

Women's Flood Preparedness Strategies: A Case Study in North Tongu District of Ghana

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Abstract

Past studies and international organizations identified several factors that contribute to women's flood preparedness practices. However, in some sub-Saharan countries, such as Ghana, little is known about women's flood preparedness strategies in the face of climate change-induced floods. This study examines women's flood preparedness strategies based on an integrated theoretical approach. It focuses on the North Tongu District, where a recent devastating flood incident led to wide-ranging consequences. A questionnaire survey was conducted among 120 randomly selected women from September to October 2024. The data analysis involved descriptive statistics and a probit regression analysis. The results show that the respondents had adopted several flood preparedness strategies, including cleaning/digging drains around houses (79.8%), sandbagging (63.3%), and participation in community volunteer programs (68.2%). About half had been involved in local savings through susu, a communal mutual help group (56.7%), and evacuation drill participation (51.4%). The probit regression analysis shows that age, flood experience, and perceived flood risks are significantly correlated with the respondents' flood preparedness. Based on these findings, we elaborate on policy options that may better promote women-oriented flood-resilient programs.

Keywords

Flood Preparedness, Women, Susu, Rural Communities, Ghana, North Tongu

1. Introduction

Preparedness is an integral aspect of reducing climate-induced disaster vulnera-

bility (IPCC, 2012). It means enhanced individual or collective capacities to adequately anticipate and respond to disasters, thereby minimizing economic, social, and emotional losses (Driessen et al., 2016; Paton & McClure, 2013). The US Chamber of Commerce and the World Bank Group (2024) found that investing \$1 in flood preparedness could save \$13 through reduced economic impact and faster recovery after a disaster. Implementing effective preparedness measures at the household level, especially in rural and low-income areas, is largely dependent on women (Ajibade et al., 2013); however, they face significant challenges during flood events, including physical injuries, domestic violence, and harassment (Azad et al., 2013). Various reasons were attributed, including cultural, biological, and economic factors (Dang, 2021; Nahar et al., 2024; Okai, 2022). In a society with strong patriarchal norms, women's flood vulnerability was found to be worse as these norms forced them to take an additional load of household caregiving (Azad & Pritchard, 2023; De Silva & Jayathilaka, 2014). Fatema et al. (2023) found in Bangladesh that women faced significant risks at disaster shelters, such as poor safety and privacy, compromised hygiene, and sexual abuse risks.

Scholars have demonstrated that women have adopted several preparedness strategies to curb the impact of flood disasters, including livelihood diversification and involvement in community networks (Alam & Rahman, 2018). In Africa, very limited studies showed how rural women prepared for floods and what factors motivated their preparedness actions. In Ghana, flooding has been the subject of disaster research (Yin et al., 2021; Mensah & Ahadzie, 2020), but studies about women's flood preparedness are scarce. Some suggested that future studies should focus more on women's local/indigenous knowledge for mitigating disasters in order to enhance a more resilient society (Alam & Rahman, 2018). In this study, we try to tease out women's strategies for mitigating flood risks and enhancing the safety of livelihoods, properties, and communities.

