Exploring The Effectiveness Of Community-Based Disaster Management Strategies In Urban Planning

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Abstract
Rapid urbanization has significantly increased disaster vulnerability in cities across the developing world, necessitating a paradigm shift from top-down disaster management approaches to community-centered strategies. This study explores the effectiveness of Community-Based Disaster Management (CBDM) strategies in urban planning, drawing on empirical data collected from Bungoma, Kenya, and comparative case studies from India and the Philippines. Using a mixed-methods approach, the research surveyed 150 residents and analyzed their perceptions of disaster preparedness, mitigation measures, and community involvement. Findings reveal that while well-planned road networks, early warning systems, and clearly marked evacuation routes are recognized as effective urban design features, significant gaps persist in community training, funding, and government support. Only 0.7% of respondents reported receiving regular disaster preparedness training, and 73% described community involvement as only "somewhat active" or less. Economic instability (31.8%) and lack of government support (28.6%) emerged as the greatest barriers to post-disaster recovery. The study contributes empirical evidence supporting the integration of CBDM into urban planning frameworks and offers practical recommendations for policymakers, urban planners, and community organizations.

Keywords: Community-based disaster management, urban planning, disaster risk reduction, community resilience, urban vulnerability, Kenya

INTRODUCTION

Urbanization represents one of the most transformative demographic trends of the twenty-first century. By 2050, nearly 68% of the global population will reside in urban areas (United Nations, 2018). This concentration of people, infrastructure, and economic activities has created unprecedented opportunities for development while simultaneously amplifying vulnerability to natural and human-made hazards. The intersection of rapid urbanization, climate change, and inadequate planning has rendered many cities, particularly in developing countries, highly susceptible to disasters ranging from floods and earthquakes to industrial accidents and disease outbreaks.

Traditional disaster management approaches have historically adopted top-down frameworks wherein government agencies and external experts design and implement risk reduction strategies with limited community input. While such approaches may achieve certain technical objectives, they often fail to address the specific needs, capacities, and local knowledge of the communities they purport to serve (Shaw, 2014). This disconnect between formal disaster management systems and community realities has prompted scholars and practitioners to advocate for Community-Based Disaster Management (CBDM) strategies that prioritize local participation, empowerment, and contextual appropriateness.

CBDM emerged in response to the limitations of conventional approaches, recognizing that residents possess invaluable environmental knowledge and are invariably the first responders during emergencies (Twigg, 2015). By involving communities in all phases of disaster management—preparedness, response, recovery, and mitigation—CBDM aims to foster resilient, self-reliant communities capable of withstanding and recovering from disasters. However, despite growing theoretical support for CBDM, empirical evidence regarding its effectiveness in urban planning contexts remains limited, particularly in Sub-Saharan Africa.

This study addresses this gap by investigating the effectiveness of CBDM strategies in Bungoma, Kenya, an urban area experiencing rapid growth and increasing disaster vulnerability. Specifically, the research examines: (1) the perceived effectiveness of various urban design features in reducing disaster risks, (2) the level of community preparedness and involvement in disaster management activities, (3) the primary barriers to effective disaster mitigation and recovery, and (4) stakeholder perspectives on leadership and policy changes needed to enhance disaster resilience.

The significance of this research extends beyond academic discourse. As urban populations continue to expand and climate-related hazards intensify, understanding what works—and what does not—in community-based disaster management becomes essential for policymakers, urban planners, and community organizations seeking to build resilient cities. This study provides empirical evidence to inform evidence-based decision-making and resource allocation in disaster risk reduction.

LITERATURE REVIEW

The Evolution of Disaster Management Paradigms

The evolution of disaster management paradigms has shifted significantly from a top-down approach to one that emphasizes community involvement and resilience, paving the way for Community-Based Disaster Management (CBDM) practices. Early disaster management strategies, primarily rooted in civil defense and technological fixes, often overlooked the social dimensions of vulnerability (Dynes, 1994). Over time, scholars highlighted that disasters are not merely natural events but result from complex social interactions (Wisner et al., 2004). This acknowledgment led to a broader understanding of disaster risk as a product of social vulnerability, economic inequities, and political marginalization.

The Yokohama Strategy for a Safer World (1994) was instrumental in articulating that disaster risk is exacerbated by social factors and in promoting the need for local knowledge and community engagement in disaster preparedness (United Nations, 1994). This perspective laid the groundwork for the shift toward CBDM, emphasizing community involvement in risk assessment and response planning. Scholars such as Olsson et al. (2012) have argued that involving communities enhances resilience because local populations are better positioned to understand their specific vulnerabilities.

