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Dual Burden: Physical and Psychosocial Health Impacts of the 2024 Flood in Bauchi State, Nigeria — A Cross-Sectional Household Survey

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ABSTRACT

Background: Flooding is Nigeria's most frequent natural disaster, yet its combined physical and psychosocial health consequences remain poorly characterised, particularly in resource-constrained sub-Saharan African settings. This study examined the prevalence and correlates of physical morbidity and psychosocial distress following the August 2024 floods in Bauchi State, Nigeria.

Methods: A cross-sectional household survey was conducted among 411 heads of household across six flood-affected Local Government Areas (Katagum, Itas/Gadau, Jama'are, Gamawa, Shira, and Zaki), approximately three months after the flood peak. A structured, interviewer-administered questionnaire captured socio-demographic characteristics, flood exposure history, environmental and infrastructural impacts, self-reported physical morbidity, and psychosocial events. Data were analysed in IBM SPSS v.28 using descriptive statistics, chi-square tests of association, and binary logistic regression.

Results: Most respondents (85.2%) rated the flood's household impact as severe, and 72.3% (297/411) reported flood damage to property. Self-reported physical morbidity was high: malaria (93.4%), self-reported waterborne disease/suspected cholera (77.4%), acute watery diarrhoea (56.4%), and self-reported undernutrition (56.9%). Financial strain (92.9%) and homelessness (92.5%) were near-universal, while 39.7% of households reported a suspected mental-illness event (post-traumatic stress, depression, or anxiety, as recognised by the respondent). Self-reported mental illness varied markedly by LGA, from 10.0% in Itas/Gadau to 82.4% in Jama'are (χ^2=109.0, p<0.001), and was independently associated with property damage (adjusted OR=2.32, 95% CI 1.25–4.29, p=0.008) and LGA of residence, but not with sex, age, or household income. Sanitation access was strongly associated with waterborne illness and diarrhoea (both p<0.001).

Conclusion: Flooding in Bauchi State produced a substantial and geographically uneven dual burden of physical and psychosocial ill-health, driven more by asset loss and locality-specific exposure than by individual demographic characteristics. Disaster response should integrate water, sanitation and hygiene (WASH) restoration, health-facility rehabilitation, and psychosocial support, with resources weighted toward the worst-affected LGAs.

KEYWORDS: Flooding; physical health; psychosocial health; disaster recovery; Bauchi State; Nigeria; water, sanitation and hygiene (WASH); mental health

1. INTRODUCTION

Flooding is the most frequent and destructive natural hazard in Nigeria, and its frequency and severity have escalated in recent decades in tandem with climate change, rapid urbanisation, and land-use change [1,2]. Nigeria ranks among the twenty countries most vulnerable to flooding globally, with major events recorded in 2012, 2018, 2022, and 2024 [3]. Bauchi State, in Nigeria's semi-arid northeast, was the second most flood-affected state nationally following the 2024 floods, with widespread displacement, destruction of homes and farmland, and damage to health infrastructure across the Katagum senatorial zone [4,5,6].

Beyond the immediate destruction of homes, schools, and health facilities, flooding of this scale generates a compounded and often protracted public-health emergency. Physically, the disruption of water and sanitation systems, contamination of water sources, and displacement into crowded temporary shelters create favourable conditions for outbreaks of waterborne disease (e.g., cholera, typhoid, diarrhoeal illness), vector-borne disease (notably malaria), and skin and soft-tissue infections [1,3,7]. Psychosocially, the loss of homes, livelihoods, and in some cases family members is associated with elevated anxiety, depression, post-traumatic stress, and disruption of social support networks [8,9]. In low-resource settings such as northeastern Nigeria, where health systems are already fragile and pre-existing vulnerabilities (poverty, agrarian dependence, and in some areas insecurity) are widespread, a major flood can rapidly overwhelm local response capacity [4,7].

Despite this recognised dual burden, most flood-impact research in Nigeria has examined physical, infrastructural, or economic consequences in isolation, with comparatively few studies jointly quantifying physical morbidity and psychosocial distress in the same affected population [10,11,12,13]. Disaster management programming in Nigeria correspondingly places little emphasis on mental health and psychosocial support (MHPSS), which is rarely integrated into national or state-level disaster response frameworks despite international humanitarian funding directed at Bauchi following the 2024 floods [14].

