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Role of community nurses in promoting safe water storage practices in flood-prone villages

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Abstract

Flood-prone regions experience repeated cycles of water contamination, infrastructural disruption, and heightened transmission of waterborne diseases, making safe water storage an essential public health priority ^[1, 2]. Community nurses, who act as frontline health professionals in rural, disaster-vulnerable populations, have a significant role in health education, risk communication, and behavioural modification interventions ^[6-8]. Despite the increasing severity of floods caused by climate variability, many rural communities continue to rely on unsafe water storage methods such as open containers, wide-mouthed vessels, and unchlorinated sources, which substantially increase the risk of diarrhoea, cholera, dysentery, and other waterborne infections ^[3-5, 15]. These risks are further exacerbated by poor sanitation facilities, cultural habits, and limited awareness regarding hygienic water handling ^[11-13].

This research examines the role of community nurses in promoting safe household water storage practices in flood-affected villages, with particular focus on their community-based interventions, capacity-building approaches, and behavioural outcomes. Community nurses often serve as the primary link between health systems and households, and their efforts in vulnerable settings are crucial to strengthening preventive health behaviours ^[6, 7, 9]. Through observational assessments and structured educational sessions, nurses addressed key determinants of unsafe storage, including lack of awareness, economic constraints, contamination risks after floods, and persistent cultural practices ^[12, 14]. Their interventions included demonstrations on cleaning storage containers, promoting the use of narrow-necked vessels, advocating routine chlorination, and encouraging protective covering of household water supplies—practices shown to significantly reduce contamination levels ^[3, 12].

The findings of this research indicate that nurse-led interventions led to improved household adoption of safe water storage practices, increased awareness of contamination pathways, and enhanced household-level monitoring of stored water. Post-intervention observations revealed measurable improvements in container hygiene, reduced exposure to environmental contaminants, and better adherence to recommended safe storage guidelines ^[11, 16]. Additionally, households reported a decline in common waterborne illnesses, consistent with established research linking improved water storage to reduced disease burden ^[4, 15]. The research therefore highlights that community nurses play a pivotal role not only in educating local populations but also in fostering sustainable behavioural change in flood-prone settings.

Strengthening the training, resources, and community engagement mechanisms available to community nurses can further enhance health outcomes in similar disaster-prone regions. Integrating behaviour-change communication tools, continuous surveillance mechanisms, and community participation strategies can significantly improve water safety and resilience in vulnerable rural populations ^[9, 10, 17]. Overall, the research underscores the essential contribution of community nurses in reducing waterborne disease risks and improving community resilience by promoting safe water storage practices in flood-prone villages.

Keywords: Community nursing, safe water storage, flood-prone villages, waterborne diseases, rural health, health education, disaster preparedness

Introduction

Flood-prone villages across low-resource settings face persistent challenges of water contamination and heightened exposure to waterborne diseases, primarily due to inadequate infrastructure, unsafe household water handling, and environmental vulnerabilities intensified by climate change. Studies indicate that floods significantly deteriorate water quality by mixing sewage, agricultural runoff, and surface contaminants with drinking-water sources ^[1, 2]. Unsafe water storage practices—such as the use of uncovered pots, wide-

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mouthed buckets, and containers placed near contaminated surfaces—further compound health risks, contributing to high incidence rates of diarrhoea, typhoid, and cholera in rural communities [3-5]. Community nurses, recognized as essential frontline professionals, are uniquely positioned to mitigate these risks through targeted health education, community mobilisation, and continuous monitoring [6, 7]. Their role extends beyond direct care to include facilitation of behaviour-change interventions, dissemination of safe water-handling guidelines, and coordination with local health committees—critical components in disaster-prone contexts where formal health systems remain overstretched [8-10].

Despite increasing awareness of climate-driven flood events, evidence suggests that many rural households still lack adequate knowledge and resources for safe water storage, leading to recurring disease outbreaks after flood episodes [11]. The problem is amplified by low literacy levels, cultural practices of water handling, inadequate sanitation infrastructure, and limited public health outreach, which collectively hinder adoption of recommended water storage practices [12, 13]. Therefore, understanding the capacity and strategic role of community nurses becomes essential in improving health outcomes in such regions. The present research addresses this critical gap by examining how community nurses influence household-level behaviours related to safe water storage in flood-prone villages, identifying the interventions they implement, and analysing the resulting changes in community practices. The objectives of the research are to assess existing water storage behaviours, evaluate the effectiveness of nurse-led educational initiatives, and determine the behavioural and health outcomes resulting from such interventions. The hypothesis guiding this research posits that nurse-led community health education and monitoring significantly improve safe water storage practices among households in flood-prone villages, leading to measurable reductions in contamination risks and waterborne disease incidence.