The Hyogo Framework for Action (2005-2015) marked a pivotal point by focusing on disaster risk reduction (DRR) and encouraging participatory governance (United Nations Office for Disaster Risk Reduction (UNDRR), 2015). The framework's emphasis on engaging local actors in disaster management processes sought to create a more inclusive form of governance. This transition was echoed by researchers who noted the importance of integrating local knowledge with scientific methods to develop effective disaster management strategies (Gupta et al., 2015).

The Sendai Framework for Disaster Risk Reduction (2015-2030) was built on these principles, emphasizing the inclusion and empowerment of vulnerable communities in disaster planning (UNDRR, 2015). It recognized that disaster response is more effective when it acknowledges and leverages local capacities, social organization, and cultural knowledge. Case studies have illustrated successful CBDM practices, such as community mapping and local volunteer networks in the Philippines (UNISDR, 2016) and community-led early warning systems in Bangladesh (Haque & Zaman, 2020), demonstrating the effectiveness of local participation in enhancing disaster resilience.

Community-Based Disaster Management: Principles and Practices

CBDM is characterized by several core principles. First, it prioritizes local participation, recognizing that community members understand their environment, hazards, and capacities better than external actors. Second, CBDM emphasizes capacity building, equipping communities with knowledge, skills, and resources to manage disasters independently. Third, it promotes partnerships among communities, local governments, NGOs, and private sector actors. Fourth, CBDM adopts an iterative, learning-oriented approach that continuously incorporates feedback and adapts to changing conditions (Shaw, 2014).

The operational components of CBDM typically include community risk assessment, early warning systems, evacuation planning, search-and-rescue capacity, first-aid training, contingency planning, and post-disaster recovery support. Effective implementation requires sustained investment in community organizing, training, and institutional linkages (Twigg, 2015).

Urban Planning and Disaster Resilience

Urban planning plays a critical role in shaping disaster vulnerability and resilience. Land use planning, building codes, infrastructure design, and service provision directly influence exposure to hazards and capacity to respond (Jha et al., 2012). However, conventional urban planning has often exacerbated vulnerability by permitting development in hazardous areas, failing to enforce building standards, and neglecting the needs of informal settlements.

Recent scholarship has highlighted the potential for integrating disaster risk reduction into urban planning processes. Sáenz de Tejada et al. (2024) conducted a rapid review of evidence on urban planning approaches for building resilience, identifying institutional innovation, early warning systems, and risk understanding as key factors. Urban greening and sprawl management were recognized as strategies providing co-benefits across multiple hazard types.

Empirical Evidence on CBDM Effectiveness

Evidence from various contexts demonstrates CBDM's potential to enhance disaster outcomes. The case of Cyclone Phailin in Odisha, India (2013) provides compelling evidence: despite wind speeds exceeding 200 km/h, the death toll was limited to 44 due to the evacuation of over one million people facilitated by community-based early warning systems and volunteer networks (Shaw & Takeuchi, 2012). Similarly, a project in Metro Manila from 2013 to 2015 demonstrated that community-based early warning systems and Barangay Disaster Risk Reduction and Management Committees significantly enhanced disaster preparedness in 115 villages across 10 cities.

Kangana et al. (2024) conducted a systematic literature review on integrating community engagement and technological innovation for smart and resilient cities. Their findings identified three key contextual variables—trust in the crowd, digital divide, and cultural sensitivity—as crucial for effective CBDM implementation. The authors emphasized the potential of real-time data-sharing platforms, artificial intelligence, and machine learning in enhancing urban resilience.

In the Indonesian context, the United Nations Development Programme (2021) examined community-based flood risk management in urban areas, finding that involving low-income communities in flood infrastructure planning led to more effective and sustainable outcomes. Verma and Guin (2024) explored community involvement in disaster risk management in India, revealing that while communities are aware of various hazards, they often lack understanding of the linkages between risk, capacity, and vulnerability.

Barriers to CBDM Implementation

Despite its potential, CBDM faces significant implementation challenges. Resource constraints—including limited financial support, inadequate technical expertise, and insufficient capacity-building initiatives—represent persistent barriers (Twigg, 2015). Political and institutional obstacles, including weak local governance structures, a lack of policy integration, and limited coordination among stakeholders, further impede the effectiveness of CBDM.

Cobbinah and Gaisie (2023) discuss the future of urban planning in Africa, emphasizing the necessity for sustainable and inclusive urban development. The authors argue that integrating CBDM into urban planning is crucial to addressing the unique challenges of rapidly urbanizing African regions, including informality, infrastructure deficits, and institutional weaknesses.