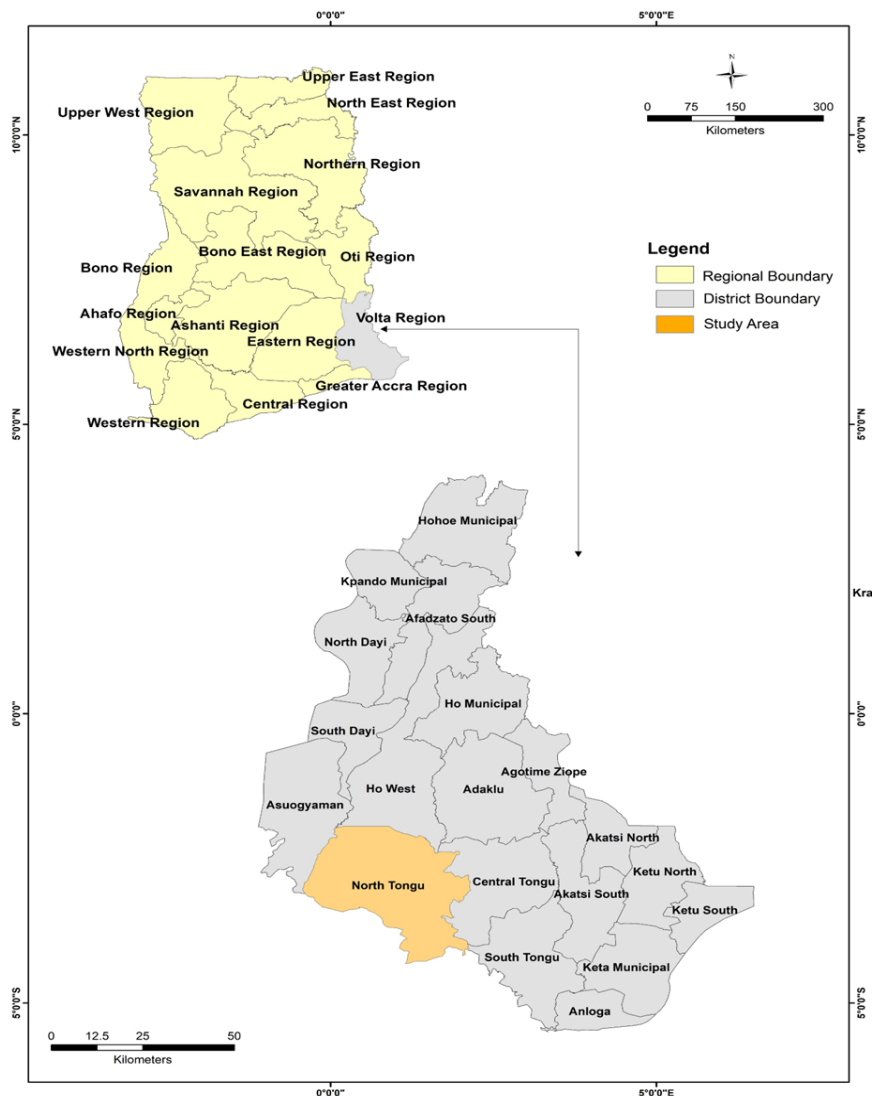
2. Methodology

2.1. The Study Area

This study was conducted in one of the flood-prone and economically prominent rural regions of Ghana, North Tongu District, as shown in **Figure 1**. This District is in the Volta Region, through which the mighty transnational Volta River runs. The Volta Region has experienced riverine and pluvial floods with devastating impacts on food security, water supplies, sanitation, and businesses (Ayivor & Ofori, 2017). It covers a total land area of 20,570 km² or about 8.6% of Ghana (Asoglistate, 2011).

North Tongu District is located along the lower Volta River. Most of its communities are dispersed along the Volta River and other small channels, such as the Albo, Kolo, Gblor, and Bla Battor rivers. It was formerly called Adidome and became an independent administrative authority in 2012 (Ministry of Finance and Economic Planning, 2024). This District has a total land size of about 1,154 km². It shares boundaries with Ho Municipality to the north, Shai Osudoku to the south, Asuogyaman to the west, and Central Tongu to the east. It has a population of

110,891 people, with women accounting for 52%. The average household size is 4.8 persons (Ghana Statistical Service, 2021b).



Source: Authors, 2024.

Figure 1. Map showing the study area, highlighting North Tongu in the Volta Region.

North Tongu has a tropical savanna climate with a bimodal rainfall pattern. The annual mean rainfall ranges from 900 mm to 1100 mm (Ghana Statistical Service, 2021a). The major wet season begins in late March or early April and lasts until July. In this period, most farmers plant crops like rice, maize, and cassava. The minor rainy season begins in late September and continues through November. This season has a shorter duration and low-intensity rainfall. However, due to climate change effects, farmers have recently observed changes in rainfall patterns. The main economic activities include peasant rainfed agriculture, fishing, and petty trading, of which women are fully involved.

The District has experienced several flood events over the years, with 2015 and

2023 being among the most impactful (Okwei et al., 2025). Many of these floods are attributed to dam-induced spillages and rainstorms. Reports show that more than 30,000 people were displaced, and many schools were moved to temporary shelters in the 2023 Akosombo dam spillage-induced flood (Asuamah-Tawiah, 2024). Most affected communities included Battor, Mepe, and Aveyime (Dumevi et al., 2024).

