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**THE ASSOCIATION BETWEEN EXPOSURE TO RECURRENT
FLOODING AND PSYCHOLOGICAL DISTRESS AMONG ADULT
RESIDENTS OF CHORKOR, ACCRA**

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Abstract

Flooding is a recurring environmental and public-health challenge in Accra. Although its physical, economic and infrastructural consequences have received considerable attention, its psychological consequences remain less understood within flood-prone communities in Ghana. This proposed study will examine the association between exposure to recurrent flooding and psychological distress among adult residents of Chorkor, Accra. The study will employ an analytical cross-sectional design. A multistage sampling procedure will be used to select adults aged 18 years or above who have lived in Chorkor for at least two years. Data will be collected using a structured questionnaire. Flood exposure will be measured using indicators including frequency, household inundation, water depth, duration, property damage, displacement and loss of income. Psychological distress will be assessed using the 10-item Kessler Psychological Distress Scale. Descriptive statistics will summarise flood exposure and estimate the prevalence of psychological distress. Multivariable regression analysis will examine the association between flood exposure and psychological distress while controlling for relevant demographic, socioeconomic and health characteristics. Ethical approval, informed consent, confidentiality and procedures for supporting participants who experience distress will be incorporated into the study. The findings are expected to contribute evidence for integrating mental-health considerations into flood preparedness and public-health responses in Accra.

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Chapter One: Introduction

1.1 Background to the Study

Flooding constitutes an important environmental and public-health challenge. Its immediate consequences include injury, death, displacement, destruction of property, interruption of essential services and contamination of water supplies. Flooding can also produce less visible psychological consequences through fear, uncertainty, financial loss, displacement and repeated disruption of everyday life.

Systematic reviews demonstrate that flood exposure is associated with psychological distress, anxiety, depression, post-traumatic stress symptoms and reduced wellbeing (Alderman et al., 2012; Fernandez et al., 2015; Zhong et al., 2018). These consequences may continue after floodwater has receded because affected people must repair their homes, replace lost property, recover their livelihoods and live with the possibility of another flood. Secondary stressors, including financial difficulties, temporary displacement and prolonged disruption, may therefore extend the psychological consequences of flooding.

Recurrent exposure may be particularly important. French et al. (2019) found that people exposed to repeated flooding experienced poorer mental-health and health-related quality-of-life outcomes than those with lower exposure. Similarly, Waite et al. (2017) established that the mental-health consequences of flooding can be substantial and may extend beyond households whose homes were directly inundated. Follow-up research also found elevated psychological morbidity two years after flooding (Jermacane et al., 2018).

Flooding is a longstanding challenge in Accra. Its occurrence has been associated with heavy rainfall, inadequate drainage, poorly coordinated land-use planning, settlement in vulnerable locations, rapid urban development and waste accumulation in drainage channels

(Amoako & Frimpong Boamah, 2015; Mensah & Ahadzie, 2020). Research has also demonstrated that exposure and vulnerability are shaped by household socioeconomic conditions and the capacity to protect property, relocate or recover after a flood (Aboagye, 2012).

Recent spatial research indicates that substantial areas of the Accra Metropolitan Area are vulnerable to flooding and identifies Chorkor among the communities situated within flood-vulnerable parts of the metropolis (Atakorah et al., 2023). Recurrent flooding in Accra can interrupt livelihoods, mobility and access to markets, education and healthcare services (Andreasen et al., 2022). These disruptions may create or intensify stress, particularly among households with limited financial resources and few alternatives for accommodation or employment.

Psychological distress refers to a general state of emotional suffering characterised by symptoms such as nervousness, restlessness, hopelessness, sadness and feelings of worthlessness. It is not equivalent to a clinical diagnosis. However, it is an important population-level indicator of mental wellbeing and possible need for further support. Studies using Ghanaian population data have found a meaningful burden of moderate and severe psychological distress and associations with unemployment, reduced productivity and socioeconomic disadvantage (Canavan et al., 2013; Sipsma et al., 2013).

Despite the recurrent nature of flooding in Accra, much of the existing Ghanaian research has concentrated on the causes of flooding, physical vulnerability, economic losses, infrastructure, household coping strategies and institutional responses. Comparatively less empirical attention has been given to psychological distress among adults living in repeatedly affected communities. This proposed study will address this gap by examining the association

between exposure to recurrent flooding and psychological distress among adult residents of Chorkor.