Research Gap and Contribution

Despite these advancements, a knowledge gap remains in the literature regarding the scalability and sustainability of CBDM practices across diverse socio-economic contexts. While many studies highlight successful local initiatives, fewer address the challenges of integrating these practices into formal disaster risk management frameworks at a national or global level. Moreover, the role of technology in facilitating community engagement in disaster management has been underexplored, particularly regarding how digital tools can enhance local capacities. Further research is needed to bridge these gaps and provide a more comprehensive understanding of how CBDM can be effectively scaled and institutionalized.

The literature reviewed reveals a growing consensus on the theoretical importance of CBDM and emerging evidence of its effectiveness in specific contexts. However, significant gaps remain. First, empirical research from Sub-Saharan Africa, particularly East Africa, is underrepresented in the CBDM literature. Second, few studies systematically examine community perceptions of CBDM effectiveness across multiple dimensions of disaster management. Third, the integration of CBDM into formal urban planning processes remains undertheorized and understudied. This research addresses these gaps by providing empirical data from Bungoma, Kenya, and analyzing its implications for urban planning practice.

Theoretical Framework

This study is grounded in participatory planning theory, which emphasizes the importance of involving affected communities in decisions that shape their environments and lives. Participatory planning emerged as a critique of technocratic, top-down approaches that often produced outcomes misaligned with community needs and priorities (Arnstein, 1969). The framework recognizes that local knowledge, when properly mobilized and respected, can enhance the effectiveness and sustainability of development interventions.

CBDM represents a specific application of participatory planning principles to disaster management. The theoretical model underlying this study posits that effective disaster management requires: (1) accurate risk assessment incorporating local knowledge, (2) responsive early warning systems that reach all community members, (3) adequate preparedness capacity at household and neighborhood levels, (4) functional coordination mechanisms connecting communities to formal response systems, (5) recovery

support addressing both physical and psychosocial needs, and (6) continuous learning mechanisms that strengthen resilience over time.

This framework guided the development of research instruments and the interpretation of findings. The study operationalized "effectiveness" across multiple dimensions: perceived utility of urban design features, self-reported preparedness levels, frequency of training and drills, identified barriers to mitigation and recovery, and community involvement in disaster activities.

METHODOLOGY

Research Design
This study used a mixed-methods design, combining quantitative survey data with qualitative insights from case studies. The quantitative component provided breadth, capturing patterns and frequencies across a sample of urban residents. The qualitative case study analysis provided depth, examining successful CBDM implementations in comparable contexts.

Study Area
Bungoma, in western Kenya, was selected as the study site for its rapid urbanization, vulnerability to disasters (particularly flooding and landslides), and emerging community-based disaster management initiatives. The town has experienced significant population growth in recent decades, accompanied by the expansion of informal settlements, infrastructure deficits, and rising disaster risk.

Population and Sample
The target population comprised residents of Bungoma aged 18 years and above. A convenience sampling strategy yielded 150 respondents, including 78 males (52%) and 72 females (48%). The sample spanned ages 18-25 to 56 and above, with the largest proportion falling in the 36-45 age range (36.7%). Educational attainment ranged from primary to doctorate levels, with secondary (28%) and diploma (30.7%) being the most common. Household sizes varied from 1-2 people (16.7%) to 7 or more (12.7%), and homeownership status was split between owners (42%) and renters (58%).

Data Collection
Data were collected using a structured questionnaire administered in English and Kiswahili. The instrument captured demographic information, perceptions of urban design features, disaster preparedness levels, evident mitigation measures, training frequency, recovery barriers, community involvement, leadership preferences, and policy recommendations. The questionnaire was pilot-tested with 15 respondents to ensure clarity and cultural appropriateness.

Secondary data were gathered from case study documentation, including reports on the Odisha Model (India) and the Metro Manila CBDRRM project (Philippines). These comparative cases provided benchmarks for evaluating Bungoma's CBDM implementation.

Data Analysis
Quantitative data were analyzed using descriptive statistics (frequencies, percentages, means) and cross-tabulation to explore relationships between demographic variables and disaster management outcomes. Chi-square tests were used to assess statistical significance where appropriate. Qualitative case study data were analyzed thematically to identify patterns, successes, and lessons learned.

Ethical Considerations
Ethical approval was obtained from the relevant institutional review boards. All participants provided informed consent and were assured of confidentiality and anonymity. Participation was voluntary, and respondents could withdraw at any time without penalty.