This study addresses that gap using a household survey conducted across six flood-affected Local Government Areas (LGAs) of Bauchi State. Specifically, the study aimed to: (1) quantify the prevalence of self-reported physical morbidity and psychosocial events among flood-affected households; (2) assess post-flood water, sanitation, and healthcare-access conditions; and (3) identify the socio-demographic and flood-exposure factors independently associated with reported psychosocial distress, to inform integrated, evidence-based disaster health programming.

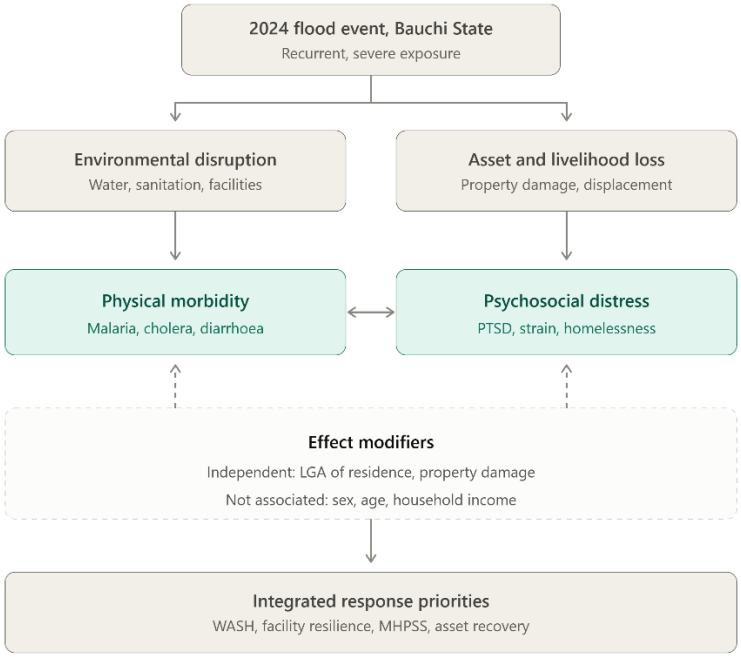

Figure 1: Conceptual framework for the study

2. METHODS

2.1 Study Design and Setting

A descriptive cross-sectional household survey was conducted across six Local Government Areas of Bauchi State — Katagum, Itas/Gadau, Jama'are, Gamawa, Shira, and Zaki — approximately three months after the peak of the August 2024 floods. These LGAs were purposively selected on the basis of documented severe and recurrent flood exposure, consistent with State Emergency Management Agency records and with humanitarian flood-extent and impact assessments of the same event [4,5].