1.2 Statement of the Problem

Residents of Chorkor face the possibility of repeated exposure to flooding, household inundation, property damage, livelihood interruption, temporary displacement and fear of future flood events. These experiences may affect their psychological wellbeing even when they do not result in physical injury.

International studies consistently show that flood exposure is associated with adverse mental-health outcomes (Fernandez et al., 2015; French et al., 2019; Waite et al., 2017). Nevertheless, findings from other countries cannot automatically be applied to Chorkor because vulnerability, social support, housing conditions, livelihoods, cultural interpretations of distress and access to mental-health services differ across settings.

Research on flooding in Accra has established the recurrence of flooding and its physical, socioeconomic and infrastructural consequences (Aboagye, 2012; Andreasen et al., 2022; Atakorah et al., 2023). However, limited community-level evidence is available on whether differences in the frequency and severity of flood exposure are associated with differences in psychological distress among adult residents of Chorkor.

Without such evidence, flood responses may concentrate primarily on drainage, sanitation, relocation and physical reconstruction while overlooking residents' psychosocial needs. The proposed study will therefore examine whether exposure to recurrent flooding is associated with psychological distress among adult residents of Chorkor, Accra.

1.3 Aim of the Study

The study aims to examine the association between exposure to recurrent flooding and psychological distress among adult residents of Chorkor, Accra.

1.4 Specific Objectives

The study will:

1. Describe exposure to recurrent flooding among adult residents of Chorkor.
2. Estimate the prevalence of psychological distress among adult residents of Chorkor.
3. Examine the association between exposure to recurrent flooding and psychological distress, after controlling for demographic, socioeconomic and health characteristics.

1.5 Research Questions

1. What is the level of exposure to recurrent flooding among adult residents of Chorkor?
2. What is the prevalence of psychological distress among adult residents of Chorkor?
3. Is exposure to recurrent flooding associated with psychological distress after controlling for demographic, socioeconomic and health characteristics?

1.6 Research Hypotheses

Null hypothesis (H_0): Exposure to recurrent flooding is not significantly associated with psychological distress among adult residents of Chorkor after controlling for demographic, socioeconomic and health characteristics.

Alternative hypothesis (H_1): Exposure to recurrent flooding is significantly associated with psychological distress among adult residents of Chorkor after controlling for demographic, socioeconomic and health characteristics.

1.7 Significance of the Study

The proposed study will contribute evidence on an insufficiently examined dimension of flooding in Accra. It will extend existing research beyond physical damage and infrastructural disruption by examining psychological wellbeing.

The findings could help:

- The Accra Metropolitan Assembly incorporate psychosocial support into flood preparedness and response.
- Public-health authorities identify groups that may require mental-health screening or referral after flooding.
- NADMO and community organisations develop more comprehensive flood-response plans.
- Researchers understand the relationship between recurrent environmental hazards and mental health in an urban Ghanaian context.
- Community leaders advocate for interventions addressing both physical safety and psychological wellbeing.

1.8 Scope of the Study

Geographically, the study will be limited to selected sections of Chorkor in the Accra Metropolitan Area. The study population will consist of adults aged 18 years or above who have lived in Chorkor for at least two years.

Conceptually, the study will focus on:

- Frequency and severity of household flood exposure.
- Property damage, displacement and livelihood interruption.
- Current psychological distress.

- Demographic, socioeconomic and health characteristics that might influence psychological distress.

The study will measure psychological distress through a screening questionnaire. It will not clinically diagnose anxiety, depression or other mental disorders.

1.9 Operational Definition of Key Terms

Flood exposure: Direct experience of floodwater affecting a participant's home, compound, immediate neighbourhood, livelihood or access to essential services.

Recurrent flooding: For this study, experiencing two or more flood incidents affecting the household or immediate residential area during the preceding three years.

Flood severity: The extent of exposure measured through indicators such as water depth, duration, household inundation, property damage, displacement, injury and loss of income.

Psychological distress: Non-specific symptoms of emotional suffering, including nervousness, hopelessness, restlessness, sadness and feelings of worthlessness, measured using the Kessler Psychological Distress Scale.

Adult resident: A person aged 18 years or above who has lived in Chorkor for at least two years.

1.10 Organisation of the Study

Chapter One presents the background, problem statement, objectives, research questions, hypotheses, significance and scope. Chapter Two reviews the conceptual, theoretical and empirical literature and presents the conceptual framework. Chapter Three describes the proposed research design, population, sampling, data collection, analysis and ethical considerations.