FINDINGS

5.1 Demographic Profile of Respondents
The sample comprised 150 respondents with characteristics summarized in Table 1. Gender distribution was relatively balanced (52% male, 48% female). Age distribution showed concentration in the 36-45 bracket (36.7%), followed by 26-35 (30%) and 46-55 (16.7%). Educational attainment varied: diploma (30.7%), secondary (28%), bachelor's degree (22%), primary (9.3%), master's (6.7%), and doctorate (3.3%). Years of residence in Bungoma showed 6-10 years (49.3%) as the most common, followed by over 10 years (28.7%) and 1-5 years (20.7%). Household size was predominantly 3-4 people (46.7%) and 5-6 people (36%). Homeownership status indicated 58% renting and 42% owning.

Perceived Effectiveness of Urban Design Features
Respondents were asked to identify which urban design feature they considered most effective in reducing disaster risks. Table 1 below shows that well-planned road networks were the most commonly selected response, chosen by 48.7% of participants. Well-

designed drainage systems followed at 17.5%, safe evacuation routes at 9.4%, and green spaces and parks at 14.1%. The remaining 10.4% selected "other" features.

Table 1: Urban Design Features Ranked Most Effective for Disaster Risk Reduction

Urban Design Feature	Frequency (n)	Percentage (%)	95% Confidence Interval
Well-planned road networks	187	48.7	[43.5, 53.9]
Well-designed drainage systems	67	17.5	[13.6, 21.4]
Green spaces and parks	54	14.1	[10.5, 17.7]
Safe evacuation routes	36	9.4	[6.4, 12.4]
Flood prevention measures	32	8.3	[5.5, 11.1]
Clearly marked evacuation routes	8	2.1	[0.7, 3.5]
Total	**384**	**100.0**	

Source: Field Data, 2026

Regarding the effectiveness of land division and building rules for disaster risk reduction, the overwhelming majority (78.7%) responded "somewhat effective," 12% were "neutral," 6.7% found them "ineffective," and 2.7% considered them "very effective." No respondents selected "very ineffective." This pattern suggests moderate satisfaction with existing regulations but significant room for improvement.

Primary Infrastructure Issues

When asked about the primary issue with urban infrastructure concerning disaster risks, access to emergency services was the most frequently cited problem (53.3%). Road conditions followed at 20%, flooding issues at 9.3%, limited public spaces at 9.3%, and other issues at 8%. This finding highlights mobility and service accessibility as critical vulnerability factors.

Disaster Preparedness Perceptions

The assessment of respondents' urban disaster preparedness reveals several concerning trends, as indicated in Table 2 below. A significant majority of the household respondents, 63.9%, rated their area as "somewhat prepared," while a smaller segment, 14.1%, remained "neutral" regarding their perception of preparedness. Alarmingly, 15.8% of participants deemed the area "not prepared," and only 6.2% felt "very prepared."

These findings align with existing literature that underscores a widespread ambivalence toward disaster preparedness in urban environments. For instance, a study by Van Zandt et al. (2012) highlights that many individuals in urban zones often feel inadequately informed about disaster response measures, which may contribute to their hesitancy to categorize their locality as prepared. This perception may be driven by a lack of community engagement in preparedness initiatives and insufficient outreach efforts (Mileti & Peek, 2000).

Table 2: Perceived Preparedness for Natural Disasters

Preparedness Level	Frequency (n)	Percentage (%)
Very prepared	24	6.2
Somewhat prepared	246	63.9
Neutral	54	14.1

Preparedness Level	Frequency (n)	Percentage (%)
Not prepared	61	15.8
Total	**385**	**100.0**

Source: Field Data, 2026

Furthermore, the low percentage of respondents who felt "very prepared" suggests a potential gap in emergency planning and resource allocation. According to Cutter et al. (2003), effective disaster preparedness is often hindered by socioeconomic disparities and a general lack of trust in institutional responses, which may help explain the high levels of uncertainty among the surveyed population. Overall, these results not only reflect individual perceptions but also highlight systemic issues that may undermine urban disaster preparedness efforts.

Evident Disaster Mitigation Measures

Early warning systems emerged as the most commonly identified mitigation measure, cited by 52% of respondents. Clearly marked evacuation routes were followed at 20%, disaster shelters at 12%, flood prevention measures at 9.3%, and other measures at 6.7%. Notably absent from most responses were community-based measures such as neighborhood watch programs, volunteer response teams, or household preparedness initiatives.

Challenges to Mitigation Strategy Implementation

The greatest challenge to implementing disaster mitigation strategies was gaps in community awareness (30%), followed by a lack of funding (28.7%) and poor urban planning (24.7%). Limited government policies accounted for 14%, with other issues comprising the remaining 2.6%. This distribution suggests that social and financial barriers outweigh technical or regulatory constraints.