The rate of poverty in North Tongu is estimated at 39.2% (Ghana Statistical Service, 2021a). Women tend to endure a low economic status as they are disproportionately engaged in low-paying, climate-sensitive jobs (Ghana Statistical Service, 2021a; Amankwaa, 2025). More than half of the employed population in skilled agriculture and fishery were women (North Tongu District Assembly, 2018) without the prospect of engaging in large-scale farming or accessing credit facilities (Addaney et al., 2022; Chigbu, 2019). Instead of relying on formal credit organizations, women formed susu associations or mutual help groups. Susu in the Twi language means “to plan little by little” (Steel & Andoh, 2003). It is an informal association in which members contribute to a pool and distribute it to one another in turns. Joining the Susu association is a lifestyle for most low-income Ghanaian women (Bortei-Doku & Aryeetey, 2024).

2.2. Sampling, Data Collection, and Analysis Methods

We used purposive sampling to select three communities: Mepe, Battor, and Aveyime. These communities were among the most flood-affected communities in 2023 (Asuamah-Tawiah, 2024; Mensah-Brako et al., 2025). We first collected annual flood reports from the National Disaster Management Organization (NADMO), as well as published academic articles and online sources. This preliminary research helped us design questions that are relevant to understanding localized flood preparedness in the study area.

We then used simple random purposive sampling to select the respondents based on Yamane’s sample size estimation formula (Equation (1)). Our study used both primary and secondary data. Primary data were obtained from a questionnaire survey among 120 respondents, who were randomly selected from these communities. While 123 questionnaires were administered, 120 valid responses were received, with three being rejected due to incompleteness. We targeted women household heads, but we experienced difficulties as household heads were mainly males in the study area. According to the Ghana Statistical Service (2010) report on North Tongu District, female household heads constituted 16% of the total female household composition. However, we based the study on the total female population at the time of design due to limited availability and access to information on the total number of female household heads in the District, employing Yamane’s formula for sample estimation (Yamane, 1967). It was conducted in October and November 2024. Yamane’s formula is expressed as:

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

$$n = \frac{60,470}{1 + 60,470(0.09)^2} = 123.20 \approx 123$$

$$n = 123 - 3 \text{ (Invalid responses)} = 120$$

where n = the sample size to be estimated, N = the total population of females in the study area, and e = the margin of error (which is 0.09) with a reliability level of 91%.

The questionnaire consisted of three parts. The first part pertained to the demographic profile of respondents. The second was about respondents' flood preparedness strategies and vulnerability. The third focused on respondents' information sources. The questions included a five-point Likert scale, where 1 means strongly disagree, and 5 means strongly agree. A multiple-choice question design was also utilized. A senior high school teacher who had lived and worked in the district for more than ten years assisted with the data collection. All respondents were informed about the purpose and expected outcomes of this survey and subsequently consented before answering any questions.

After coding the collected data in Excel, we used Statistical Package for Social Sciences (SPSS) version 27 for analyses. Next, we conducted descriptive statistics and a probit regression analysis. In doing so, descriptive statistics such as frequencies and percentages were taken. A probit regression analysis was done to assess factors influencing respondents' flood disaster preparedness strategies. Following Wooldridge (2010), the probit regression analysis was specified as an index function, with an unobserved continuous variable (Y_i^*) given in Equation (2):

$$Y_i^* = \beta_i X_i + \varepsilon_i \quad (2)$$

$$Y_i = \begin{cases} 1, & \text{if } Y_i^* > 0 \\ 0, & \text{if } Y_i^* \leq 0 \end{cases}$$

where Y_i is the observed binary dependent variable (1 if a respondent adopts flood preparedness strategies, and 0 otherwise), the flood preparedness strategies include susu saving, sand bagging, evacuation drills, clean drains, communal activities, X_i represents all the independent variables that may influence respondents' flood preparedness strategies, β_i represents the vector of parameters to be estimated, and ε_i is the error term.

The general probit model representing the probability of a respondent adopting flood preparedness strategies can be expressed as:

$$P_i = P(Y_i = 1 | X_i) = \phi(\beta_0 + \beta X_i) \quad (3)$$

where $P_i = P(Y_i = 1)$ implies the probability that a respondent adopts a flood preparedness strategy, $\phi(\cdot)$ denotes the standard normal cumulative distribution function (cdf).

The empirical model for respondents adopting flood preparedness strategies in the study area can be expressed as:

$$P(Y_i = 1) = \phi(\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \cdots + \beta_8 X_{8i}) \quad (4)$$

where β_0 = intercept, X_1 = age, X_2 = marital status, X_3 = education, X_4 = household size, X_5 = income, X_6 = flood experience, X_7 = perceived threat, X_8 = access to information, β_s = unknown parameters to be estimated.