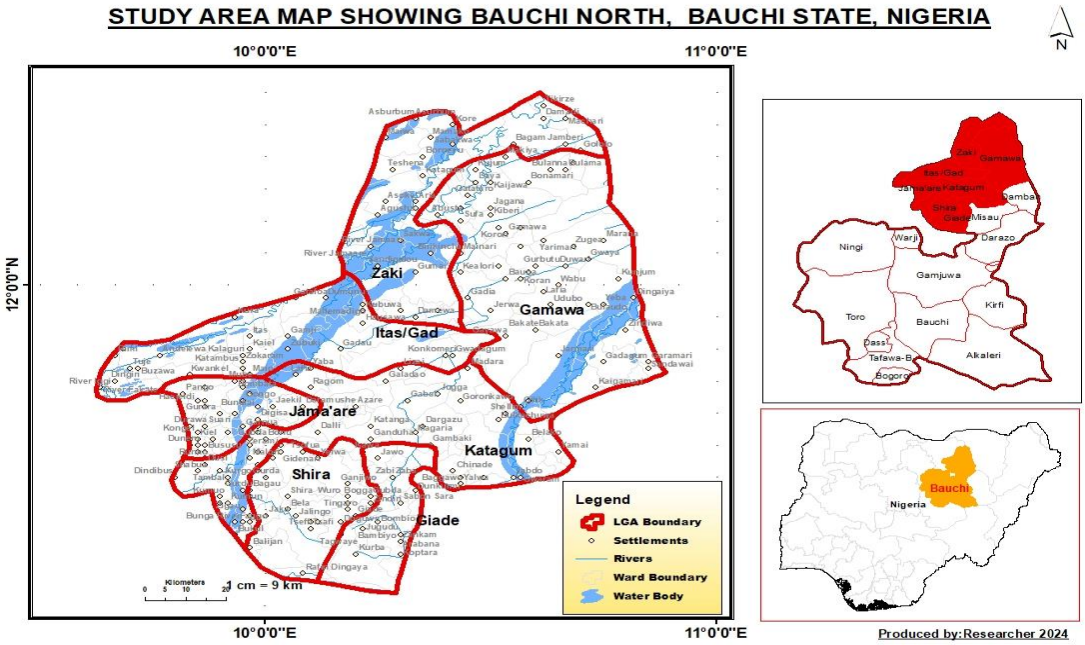

Figure 2: Map of the study area — Katagum Zone, Bauchi State

2.2 Study Population and Sampling

The target population comprised adult heads of household (≥18 years) resident in communities that experienced direct flood impact during the 2024 rainy season. A minimum sample size of 385 was calculated using the Cochran formula for population proportions ($Z=1.96$, assumed prevalence $p=0.5$, margin of error $d=0.05$), inflated by approximately 10% to allow for non-response, yielding a target of 424; 411 valid responses were obtained (response rate 96.9%). A multi-stage sampling approach was used: LGAs were purposively selected for flood severity, flood-affected wards/communities were selected within each LGA, and households were subsequently selected using a patterned-walk procedure, with the head of household (or an available adult representative) as the respondent.

2.3 Data Collection Instrument

Data were collected through a structured, interviewer-administered questionnaire delivered via an electronic data-collection platform with GPS-tagged submissions. The instrument captured: (i) socio-demographic characteristics (age, sex, marital status, education, occupation, monthly income); (ii) flood exposure history and household-level impact severity; (iii) perceived environmental degradation and damage to farmland, livestock, bridges, and roads; (iv) post-flood water quality and sanitation access; (v) a checklist of physical health events occurring in the household following the flood (acute watery diarrhoea, malaria, waterborne disease/suspected cholera, skin disease, undernutrition, physical injury, near-drowning, and death); (vi) health-facility disruption and healthcare-access barriers; (vii) a checklist of psychosocial events experienced by the household following the flood (a household member experiencing a recognised mental-illness event such as post-traumatic stress, depression, or anxiety; isolation from family; family discord; financial strain; homelessness; and loss of a close relative); and (viii) property damage and assistance received. Health and psychosocial items were captured as respondent-reported occurrence (yes/no) rather than through administration of standardised diagnostic instruments (e.g., PHQ-9, GAD-7, or PCL-5); this is an important methodological distinction from clinically validated case-finding and is addressed under Limitations.

2.4 Data Analysis

Data were exported to IBM SPSS Statistics v.28 for analysis. Descriptive statistics (frequencies, percentages, means, standard deviations) summarised socio-demographic characteristics and the prevalence of physical and psychosocial events. Pearson's chi-square test assessed bivariate associations between categorical variables (e.g., reported mental-illness event by LGA, sex, age group, and property damage; waterborne disease and diarrhoea by sanitation access). Binary logistic regression was used to identify factors independently associated with a household reporting a mental-illness event, adjusting for sex, age, monthly income, property damage, and LGA of residence; adjusted odds ratios (aOR) with 95% confidence intervals are reported. Statistical significance was set at $p<0.05$.

2.5 Ethical Considerations

The study was approved by the Bauchi State Health Research Ethics Committee (BSMOH/REC/0137/2024). Informed consent was obtained from all respondents prior to interview, participation was voluntary, and confidentiality of individual responses was maintained throughout data handling and analysis.

3. RESULTS

3.1 Socio-demographic and Flood Exposure Profile

A total of 411 household heads were surveyed across the six LGAs: Katagum (n=87, 21.2%), Jama'are (n=85, 20.7%), Itas/Gadau (n=70, 17.0%), Gamawa (n=69, 16.8%), Zaki (n=62, 15.1%), and Shira (n=38, 9.2%). The mean respondent age was 42.8 years (SD=16.1; median 41, IQR 30–53), and 56.9% (234/411) were male. Most respondents were married (63.5%), had non-formal education (48.2%), and were engaged in farming (30.4%) or trading (25.5%) (Table 1). Nearly all respondents (95.1%) reported having experienced flooding more than once in the preceding five years, and 85.2% rated the 2024 flood's impact on their household as severe. Property damage was reported by 72.3% (297/411) of households.

Table 1. Socio-demographic and flood-exposure profile of survey respondents (N=411).