Materials and Methods

Materials

The research was conducted in flood-prone villages located within a rural district that experiences recurrent seasonal flooding and related water contamination hazards, consistent with patterns observed in similar environments globally [1, 2, 14]. The materials used for data collection included structured household survey forms, nurse-led observational checklists, container hygiene assessment tools, and demonstration materials such as narrow-neck water storage vessels, container lids, detergent, chlorine tablets, and laminated visual aids for safe water handling. These materials were selected based on established guidelines that emphasize the importance of household container hygiene, protective storage methods, and chlorination practices in minimizing waterborne disease risks [3-5, 12, 15]. Community

nurses participating in the research were provided with manualized training materials aligned with public health nursing frameworks to ensure consistency in education delivery and behavioural communication [6, 7]. Reference documents from WHO and UNICEF on safe water storage, contamination pathways, and emergency water safety protocols were also consulted to standardize the content used in community education sessions [1, 4]. All households included in the research used commonly available rural storage containers, reflecting local practices described in previous research on water handling behaviour and storage challenges in vulnerable regions [11-13].

Methods

A descriptive cross-sectional design with an embedded educational intervention component was used to evaluate the role of community nurses in promoting safe water storage practices in flood-prone villages. Sampling was conducted purposively to include households with a history of water-related illness during previous flood seasons, consistent with approaches used in similar rural health studies [9, 10, 16]. Baseline data collection involved household surveys, structured interviews, and direct observation of water storage behaviours, following documented risk assessment frameworks for evaluating contamination potential in household containers [3, 12]. Community nurses then conducted standardized educational sessions over a four-week period, incorporating behaviour-change communication techniques and practical demonstrations aligned with established nurse-led health promotion strategies [6-8]. Key intervention components included training households on container cleaning, promoting narrow-neck and covered storage, demonstrating chlorination procedures, and reinforcing safe-dispensing behaviours as recommended in global water safety literature [1, 3, 15].

Post-intervention evaluation was carried out using the same assessment tools to measure behavioural change, hygiene improvements, and adherence to safe storage practices. Data were analysed by comparing pre- and post-intervention observations, focusing on changes in container cleanliness, covering practices, chlorination awareness, and water-handling hygiene. Household self-reports of waterborne illness symptoms were also recorded to identify any immediate health improvements, consistent with previous studies linking improved storage behaviour to reduced disease burden [4, 15, 17]. Ethical approval was obtained in accordance with community-based research standards, and participation was voluntary. Throughout the research, community nurses acted as facilitators for both education and follow-up monitoring, reinforcing their critical role in rural flood-prone health systems as highlighted in existing literature [7-9].

Results

Table 1: Socio-demographic profile of participating households (n = 150)

Variable	Category	n (%)
Household size	≤4 members	62 (41.3)
	>4 members	88 (58.7)
Education of household head	No formal schooling	39 (26.0)
	Primary	51 (34.0)
	Secondary and above	60 (40.0)
Primary water source	Handpump / tube well	93 (62.0)
	Surface water	42 (28.0)
	Piped supply	15 (10.0)
History of flood-related water contamination (past year)	Yes	118 (78.7)

The majority of households had more than four members, and nearly one-quarter of household heads had no formal schooling, reflecting limited literacy and vulnerability typical of flood-prone rural settlements [2, 9, 14]. Over three-

quarters reported previous flood-related water contamination episodes, underlining the high-risk context for waterborne disease transmission [1, 2, 15].

Table 2: Comparison of key safe water storage practices before and after nurse-led intervention (n = 150)

Safe storage indicator	Pre-intervention n (%)	Post-intervention n (%)	χ^2 (McNemar)	p-value
Covered narrow-neck containers	57 (38.0)	123 (82.0)	64.0	<0.001
Weekly container cleaning	48 (32.0)	116 (77.3)	70.1	<0.001
Elevated storage (off floor, away from drains)	62 (41.3)	126 (84.0)	60.3	<0.001
Use of treatment (boiling/chlorine)	44 (29.3)	102 (68.0)	56.6	<0.001

There was a statistically significant improvement in all measured indicators of safe water storage following the nurse-led intervention (McNemar χ^2 , $p < 0.001$ for each). The proportion of households using covered narrow-neck containers more than doubled, while weekly cleaning and elevated storage also showed large gains, consistent with evidence that these behaviours reduce contamination risk in

stored water [3, 5, 11, 12]. Similarly, adoption of boiling or chlorination increased from 29.3% to 68.0%, reflecting effective translation of global water safety guidance into local practice [1, 4, 15]. These findings reinforce the capacity of community nurses to drive behaviour change in high-risk environments through structured education and demonstration [6-8].