2.3. Theoretical Approach

This research drew on past theoretical approaches to flood disaster preparedness in terms of public attitude, perception, and adaptive response. Rogers's protection motivation theory (PMT) (1975), the Gender and Development (GAD) framework (Bradshaw & Fordham, 2015), and the Sendai Framework for Disaster Risk Reduction (2015-2030) (United Nations Office for Disaster Risk Reduction, 2015) are among the most widely applied in case studies on flood disaster preparedness (Babcicky & Seebauer, 2019; Kurata et al., 2023).

PMT examines individual responses to a situation by first evaluating a perceived threat (threat appraisal) and then coping ability (coping appraisal process). According to Shillair (2020), the coping appraisal process includes response efficacy consideration (e.g., cost). This theory is based on the premise that individual actions are determined by their perceptions about threat levels, vulnerability to perceived threats, the effectiveness of recommended responses, and their capacity to respond. When individuals perceive the severity of the threat as high, they are more likely to adhere to the recommended precautionary measures (Grothmann & Reuswig, 2006).

Bradshaw's Gender and Development (GAD) framework (2015) explains how socially constructed gendered roles and socioeconomic inequalities, such as unequal access to resources, income, information, and the like, influence women's preparedness strategies and adaptation outcomes rather than their biological characteristics of being women. Despite this inequality, the GAD framework highlights that women should be seen as agents of resilience rather than being viewed solely as a vulnerable group (Bradshaw & Fordham, 2015). Studies have applied the GAD concept to analyze women's collective preparedness actions, such as drainage cleaning, informal savings, evacuation drills, and communal empowerment measures, as important resources for disaster preparedness and resilience building (Karimi & Mousavi, 2025).

The Sendai Framework for Disaster Risk Reduction (SFDRR) is a United Nations framework that influenced policy formulations and academic investigations about disaster risk preparedness. It emphasizes the need for gender inclusive and community-based disaster resilience and recommends women's participation in disaster preparedness. Since its adoption, scholars have applied its principles for disaster risk reduction to investigate community resilience, flood preparedness, early warning systems, and gender-inclusive disaster response. Zaidi and Fordham (2021), drawing from the Sendai framework's gender inclusivity, highlight the need to acknowledge women's efforts in community disaster resilience as a means of empowering them. Keating (2020) similarly endorses the principle of the Sendai framework that, aside from hazard exposure, access to resources, information, and gender inclusiveness influence disaster risk preparedness. These theories align with Sustainable Development Goals 5 (Gender equality) and 13 (Climate Action).

3. Results and Discussions

3.1. Respondents' Demographic Characteristics

This section discusses the results of the questionnaire survey. The first part about the socio-demographic characteristics of the respondents (**Table 1**) found that about 61% of the respondents were 56 years old or older. This age concentration is somewhat unique among female household heads in the study area. Consistent with the district's profile, in which most women aged 15 years and above are in formal marriage or consensual relationships, about 63% of the respondents were married (*Ghana Statistical Service, 2021a, 2021b*). About 70% had completed either primary or secondary education, whereas 14.4% had no formal education. In this District, 63% of women had completed formal education at primary and secondary levels, but only about 0.3% completed tertiary education (*Ghana Statistical Service, 2010, 2021a*). Our survey found that 55% had a household size of 4 - 6 people. This result is consistent with the district average household size of 4.8 persons per household, but more than the national average household size of 3.6 persons (*Ghana Statistical Service, 2021a*).

Table 1. Socio-demographic profile of the respondents.

Variable	Category	Frequency (n = 120)	Percentage (%)
Age	25 - 35	6	5.0
	36 - 45	21	17.5
	46 - 55	20	16.7
	56 and above	73	60.8
Marital Status	Single	45	37.5
	Married	75	62.5
	No formal	28	23.3
Education	Primary	21	17.5
	Secondary	63	52.5
	Tertiary	8	6.7
Household Size	1 - 3	23	19.2
	4 - 6	66	55.0
	6 and above	31	25.8
Flood Experience	After every heavy rain	9	7.5
	Every rainy season	96	80
	Every six months	15	12.5
Occupation*	Government worker	22	18.3
	Petty trading	7	5.8
	Crop/animal farming	59	49.2
	Fishing/fish farming	26	21.7

Continued

	Less than 500	3	2.5
Average Monthly	500 - 2500	62	51
Income (GHC)	2501 - 4500	52	43.3
	Above 4500	3	2.5

\$1 = GH¢15.486 (BoG, 2025); *Multiple choice.

