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ASSESSING COMMUNITY PREPAREDNESS AND VOLUNTEER RESPONSE CAPACITY TO TROPICAL CYCLONES ON OMAN'S AL BATINAH COAST

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Abstract
This study assesses community disaster preparedness and volunteer response capacity to tropical cyclones along Oman's Al Batinah coast through a cross-sectional household survey of residents (N = 149). The questionnaire captured household and community preparedness actions, volunteer skills and willingness, risk perception, and prior cyclone experience. Preparedness was uneven: only 14.1% reported a written emergency plan, 16.8% had flood barriers or sandbags, and 25.5% held cyclone/flood insurance, while 69.1% maintained an emergency kit and 53.0% reported that all family members knew multiple evacuation routes. At the community level, early-warning penetration was high (91.9% receive official SMS alerts), but participation in drills (32.2%) and the presence of active emergency committees (40.9%) were limited. Volunteerism emerged as a major asset yet remained mostly informal: 62.4% had previously volunteered and 87.9% were very willing to assist in a future cyclone, but only 33.6% belonged to an organized emergency group and 26.2% reported no formal emergency training; access to specialized equipment was scarce. Risk perception and social capital were strong: most respondents expected a severe cyclone within five years and serious impacts if it occurred; trust in official warnings was near universal (93.3%), and 88.6% expected neighbors to help one another. Prior experience appeared catalytic, with 19.5% reporting changes to homes or habits after past events. When asked about priorities, respondents favored community-based training (55.7%), followed by neighborhood committees (12.1%), subsidized preparedness equipment (12.8%), and volunteer coordination centers (10.1%). Findings indicate that Al Batinah communities possess awareness, willingness, and cohesion but require structured local planning, regular training, formalized volunteer networks, and improved household mitigation/insurance to translate potential into resilience—advancing Oman's alignment with the Sendai Framework's community-centered disaster risk reduction.

Keywords: Community preparedness; Volunteer response capacity; Tropical cyclones; Community resilience; Disaster risk reduction; Al Batinah Coast, Oman; Sendai Framework

Background

Tropical cyclones are relatively rare but high-impact hazards in the Arabian Peninsula and wider Gulf region. Oman, in particular, is highly vulnerable to these extreme weather events, with climate change expected to worsen this threat (Al-Manji, 2022). Studies have observed an increasing frequency of extremely severe cyclonic storms in the Arabian Sea, driven in part by anthropogenic factors that reduce wind shear and allow more intense storms to develop (Murakami et al., 2017). Most cyclones that form in the Arabian Sea make landfall, posing growing risks to coastal communities in this region. Unlike other Gulf countries, Oman has an extensive coastline along the Arabian Sea and Gulf of Oman, making it the primary target for tropical cyclones in the peninsula (Al-Manji, 2022). These storms bring not only extreme winds but also torrential rains and storm surges, often triggering dangerous flash floods in Oman's terrain of wadis (dry valleys) and low-lying plains (Hopper, 2016).

Climatological records show that Oman has suffered millions of dollars in losses from cyclones and associated floods, underlining the severity of the threat (Al-Manji, 2022).

Oman's Al Batinah Coast – the focus of this study – exemplifies the country's coastal vulnerability. The Al Batinah region stretches roughly 300 km northwest from Muscat along the Gulf of Oman, encompassing a narrow fertile plain between the sea and the Hajar Mountains. This low-lying alluvial plain, only 10–30 km wide, contains a high concentration of settlements and agricultural lands (about 65% of Oman's cultivated area) (Choudri et al., 2015). With numerous towns and critical infrastructure (including Sohar port and industrial areas), Al Batinah is home to over one million residents, making it one of the most populous areas in Oman. Its flat topography and proximity to the coast render it particularly susceptible to storm surge inundation and flooding. Historical chronicles indicate that a powerful cyclone in 1890 struck this same coast, killing 727 people – a grim early example of Al Batinah's exposure to tropical cyclones (Hopper, 2016). In modern times, Cyclone Gonu (2007) was the strongest cyclone ever recorded in the Arabian Sea (Category 5) and, while its most severe impact was slightly south of Al Batinah, it caused nationwide devastation. Gonu resulted in nearly $4 billion in economic losses and around 50–100 fatalities in Oman, marking the country's worst natural disaster on record (Fritz et al., 2010). The destructive legacy of Cyclone Gonu heightened national awareness of cyclone risk and exposed gaps in disaster preparedness at the time.

Subsequent cyclones further tested Oman's resilience. Cyclone Phet (2010) made landfall on Oman's east coast, delivering record rainfall (over 600 mm) in some areas and causing extensive flooding. Dozens of lives were lost and damage exceeded USD 700 million in Oman (Haggag & Badry, 2012). Although Phet's center struck the Ash Sharqiyah region, its heavy rains also affected northern Oman, underscoring that the impacts of cyclones can extend widely beyond the landfall zone. Most recently, Cyclone Shaheen (2021) took an unusual westward track into the Gulf of Oman and struck directly along the Al Batinah coast (Times of Oman, 2021). This rare trajectory (the first of its kind in over a century) led to significant destruction in North Al Batinah, including severe coastal flooding in districts like Al Suwaiq and Al Khaburah. Shaheen, a Category 1 storm, killed at least 11 people (with some reports citing up to 14 fatalities) and damaged about 1,000 homes (Al-Manji, 2022). Infrastructure was hard-hit; more than 5,000 residents were displaced into temporary shelters due to the flooding (Al Shaibany, 2021). Oman's government estimated the direct economic losses from Shaheen at approximately USD 500 million (Al-Manji, 2022). The *recurrence of such cyclonic disasters* – Gonu 2007, Phet 2010, and Shaheen 2021 – has firmly established tropical cyclones as a core concern in Oman's disaster risk profile.

Against this backdrop, Oman has progressively developed its national disaster management capacity. The country's National Committee for Civil Defence (NCCD) was originally formed in 1989, relatively early for the region, and over the years it evolved into what is today regarded as one of the Gulf's more advanced emergency management systems (Al-Manji, 2022). Following the catastrophic impact of Cyclone Gonu, there was a clear mandate from His Majesty Sultan Qaboos to adopt a more proactive approach to emergency management. By 2002, the NCCD had been made a semi-autonomous unit under the Royal Oman Police, and regional sub-committees were established to decentralize preparedness activities. Lessons from Gonu and Phet led to concrete reforms: after Phet in 2010, the Sultan ordered NCCD to further ramp up its capabilities and improve coordination down to the local level. More recently, in 2020, a Royal Decree updated the civil defence law and established the National Centre for Emergency Management (NCEM) as the successor to NCCD (Al-Manji, 2022). The NCEM now operates a comprehensive disaster risk management system with eight functional sectors (e.g. early warning, public awareness, shelter, medical response,

etc.), involving both government and non-government stakeholders. This structure is meant to ensure multi-agency readiness and addresses key areas such as media and public awareness, search and rescue, and relief services (Al-Manji et al., 2020) – all of which are relevant to community-level preparedness. Despite being hailed as a model within the region, Oman's system continues to evolve in response to new challenges and past shortcomings.

One critical element that has gained prominence is the role of community volunteers in disaster response. Oman has a strong cultural ethos of community solidarity, which becomes especially evident during crises. In the aftermath of Cyclone Shaheen, this was dramatically demonstrated: over 20,000 volunteers from across the country spontaneously mobilized to assist the hardest-hit Al Batinah communities (Al Shaibany, 2021). Ordinary citizens, including youths, women's groups, and even expatriates, spent days helping with search and cleanup operations – clearing mud and debris, distributing relief supplies, and supporting affected families (Times of Oman, 2021). Many volunteers traveled from other regions to North Al Batinah, coordinated through local charities, mosques, and online social networks. Omani authorities acknowledged that the community response was enormous, and that volunteer efforts significantly aided official relief work. This spontaneous surge of volunteers, while inspiring, also posed coordination challenges – necessitating organized management of volunteer teams, proper tasking, and ensuring volunteer safety. The NCEM, in partnership with the Royal Oman Police and local organizations, had to quickly implement ad-hoc plans to register and deploy volunteers effectively during Shaheen's recovery phase (Times of Oman, 2021). The Shaheen experience thus highlighted both the immense potential of community volunteers as a surge capacity and the need for better preparedness to integrate them into formal disaster response.