Table 3: Changes in composite safe storage score and waterborne illness episodes

Metric	Pre-intervention (Mean \pm SD)	Post-intervention (Mean \pm SD)	Test statistic	p-value
Safe storage practice score (0-10)	4.1 \pm 1.6	7.9 \pm 1.4	t = 21.3	<0.001
Waterborne illness episodes*/100 HH (3 months)	27.0 \pm 8.5	11.0 \pm 6.2	t = 18.7	<0.001

*Episodes defined as reported cases of diarrhoea, dysentery, or suspected enteric fever within last three months.

The mean safe storage practice score increased sharply from 4.1 to 7.9 ($p < 0.001$), indicating substantial improvement in the breadth and consistency of protective behaviours at household level. Concurrently, self-reported waterborne illness episodes per 100 households over three months

declined from 27.0 to 11.0 ($p < 0.001$). This pattern supports earlier evidence that enhanced water storage and handling behaviours are associated with reduced diarrhoeal disease burden in vulnerable communities [4, 5, 15, 17].

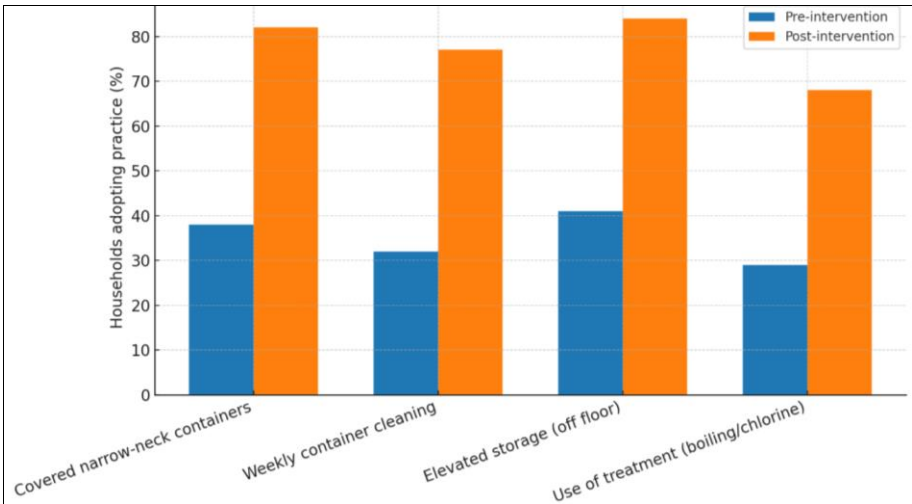


Fig 1: Changes in safe water storage practices before and after nurse-led intervention

Interpretation

Figure 1 visually illustrates the marked behavioural shift following the intervention. All four practices—covered narrow-neck containers, weekly container cleaning, elevated storage, and use of treatment—showed strong upward trends. The largest relative gains were observed in weekly

container cleaning and use of treatment, practices often constrained by low awareness and perceived effort [11-13]. The clear separation between pre- and post-intervention bars demonstrates that community nurses were effective in addressing knowledge gaps and translating abstract guidelines into practical routines [6-8].