These respondents attempted to have multiple sources of income, including petty trading (55.8%), crop farming/animal husbandry (49.2%), fish farming (21.7%), and public sector work (18.3%). This is generally similar to the national profile of rural women. Most rural women are engaged in agriculture and trading (*Ghana Statistical Service, 2021a, 2021b*). According to the *Ghana Statistical Service (2010)*, the private informal sector is the largest employer in the District. Regarding their monthly income, 51.7% earned between Gh¢500 and 2500, and only 1.7% of the respondents earned more than Gh¢4500. In Ghana, the average annual household income is GH¢33,937, or the average monthly income of GH¢2,828 (*Ghana Statistical Service, 2019*). This suggests that respondents belonged to low-income levels.

Regarding flood experience, about 80% of the respondents had experienced floods during every rainy season in the locality, while 12.5% had experienced floods every six months. Some respondents (7.5%) indicated that they had experienced floods after heavy rain.

3.2. Respondents' Flood Preparedness Strategies

In the second part of the survey, we attempted to understand flood preparedness strategies among the respondents. In doing so, several options were presented to choose from with multiple-choice. These include participating in community volunteer activities, sandbagging, local savings (susu), wall installation around the house, drain cleaning, insurance plan purchase, and evacuation drills.

The results show that 79.8% had cleaned drains around their houses and house premises to prevent waterlogging (**Figure 2**). This shows the gendered division of labor in North Tongu. Traditionally, women are responsible for housekeeping and cleaning around household premises (e.g., sweeping, managing waste). Past studies found similar gendered roles in sub-Saharan Africa (*Wuyep et al., 2014; Park et al., 2020; Kwagala, 1999*). This means that there is limited institutional drainage maintenance.

Another 68.2% had participated in community activities such as communal cleanup exercises in neighborhoods. Women in this District gather regularly to clean the main public gutters. On National Sanitation Day, North Tongu District organizes intensive mass cleaning exercises, focusing on clearing refuse and waterways, sweeping, and improving the overall sanitation of public spaces to promote hygiene and reduce flooding (*MLGCRA, 2025; Mensah & Ahadzic, 2020*). According to the North Tongu District Assembly, these exercises not only im-

prove environmental sanitation but also enhance the spirit of unity among members (NTDA, 2026). The findings align with Protection Motivation Theory, which explains that individuals engage in protective actions when they perceive environmental threats and believe their responses can mitigate such risks. Women's involvement in drainage cleaning in North Tongu reflects their perception that clogged drainage in their households poses a threat and that cleaning efforts can prevent flooding, stagnation of water, and sanitation-related diseases within their households. Women's participation in community activities such as sweeping, clearing garbage, and improving the public areas of the district correlates with the Sendai Framework for Disaster Reduction, which emphasizes community participation in preventive approaches to risks.

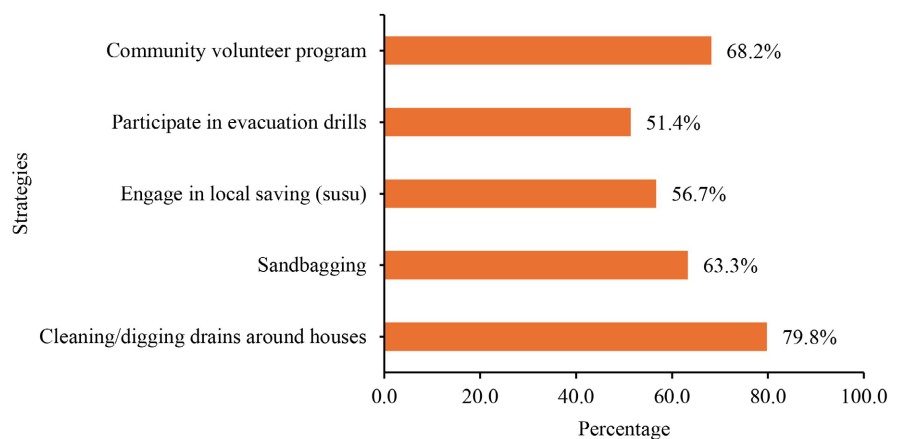


Figure 2. Flood preparedness strategies adopted by the respondents.