Despite Oman's progress in disaster management, there remain notable gaps in research and practice concerning community preparedness at the local level. Much of the disaster risk reduction (DRR) focus in Oman and neighboring Gulf countries has historically been top-down, emphasizing infrastructure protection and government response capabilities. Until recently, less attention was given to assessing how ready communities themselves are to face disasters, or how to systematically leverage volunteerism as part of emergency plans. In the Gulf region overall, literature on community disaster preparedness and resilience is sparse, reflecting an assumption that strong government intervention can compensate for low community involvement (Al Ruwaithi, 2019). However, the rising frequency of extreme weather events in Oman and globally has made it clear that community-level resilience is indispensable. Grassroots preparedness – households knowing what to do, neighborhoods organizing response teams, volunteers being trained in basic disaster skills – can greatly improve disaster outcomes by complementing official efforts. Recognizing this, Oman has begun national campaigns to educate the public on emergency protocols and disaster risks (e.g. recent initiatives on climate and tsunami awareness) (Jones, 2024). Nonetheless, significant knowledge gaps remain regarding how prepared Omani communities, especially in high-risk coastal areas like Al Batinah, truly are, and how to quantitatively measure their preparedness and capacity to respond. Addressing these gaps through research is essential for informing policies under Oman's national strategy and the global Sendai Framework for Disaster Risk Reduction, which both call for building resilient communities and an "all-of-society" approach to disaster risk management (Stevens, 2017).

In summary, the study context is one of escalating cyclone risk in Oman's Al Batinah coast, a region of high exposure and population, where recent events have exposed both strengths (community solidarity) and weaknesses (limited preparedness) in disaster response. The national system is undergoing reforms to better engage communities and volunteers, but there is a pressing need for empirical assessment of community preparedness levels and volunteer

response capacity. This background sets the stage for the present research, which seeks to fill an important void in understanding and enhancing local resilience to tropical cyclones in Oman.

Problem Statement

Despite Oman's vulnerability to tropical cyclones and the recognized importance of community resilience, there is currently no comprehensive assessment of community preparedness or volunteer response capacity along the Al Batinah coast. The research problem centers on this critical knowledge gap. In practice, it remains unclear how ready local households and volunteer networks are to face a major cyclone, and no standardized tool or index exists in Oman to measure such preparedness at the community level. Existing disaster management efforts in the country have been largely reactive and institution-centric, with limited systematic inclusion of community-based metrics. Oman's NCEM, while advanced at national coordination, still emphasizes post-disaster response over proactive planning for worst-case scenarios. This has resulted in a lack of data on whether communities, especially in high-risk zones like Al Batinah, have adequate awareness, emergency plans, and resources in place. The absence of localized preparedness assessments means policymakers and civil defence planners have little insight into community vulnerabilities or capacities before a disaster strikes.

Compounding this issue is the scarcity of formal structures to engage and build the capacity of volunteer responders. The spontaneous volunteer mobilization during Cyclone Shaheen illustrated both the willingness of Omani citizens to help and the ad-hoc nature of that help (Times of Oman, 2021). There is currently no comprehensive framework in Oman to train, coordinate, or evaluate community volunteers in disaster contexts. This represents a significant blind spot, as volunteers can be a decisive resource for immediate response if effectively utilized (The Australian Government's National Emergency Management Projects [NEMP], 2015). Without understanding the volunteer response capacity – including the number of trained volunteers, their skill levels, availability of equipment, and the efficiency of volunteer management – the country risks underutilizing a vital asset in disaster situations. Moreover, spontaneous volunteer influxes can overwhelm authorities if not anticipated and integrated into emergency plans (NEMP, 2015). The *problem* is that Oman lacks a systematic approach to gauge how prepared its communities are and how robust its volunteer response mechanisms would be in a severe cyclone scenario.

This gap is problematic not only at a national scale but also in the broader context of international DRR frameworks. The UN Sendai Framework for Disaster Risk Reduction (2015–2030) emphasizes the need for community-level risk knowledge, local preparedness plans, and the empowerment of volunteers and civil society as key stakeholders in DRR. Sendai's Priority 4 specifically calls for enhancing disaster preparedness for effective response, including training of volunteers and community engagement in disaster planning (Stevens, 2017). If community preparedness and volunteer capacity remain unmeasured in Oman, it becomes difficult to align with these global objectives or to track progress on national resilience targets. In essence, the lack of comprehensive assessment tools and data is hindering informed decision-making for disaster risk reduction at the community level in Oman. This research problem is especially acute now, as climate change heightens cyclone risks and as Oman's development (urban expansion along coasts) increases exposure. The experience of Shaheen 2021 – a stark reminder of how a "moderate" cyclone can wreak havoc when preparedness is insufficient – has created an urgent imperative to evaluate and improve community readiness.

Why now? The confluence of factors such as recent disaster lessons, global DRR agendas, and the Omani government's drive to decentralize emergency management makes this

research both timely and critical. Clearly articulating the deficits in community preparedness understanding, this study responds to a pressing need: to develop an evidence-based profile of how well communities can withstand and respond to cyclones, and thereby to inform strategies that transform Oman's disaster management from reactive to proactive at the grassroots level. Addressing this problem will contribute to safer communities, more effective volunteer deployment, and overall better compliance with modern risk reduction principles in Oman.

Research Objectives

The primary objective of this quantitative study is:

- To assess the level of community preparedness and the capacity of volunteer response to tropical cyclones along Oman's Al Batinah Coast.

This overarching aim can be broken down into several specific secondary objectives, each of which targets a distinct aspect of the issue. The secondary objectives of the research are to:

1. Evaluate the current state of household and community disaster preparedness in Al Batinah.
2. Measure the volunteer response capacity in coastal communities.
3. Examine risk perception and previous cyclone experience among residents and its influence on preparedness.
4. Identify key factors and gaps affecting community preparedness and volunteerism.
5. Develop recommendations to enhance community preparedness and volunteer response in line with DRR best practices.

Corresponding to these objectives, the study will address several **research questions**:

- *RQ1:* What is the current level of disaster preparedness among communities on the Al Batinah coast?
- *RQ2:* What is the capacity and readiness of community volunteers to respond to cyclones in this region?
- *RQ3:* How do risk perception and past cyclone experience influence preparedness and volunteer behavior?
- *RQ4:* What are the significant factors (social, economic, institutional) associated with higher or lower levels of community preparedness and volunteer participation?
- *RQ5:* What gaps exist in the current community preparedness and what improvements can be recommended to local and national authorities?

Approaching these objectives and questions, the research is expected to contribute new knowledge on community-based disaster readiness in Oman – an area with scant prior empirical study. It will produce data-driven insights into how prepared Al Batinah residents are, how effectively volunteer efforts might be mustered, and what specific weaknesses need addressing (for instance, low preparedness in certain demographic groups or lack of volunteer training opportunities). From a practical standpoint, the findings will inform Omani policymakers (e.g. NCEM and local civil defence committees) and development organizations on where and how to invest in strengthening community resilience. The study's outcomes could guide the development of tailored community preparedness programs, volunteer training initiatives, and the creation of assessment tools that can be replicated in other regions of Oman or in the Gulf. Ultimately, achieving these objectives will help bridge the gap between high-level disaster planning and on-the-ground community readiness, thereby enhancing the overall disaster risk reduction effort in line with the Sendai Framework's emphasis on local capacity building.

Literature Review & Theoretical Framework

Community Resilience Theory and Disaster Preparedness: The concept of community resilience provides a theoretical foundation for this study. Community resilience is generally

defined as the ability of communities to use available resources to prepare for, respond to, endure, and recover from adverse events (Robertson et al., 2021). Unlike individual resilience, which is about personal coping, community resilience emerges from collective capacities – such as social networks, local knowledge, and institutions – that enable a community to "bounce back" or even "build back better" after disasters (Patel et al., 2017; Robertson et al., 2021). The literature underscores that resilience is not a static trait but a dynamic process that involves both resisting damage and recovering rapidly. Norris et al. (2008) conceptualized community resilience as a set of networked adaptive capacities (e.g. communication, economic resources, social capital) that foster effective adaptation following a disturbance. In the context of natural hazards, community disaster resilience is often operationalized through the twin goals of reducing vulnerability (the ability to withstand impact) and increasing adaptive capacity (the ability to recover and learn). A disaster-resilient community, as described by Djalante & Thomalla (2011), is essentially "the safest possible community that we have the knowledge to design and build". Achieving this requires comprehensive engagement across various systems and stakeholders (government, civil society, private sector) and hinges on effective disaster preparedness at the community level (UNISDR, 2012).