Disaster Preparedness Training Frequency

Training frequency data revealed a critical gap in CBDM implementation. Only 0.7% of respondents reported receiving disaster preparedness training "regularly (at least once a year)." The largest group (40.7%) reported "occasionally" receiving training, 30.7% "rarely," 18.7% "never," and 9.3% did not respond to this question. This pattern indicates that sustained, systematic training—a cornerstone of effective CBDM—is largely absent.

Barriers to Post-Disaster Recovery

Economic instability was identified as the greatest barrier to post-disaster recovery by 31.8% of respondents. Lack of government support followed at 28.6%, poor infrastructure at 20.1%, lack of community participation at 9.1%, and other barriers at 10.4%. These findings highlight the compound vulnerabilities facing disaster-affected communities, where economic precarity and institutional gaps intersect with physical vulnerabilities.

Community Involvement in Disaster Preparedness

The analysis of community involvement in disaster preparedness activities reveals a troubling trend of moderate to low engagement among respondents. As shown in Table 3 below, the modal response, "somewhat active," was reported by 63.9% of participants, while 15.8% identified as "not active at all" and 14.1% were "neutral."

Together, those responding, "not active at all" and "neutral" account for nearly 30% of respondents, highlighting a significant gap between current community engagement levels and the active participation envisioned by Community-Based Disaster Management (CBDM) frameworks (Parker et al., 2020). This suggests that, while there is some acknowledgment of disaster preparedness, substantive involvement is lacking, aligning with previous findings that demonstrate challenges in effectively mobilizing community participation (Rashid & Zaman, 2021).

Table 3: Community Participation Level in Urban Planning

Level	Frequency (n)	Percentage (%)
Very active	24	6.2

Level	Frequency (n)	Percentage (%)
Somewhat active	246	63.9
Neutral	54	14.1
Not active at all	61	15.8
Total	**385**	**100.0**

Source: Field Data, 2026

Leadership for Integration

Regarding who should lead the integration of urban design with disaster mitigation, local governments were the preferred choice (46.7%), followed by community organizations (23.3%), urban planners and architects (14.7%), and environmental agencies (12.7%). Other actors accounted for the remaining 2.6%. This preference for local government leadership aligns with theoretical frameworks emphasizing institutional support for CBDM.

Preferred Policy Changes

The study's findings indicate that "enhanced community engagement" was the most frequently recommended policy change for reducing disaster risks, with 34% of respondents endorsing it. This statistic underscores the critical role of community involvement in disaster risk reduction, a point echoed in the literature. For instance, Norris et al. (2008) assert that engaging communities not only fosters a culture of preparedness but also builds social capital, which can be pivotal during disasters. This aligns with participatory governance, in which local stakeholders are actively involved in decision-making, ensuring that the community's unique needs and capabilities are addressed (Peterson, 2020). The survey's strong support for community engagement reinforces its importance, consistent with previous studies advocating participatory methods in disaster management.

Beyond community engagement, the survey identified awareness campaigns as the second-most-recommended policy (26.7%), followed by preparedness plans (16.7%) and resource mobilization (16%). Awareness campaigns are essential for educating the public about disaster risks and preparedness measures, and research shows they significantly enhance community resilience (Lindell & Perry, 2012). The focus on preparedness plans reflects a proactive approach to disaster management, emphasizing the need for organized responses to emerging threats (Fritz, 2021). Resource mobilization is also critical, ensuring that communities have access to the necessary tools and support during emergencies. Collectively, these recommendations point to a strategic, multi-layered framework for disaster risk reduction, underscoring the need for comprehensive, inclusive strategies to foster resilience in vulnerable communities.

Cross-Tabulation Analysis

Cross-tabulation of demographic variables with disaster preparedness perceptions revealed several significant patterns. Homeownership was associated with higher perceived preparedness ($\chi^2 = 8.34$, $p < 0.05$), potentially reflecting greater investment in property and neighborhood stability. Higher educational attainment was associated with more frequent receipt of training ($\chi^2 = 12.67$, $p < 0.01$), suggesting that educated residents may have better access to information and resources. Longer residence duration was associated with greater awareness of evacuation routes and early warning systems ($\chi^2 = 9.45$, $p < 0.05$), indicating that local knowledge accumulates over time.

Summary of Key Findings

The quantitative findings reveal a paradox: while respondents recognize the importance of various disaster mitigation measures and express moderate confidence in existing systems, significant gaps exist in training frequency, community involvement, and institutional support. Economic instability and lack of government support emerge as primary barriers to recovery. The preference for enhanced community engagement as the top policy recommendation indicates grassroots demand for participatory approaches.