These women often relied on sandbagging during major rainy periods to divert water from affecting their structures (63.3%). This is a common practice among those living in low-lying areas. Cudjoe and Alorvor (2021) found that residents utilize indigenous knowledge for low-cost measures such as sandbagging to reduce their flood vulnerability and impacts. Gbedemah (2023) showed that most residents in the Volta Region had adopted locally viable strategies, such as filling compounds and raising mini temporary walls with sandbags. Naah et al. (2025) found that residents in Wa Metropolis of Ghana's Upper West Region arranged sandbags at their doorways and around walls to prevent floodwaters from entering their premises. These findings align with the Protection Motivation Theory (Rogers, 1975) and Grothmann and Reusswig's (2006) argument on adaptation. Gender and Development theory underscores women's role in disaster preparedness for protecting family well-being.

Regarding the use of local savings (susu), 56.7% was positive. In the study area, women finance their businesses and households through personal savings. They do so through susu, a widely trusted system of saving and mutual help among small women businesses in the market, laborers, and other low-income daily earners, as discussed earlier. These are popular among low-income women, as they may not be able to get formal bank loans due to a lack of collateral (Wrigley-Asante, 2012).

3.3. Women's Flood Information Sources

In the third section, we attempted to understand how information access could help women undertake prompt measures against flood events. Past studies showed that information sources for early flood warnings can enhance flood preparedness (Zulfaqar et al., 2024). We asked our respondents about their trusted sources of information for flood mitigation and prevention with multiple-choice questions.

The results show that 92.5% and 83.3% trusted radio and television most, respectively (Figure 3). In agreement with Atreya et al. (2017) and Priyanti et al. (2019), early warning information on radio was trusted more than other sources because, in the Volta Region, weather reports and emergency information are mainly disseminated through radio and, to a lesser extent, television. Another reason that supports our respondents' reliance on radio is the low level of trust in social media information (13.3%). The use of local language on local radio in disseminating information made information more accessible to those women who depend on local language for daily communication. Other relatively trusted information sources are the National Disaster Management Organization (NADMO) (60.8%). NADMO is responsible for awareness creation through the media or by visiting local communities in person (Ministry of Interior, 2023).

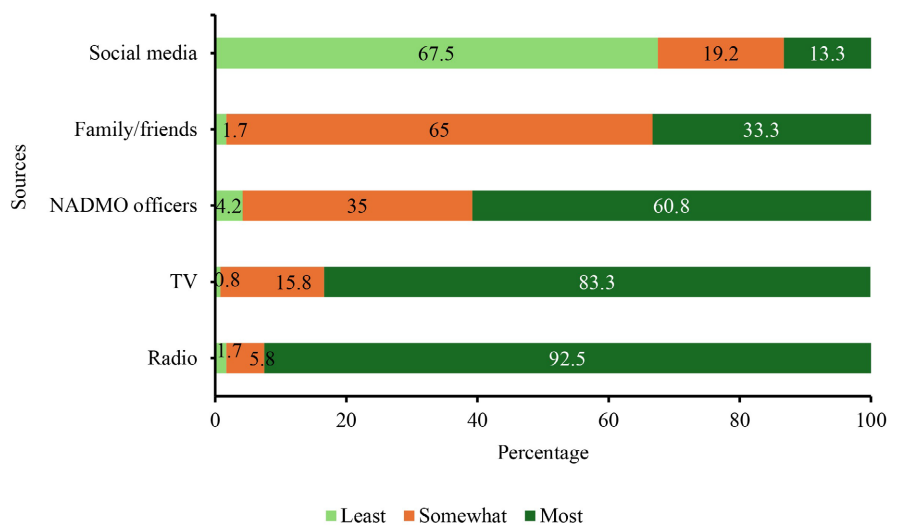


Figure 3. Trusted information sources of the respondents for disaster preparedness.

Interestingly, information from family/friends was trusted to a lesser degree, with 33.3% selected as the most trusted category. Our preliminary field research found that women tended to discuss their flood impacts, experiences, strategies, and other important information with friends and family members when they gather. The respondents likely categorized this type of information as somewhat trustworthy, as hearsay and grapevine information can lead to the spread of false rumors and unnecessary panics (Turner, 2023). Flood information at large may be perceived as technical in nature and more credible when it comes from government sources.