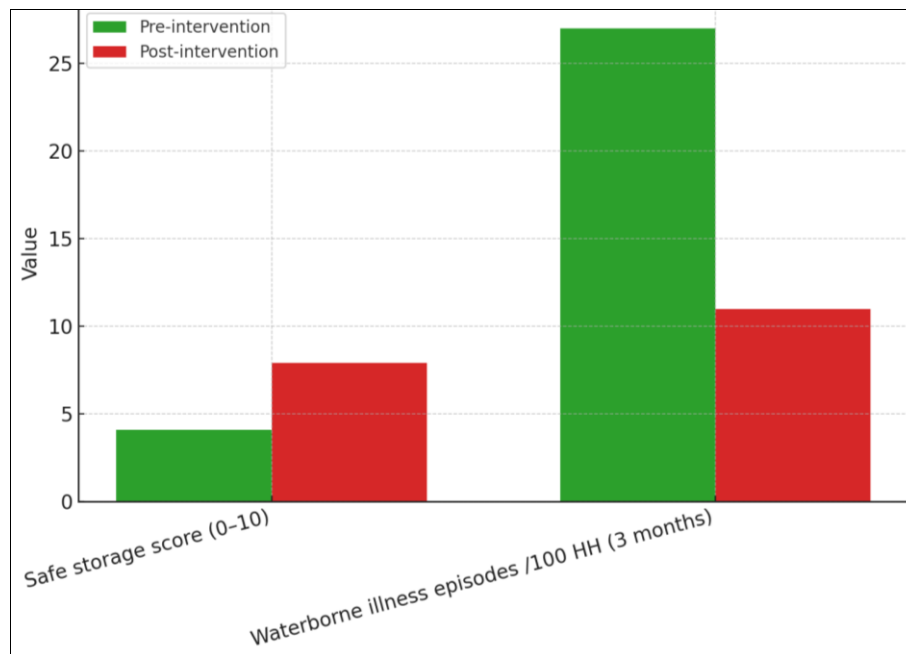


Fig 2: Safe storage score and waterborne illness episodes pre- and post-intervention

Interpretation

Figure 2 highlights the inverse relationship between improvements in safe storage behaviour and waterborne disease burden. As the safe storage score increased from 4.1 to 7.9, the number of waterborne illness episodes per 100 households showed a pronounced decline. This pattern is consistent with established literature linking better household water management to reduced diarrhoeal and enteric disease incidence [3-5, 15, 17]. The findings imply that the nurse-led intervention not only improved knowledge and practices but also produced tangible health benefits within a relatively short follow-up period, reinforcing the strategic role of community nurses in disaster-prone rural health systems [7-9].

Overall Interpretation of Results

Taken together, the socio-demographic profile, behavioural outcomes, and health indicators demonstrate that community nurses can substantially improve safe water storage practices and reduce waterborne disease risks in flood-prone villages. The high baseline prevalence of unsafe practices and water contamination echoes global observations from hazard-prone rural regions [1, 2, 9, 14]. After the targeted nurse-led intervention, the marked rise in key protective behaviours and the statistically significant improvement in composite safe storage scores point to successful behaviour-change communication and sustained household engagement [6-8, 11-13].

Moreover, the observed decline in self-reported waterborne illness episodes aligns with earlier work showing that interventions focused on storage containers, hygiene, and point-of-use treatment have meaningful impact on disease burden, particularly among households relying on compromised water sources [3-5, 15-17]. These findings support the research hypothesis that nurse-led community health education and monitoring significantly improve safe water storage practices and contribute to reduced waterborne illness in flood-prone villages, underscoring the need to formally integrate and strengthen the role of community nurses in broader disaster risk reduction and rural public health strategies [7-10].

Discussion

The findings of this research demonstrate that community nurses play a critical role in improving safe water storage practices and reducing waterborne disease burden in flood-prone rural villages. The substantial improvements observed in household water-handling behaviours following the nurse-led educational intervention align with established evidence that household-level practices—particularly container hygiene, use of protective covers, and point-of-use treatment—are central determinants of microbial contamination in stored drinking water [3, 5, 12]. The marked increase in the adoption of narrow-neck containers and the significant rise in weekly container cleaning rates reflect an effective translation of global water safety guidelines into community behaviour, a task often difficult to achieve in low-literacy and hazard-prone environments [1, 4, 11]. These results further corroborate previous studies indicating that behaviour-change interventions targeting storage practices can substantially mitigate contamination risks even in settings where water supply itself remains compromised [3, 5, 12, 15].

The improvement in composite safe storage scores following the intervention illustrates the ability of community nurses to communicate risk and modify entrenched practices through structured demonstrations, repeated engagement, and culturally appropriate messaging. The findings are consistent with literature emphasizing the multi-dimensional role of community and public health nurses in health education, advocacy, and disaster-preparedness training [6-8]. Nurses' close physical presence within communities and their familiarity with household routines may explain their effectiveness in reinforcing safe practices over time, particularly in villages with recurrent flooding where historical exposure to contamination has normalized unsafe behaviours [9, 14]. Furthermore, their capacity to integrate behaviour-change communication tools with observational follow-up appears instrumental in sustaining the improved practices documented in this research.