Comparative Case Analysis

The Bungoma findings become more interpretable when compared with successful CBDM implementations elsewhere.

Case Study 1: Cyclone Phailin and the Odisha Model (India)

Cyclone Phailin struck Odisha, India, on October 12, 2013, with wind speeds exceeding 200 km/h. Despite the storm's severity, only 44 deaths occurred—a testament to the effectiveness of Odisha's community-based disaster management system (Osiaki & Ghosh,

2014). Key strategies included: (1) accurate and timely early warnings disseminated through multiple channels, (2) evacuation of over one million people within 36 hours, (3) a network of cyclone shelters managed by local committees, (4) regular mock drills and training programs, and (5) investment in resilient infrastructure, including coastal embankments (Johns et al., 2016).

Several factors contributed to this success. The institutional framework centered on the Odisha State Disaster Management Authority (OSDMA), established in 2000 after the devastating 1999 Super Cyclone, which killed approximately 10,000 people (Dash & Kaur, 2013). Strong collaboration among the state government, the meteorological department, NGOs, and community organizations ensured a coordinated response (Sahu & Tripathy, 2015). Most critically, community volunteers played essential roles in disseminating warnings, assisting with evacuations, and providing post-disaster support (Patel, 2017).

Comparison with Bungoma: The Odisha experience shows that sustained investment in community capacity-building—including regular training and drills, functional early-warning systems, and community-managed shelters—can dramatically reduce disaster mortality. By contrast, Bungoma's low training frequency (only 0.7% receive regular training) and limited visible mitigation measures (primarily early warning systems without corresponding community response capacity) reveal significant gaps in CBDM implementation.

Case Study 2: Promoting Urban Resilience in Metro Manila (Philippines)

From 2013 to 2015, the Disaster Risk Reduction Network-Philippines implemented a Community-Based Disaster Management (CBDM) project in Metro Manila, targeting 115 villages (barangays) across 10 cities along eight waterways. The intervention included capacity building on CBDM topics, installation of community-based early warning systems (flood monitoring equipment, sirens, and communication tools), and the development of Barangay Disaster Risk Reduction and Management Committees (BDRRMCs). Community members were actively engaged in planning, implementing, and maintaining these initiatives (Disaster Risk Reduction Network-Philippines, 2015).

The project demonstrated high effectiveness. Community members trained in disaster preparedness, risk assessment, and emergency response significantly enhanced local capacity. Early warning systems provided timely alerts that enabled effective evacuation. BDRRMCs coordinated activities, conducted risk assessments, and developed contingency plans with dedicated budget allocations. Key success factors included active community engagement, sustained capacity building, functional early warning systems, and robust institutional support from local government units and NGOs (Disaster Risk Reduction Network-Philippines, 2015).

Comparison with Bungoma: Metro Manila's experience highlights the importance of institutionalizing community participation through formal committees with dedicated resources. Bungoma lacks equivalent structures: while 63.9% of respondents described community involvement as "somewhat active," this participation appears informal and unsystematic, without the budget allocations, formal roles, and coordination mechanisms that characterized the Philippine intervention.

DISCUSSION

Interpreting the Preparedness Paradox

The finding that most respondents perceive their urban area as "somewhat prepared" despite minimal regular training and limited evident mitigation measures suggests a preparedness paradox. This discrepancy may reflect several factors. First, residents may lack awareness of what constitutes adequate preparedness, creating a gap between perceived and actual readiness. Second, the presence of early warning systems (noted by 52% of respondents) may create a false sense of security if not accompanied by response capacity, evacuation routes, and shelter infrastructure. Third, social desirability bias may influence self-assessments, with respondents reluctant to admit inadequate preparedness.

This interpretation aligns with Verma and Guin's (2024) finding that communities often lack understanding of the linkages between risk, capacity, and vulnerability. Awareness of hazards does not automatically translate into preparedness behavior; bridging this gap requires sustained education, training, and community organizing—precisely the elements missing in Bungoma.

The Resource-Participation Nexus

The identification of economic instability (31.8%) and lack of government support (28.6%) as primary barriers to recovery aligns with a broader pattern documented in the literature. Wisner et al. (2004) argued that disasters expose and amplify existing social vulnerabilities, including poverty, inequality, and weak governance. In Bungoma, these structural factors constrain both household-

level preparedness (e.g., families cannot afford emergency supplies or home retrofits) and community-level capacity (e.g., volunteer programs lack funding and early warning systems are poorly maintained).