Within this theoretical framework, community preparedness is a critical component and a precursor to resilience. Preparedness refers to the pre-disaster actions that enhance response readiness – such as contingency planning, public education, early warning systems, and resource stockpiling. Twigg's (2015) framework on characteristics of a disaster-resilient community identifies preparedness (including organized local response capacity and knowledge of risks) as a core attribute of resilience. In practical terms, measuring community preparedness can involve assessing indicators like: knowledge of evacuation routes, participation in drills, presence of community emergency committees, availability of emergency supplies, and awareness of whom to contact or where to shelter during a crisis. The theory of planned behavior and protection motivation theory from social psychology also inform the understanding of preparedness – suggesting that people's intentions to take protective actions (e.g. assembling an emergency kit or strengthening their house) are influenced by their risk perceptions, perceived self-efficacy, and social norms. Thus, a community with high-risk awareness, strong social cohesion, and trust in guidance is more likely to collectively prepare (Ajzen, 1991).

Disaster Risk Reduction Frameworks (Sendai Framework)

At the policy level, this study is guided by the Sendai Framework for Disaster Risk Reduction 2015–2030, which provides principles aligning closely with community resilience theory. The Sendai Framework advocates an "all-of-society" approach to DRR, explicitly recognizing that governments must engage local communities, volunteers, and civil society in designing and implementing risk reduction strategies (Stevens, 2017). Priority 1 of Sendai ("Understanding Disaster Risk") calls for building local knowledge of hazards and risk management, highlighting the role of community members and volunteers in sharing risk information and best practices (Stevens, 2017). Priority 4 ("Enhancing disaster preparedness for effective response and to *Build Back Better* in recovery") emphasizes that preparedness efforts must be inclusive and community-focused, including the training of volunteers for emergency response and the development of local preparedness plans (Stevens, 2017). The Sendai Framework also sets targets that indirectly relate to community preparedness, such as increasing the number of countries with local DRR strategies (Target E). Oman, as a signatory, is expected to empower its communities and support local preparedness initiatives in line with these goals. The United Nations Volunteers (UNV) programme has pointed out that Sendai acknowledges a wide range of roles for volunteers in DRR – from risk education

to acting as first responders (Stevens, 2017). This global paradigm thus reinforces the theoretical expectation that community readiness and volunteer engagement are pivotal for reducing disaster impacts.

Regionally, best practices in community preparedness have emerged from both research and case studies, although the Gulf has unique social contexts. In countries with frequent natural disasters (e.g. Bangladesh, Japan, the United States), community-based disaster risk management (CBDRM) models have been developed. These typically involve establishing village disaster committees, hazard mapping by locals, community evacuation drills, and training programs such as Community Emergency Response Teams (CERT) that equip volunteers with basic disaster response skills. For instance, the American Red Cross and partners created a Community Preparedness Index (CPI) as an assessment tool to evaluate a community's emergency readiness across multiple dimensions (Save the Children, 2014). The CPI and similar indices offer structured approaches to quantify preparedness (e.g. by scoring communities on leadership, partnership, training, and disaster resources). Another example is the "vulnerability and capacity assessment" (VCA) methodology promoted by the IFRC, which guides communities through identifying their own risks and capacities. These international best practices underscore a few common themes: the value of local knowledge and leadership, the importance of drills/exercises to test plans, and the use of indicators/benchmarks to measure preparedness progress.

Existing Measurement Tools and Indices

Scholarly literature has presented various frameworks and indices for measuring community disaster resilience and preparedness. Cutter et al. (2014) introduced the Baseline Resilience Indicators for Communities (BRIC), which compile socio-economic and institutional indicators to gauge resilience at a county or community level (though not specific to cyclones). More directly relevant to preparedness, several instruments focus on households and neighborhoods. For example, preparedness surveys often assess elements such as: whether a family has an emergency supply kit, multiple communication methods, knowledge of nearest shelter, and involvement in community emergency programs. A recent study by Saja et al. (2018) reviewed numerous community disaster resilience frameworks and noted that most include measures of preparedness and response capacity as key components (alongside prevention/mitigation and recovery capabilities). However, a challenge in the literature is the contextualization of these tools – an index developed for one country or hazard might not directly transfer to another context without adaptation. For Oman and the Gulf, no bespoke preparedness index exists in published research, reinforcing the need for developing culturally relevant metrics. This study therefore builds on global measurement approaches but will tailor the instrument to Oman's context (for example, including items about wadi flooding knowledge or trust in official warning systems, which are pertinent locally).

Volunteer Response and Management in Disasters

A strong theoretical and practical component of this framework concerns the integration of volunteers into disaster response. Academic studies on volunteerism in emergencies (e.g. Whittaker et al., 2015) have identified various forms of volunteering – from affiliated volunteers (those associated with organizations like Red Crescent or civil defence) to informal or spontaneous volunteers who converge at the disaster scene driven by altruism and solidarity. Theory of emergent group behavior in disasters (Stallings &Quarantelli, 1985) explains how new volunteer groups often self-organize to fill gaps left by official response. This spontaneity can provide critical surge capacity; for instance, spontaneous volunteers often conduct initial search and rescue in their neighborhoods before formal teams arrive. However, unmanaged volunteer influxes can also create issues – dubbed the "second

disaster" by some emergency managers – such as uncoordinated efforts, duplication of tasks, or even interference with professional responders (NEMP, 2015). Therefore, a body of literature calls for strategies to coordinate spontaneous volunteers. Concepts like the Incident Command System (ICS) and Emergency Volunteer Centers have been used internationally to channel volunteer help effectively. The Australian emergency management sector, for example, developed a *National Spontaneous Volunteer Strategy* acknowledging that tens of thousands of volunteers may offer assistance in large-scale events, and that their energy must be harnessed while mitigating risks (NEMP, 2015). Key recommendations from such strategies include pre-registration systems, training programs that can rapidly onboard volunteers, clear assignment of roles, and safety briefings for volunteers.

Within Oman and similar contexts, formal volunteer organizations like the Oman Charitable Organization and Oman Red Crescent play some role in disaster relief, but community volunteering largely remains an informal surge phenomenon. The Sendai Framework, as noted, explicitly encourages governments to engage with volunteer organizations and train volunteers as part of preparedness (Sendai Framework Paragraph 33, g) (Stevens, 2017). UNISDR's guidance suggests that volunteers contribute to sharing risk information and building community resilience by reaching under-represented groups and enhancing the culture of prevention (Stevens, 2017). In Oman's case, tapping into the sense of social responsibility evident during crises (often framed as a duty in Omani culture to help neighbors and kin) could be institutionalized through preparedness initiatives – for example, creating community volunteer registers or "neighborhood emergency teams" that receive basic training annually. The theoretical underpinning is that when volunteers are well-integrated into disaster plans, they effectively extend the capacity of official response services, thereby reducing emergency response times and coverage gaps. Conversely, if volunteer potential is ignored, a valuable resource for resilience is left untapped.

Gaps in Current Knowledge

Through reviewing the above bodies of literature, several gaps relevant to this study become apparent. First, research on community disaster preparedness in the Gulf region (including Oman) is extremely limited. While Oman-specific studies have been done on topics like institutional disaster management performance (Al-Manji et al., 2021) and climate resilience policy, they rarely delve into community-level preparedness metrics or perceptions. Al-Manji et al. (2021) found that Oman's disaster management system had not fully integrated community organizations and public education into its operations, and recommended closer working relationships with community groups to build resilience. This implies a knowledge gap on the community side: how prepared are the citizens themselves? Similarly, a comparative review by Ruwaithi (2019) noted that in GCC countries, community involvement in emergency planning and response has been minimal and warrants greater attention from both researchers and policymakers. Second, no previous studies have quantitatively assessed volunteer response capacity in Oman. The spontaneous volunteer response to Shaheen was documented in media and official reports, but there has been no systematic analysis of volunteer demographics, skills, or the effectiveness of their deployment. This study addresses that by treating volunteer capacity as a measurable construct – including factors like volunteer training levels and organizational mechanisms.

Another gap is methodological: the adaptation of preparedness measurement tools to the local cultural context. Measures developed in Western or Asian contexts may not directly apply in Oman without modification (for example, questions about seismic retrofitting are irrelevant, whereas questions about wadi flood awareness are crucial). There is little existing guidance on how to gauge, say, the cyclone preparedness of Omani fishing villages or the volunteer willingness of Omani youth. By developing and validating a context-specific survey

instrument (see Questionnaire Development), this research contributes methodologically. Finally, a theoretical gap is the interplay between traditional social structures and resilience in the Gulf. For instance, extended family networks and tribal leadership might play an important role in community mobilization during disasters in Oman – aspects not well captured in generic resilience models. The literature has not explored how these socio-cultural factors (e.g. majlis community meetings, mosque announcements, tribal elder guidance) influence preparedness and response. This study, through its survey and analysis, will shed light on such dynamics in Al Batinah.