3.4. Factors Affecting Respondents' Flood Preparedness Strategies

After collecting descriptive results from our survey, we sought to understand the factors that influenced respondents' flood preparedness through statistical analyses. As discussed earlier, flood preparedness involves the strategies the respondents had adopted to mitigate flood impacts. The flood preparedness strategies considered as dependent variables were susu savings, sandbagging, participation in evacuation drills, cleaning of drainages, and participation in communal activities. We then interpreted the results partly by considering how each independent variable influences the dependent variables. The probit regression results show that the determinants of the women's flood preparedness were not the same; different factors influenced the adoption of flood preparedness strategies as discussed below. As shown in **Table 2**, the overall model fit (Prob > χ^2) indicates that all five preparedness strategy models were statistically significant at 5% level, indicating that the independent variables (e.g., age, marital status, education, household size, income, flood experience, perceived threat, information access) jointly helped in predicting the adoption of flood preparedness measures.

Table 2. Probit regression analysis on factors influencing respondents' flood preparedness measures.

Variable	Parameter	Susu Saving	Sandbagging	Evacuation Drill	Clean /Dig Drains	Participation in Community Activity
Age	β_1	-0.265 (0.173)	-265 (0.148)	-0.387** (0.150)	0.323** (0.164)	-0.299** (0.150)
Marital Status	β_2	0.81** (0.361)	-0.298 (0.325)	0.698** (0.330)	-0.493 (0.358)	0.517 (0.327)
Education	β_3	0.363* (0.186)	0.0616 (0.171)	-0.0203 (0.173)	0.0538 (0.179)	0.114 (0.180)
Household Size	β_4	-0.417 (0.256)	0.545** (0.237)	-0.385 (0.237)	-0.228 (0.250)	-0.322 (0.238)
Income	β_5	0.425* (0.250)	-0.101 (0.219)	-0.205 (0.217)	-0.484** (0.236)	-0.271 (0.225)
Flood Experience	β_6	0.410 (0.340)	0.292 (0.290)	-0.0620 (0.298)	0.214 (0.334)	0.507 (0.311)
Perceived Threat	β_7	-0.0554 (0.128)	0.192* (0.109)	-0.0150 (0.114)	0.345** (0.148)	-0.147 (0.108)
Information Access	β_8	0.563** (0.282)	-0.348 (0.257)	0.478* (0.267)	0.133 (0.279)	0.155 (0.268)
Constants	β_0	-0.265 (1.174)	-1.161 (1.035)	1.718 (1.061)	2.664** (1.191)	1.409 (1.079)
N		116	116	116	116	116
Pseudo R ²		0.161	0.078	0.115	0.142	0.107
Log Likelihood		-57.308	-71.355	-68.534	-58.628	-67.800
Prob > Chi ²		0.005	0.041	0.022	0.013	0.038

Note: Standard errors in parentheses, *10%, **5%, significance level.

Financial preparedness in the form of susu savings was positively correlated with marital status ($\beta_2 = 0.815$, 5% significance level), education ($\beta_3 = 0.363$, 10% significance level), income ($\beta_5 = 0.425$ at 10% significance level), and information access ($\beta_8 = 0.563$ at 5% significance level). This means that married women with a higher level of education and income with better access to information are more likely to engage in the susu saving strategy. Married women who received household food allowances (“chop money”) from their husbands tend to save a portion through susu schemes as a strategy for future financial security and household needs (Aryeetey, 2008). On the contrary, a study in Zambia and Namibia observed a negative correlation between marital status and flood preparedness (Mabuku et al., 2018).

Sandbagging had two variables influencing its adoption by women. Household size ($\beta_4 = 0.545$) and perceived threat ($\beta_7 = 0.345$) were positively correlated at 5% and 10% significance levels, respectively. This indicates that larger households are more likely to engage in sandbagging, largely due to the availability of a larger labor force and the assumed low initial cost (Lankenau & Koppe, 2019). In light of Protection Motivation Theory (PMT), when an individual perceives the threat of an impending disaster to be high, they are likely to engage in preparedness actions.

Age ($\beta_1 = -0.387$ at 5% significance level), marital status ($\beta_2 = 0.698$ at 5% significance level), and access to information ($\beta_8 = 0.478$ at 10% significance level) were found statistically significant for women to engage in evacuation drills. This means that more elderly women were less likely to engage in evacuation drills. Married women and women with sufficient access to information were more likely to participate in evacuation drills. One study in North Carolina similarly found that married women were more likely to participate in evacuation drills for the sake of their families’ security and safety during flood disasters, especially those with children (Bateman & Edwards, 2002). Adequate access to flood mitigation information can encourage people to be responsible for participating in evacuation drills.