Chapter Two: Literature Review

2.1 Concept of Recurrent Flooding

Flooding occurs when water covers land or built environments that are ordinarily dry. Urban flooding may arise from intense rainfall, inadequate drainage, blocked waterways, development on wetlands and increased impermeable surfaces.

Recurrent flooding involves repeated exposure rather than a single exceptional event. Repetition may prevent households from fully recovering before another flood occurs. Households may repeatedly spend money on repairs, lose income, replace possessions and experience disruption to work, education and healthcare.

In Accra, recurrent flooding reflects interacting physical, institutional and social conditions. Amoako and Frimpong Boamah (2015) grouped the causes into physical, behavioural and institutional dimensions. Mensah and Ahadzie's (2020) systematic review similarly identified poor urban planning, inadequate drainage, environmental practices and extreme rainfall as major factors.

2.2 Concept of Psychological Distress

Psychological distress is a broad emotional state involving symptoms of anxiety and depression. It does not necessarily indicate the presence of a psychiatric disorder. Nevertheless, high levels of distress may affect daily functioning, employment, relationships, physical health and quality of life.

The Kessler Psychological Distress Scale was developed to measure non-specific psychological distress in population surveys (Kessler et al., 2002). The K10 asks participants how frequently they experienced ten emotional states during the previous four weeks. It is

appropriate for this study because it measures broad distress without requiring the researcher to make clinical diagnoses.

Ghanaian studies have previously used the K10 to investigate psychological distress. Sipsma et al. (2013) found that psychological distress was associated with socioeconomic and gender-related vulnerabilities. Canavan et al. (2013) also reported an association between psychological distress, unemployment and reduced productivity.

2.3 Pathways Linking Flooding to Psychological Distress

2.3.1 Direct exposure

Fear of drowning, injury, witnessing destruction or becoming trapped may create an immediate stress response.

2.3.2 Property and financial loss

Damage to houses, furniture, documents and livelihood assets may create financial pressure and feelings of helplessness.

2.3.3 Displacement

Temporary or prolonged displacement may disrupt privacy, family life, social relationships and access to familiar support systems.

2.3.4 Livelihood interruption

Flooded roads, workplaces and markets may prevent residents from working or trading. Andreasen et al. (2022) found that heavy rainfall and flooding in Accra disrupted mobility, livelihoods and access to services.

2.3.5 Anticipatory fear

People exposed repeatedly may experience fear whenever heavy rainfall begins. The expectation of another flood can sustain distress even when no flood is currently occurring.

2.3.6 Secondary stressors

Difficulties repairing property, obtaining assistance, paying debts or recovering income may prolong distress after the immediate event has ended.

2.4 Empirical Evidence on Flooding and Mental Health

Alderman et al. (2012) found consistent evidence linking floods with psychological distress and other adverse health outcomes. Fernandez et al. (2015) similarly identified depression, anxiety, post-traumatic stress and general psychological distress as recurring outcomes in flood-affected populations.

Waite et al. (2017) found that the psychological consequences of flooding were substantial and extended beyond residents whose homes had been directly flooded. Jermacane et al. (2018) subsequently found that probable anxiety, depression and post-traumatic stress remained elevated two years after exposure.

Repeat exposure may further increase the mental-health burden. French et al. (2019) reported that repeat flooding was associated with poorer mental-health and health-related quality-of-life outcomes. Zhong et al. (2018) also found that the psychological consequences of flooding can persist over time, although the magnitude and duration vary according to exposure, vulnerability and access to support.

These studies provide strong evidence for an association between flooding and mental-health outcomes. However, much of the available evidence originates from high-income

countries. Housing, social protection, emergency response, insurance and mental-health service availability differ substantially from those in flood-prone communities in Accra.

2.5 Evidence from Ghana and Accra

Aboagye (2012) showed that flood vulnerability in Accra is socially differentiated and that repeated floods affect households' property, livelihoods and ability to recover. Atakorah et al. (2023) demonstrated substantial spatial variation in flood vulnerability across Accra and identified known vulnerable residential communities.

Andreasen et al. (2022) found that flooding and heavy rainfall commonly disrupted travel, livelihood activities and access to health and other services. Mensah and Ahadzie (2020) concluded that health concerns were among the documented consequences of flooding in Ghana but also identified important gaps in the national evidence base.

Although these studies demonstrate that Accra residents experience repeated physical, social and economic disruptions, they do not provide sufficient evidence concerning psychological distress among adults in Chorkor. The proposed study will address this contextual and outcome-specific gap.