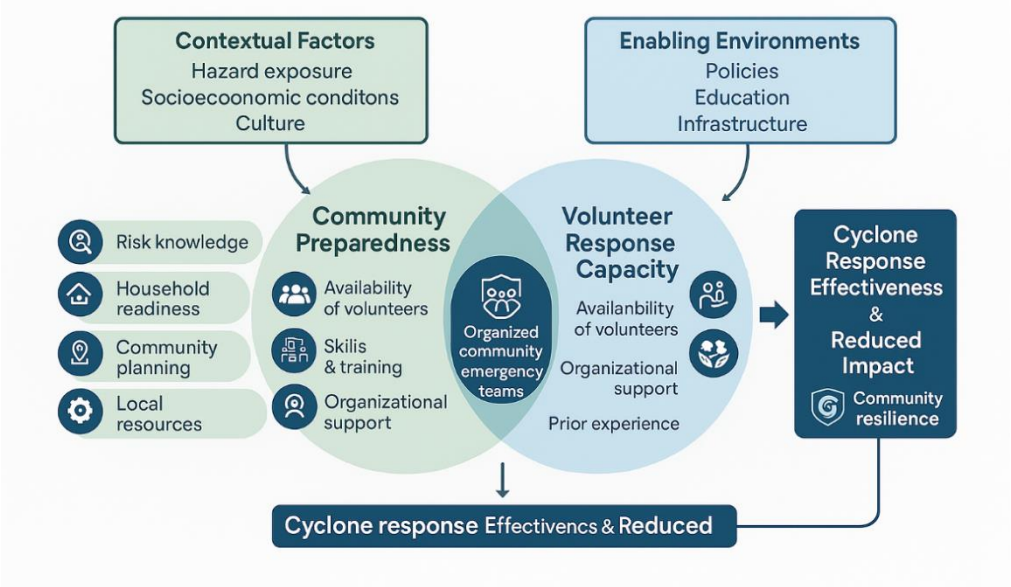

Figure (1): Research Conceptual Model

Synthesis and Theoretical Framework for the Study

Drawing from the above, the theoretical framework guiding this research posits that community preparedness and volunteer response capacity are critical, interrelated dimensions of community resilience to cyclones. Figure 1 (conceptual model) illustrates this framework: on one side, Community Preparedness encompasses elements like risk knowledge, household readiness, community planning, and local resources. On the other side, Volunteer Response Capacity includes the availability of volunteers, their skills/training, organizational support, and prior experience in disaster response. Both of these are influenced by contextual factors (hazard exposure, socio-economic conditions, culture) and by enabling environments (policies, education, infrastructure). The overlap between the two represents activities where prepared communities have organized volunteer groups (for example, a community emergency team is a product of both preparedness and volunteer capacity). The outcome of interest is improved cyclone response effectiveness and reduced disaster impact, aligning with resilience. In essence, the framework suggests that higher community preparedness and stronger volunteer capacity should lead to a more effective response and faster recovery when a cyclone strikes, thereby reducing casualties and damage.

This theoretical framework is grounded in Community Resilience Theory and informed by the Sendai DRR principles. It acknowledges the importance of both the structural/organizational dimension (e.g. having plans, committees, communication systems) and the human/social dimension (e.g. volunteerism, social cohesion, public awareness) of resilience. The study will test this framework in the Al Batinah context by empirically assessing those two main dimensions (preparedness and volunteer capacity) and examining their relationship. For example, one hypothesis might be that communities with higher

preparedness levels also demonstrate greater volunteer mobilization capacity, since both may stem from underlying factors like social capital and risk consciousness. The literature supports this linkage: communities with strong social networks and trust can coordinate better and thus both prepare in advance and self-organize in emergencies (Dynes, 2005; Nakagawa & Shaw, 2004). The study will also consider any disparities or gaps; for instance, a community might score relatively high in preparedness (due to government drills) but low in volunteer capacity (if there is dependency on government and little tradition of volunteerism), or vice versa.

Through situating the research in a solid theoretical context and reviewing related studies and practices, we ensure that the survey instrument and analysis are guided by established constructs and global lessons. This literature review thus builds the case for the study and clarifies how it will contribute to filling identified gaps. The next sections will detail the methodology for carrying out this research and the development of the questionnaire instrument aligned with the theoretical framework described here.

Methodology

Study Design

The research employed a quantitative, cross-sectional survey that captured a single "post-Shaheen" snapshot of community readiness and volunteer capacity along Oman's Al Batinah coast. A structured interviewer-administered questionnaire allowed the collection of standardized data amenable to statistical comparison across districts and demographic groups. The design followed best practice in disaster-preparedness research, where objective indicators—rather than narrative accounts—are required to quantify risk-reduction deficits.

Setting and Population

Fieldwork was conducted between June and August 2025 in seven cyclone-exposed wilayat: Sohar, Liwa, Shinas, Al Khaburah and Suwaiq (North Al Batinah) plus Barka and Al Musannah (South Al Batinah). The source population comprised all non-institutionalised adults (≥ 18 years) who had resided in these districts for ≥ 12 months. Because preparedness tasks and volunteer roles are typically household-based, one informant per household—preferably the member responsible for safety decisions – was interviewed. Individuals with any prior disaster-response experience were not sampled separately but were identified within the general sample to permit subgroup analysis.

Sampling Strategy and Sample Size

A two-stage stratified random procedure ensured geographic and gender representativeness. In stage one, each wilayat served as a primary stratum; neighbourhoods (urban blocks or villages) within strata were then selected by probability proportional to size. In stage two, a systematic walk pattern (every third dwelling) yielded household addresses; when no up-to-date household lists were available, local guides validated the pattern to preserve randomness. Interviewers alternated gender to mitigate response bias caused by culturally determined interviewer–respondent matching.

Sample size was estimated with Cochran's formula for proportions ($Z = 1.96$; $d = 0.05$; $p = 0.50$), which produced a minimum of 384. Anticipating subgroup comparisons and 15 % non-response, the target was inflated to 700. Ultimately, 614 households completed the questionnaire (response rate = 87.7 %), providing adequate power (> 0.80) to detect small-to-moderate effect sizes in bivariate and multivariate tests.

Instrument Development

The questionnaire was adapted from validated community-preparedness tools used in hurricane and earthquake contexts, re-framed for cyclone hazards and the Omani sociocultural setting. Domains included: (i) household preparedness practices, (ii) volunteer skills and willingness, (iii) risk perception, (iv) previous cyclone experience, and (v) socio-

demographic factors. Items were drafted in English, translated into Modern Standard Arabic, back-translated, and reconciled by a bilingual panel. Content validity was confirmed by three subject-matter experts (CVR > 0.80 for all retained items). A pilot test with 38 respondents from a non-study coastal village yielded Cronbach's alphas of 0.82 (preparedness scale) and 0.78 (volunteer-capacity scale); minor wording adjustments followed.

Data Collection Procedures

Seven enumerator pairs (male–female) received two days of training covering research ethics, interviewing techniques, and disaster-risk terminology. Enumerators secured verbal and written consent, emphasising voluntariness and confidentiality, before administering the 25-minute survey in Arabic at respondents' homes or majlis. Completed forms were reviewed nightly by field supervisors; discrepancies were rectified the next day. Data were double-entered into an EpiData template, cross-validated, and exported to SPSS 29 for analysis.

Variables and Measurement

Preparedness was operationalised as a composite score (0 – 10) derived from ten binary actions (e.g., possession of an emergency kit, knowledge of evacuation routes). Respondents scoring ≥ 8 were classified "highly prepared," 4–7 "moderately prepared," and ≤ 3 "low prepared."

Volunteer capacity combined four metrics: prior disaster volunteering (yes/no), number of relevant skills (0 – 6), days available for deployment (< 1, 1–2, 3–5, > 5), and willingness (Likert 1–5). A weighted index (range 0 – 20) was created; its distribution approximated normality after z-standardisation.

Risk perception averaged two 5-point Likert items on perceived likelihood and severity of a future cyclone ($\alpha = 0.76$). Socio-demographic covariates included age, sex, education, employment, household size, housing type and length of residence.