The independent variables shaping participants’ involvement in drainage digging/cleaning around their houses demonstrated an interesting pattern, including age ($\beta_1 = 0.323$ at 5% significance level), perceived threat ($\beta_7 = 0.323$ at 5% significance level), and income ($\beta_5 = -0.484$ at 5% significance level). Older women and those with higher perceived flood threat were more likely to engage in digging/cleaning the drains around their houses. However, we found a negative correlation between income and digging/cleaning drains around houses, possibly due to their business-related time constraints and relatively better living conditions against floods. This could mean that higher-income earners could afford alternative measures, such as improving the condition of their houses or probably relocating to higher elevation areas. Magda et al. (2023) similarly found that women with a higher household income were less likely to engage in traditional domestic labor in Poland.

Participation in community flood-related activities was negatively associated with age ($\beta_1 = -0.299$ at a 5% significance level). This finding suggests that older women were less likely to participate in community flood-related activities, possibly because of physical constraints. In the study area, younger women are expected to engage in physical communal activities such as sweeping and cleaning of public areas and main gutters, enhancing the general sanitation of the community. No other explanatory variable is significantly correlated with participation in community activities.

Overall, the analysis demonstrates that women's flood preparedness is shaped by the interplay among socioeconomic factors, threat perceptions, and information access. Here, Protection Motivation Theory can shed light on the positive correlation of information access with most preparedness measures, significantly on participation in susu savings and evacuation drills. This means that reasonable access to disaster-related information motivates rural women to take preventive measures against perceived threats through appraisal. Additionally, the differences in preparedness strategies across socioeconomic groups underscore how gendered restricted resource access influences how women adopt preparedness options, within the context of the Gender and Development Framework. Further, the result resonates with the emphasis of the Sendai Framework's inclusive resilience enhancement through risk awareness and information sharing. This highlights the need for gender sensitive means of disseminating flood-related information to ensure timely and equal accessibility by women.

4. Conclusion

This paper focused on the flood preparedness of female household heads in rural Ghana. We showed that these women were unique in several ways in Ghana and even in many parts of sub-Saharan Africa. The women were generally aged, with about 61% at 65 years old or older. They had completed only primary or secondary education decades ago. About 14% had not received a formal education. They take care of 4 - 6 people at their households, largely engaging in crop farming, livestock raising, fish farming, and petty trades, though they could only generate income lower than the national average.

About 85% had experienced floods in every wet season, of which about 7.5% had endured floods after every heavy rain. The most common flood impact mitigation preparation involved drainage cleaning and sandbagging. Sandbags are widely used flood preparation measures among rural households in Ghana, but this was especially so among those women who had larger household members. Younger women tend to be mobilized for community-led disaster preparedness actions, such as community drainage cleaning. Those women who were married and had reasonable access to information tended to participate more in evacuation drills. Susu savings were another important measure for those more educated women who receive household allowances from their husbands. These women saved some portion of these allowances to contribute to the susu savings, which is

communally organized among women. Information access determined women's decision-making for joining this savings scheme, which mainly came from radio, TV, or friends/relatives.

These findings in our study can advance our understanding of women's flood preparedness. Flood preparedness measures are clearly gendered in the study area, if not entirely so. It is also important to point out that even within a small locality, the level, scale, and type of flood preparedness actions differ among women to some extent, due partly to their education, information access, age, and income. These mixed responses are related to the GAD framework, in which rural women can be placed as agents for resilience. Some past studies highlighted collective actions among women, but our findings support them with some reservations. Our respondents are resilient and active in responding to flood risks, but some were more prepared than others, even though their income levels are similarly restrictive.

All said, we acknowledge the limitations of our results. Past studies highlighted the existence of locally viable indigenous knowledge for disaster preparedness, but our research could not clarify how women practiced their traditional ecological knowledge to better cope with flood situations. We simply focused on women household heads without looking into a comparative analysis possibility with a larger female population, geographical constraints, and male household heads. These limitations were due largely to our small-scale research activity with limited funding availability. A long-term fieldwork could have clarified more about their traditional knowledge for disaster mitigation.

Author Contributions

B.M. and K.M. contributed to the conception and design of the study. B.M. conducted a questionnaire survey, analysis, and drafted the manuscript. K.M. supervised the study and provided critical revisions. Both authors approved the final version of the manuscript and are responsible for the content.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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