2.6 Theoretical Framework

The study will be guided by the Conservation of Resources Theory developed by Hobfoll (1989). The theory proposes that people attempt to obtain, retain and protect resources they value. Psychological stress occurs when these resources are threatened, lost or insufficiently restored after substantial effort.

Resources relevant to recurrent flooding include housing and household property, income and livelihood assets, physical safety, health, family stability, social support, time, personal energy and a sense of security and control.

Flooding may threaten or remove several resources simultaneously. Repeated floods may also produce loss spirals, whereby an initial loss makes households more vulnerable to additional losses. For example, property damage may lead to debt, debt may affect the ability to repair a house, and an unrepaired house may increase vulnerability to another flood.

The theory is appropriate because it explains how the frequency and severity of flood-related losses may be associated with psychological distress.

2.7 Conceptual Framework

Component	Proposed variables
Main exposure	Frequency of flooding, household inundation, water depth and duration
Flood-related consequences	Property damage, displacement, injury, loss of income and disruption of essential services
Outcome	Psychological distress measured with the Kessler Psychological Distress Scale (K10)
Potential protective factors	Social support, preparedness and access to assistance
Potential confounders	Age, sex, education, employment, income, marital status, chronic illness and previous mental-health problems

The framework proposes that greater frequency and severity of flood exposure will be associated with higher psychological-distress scores. Flood-related losses may help explain this relationship, while social support and preparedness may reduce the severity of distress.

2.8 Research Gap

Existing studies establish that:

- Accra experiences recurrent flooding.
- Flood vulnerability varies across communities and households.

- Flooding causes property, livelihood and mobility disruptions.
- Flood exposure is associated internationally with adverse mental-health outcomes.

However, limited empirical evidence directly examines the association between recurrent flood exposure and psychological distress among adults in Chorkor. The proposed study will address this gap using a standardised psychological-distress measure and a multidimensional assessment of flood exposure.

Chapter Three: Proposed Methodology

3.1 Research Approach and Design

The study will use a quantitative approach and an analytical cross-sectional design. Information on participants' flood exposure and current psychological distress will be collected at one point in time.

The design is appropriate because it will allow the researcher to describe flood exposure, estimate the prevalence of psychological distress, compare distress across different levels of exposure and test for an association between flood exposure and distress.

Because the design is cross-sectional, the study will not claim that flooding caused psychological distress. It will assess statistical association.

3.2 Study Area

The study will be conducted in Chorkor, within the Accra Metropolitan Area. Chorkor has been selected because it is located within a flood-vulnerable part of Accra and contains households with differing experiences of recurrent flooding. The study will focus on clearly identified residential sections rather than assuming that all Chorkor residents have identical exposure.

3.3 Study Population

The target population will comprise adult residents of Chorkor.

3.3.1 Inclusion criteria

- Adults aged 18 years or above.
- Residents who have lived in Chorkor for at least two years.
- Individuals able and willing to provide informed consent.

3.3.2 Exclusion criteria

- Temporary visitors.
- Residents unable to provide informed consent.
- Individuals experiencing an immediate health or psychological emergency at the time of recruitment.

3.4 Sample Size

Cochran's formula for estimating a proportion in a large population will be used:

$$n_0 = Z^2 p(1 - p) / e^2$$

Where n_0 is the required sample size, Z is 1.96 at the 95% confidence level, p is 0.50 where the expected prevalence is uncertain, and e is the 0.05 margin of error.

$$n_0 = [1.96^2 \times 0.50 \times 0.50] / 0.05^2 = 384$$

Allowing 10% for non-response gives $384 + 38.4 = 422.4$. The proposed final sample will therefore be approximately 423 adult residents.

3.5 Sampling Procedure

A multistage sampling procedure will be used:

1. Enumeration areas covering selected sections of Chorkor will be identified.
2. A sample of enumeration areas will be selected.
3. Households within the selected areas will be listed or identified using available community maps.
4. Households will be selected systematically from the resulting lists.
5. Where more than one eligible adult lives in a selected household, one adult will be selected randomly.

This procedure will reduce the risk of interviewing only highly visible or easily accessible residents.

3.6 Data-Collection Instrument

Data will be collected using a structured, interviewer-administered questionnaire containing the following sections:

3.6.1 Section A: Demographic, socioeconomic and health information

Age, sex, marital status, education, employment, household income, length of residence, housing tenure, household size, chronic illness and previous mental-health history.