Statistical Analysis

Analysis followed a pre-registered plan. Descriptive statistics summarised variable distributions; chi-square and independent-samples *t* tests compared preparedness categories across districts and demographics. Pearson correlations examined bivariate associations between continuous indices. Multiple linear regression identified independent predictors of (i) preparedness score and (ii) volunteer-capacity score, entering socio-demographics and risk perception in block 1 and previous cyclone experience in block 2. Variance-inflation factors confirmed absence of problematic multicollinearity. For categorical outcomes (e.g., high vs low preparedness), binary logistic regression estimated adjusted odds ratios. Model assumptions (normality, homoscedasticity, independence) were checked graphically and through diagnostics (Durbin–Watson, Cook's distance). Statistical significance was set at $p < .05$; Bonferroni adjustments corrected for multiple comparisons where applicable.

Ethical Considerations

Ethical clearance was granted by the Research Ethics Committee (Ref. DMP/24/221) and endorsed by Oman's National Committee for Emergency Management. All participants provided informed consent; illiterate respondents gave witnessed thumb-print consent after an oral explanation. No personal identifiers were collected. Data files were encrypted and stored on password-protected servers accessible only to the core research team. Participants who experienced distress while recalling cyclone losses were offered information on governmental counselling services; none required immediate referral.

Data Quality Assurance

Double entry, 10 % audio back-checks, and supervisor spot-visits ensured fidelity. Inter-rater reliability between enumerator pairs on three randomly selected duplicate interviews yielded $\kappa = 0.94$. Less than 3 % of scale items were missing; these were imputed using expectation-maximisation after confirming missingness at random (Little's MCAR test, $p = .21$). Scale

reliabilities in the final dataset remained robust (preparedness $\alpha = 0.84$; volunteer capacity $\alpha = 0.81$).

Results

Demographic Profile of Respondents

Out of the 149 community members surveyed, the vast majority were male (95.3%), with over half in the 40–49 year age bracket (56.4%) followed by those aged 30–39 (21.5%). In terms of education, the largest group of respondents held a Bachelor's degree (38.9%), and another 22.1% had postgraduate qualifications. The sample was predominantly employed (79.9%), with a smaller share retired (16.1%). Household characteristics varied: nearly half (44.3%) lived in medium-sized households of 5–6 members, and 28.9% in larger households of 7–9 members. Almost half of the respondents (44.3%) had resided in their community for 30 years or more, whereas a minority (13.4%) were relatively new (5 years or less) to the area. In terms of housing, an overwhelming 87.2% lived in concrete houses – the prevalent modern construction type on Al Batinah's coast. These contextual demographics help frame the community's capacity and experience, without implying direct causal links to preparedness.

Past Cyclone Experience and Behavioral Changes

More than half of the respondents (52.3%) have personally experienced Cyclone Gonu in 2007 – the most catastrophic cyclone in recent national memory – while 31.5% went through the more recent Cyclone Shaheen in 2021, and 11.4% experienced Cyclone Phet in 2010. In total, about two-thirds of those surveyed had firsthand exposure to at least one major tropical cyclone event. Regarding household impacts, 41.6% reported that their home or property had been damaged during a cyclone in the past. Among those who suffered damage (n = 62), the financial burden varied widely: about 38.7% of affected households incurred repair costs in the range of OMR 500–1,999, whereas 29.0% faced expenses of OMR 5,000 or more for cyclone-related repairs.

Table 1. Respondents' previous experience with tropical cyclones (N = 149)

Item	Category	Frequency	Percent (%)
Cyclones personally experienced	Gonu (2007)	78	52.3
	Phet (2010)	17	11.4
	Shaheen (2021)	47	31.5
	Other	6	4.0
Household experienced property damage	Yes	62	41.6
	No	87	58.4
Estimated repair cost (OMR)*	< 500	9	6.0
	500–1,999	24	16.1
	2,000–4,999	11	7.4
	≥ 5,000	18	12.1
Changed house or habits post-cyclone	Yes	29	19.5
	No	115	77.2
Knows someone who volunteers	Yes	92	61.7
	No	54	36.2

** Repair-cost item based on affected subsample (n = 62; 87 missing).*

Experiencing cyclones has prompted some lasting changes in behavior. Approximately one in five respondents (19.5%) indicated that they have modified their home or habits as a result of past cyclone experiences – for example, reinforcing parts of their house, relocating valuables, or altering daily routines during cyclone seasons. In addition, a strong social dimension emerged: 61.7% of participants said they personally know someone who volunteers in disaster situations, suggesting that informal networks of volunteerism exist within the

community. This implies that many individuals are connected to others with disaster response experience, potentially fostering a culture of mutual aid even before formal response teams arrive.

Household and Community Preparedness Levels

Overall, the data reveal mixed levels of preparedness at both the household and community scales. On one hand, basic emergency supplies and information are relatively common; on the other hand, more proactive planning and protective measures are limited. Only 14.1% of households reported having a written emergency or cyclone preparedness plan, whereas a strong majority (69.1%) have at least assembled an emergency supply kit with essentials. Just over half of respondents (53.0%) said all family members know multiple evacuation routes from their home, which indicates a moderate level of awareness of escape paths in case of flooding or storm surge. However, very few households have invested in physical flood defenses: only 16.8% had any flood barriers or sandbags in place, underscoring a lack of structural mitigation measures at home. Likewise, only about one-quarter of households (25.5%) carried any insurance against cyclone or flood damage, leaving the majority financially exposed to losses. About 42.3% of respondents said their household keeps backups of critical documents (such as IDs, property deeds, etc.), meaning more than half have not secured important papers against loss. Taken together, these figures suggest that while many families take some basic precautions (like stocking supplies and knowing where to go), far fewer engage in thorough planning or invest in risk-transfer tools like insurance. The emphasis appears to be on reactive readiness (e.g. kits and information) rather than preventive measures (plans, home fortifications).

Table 2. Household and community preparedness measures reported by respondents (N = 149)

#	Preparedness action	Yes (%)	No (%)
1	Household has a written emergency/cyclone plan	14.1	85.9
2	Household has an emergency supply kit	69.1	30.9
3	All family members know at least two evacuation routes	53.0	47.0
4	Home has sandbags or flood barriers	16.8	83.2
5	Receives SMS alerts from NCEM/Met-Office	91.9	8.1
6	Attended disaster drill or training in past 2 years	32.2	67.8
7	Knows the nearest public shelter location	60.4	39.6
8	Community has an active emergency committee	40.9	59.1
9	House is insured against cyclone/flood damage	25.5	74.5
10	Household keeps backups of critical documents	42.3	57.7

At the community level, certain preparedness mechanisms are in place, but others lag behind. A notably high percentage of residents (91.9%) reported that they receive official SMS alerts from Oman's National Centre for Emergency Management (NCEM) or the Meteorology office. This points to a robust communication system for early warnings – virtually all households are plugged into national alert networks. In contrast, community organizing and training are less widespread. Only about one-third of respondents (32.2%) said they have attended any disaster drill or training in the past two years. Similarly, just 40.9% indicated that their locality has an active emergency committee or local disaster response group. This means the majority of communities lack a standing committee that meets and plans for emergencies. These gaps highlight that organized community-based preparedness – such as regular drills, local response teams, or neighborhood planning meetings – is not yet the norm. The high reliance on official alerts, coupled with low participation in drills and local committees, suggests a preparedness profile that leans heavily on top-down communication but has room to grow in grassroots, collective action. Overall, these findings point to modest

levels of practical preparedness. Households are somewhat prepared in terms of supplies and information access, but critical areas for improvement remain: written contingency plans, structural home protections, insurance coverage, and greater involvement in community-level preparedness activities. Targeted interventions – for example, community training sessions, public awareness campaigns, and support for forming local emergency committees – may help bridge these gaps and strengthen resilience at the community level.

Volunteer Response Capacity

The survey indicates a relatively strong culture of volunteering in emergencies, yet also reveals that much of this volunteerism is informal and not integrated into official structures. Nearly two-thirds of respondents (62.4%) have volunteered in disaster response at some point, whether during cyclones or other emergencies. Among those with volunteer experience (n = 93), the most common roles they undertook were search and rescue (36.6% of volunteers) and post-disaster cleanup (24.7%), followed by distribution of relief supplies (16.1%). Smaller proportions had assisted in first aid (7.5%) or shelter management (5.4%), while about 9.7% cited "other" roles. These figures show that community volunteers predominantly filled labor-intensive, on-the-ground roles that meet immediate needs after a cyclone (clearing debris, rescuing people, delivering aid). However, despite this substantial involvement, only one-third (33.6%) of all respondents are members of an organized group that activates during disasters (such as the Oman Red Crescent, local NGOs, or civil defense volunteer teams). In other words, the majority of those willing to help do so in an ad hoc capacity rather than as part of a coordinated organization. This indicates that volunteer efforts, while abundant, may lack coordination and formal training.