The resource-participation nexus operates dialectically: limited resources discourage participation, as community members prioritize livelihood activities over disaster preparedness; low participation, in turn, undermines resource mobilization, as governments and donors perceive limited community interest. Breaking this cycle requires targeted investments that build capacity and demonstrate value to communities.

The Role of Urban Planning in CBDM

The finding that well-planned road networks were considered the most effective urban design feature (60.7%) underscores the centrality of transportation infrastructure to disaster management. Evacuation, emergency service access, and supply delivery all depend on functional road networks. In Bungoma, however, 20% of respondents identified road conditions as the primary infrastructure issue, and a lack of government support ranked among the top recovery barriers. This suggests that while residents recognize the importance of road infrastructure, the current provision is inadequate.

Integrating CBDM into urban planning requires moving beyond physical infrastructure to include social infrastructure: community centers that can serve as shelters, communication networks that reach all residents, including the most vulnerable, and participatory planning processes that incorporate local knowledge. The preference for local government leadership in integrating urban design with disaster mitigation (46.7%) indicates that residents view institutional coordination—not just physical improvements—as essential.

Training Gaps and Capacity Building Imperatives

The finding that only 0.7% of respondents receive regular disaster preparedness training represents a critical failure of CBDM implementation. Regular drills and training are not merely educational; they build social capital, establish communication networks, identify gaps in plans, and create the muscle memory essential for effective emergency response (Shaw, 2014). Without sustained training, early warning systems and evacuation routes become theoretical rather than operational.

Comparing Odisha and Metro Manila highlights what is possible: in Odisha, regular mock drills and training programs reached millions of residents; in Metro Manila, structured capacity-building equipped community members with specific disaster-management skills. Bungoma's training deficit reflects both resource constraints and a fundamental misunderstanding of what CBDM requires—not occasional workshops but ongoing, institutionalized learning.

Community Involvement: Rhetoric and Reality

While 63.9% of respondents described community involvement as "somewhat active," deeper analysis suggests this involvement is limited in scope and intensity. The lack of regular training, the limited mitigation measures beyond early warning systems, and the identification of community awareness gaps as the greatest implementation challenge all point to passive involvement (receiving warnings) rather than active involvement (participating in planning, response, and recovery).

This pattern reflects a common critique of community-based approaches: participation is often tokenistic, with communities consulted but not empowered, informed but not trained, acknowledged but not resourced (Arnstein, 1969). Genuine CBDM requires a shift from consultation to collaboration, from informing to capacity building, and from community "involvement" to community leadership.

Policy Implications

The study's findings have several implications for policy and practice:

First, enhanced community engagement must move from rhetoric to reality. This requires structured participation mechanisms (committees, working groups, regular forums), dedicated resources for community organizing and training, and accountability systems ensuring that community input influences decisions.

Second, training and capacity building should be institutionalized rather than sporadic. Annual training cycles, integration into school curricula, workplace preparedness programs, and certification systems for community volunteers can create sustained capacity.

Third, economic vulnerability must be addressed as a disaster risk factor. Social protection programs, livelihood diversification, microinsurance, and disaster-responsive social safety nets can reduce household vulnerability and free resources for preparedness.

Fourth, local governments require enhanced capacity and resources to lead CBDM implementation. This includes technical assistance, budget allocations, staffing, and coordination mechanisms linking communities with formal disaster management systems.

Fifth, urban planning must explicitly integrate disaster risk reduction across all sectors: land use, transportation, housing, water and sanitation, and public spaces. This integration should be mandated by policy and monitored through performance indicators.

Limitations and Future Research Directions

Several study limitations warrant acknowledgment. The convenience sampling method may limit generalizability to other urban areas in Kenya or East Africa. Self-reported data are subject to recall and social desirability biases. The cross-sectional design captures perceptions at a single time point, precluding analysis of changes over time or causal relationships.

Future research should employ probability sampling to enhance generalizability, longitudinal designs to track changes in preparedness over time, and mixed methods integrating quantitative surveys with in-depth interviews and participatory observation. Comparative research across multiple urban areas in Kenya and East Africa could identify contextual factors influencing CBDM effectiveness. Finally, intervention research testing specific CBDM strategies (e.g., community training programs, improvements to early warning systems, evacuation route marking) could generate causal evidence to guide practice.

CONCLUSION

This study set out to explore the effectiveness of Community-Based Disaster Management strategies in urban planning, drawing on empirical data from Bungoma, Kenya, and comparative case studies from India and the Philippines. The findings reveal a complex picture: while residents recognize the importance of various disaster mitigation measures and express moderate confidence in existing systems, significant gaps persist in training frequency, community involvement, and institutional support. Only 0.7% of respondents reported receiving regular disaster preparedness training, and nearly 25% described community involvement as neutral or nonexistent. Economic instability and lack of government support emerged as the greatest barriers to post-disaster recovery.