Characteristic	Category	n	%
Sex (n=411)	Male	234	56.9
	Female	177	43.1
Age group (years) (n=409)	18–35	165	40.1
	36–55	152	37.0
	56+	92	22.4
Marital status (n=411)	Married	261	63.5
	Single	75	18.2
	Widowed	51	12.4
	Divorced	24	5.8
Education (n=411)	Non-formal	198	48.2
	Secondary	105	25.5
	Tertiary	103	25.1
	Primary/not stated	5	1.2
Occupation (n=411)	Farming	125	30.4
	Business/trading	105	25.5
	Civil servant	43	10.5
	Housewife	43	10.5
	Health worker	41	10.0
	Other	54	13.1
Flood recurrence (past 5 yrs) (n=379)	≥3 times	281	68.4
	1–2 times	98	23.8
Perceived household impact (n=411)	Severe	350	85.2
	Moderate	31	7.5
	Minor	29	7.1
Property damaged by flood (n=408)	Yes	297	72.3
	No	111	27.0

3.2 Physical Health Outcomes

Self-reported physical morbidity following the flood was widespread. Suspected malaria was the most frequently reported event (93.4%), followed by self-reported waterborne disease/suspected cholera (77.4%), self-reported undernutrition (56.9%), acute watery diarrhoea (56.4%), and reported near-drowning experiences (52.1%). Skin disease (15.3%), physical injury (5.6%), and death of a household member (5.4%) were less common but still substantial in absolute terms across 411 households (Table 2). On average, households reported 3.6 (of 8 possible) distinct physical health events, indicating considerable co-occurrence of morbidities within the same household rather than isolated single-condition exposure.

Post-flood water quality was rated as contaminated by 94.9% of respondents, and 52.1% of households had no toilet facility at the time of the survey (33.1% used pit latrines, 12.7% VIP latrines, and 1.7% flush toilets). Sanitation access was strongly associated with both waterborne disease (χ^2=56.9, df=4, p<0.001) and diarrhoea (χ^2=35.2, df=4, p<0.001): households without a toilet facility reported the highest rates of both conditions. Regarding health infrastructure, 85.2% of respondents reported that flooding had affected a health facility serving their community — almost exclusively public facilities (98.8%) — and of these, 41.9% described the facility as totally shut down and 38.8% as extremely affected. Consequently, 86.6% of respondents reported having to travel outside their community to access healthcare, and this was associated with facility disruption (χ^2=237.4, df=6, p<0.001).

Physical Health Event	n (%) of households reporting
Self-reported Malaria	384 (93.4)
Waterborne disease / suspected cholera	318 (77.4)
Perceived Undernutrition	234 (56.9)
Acute watery diarrhoea	232 (56.4)
Near-drowning experience	214 (52.1)
Skin disease	63 (15.3)
Physical injury	23 (5.6)
Death of a household member	22 (5.4)

Categories are non-mutually exclusive (households could report more than one event).

3.3 Psychosocial Impacts

Psychosocial disruption was near-universal. Financial strain (92.9%) and homelessness (92.5%) were reported by the great majority of households, reflecting the scale of asset and livelihood loss described in Section 3.1. A substantially smaller, but still clinically important, proportion of households (39.7%) reported a member experiencing a recognised mental-illness event — post-traumatic stress, depression, or anxiety, as identified by the respondent. Family discord (9.7%), loss of a close relative (8.8%), and isolation from family members (7.3%) were reported less frequently (Table 3).

Self-reported mental-illness events varied markedly by LGA, from 10.0% in Itas/Gadau to 82.4% in Jama'are (χ^2=109.0, df=5, p<0.001), a substantially larger difference than any observed by sex (43.9% female vs. 41.9% male; χ^2=0.91, p=0.339), age group (p=0.744), or household income tertile (p=0.139). Self-reported suspected mental-illness events were significantly more common among households that reported property damage (45.8%) than those that did not (23.4%; χ^2=16.9, df=2, p<0.001). Family discord was significantly more common among male-headed households (14.1%) than female-headed households (4.0%; χ^2=10.7, df=1, p=0.001), while reported loss of a close relative and skin disease both varied significantly by LGA (p<0.001 for both), broadly tracking the same pattern of geographic concentration seen for mental-illness events.

Table 3. Prevalence of self-reported psychosocial events following the flood (N=411).