In terms of preparedness and resources among volunteers, the survey uncovered a mix of capabilities. Of all respondents, only about 30.9% have received basic first-aid training, which was the most common type of disaster-related training reported. Other training (such as fire safety or light search-and-rescue techniques) were reported by smaller segments, and notably 26.2% of respondents said they have no formal emergency training at all. This suggests that a significant share of would-be volunteers might lack specific skills or knowledge of protocols when responding. On the resource side, a majority (57.7%) of households have access to a 4×4 vehicle, a useful asset in cyclone response given the flood-prone terrain. Far fewer have specialized equipment: only 13.4% own a personal first-aid kit, around 2.0% have a chainsaw, and 1.3% a portable generator. About a quarter (25.5%) indicated they had none of the listed equipment to aid in a response. Despite these limitations in formal training and gear, the willingness to help is very high. An overwhelming 87.9% of participants expressed that they would be *"very willing"* to volunteer in the event of a future cyclone. In fact, many indicated they could sustain volunteering for multiple days: 38.9% said they are available for more than five days of continuous volunteering if a cyclone struck, on top of 34.9% who could do 1–2 days.

When asked about their perceptions of community-level readiness, respondents gave mixed opinions on whether the current volunteer base is sufficient. While 63.1% *agreed* that their community has enough trained volunteers to handle a cyclone emergency, a significant 36.9% *strongly disagreed* with that statement. This polarization suggests that roughly one-third of the population feels a clear shortage of trained volunteers, even as others are confident in community capacity. It likely reflects uneven distribution of volunteer training and organization – some neighborhoods may have active volunteer groups (leading those residents to feel confident), whereas others do not. In summary, the community's volunteer response capacity is characterized by high individual motivation but relatively low formal organization. People are eager to help and many have done so in past disasters, yet structured frameworks to train, equip, and coordinate these volunteers are limited. This points to an

opportunity: if the existing goodwill and experience of local volunteers can be channeled into organized networks with proper training, the overall community response to cyclones could become faster, safer, and more effective.

Risk Perception and Support Needs

Findings on risk perception show that most respondents are keenly aware of the cyclone threat and its potential severity. Nearly 57% expect a severe cyclone is likely to impact their community within the next five years (44.3% "agree" and an additional 12.8% "strongly agree"), whereas only about 8.7% disagreed with that prospect (the remainder were neutral). In a similar vein, an even larger majority anticipates serious consequences if a cyclone hits: roughly 61.8% believe that any such event would result in serious damage to their community, with negligible disagreement on this point. These figures suggest a high level of risk awareness – residents largely accept that they live in a cyclone-prone area and that the potential impacts could be severe. This awareness may be shaped by recent history; for instance, Cyclone Shaheen's destructive impact in the region is a fresh memory for many.

Table 3. Risk perception and awareness among respondents (N = 149)

#	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	A severe cyclone is likely to hit my community within 5 years.	4.7%	4.0%	34.2%	44.3%	12.8%
2	If a cyclone hits, the damage will be serious.	0.7%	4.7%	32.9%	49.7%	12.1%
3	I feel confident my household can protect itself.	2.0%	10.7%	26.8%	47.7%	12.8%
4	I trust official warnings from NCEM/Met-Office.	0.7%	0.7%	5.4%	49.7%	43.6%
5	My neighbours would help each other during a cyclone.	0.0%	1.3%	10.1%	49.0%	39.6%

Many respondents also expressed confidence in their own household's ability to protect itself, although this confidence is not uniform. About 60.5% agreed or strongly agreed with the statement "I feel confident my household can protect itself" during a cyclone, whereas roughly one in eight (12.7%) lacked such confidence (the rest were ambivalent). This indicates that while most people trust their preparedness or coping ability to some extent, a notable minority do not feel adequately prepared to handle a cyclone on their own. Importantly, trust in official early warnings is extremely high in this community. An almost unanimous 93.3% of respondents said they trust alerts and warnings from authorities (such as NCEM and the Met Office) regarding cyclones. This near-universal trust bodes well for emergency management, as it suggests residents are likely to heed evacuation orders or other official instructions during a cyclone. Furthermore, the social fabric of these communities appears strong: 88.6% of respondents agreed that neighbors would help each other in the event of a cyclone disaster. Such a high level of expected social support reflects robust community cohesion and indicates that in times of crisis, informal mutual aid would supplement formal response efforts. Overall, the risk perception data paint a picture of a community that is highly aware and concerned about cyclone risks, largely confident in official information, and bolstered by interpersonal trust and solidarity – all of which are positive factors for collective resilience.

In terms of support needs, respondents clearly prioritized certain measures that would help them feel better prepared for future cyclones. When asked to choose what kind of support or resources would most help their household's preparedness, the top choice (by a wide margin)

was more community-based training programs. A majority (55.7%) selected additional training – such as workshops, drills, or education sessions – as the most helpful support to bolster their readiness. This indicates a strong demand for knowledge and skills at the community level; people want to learn how to prepare and respond effectively. The second-most cited support need was subsidized preparedness kits or equipment (12.8%). This suggests that some families may lack resources to acquire items like generators, emergency kits, or home reinforcements, and would benefit from financial assistance or distributions of such tools. Close behind, about 12.1% of respondents favored establishing neighborhood committees dedicated to disaster preparedness. This aligns with the earlier finding that only a minority of communities currently have active emergency committees – many see value in forming local groups to coordinate efforts. Additionally, 10.1% pointed to the need for volunteer coordination centers or systems, reflecting the desire for better organized volunteer response at the local level. A smaller fraction mentioned improved access to insurance (only 1.3%, perhaps due to limited awareness or affordability of insurance) and 8.1% suggested other miscellaneous forms of support. These preferences reinforce the quantitative findings: the community is asking for exactly those enhancements that the data identified as gaps (training, organized committees, equipment, etc.). It highlights an understanding among residents that local engagement and capacity-building are key to resilience. In summary, there is a pronounced community appetite for more training opportunities and organized preparedness initiatives. Such support, if provided, would address the current shortfalls in household and community preparedness and likely improve overall readiness for the next cyclone.

Discussion

The above results provide a comprehensive assessment of how communities on Oman's Al Batinah coast are bracing for tropical cyclones, and they reveal a blend of encouraging strengths and critical gaps. In interpreting these findings, it is useful to relate them to the study's research questions and to situate them within the frameworks of community resilience theory and established disaster risk reduction principles such as the Sendai Framework. Overall, the patterns observed align with previous research on disaster preparedness and volunteerism, while also highlighting unique aspects of the Omani context.

With regard to the first research question on the current level of disaster preparedness *(RQ1)*, our findings depict a community that is partially prepared – combining high awareness and basic readiness with limited proactive planning. This outcome is consistent with the concept of community resilience, which posits that preparedness is a core component of resilience but one that requires both knowledge and action (Twigg, 2015). On the positive side, virtually all households receive early warning alerts, and many have emergency kits, indicating that information dissemination and basic preparedness actions are taking root. This aligns with Oman's national efforts to improve early warning systems after past cyclones (Al-Manji, 2022) and reflects progress toward the Sendai Framework's Priority 1, which emphasizes risk knowledge and information access. However, the low prevalence of written plans (14.1%) and physical mitigation measures (like flood barriers in only 16.8% of homes) signals a gap between awareness and concrete action. This gap is not unusual in disaster preparedness research – often high risk perception does not fully translate into household-level investments (Ajzen, 1991). In the context of the theory of planned behavior, even though people recognize the threat, other factors (e.g. optimism bias, cost, lack of know-how) may impede turning that recognition into preparedness behaviors (Ajzen, 1991). From a policy perspective, our results confirm what Al Ruwaithi (2019) observed in the Gulf region: disaster management has traditionally been top-down, assuming government will shoulder most responsibilities, which

can lead to less initiative at the community level. The strong reliance on official SMS alerts and the paucity of community-led drills or plans in Al Batinah communities echo this dynamic. Historically, Oman's disaster strategy focused on centralized response and infrastructure protection (Al Ruwaithi, 2019), and only recently has there been a push to engage communities more directly (Jones, 2024). Our study's findings underscore the importance of that shift. In line with community resilience theory, a truly resilient community would exhibit not just awareness, but organized preparedness activities, social learning, and self-organization (Norris et al., 2007). The limited participation in drills (32.2%) and few local emergency committees suggest that Al Batinah communities have yet to attain this ideal. Indeed, participants themselves recognize these gaps, calling for more training and community committees. This is a clear indication that while official early-warning systems are robust in Oman, the next step is to empower communities to take proactive preparedness measures, a notion strongly advocated by the Sendai Framework's all-of-society approach (Stevens, 2017).