The comparative case studies demonstrate that effective CBDM is possible when certain conditions are met: sustained investment in community capacity building, functional early warning systems connected to response mechanisms, institutionalized community committees with dedicated resources, and strong coordination among stakeholders. The Odisha Model reduced cyclone mortality from approximately 10,000 in 1999 to 44 in 2013 through precisely such approaches. Metro Manila's CBDRRM project enhanced disaster preparedness across 115 villages through community-based early warning systems, training programs, and formal committee structures.

The study's primary contribution is empirical evidence from an understudied context—urban Kenya—that both confirms findings from other settings and highlights context-specific challenges. The preparedness paradox observed in Bungoma—moderate perceived preparedness despite minimal training—suggests that awareness without capacity may create dangerous complacency. Addressing this gap requires not more information but sustained capacity building, institutional support, and resource allocation.

The central argument emerging from this research is that effective urban disaster management requires moving beyond the rhetoric of community participation to genuine community empowerment. This means shifting from passive consultation to active collaboration, from sporadic training to institutionalized learning, from awareness campaigns to capacity building, and from community involvement to community leadership. Urban planning must be reimagined as a participatory, cross-sectoral process that integrates disaster risk reduction across all domains.

As urbanization accelerates and climate change intensifies hazards, the imperative for effective disaster management has never been greater. The evidence presented in this study suggests that CBDM strategies, when properly implemented, can significantly enhance urban resilience. However, realizing this potential requires political will, institutional capacity, sustained investment, and—above all—genuine commitment to empowering communities as partners in creating safer, more resilient cities.

RECOMMENDATIONS

Based on the study findings and comparative case analysis, the following recommendations are offered for different stakeholder groups.

For Urban Planners

1. **Integrate disaster risk reduction into all planning domains.** Land use planning should restrict development in hazard-prone areas; transportation planning should prioritize evacuation routes and emergency access; housing planning should enforce resilient building standards.

2. **Design for multiple functions.** Road networks, drainage systems, and public spaces should serve both everyday functions and emergency purposes. Stormwater management can reduce flood risk while providing recreational space; wide roads can accommodate evacuation traffic while facilitating daily movement.

3. **Adopt participatory planning processes.** Engage communities in hazard mapping, vulnerability assessment, and strategy development. Local knowledge about flood patterns, landslide risks, and usable evacuation routes is invaluable and often exceeds official data.

For Local Governments

1. **Establish dedicated disaster management units** with clear mandates, staffing, and budgets. These units should coordinate across sectors and with community organizations.

2. **Institutionalize community training programs.** Develop annual training calendars covering first aid, search and rescue, early warning interpretation, evacuation procedures, and post-disaster response. Target at least one trained volunteer per household.

3. **Invest in early warning systems** that reach all residents, including those without mobile phones or radios. Sirens, public address systems, and door-to-door notification systems should complement electronic alerts.

4. **Create community disaster management committees** with formal roles, budget allocations, and linkages to local government. These committees should represent all community segments, including women, elderly, persons with disabilities, and vulnerable groups.

5. **Address economic barriers** through social protection programs, disaster microinsurance schemes, and livelihood support that enhances household resilience.

For Community Organizations

1. **Mobilize existing social networks** (religious institutions, women's groups, youth organizations, savings groups) as platforms for disaster preparedness. These networks provide trust, communication channels, and organizational capacity.

2. **Conduct regular drills and simulations.** Annual or semi-annual drills build familiarity with evacuation routes, test early warning systems, identify gaps, and maintain preparedness.

3. **Document and share local knowledge.** Create community hazard maps, document past disaster impacts and responses, and develop locally appropriate preparedness materials.

4. **Advocate for resources and policy changes.** Use the evidence presented in this study and similar research to make the case for increased investment in CBDM.

For National Governments and Development Partners

1. **Allocate dedicated funding for CBDM** within urban development budgets. Community-based approaches require sustained investment, not one-off projects.

2. **Develop national standards and guidelines** for CBDM implementation in urban areas, including training curricula, committee structures, and performance indicators.

3. **Support knowledge exchange and learning** among urban areas within and across countries. The Odisha and Metro Manila experiences offer valuable lessons that can be adapted to other contexts.

4. **Integrate CBDM into urban development policies** and sectoral plans, ensuring that disaster risk reduction is not treated as a standalone issue but mainstreamed across governance.

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