3.6.2 Section B: Flood exposure

Number of flood incidents experienced, date of the most recent flood, household inundation, water depth, duration, property damage, temporary displacement, injury or bereavement, loss of income and interruption of access to essential services.

3.6.3 Section C: Psychological distress

Psychological distress will be measured using the Kessler Psychological Distress Scale (K10). The ten items ask participants how often they experienced specific emotional states during the previous four weeks. Responses are recorded on a five-point scale and summed to produce an overall score ranging from 10 to 50. Higher scores indicate greater psychological distress. An established scoring protocol will be selected before data collection to classify participants for estimating prevalence. The K10 is a screening measure and will not be used to make clinical diagnoses.

3.6.4 Section D: Support and coping factors

Household and family support, community support, access to emergency assistance, flood preparedness and previous contact with health or mental-health services.

3.7 Validity and Reliability

The questionnaire will be reviewed by experts in public health, mental health and disaster research to assess its content validity.

A pilot study involving approximately 20–25 adults from a comparable community outside the final sample will assess the clarity, cultural appropriateness, interview duration, translation and sensitivity of the questions.

Where required, the questionnaire will be translated into Ga and Twi using forward and back translation. Internal consistency will be assessed using Cronbach's alpha.

3.8 Data-Collection Procedure

Trained research assistants will administer the questionnaire in participants' preferred language. Interviews will take place in locations that protect participants' privacy.

Written or appropriately documented informed consent will be obtained before participation. No data will be collected before ethical approval and community entry permissions have been secured.

3.9 Measurement of Variables

3.9.1 Independent variable

Exposure to recurrent flooding will be measured using the number of flood events, household inundation, water depth, duration, property damage, displacement, injury or loss and

livelihood interruption. A cumulative flood-exposure index may be developed after testing the distribution and reliability of the component indicators.

3.9.2 Dependent variable

Psychological distress will be measured using the K10. A predetermined and appropriately justified cut-off will be used to classify participants for the prevalence estimate. The continuous K10 score may be retained for supplementary analysis because it preserves information across the full range of distress.

3.9.3 Covariates

The analysis will consider age, sex, education, employment, income, marital status, housing tenure, chronic illness, previous mental-health problems and social support.

3.10 Data-Analysis Plan

Data will be entered, cleaned and analysed using an appropriate statistical program such as SPSS, Stata or R.

3.10.1 Descriptive analysis

Frequencies, percentages, means, medians and standard deviations will summarise participant characteristics and flood exposure. The prevalence of psychological distress will be calculated as the proportion of participants meeting the selected K10 cut-off, with a 95% confidence interval.

3.10.2 Bivariate analysis

Appropriate tests will examine unadjusted relationships between flood exposure, psychological distress and participant characteristics. Depending on the measurement and

distribution of variables, these may include chi-square tests, independent-samples t-tests and correlation analysis.

3.10.3 Multivariable analysis

Multivariable logistic regression will examine whether flood exposure is associated with psychological distress after adjusting for demographic, socioeconomic and health characteristics. Results will be reported using adjusted odds ratios, 95% confidence intervals and p-values. Statistical significance will be assessed at $p < .05$. Model fit, multicollinearity and influential observations will be examined.

3.11 Ethical Considerations

Ethical approval will be obtained from the appropriate institutional review body before data collection. The study will ensure:

- Informed and voluntary participation.
- The right to decline or withdraw without penalty.
- Privacy during interviews.
- Confidentiality and anonymisation.
- Secure storage of research data.
- Restricted access to identifiable information.
- Respectful handling of distressing flood experiences.

Participants will not be pressured to describe traumatic experiences. A distress protocol will be prepared, including pausing or terminating an interview when necessary and providing information about appropriate health or mental-health support. K10 results will not be presented to participants as a clinical diagnosis.

3.12 Anticipated Limitations

The cross-sectional design will limit causal and temporal conclusions. Psychological distress may have existed before the reported flood exposure.

Self-reported flood experiences may be affected by recall error. Psychological-distress responses may also be influenced by stigma or social desirability.

The K10 is a screening instrument and cannot establish psychiatric diagnoses. Conducting the study in one community may also limit generalisation to all flood-prone communities in Accra.

These limitations will be reduced by using clearly defined recall periods, employing a standardised distress instrument, training interviewers, protecting participants' privacy, controlling for relevant background characteristics and interpreting the results as associations rather than causal effects.

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