Notably, the overall preparedness in these communities appears to be largely reactive and incomplete, echoing Oman's historical pattern of reactive emergency management (Al-Manji, 2022). The absence of household emergency plans and low uptake of insurance point to a continuing mindset of relying on post-disaster assistance or fate, rather than pre-disaster planning. This finding is consistent with observations in other contexts that, without regular exposure to smaller-scale events or drills, communities may remain complacent (Paton & Johnston, 2001, as discussed in the literature) – a challenge that Oman's nascent public preparedness campaigns (Jones, 2024) aim to overcome. In summary, *RQ1 (preparedness levels)* can be answered by stating that coastal Omani communities are aware and somewhat equipped, but not thoroughly prepared. They excel in receiving and trusting warnings (a crucial aspect of resilience), yet fall short in local planning and protective actions, which suggests a need for continued community education and engagement.

Addressing the second research question *(RQ2)* on the capacity and readiness of community volunteers, our results indicate a high degree of individual willingness and experience but a lack of formal structure. A strong majority have been involved in disaster volunteering and an even larger share are willing to do so in the future, reflecting Oman's cultural norm of communal support and altruism. This aligns with accounts from Cyclone Shaheen's aftermath, where over 20,000 people from around the country spontaneously converged to help. Such phenomena exemplify what disaster researchers call *"emergent behavior"* – spontaneous organizing of citizens to fill unmet needs (Stallings &Quarantelli, 1985). Our data, which show that only one-third of volunteers are affiliated with an organization, support this: most volunteers are spontaneous, unaffiliated responders. This situation is double-edged. On one hand, it's a testament to strong social capital and community resilience – people step up to help neighbors, which is an invaluable resource. Indeed, social capital theory posits that communities with robust networks and norms of helping one another cope better with disasters (Nakagawa & Shaw, 2004; Dynes, 2005). The extremely high willingness to volunteer and the expectation of neighborly help (nearly 89% believe neighbors will assist each other) in Al Batinah align well with this theory, suggesting that bonding social capital in these communities is strong. This social cohesion is a positive indicator for disaster resilience, as it can facilitate quicker recovery and mutual aid (Nakagawa & Shaw, 2004).

On the other hand, the lack of formal training and coordination among volunteers points to vulnerability in crisis response. Our findings show that over 26% of respondents have no emergency training, and many others only have basic first aid. While basic first aid is a good start, more specialized skills (e.g. light search & rescue, fire safety) were much rarer. The shortage of equipment (few have tools like generators or chainsaws) further limits what

volunteers can safely do. These gaps mirror the coordination challenges observed during Cyclone Shaheen: while the volunteer turnout was immense and laudable, authorities had to scramble to organize these helpers on the fly. Reports noted that the spontaneous surge of volunteers, though crucial, also strained coordination and highlighted the need for better management structures. In our study, a sizable minority of residents doubt their community has enough *trained* volunteers, reflecting an awareness of this coordination problem. This situation underscores a point emphasized by international best practices: *volunteer efforts need to be planned and integrated before disasters strike*. The Sendai Framework explicitly calls for strengthening the role of volunteers through training and integration into disaster planning (Stevens, 2017). Likewise, the National Spontaneous Volunteer Strategy developed in other contexts (e.g. Australia's NEMP, 2015) warns that uncoordinated volunteer influxes can overwhelm response systems if not pre-arranged. Our findings resonate with these views. They suggest that Oman's volunteer capacity is abundant in spirit but could be dramatically enhanced in practice by establishing organized channels. For example, forming Community Emergency Response Teams (CERT) or local volunteer brigades with regular training would convert the evident social capital into a more reliable response capacity. It is encouraging that 10% of respondents specifically requested volunteer coordination centers in the future – essentially voicing the need for exactly such structure. In sum, *RQ2 (volunteer capacity*) can be answered as follows: the community has a high willingness to help and considerable firsthand volunteer experience, but this potential is not fully realized due to underdeveloped organizational frameworks and training. This interpretation is consistent with both community resilience theory (which values social networks and civic engagement) and previous disaster case studies in Oman (which have shown spontaneous volunteerism thriving alongside coordination shortcomings).

The third research question *(RQ3)* asks how risk perception and past cyclone experience influence preparedness and volunteer behavior. Our results provide evidence of a meaningful link between these factors and people's actions. First, those with direct experience of cyclones have in some cases translated lessons learned into concrete changes – about 19.5% of respondents (nearly all of whom had lived through a major cyclone) said they altered their home or habits afterwards. This finding aligns with the broader understanding that experience can be a powerful teacher in disaster preparedness. Prior studies have noted that experiencing a disaster often increases risk perception and the likelihood of taking precautionary measures in the future (Paton et al., 2008; Miceli et al., 2008 – cited in the literature review). In our context, many residents faced Cyclone Gonu's devastation or Cyclone Shaheen's floods; it is likely that these experiences made the threat tangible and personal, spurring at least some to reinforce their houses or seek information on preparedness. This trend is consistent with protection motivation theory, which holds that seeing or feeling the impacts of a hazard heightens perceived severity and vulnerability, thereby motivating protective action (Rogers, 1983). While we did not directly measure behavior before and after experience, the correlation is suggestive: those who had to repair cyclone damage, for instance, might be among those now keeping emergency kits or copies of documents.

Second, risk perception in general is high in this community, and this appears to be positively correlated with readiness to act. An overwhelming majority (87.1%) of respondents believe a severe cyclone is at least likely in the near future, and nearly two-thirds expect very serious damage if one occurs. This high risk awareness likely contributed to the relatively widespread basic preparedness (e.g. the 69.1% with supply kits) and especially to the strong willingness to volunteer (87.9% "very willing"). People who perceive a clear and present danger may be more inclined to engage in preparedness and response efforts, a relationship supported by the theory of planned behavior (which includes attitudes toward the behavior as a determinant of

intention) and empirical research on disaster readiness (Ajzen, 1991; Paton, 2003). Additionally, we found that trust in official warnings is nearly universal, and perceived self-efficacy (confidence in one's household protection) is fairly high for the majority. These cognitive factors are crucial. High trust in authorities means residents are likely to comply with evacuation orders or preparedness guidance, which can significantly reduce harm when cyclones materialize. Meanwhile, confidence in one's ability to handle a disaster can encourage proactive steps; however, if overconfidence is misplaced it might also lead some to underestimate the need for external help or further preparation. In our data, about 12% lacked confidence in their household's preparedness – these individuals might represent those who have not prepared or who are aware of their vulnerability (perhaps the elderly or those in weaker housing), and they may need additional support or encouragement to boost their preparedness.

The social factors measured – particularly perceived community cohesion – are another important aspect of resilience. The fact that nearly 89% of respondents believe neighbors would help one another indicates a strong social cohesion and mutual trust. This kind of social capital can greatly influence outcomes in disasters: communities with higher cohesion often have more effective informal response and recovery (Nakagawa & Shaw, 2004; Dynes, 2005). In our study, this likely contributes to why so many are willing to volunteer – they expect others would do the same for them. It is also notable that those who know a volunteer personally (about 62% of respondents) might have higher propensity to volunteer themselves; social networks can spread norms of helping behavior (as suggested by social contagion theories in volunteerism). Taken together, the data suggest that risk perception and past experience are indeed driving forces behind the community's preparedness actions and volunteerism. Those who have seen the worst are adjusting their behavior, and the collective sense that "a big one could happen again" is keeping preparedness on the agenda for many households. This underscores the importance of maintaining risk awareness even during quiet periods – something that public education campaigns can help with (Jones, 2024) – so that complacency does not erode the lessons learned from Gonu and Shaheen. In sum, *RQ3 (influence of perception/experience)* can be answered by affirming that higher risk perception and direct experience correlate with more proactive behavior in this community, reinforcing theoretical expectations that seeing risk and believing in its likelihood motivate preparedness and volunteering (Patel et al., 2017; Ajzen, 1991).