Psychosocial Event	n (%) of households reporting
Financial strain	382 (92.9)
Homelessness	380 (92.5)
Self-reported suspected Mental illness event	163 (39.7)
Family discord	40 (9.7)
Loss of a close relative	36 (8.8)
Isolation from family members	30 (7.3)

Categories are non-mutually exclusive.

3.4 Factors Independently Associated with Reported Mental Illness

In binary logistic regression adjusting simultaneously for sex, age, monthly income, property damage, and LGA (n=404 with complete data), LGA of residence and household property damage remained independent predictors of a reported mental-illness event, while sex, age, and income did not (Table 4). Relative to Gamawa (reference LGA), the odds of a reported mental-illness event were significantly higher in Jama'are (aOR=9.45, 95% CI 4.37–20.46, p<0.001) and Katagum (aOR=2.13, 95% CI 1.06–4.30, p=0.034), and significantly lower in Itas/Gadau (aOR=0.23, 95% CI 0.09–0.59, p=0.002). Households reporting property damage had more than twice the odds of a reported mental-illness event compared with those without property damage (aOR=2.32, 95% CI 1.25–4.29, p=0.008). The model explained a moderate proportion of variance in outcome (pseudo R^2=0.23; likelihood-ratio p<0.001).

Table 4. Binary logistic regression: factors associated with a household reporting a suspected mental-illness event (post-traumatic stress, depression, or anxiety), N=404.

Predictor	Adjusted OR	95% CI	p-value
LGA: Jama'are (ref: Gamawa)	9.45	4.37–20.46	<0.001
LGA: Katagum	2.13	1.06–4.30	0.034
LGA: Shira	0.90	0.37–2.17	0.811
LGA: Zaki	0.49	0.20–1.16	0.104
LGA: Itas/Gadau	0.23	0.09–0.59	0.002
Property damage (ref: No damage)	2.32	1.25–4.29	0.008
Female sex (ref: male sex)	0.90	0.54–1.50	0.686
Age (per year)	1.00	0.98–1.01	0.792
Monthly income (per ₦1,000)	1.00	1.00–1.00	0.265

3.5 Post-Flood Assistance

Financial aid was the most common form of assistance received (57.4%), followed by food assistance (47.7%) and temporary shelter (16.8%); however, 34.8% of households reported receiving no assistance of any kind following the flood, underscoring gaps in the reach of the post-disaster response.

4. DISCUSSION

This survey of 411 households across six flood-affected LGAs of Bauchi State provides quantitative evidence of a substantial dual burden of physical and psychosocial ill-health following the 2024 floods, consistent with the broader pattern of compounded post-disaster health crises documented elsewhere in Nigeria and sub-Saharan Africa [1,2,3,7]. The very high prevalence of malaria, waterborne disease, and diarrhoea mirrors the expected secondary infectious-disease surge associated with contaminated water sources, damaged sanitation infrastructure, and displacement into crowded conditions [1,7]. That water quality was rated as contaminated by nearly all respondents, and that over half of households lacked any toilet facility at the time of the survey, is consistent with the strong statistical association observed between sanitation access and both waterborne disease and diarrhoea, and reinforces WASH restoration as a first-order priority in the post-flood response.

The near-universal reporting of financial strain and homelessness reflects the scale of asset and livelihood loss described in the socio-demographic profile, where almost three-quarters of households reported direct property damage. Against this backdrop, the finding that four in ten households reported a member experiencing a mental-illness event is notable, though it should be interpreted as an indicator of respondent-recognised psychological distress rather than a clinically validated psychiatric prevalence, given that standardised diagnostic instruments were not administered (see Limitations).

A key finding of this study is that reported mental illness was far more strongly patterned by locality and by the severity of material loss than by individual demographic characteristics such as sex, age, or income. The nine-fold higher odds of reported mental-illness events in Jama'are compared with Gamawa, alongside the significant association with property damage, suggests that the intensity and totality of flood exposure at the community level — rather than individual vulnerability profiles alone — is the principal driver of psychosocial distress in this context. This is broadly consistent with disaster-vulnerability frameworks in which the severity of the hazard interacts with pre-existing community-level exposure to produce disproportionate impacts [4,8]. The comparatively higher reporting of family discord among male-headed households, contrary to some assumptions in the disaster-health literature that women bear disproportionate psychosocial burden, illustrates the value of directly measured local data over untested extrapolation from other settings, and warrants further qualitative investigation.