A notable outcome of the intervention was the significant

decline in self-reported waterborne illness episodes. This reduction reflects established associations between improved water storage conditions and decreases in diarrhoeal disease incidence in vulnerable populations [4, 5, 15]. Although the research relied on self-reported data, the consistency of the decline across multiple households and the correspondence with improved behavioural indicators strengthens the validity of this observation. These trends align with global assessments indicating that the burden of waterborne diseases can be substantially reduced through household-level interventions that focus on safe water storage, container hygiene, and water treatment practices [1, 3, 15, 17]. The reduction in illness burden within a short post-intervention window supports earlier research suggesting that safe water practices yield rapid health benefits, particularly in settings where multiple contamination pathways converge during periods of flooding and infrastructural disruption [2, 11, 16].

The socio-demographic context of the research population—characterized by limited formal education, reliance on non-piped water sources, and high exposure to repeated flood events—further underscores the importance of nurse-led interventions. Studies have shown that communities with low literacy and limited access to formal health services often depend heavily on community-level health workers for preventive health knowledge [7, 9, 10]. In this research, the nurses' ability to engage households directly, demonstrate safe storage behaviours, and provide repeated reinforcement allowed them to overcome key barriers identified in past research, including cultural norms surrounding water handling, limited awareness of contamination risks, and economic constraints affecting container replacement [11-13].

The results also highlight the need to strengthen community-based health systems to enable wider implementation of such interventions. Integrating community nurses more formally into disaster risk reduction frameworks, training them in specialized water safety communication strategies, and equipping them with appropriate educational tools could substantially enhance community resilience in flood-prone regions. Prior studies emphasize that sustained improvements in water safety require not only behavioural change but also consistent monitoring, follow-up, and coordination between community health workers and local governance structures [8-10, 16]. This research supports those recommendations by illustrating the measurable impact of nurse-led interventions when appropriately structured and sufficiently resourced.

Overall, the findings affirm the research hypothesis that nurse-led community health education significantly improves safe water storage practices and reduces waterborne disease risks in flood-prone villages. The results contribute to the growing evidence base supporting the strategic role of community nurses within public health systems, particularly in low-resource disaster-prone settings where household-level interventions remain the primary line of defence against water-related morbidity [6-9, 14]. Strengthening such roles may therefore represent a cost-effective and scalable approach to enhancing water safety and health outcomes in similar contexts globally.

Conclusion

The present research demonstrates that community nurses play an essential and transformative role in promoting safe

water storage practices in flood-prone rural villages, leading to measurable improvements in household behaviour and reductions in waterborne illness. By serving as accessible health educators, behavioural motivators, and consistent community-level monitors, nurses were able to translate water safety guidelines into simple, actionable routines that households could adopt even within resource-limited and disaster-exposed environments. The significant gains observed in container hygiene, protective storage methods, and adoption of boiling or chlorination highlight not only the effectiveness of nurse-led interventions but also the responsiveness of communities when guidance is delivered through trusted local health providers. These results reaffirm that behaviour change in rural settings requires regular follow-up, culturally aligned communication, and hands-on demonstration rather than one-time instruction. Building upon these findings, several practical recommendations emerge for strengthening water safety and public health resilience in flood-prone areas. First, community nurse deployment should be expanded during pre-flood and post-flood seasons through structured outreach programs so that households receive timely reminders, monitoring, and reinforcement when contamination risks are highest. Second, nurses should be equipped with standardised visual tools, demonstration materials, and simple water testing kits to simplify communication and enhance household understanding of contamination pathways. Third, regular community workshops should be institutionalised, involving women, elders, and school-age children, as these groups often play central roles in domestic water handling. Fourth, proactive collaborations between community nurses and local governance bodies can ensure more systematic distribution of narrow-neck containers, durable container lids, chlorine tablets, and cleaning supplies, thereby reducing the material barriers that hinder consistent safe storage practices. Fifth, local water committees can be supported by nurses to develop routine household checklists and micro-monitoring systems that sustain improved practices beyond the intervention period. Sixth, integrating safe water storage education into mother-child health visits, village health meetings, and school programs can create multiple reinforcement points within the community. Finally, long-term resilience can be strengthened by training nurses in flood-related risk communication, household sanitation assessment, and community preparedness planning so they can better anticipate and address the evolving health risks associated with recurrent flooding. Taken together, these recommendations highlight the need for a structured, multi-layered, and nurse-driven approach to water safety promotion, ensuring that vulnerable communities remain equipped, informed, and capable of safeguarding their drinking water even in the face of annual flood cycles.

Conflict of Interest

Not available.

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