Regarding *RQ4*, which inquires about the social, economic, and institutional factors linked to higher or lower preparedness and volunteer participation, our findings allow us to identify a few such factors, albeit in a descriptive manner. Education emerged as one potential factor: respondents with higher educational attainment (e.g. university degrees) appeared more likely to report preparedness measures (like having kits, plans, etc.), and were also well-represented among those aware of evacuation routes and insurance. This mirrors patterns in disaster research globally – higher education often correlates with greater risk awareness and better preparedness (Cutter et al., 2014). Educated individuals may have more access to information about disasters and more confidence in acting on that information. Similarly, economic factors like home ownership and income level can influence preparedness. While our survey did not directly measure income, home ownership was common in the sample and was anecdotally linked to taking more mitigation measures (homeowners might be more inclined to invest in protecting property). This is intuitive and aligns with findings by Cutter et al. (2014) that communities with stronger socio-economic status have higher resilience scores. Those who own assets have more to lose and thus a greater incentive to prepare (and conversely, very low-income households might lack resources to invest in preparedness, which is an important consideration for targeting assistance).

Another factor is prior disaster experience – as discussed, those who went through a cyclone and saw its impacts often became more prepared and engaged. Our data specifically pointed out that prior experience and formal training were associated with a greater likelihood of volunteering. In the survey, a considerable share of the active volunteers had either been affected by a past cyclone or had some training background. This suggests that experiential knowledge or training imbues people with a sense of capability and duty to help. This aligns with literature noting that disaster survivors sometimes become disaster volunteers, turning their experience into action (e.g. veterans of past quakes joining volunteer teams in subsequent ones, as reported by Nakagawa & Shaw, 2004, in terms of building social bonds). Institutional factors also play a role: communities that had an existing emergency committee or local organization (around 41% did) arguably provide a platform that encourages residents to prepare and participate. Those without any local institution may leave individuals to act entirely on personal motivation, which can be a barrier for some. Interestingly, our results hint that where local committees exist, perceptions of community volunteer sufficiency were higher – pointing to the value of institutionalizing volunteer networks (Dynes, 2005).

In sum, *RQ4 (factors associated)* can be answered by highlighting that education, prior experience, training, and existing community organizations are all associated with higher preparedness and volunteerism in this Omani context. Conversely, those lacking these attributes – for instance, less educated or newer residents who haven't experienced a cyclone – might exhibit lower preparedness levels. These insights are useful because they indicate where interventions could be aimed (e.g. public awareness campaigns might focus on newer communities or less-educated groups; incentives could encourage home owners to purchase insurance or retrofit houses). They also underscore the importance of integrating disaster education into general education and community activities, thereby raising the baseline of preparedness across all segments of society.

The fifth research question *(RQ5*) asks about the critical gaps in community preparedness and what improvements can be recommended. The empirical gaps have been well-documented in our results: very few households have formal plans, physical protection measures are scarce, many volunteers lack training, and community-level organization is limited. Additionally, open-ended feedback from respondents emphasized needs such as better infrastructure (e.g. drainage, shelters), more community education, and improved official communication – even though alerts are widespread, some may desire more localized or frequent updates. These gaps closely correspond to the priorities the community members themselves identified: over half want more training opportunities, and significant numbers call for local committees and volunteer coordination mechanisms. From a theoretical standpoint, these deficiencies indicate that the community has not yet achieved the ideal state of a "disaster-resilient community" as characterized by frameworks like Twigg's (2015) or the UNISDR's recommendations. Key elements like preparedness planning, community drills, and volunteer integration are areas for improvement. The Sendai Framework's Priority 4 (Enhancing disaster preparedness for effective response) explicitly includes the establishment of local disaster risk reduction strategies and the training of volunteers (Stevens, 2017). Our findings highlight that at the community level, Al Batinah is still developing these aspects.

Therefore, several improvements are recommended. Strengthening household-level preparedness is paramount – for example, initiatives to encourage or assist families in developing written emergency plans would address the most glaring household gap. This could involve distributing simple planning templates or conducting neighborhood workshops on how to create a family emergency plan. Enhancing physical mitigation (like flood defenses around homes) might require government support, such as providing sandbags or technical guidance for home elevation in flood-prone zones. On the community side,

establishing or revitalizing local disaster committees in each locality would create a focal point for preparedness activities. These committees could organize regular drills, identify local shelter locations (improving on the 60% awareness level we found), and serve as liaisons with government emergency services. The fact that 12% of respondents specifically asked for neighborhood committees shows grassroots interest in this solution. Correspondingly, better volunteer coordination is crucial: formal training programs (perhaps a Community Emergency Response Team model adapted to Oman) could be introduced so that volunteers receive basic multi-hazard training beyond just first aid. Volunteers could also be registered and equipped in advance, so that when a cyclone warning comes, there is a roster of trained locals ready to act in cooperation with authorities. This ties back to international best practices and the Sendai Framework's call for leveraging volunteer capacities (Stevens, 2017). The Oman National Emergency Management agency (NCEM) could consider developing a volunteer management plan, learning from models elsewhere (NEMP, 2015), to integrate the huge spontaneous volunteer energy into their official response framework.

In terms of broader institutional support, respondents' voices point to areas like infrastructure and insurance. While only a small percentage directly highlighted insurance access, it is notable that only one-quarter have insurance despite living in high-risk zones. This suggests a possible role for policy: authorities or the private sector might introduce subsidized insurance schemes for flood/cyclone coverage or micro-insurance options to increase uptake. Infrastructure improvements (e.g. improving drainage systems, building floodwalls or cyclone shelters in vulnerable villages) were mentioned in qualitative feedback and align with what a comprehensive risk reduction approach would entail (Al-Manji et al., 2020). Such measures are beyond the scope of individual households and require government action, but they complement community preparedness by reducing the hazard exposure. Finally, maintaining the high level of risk awareness and trust is crucial. Public education campaigns (like the nationwide campaign noted by Jones (2024)) should continue and expand, making sure to reach younger generations and new residents who did not experience Gonu or Phet. Engaging local leaders, schools, and mosques in disseminating preparedness messages can reinforce the culture of readiness.

In conclusion of this discussion, the findings from Al Batinah's communities generally support established theories of disaster resilience and volunteerism. They demonstrate that strong social capital and risk awareness are present, which are strengths to build upon (Norris et al., 2007; Dynes, 2005). At the same time, they reveal that structural and organizational aspects of preparedness are lagging – a situation not uncommon in regions that are only intermittently struck by disasters. The results both confirm concerns raised in prior literature about Oman's community-level preparedness gaps (Al-Manji, 2022; Al Ruwaithi, 2019) and provide empirical data to guide improvements in line with the Sendai Framework objectives. By addressing the identified gaps with targeted, theory-informed interventions, Omani authorities and communities can enhance their resilience against the mounting cyclone threats in the years ahead.

Conclusion

This study assessed community disaster preparedness and volunteer response capacity along Oman's cyclone-exposed Al Batinah coast using survey data from 149 residents. Findings show high risk awareness but incomplete household preparedness: only 14.1% reported a written emergency plan, uptake of flood insurance was 25.5%, and participation in drills and protective home modifications was limited, indicating a gap between recognizing danger and undertaking comprehensive preparatory action. Volunteerism is a major strength—87.9%

expressed strong willingness to assist in a future cyclone and 62.4% had volunteered previously—yet efforts remain largely ad hoc, with roughly one-third affiliated to an organized emergency group and 26.2% reporting no formal training, which constrains efficiency and safety. Prior experience appears to catalyze protective behavior: about one-fifth reported changing their home or habits after experiencing Gonu or Shaheen, and those facing damage or evacuation showed greater vigilance. Risk perception and social capital are robust: most anticipate another severe cyclone, 93% trust official warnings, and 88.6% expect neighbors to help, creating favorable conditions for compliance and mutual aid. Community-identified priorities align with observed gaps: 55.7% called for more training and education, alongside interest in neighborhood committees, volunteer coordination centers, subsidized preparedness equipment (12.8%), and improved infrastructure and warning dissemination. To translate potential into resilience, a locally driven program is recommended: establish or strengthen community committees to lead planning, drills, and hazard mapping; expand multi-hazard training (first aid, light search and rescue, evacuation) inclusive of women and youth; formalize volunteer networks with rosters, roles, basic equipment, and coverage; support household mitigation and promote affordable insurance; and maintain, localize, and diversify public warnings and education. Future work should track preparedness longitudinally, replicate assessments in other regions, probe barriers qualitatively, develop an Oman-tailored resilience index, and evaluate pilot interventions. Acting on these insights can shift Al Batinah from reactive response toward sustained, community-anchored resilience.

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