, technological, and physical challenges must be addressed to enhance their participation. By integrating elderly individuals into formal disaster planning and providing targeted support, communities can significantly strengthen their resilience against future disasters.

6. Conclusion

This study highlights the critical role of elderly individuals in disaster risk reduction (DRR) within their communities. The findings indicate that despite physical and societal challenges, older adults possess valuable experience, resilience, and leadership capabilities that contribute to practical disaster preparedness and response. Many elderly individuals remain actively engaged in their communities, assuming leadership roles, sharing knowledge, and participating in mitigation efforts. These contributions emphasize the necessity of recognizing and integrating their potential into DRR policies and frameworks.

The research further reveals that social participation significantly influences the level of involvement among older adults in disaster preparedness. Those with prior leadership experience or community involvement demonstrate greater engagement in risk-reduction activities. However, barriers such as limited mobility, lack of formal education, and societal perceptions of aging may hinder their participation. Addressing these challenges through inclusive policies, targeted training, and intergenerational collaboration can enhance their contributions and foster a more resilient society.

From a policy perspective, this study underscores the importance of developing age-inclusive disaster risk reduction (DRR) strategies that empower older adults rather than marginalize them. Encouraging community-based approaches, leveraging traditional knowledge, and providing necessary support systems can strengthen disaster preparedness. Moreover, fostering partnerships between government agencies, NGOs, and local communities can facilitate the effective implementation of such initiatives.

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