The disruption of health infrastructure compounds these physical and psychosocial burdens: with the large majority of respondents reporting that a local health facility had been affected — many totally shut down — and the majority needing to travel outside their community for care, the health system's capacity to respond to the very morbidities the flood generated was itself substantially degraded. This double jeopardy, in which need rises as capacity falls, is a recurring feature of flood disasters in fragile health systems [2,7] and is reflected in the finding that over a third of surveyed households received no post-flood assistance of any kind.

5. LIMITATIONS

Several limitations should be considered when interpreting these findings. First, physical and psychosocial health events were captured through respondent self-report on a structured checklist rather than through clinical examination or administration of validated diagnostic instruments (e.g., WHO case definitions for cholera, or standardised scales such as the PHQ-9, GAD-7, or PCL-5 for psychosocial conditions); reported prevalence should therefore be interpreted as an indicator of perceived morbidity and distress rather than a clinically confirmed diagnosis, and future research should incorporate validated psychometric and clinical case-finding tools. Second, the cross-sectional design precludes causal inference and is subject to recall bias, given that data were collected approximately three months after the flood peak. Third, the notably high reported prevalence of "near-drowning experience" (52.1%) warrants cautious interpretation and may reflect either genuine widespread exposure to fast-moving floodwater or, alternatively, some ambiguity in how this item was understood by respondents; this should be clarified through cognitive testing of the instrument in future rounds. Fourth, purposive selection of severely flood-affected LGAs and communities means findings should not be generalised to less-affected areas of Bauchi State. Despite these limitations, the large sample size, multi-LGA coverage, and use of inferential statistics to identify independent correlates of distress provide a robust, policy-relevant evidence base.

6. CONCLUSION AND RECOMMENDATIONS

This study demonstrates that the 2024 flood in Bauchi State produced a severe and geographically uneven dual burden of physical and psychosocial ill-health, driven primarily by the scale of property and livelihood loss and by locality-specific exposure rather than by individual demographic characteristics. Sanitation access was strongly linked to infectious morbidity, health infrastructure disruption compounded the population's healthcare needs, and psychosocial distress was concentrated in the most severely affected communities. Based on these findings, we recommend:

1. Targeted WASH restoration: Prioritise rapid restoration of safe water supply and functional sanitation facilities in the most affected LGAs, given the strong statistical association between sanitation access and both waterborne disease and diarrhoea.
2. Health-facility resilience: Invest in flood-resilient health infrastructure and mobile/outreach clinics in flood-prone LGAs, given that the large majority of respondents relied on facilities that were themselves disrupted or shut down.
3. Geographically weighted MHPSS integration: Rather than a uniform state-wide MHPSS rollout, allocate psychosocial support resources in proportion to locality-specific need — the nine-fold difference in reported distress between Jama'are and Gamawa indicates that a one-size-fits-all response would misallocate scarce resources.
4. Linking relief to asset recovery: Given the strong association between property damage and psychosocial distress, integrate livelihood and asset-recovery support (rebuilding materials, replacement of lost farm inputs) directly with psychosocial support programming, rather than treating them as separate response pillars.
5. Strengthened assistance coverage: Address the substantial gap in post-flood assistance coverage — over a third of surveyed households received no assistance — through improved needs assessment and distribution mechanisms.

Building resilience to recurrent flooding in Bauchi State requires treating these events not as isolated emergencies but as protracted, locality-specific public-health crises in which physical and psychosocial health needs are addressed jointly and resources are allocated according to the demonstrated unevenness of impact.

Data Availability Statement

The quantitative dataset analysed for this study is available from the corresponding author on reasonable request, subject to approval by the BASHREC and in line with FUHSA data-sharing governance.

Conflict of Interest

The authors declare that they have no competing financial, professional, or personal interests that could have influenced the conduct, analysis, or reporting of this study.

Author Contributions

AI conceived and designed the study, led data collection, performed the analysis, and drafted the manuscript. AYZ contributed to study design, served as a technical expert on flood, and participated in the data collection. HMA reviewed the manuscript and made valuable inputs in the methodology and data analysis. SBS designed the conceptual framework and facilitated data collection, MAA reviewed the manuscript and assisted in data analysis, BAI, reviewed the manuscript and made strategic contribution to the overall

outlook of the work, and MJA critically revised the manuscript and provided scientific guidance on the manuscript. BMA supervised the study, provided overall scientific guidance, and critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

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