

Stress under Shocks: Food Insecurity, Weather Shocks, and Mental Health in Malawi

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Development Research in the Polycrisis Era*

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Introduction

- **Rising global incidence of mental health challenges:** Mental health issues are a significant but under-researched public health concern, particularly in low-income and resource-constrained settings such as Malawi.
- **Synergistic impacts:** The compounded effects of food insecurity and weather shocks create a vicious cycle, as one exacerbates the other.
- **Limited existing research:** While the connection between food insecurity and mental health has been explored, the role of weather shocks as a mediating or amplifying factor remains under-researched.
- **Policy and program design:** Insights from this research can inform the development of targeted policies, including social safety nets, climate-resilient agricultural practices, and mental health interventions to better support vulnerable populations.

- The relationship between food insecurity and mental health is not a new topic; several studies have examined this relationship in developing countries (Das et al. 2007; Sweetland et al. 2018; Trudel et al. 2021; Ridley et al. 2020). However, there are multiple gaps in the literature.
- Most studies are not causal (Trudel et al. 2021; Pengpid and Peltzer 2004), most use cross-sectional data from a specific region of a country (Jebena et al. 2016; Hadley and Patil 2006), and potential effects of compound shocks (such as weather shocks and food insecurity) are not studied.
- Ridley et al. (2020) conducted a systematic review of causal evidence of poverty on mental illness and the potential mechanism.
- Likewise Pourmotabbed et al. (2020) systematically reviewed papers on food insecurity and mental health and found only 19 articles - 18 of them were correlational.

Key Questions:

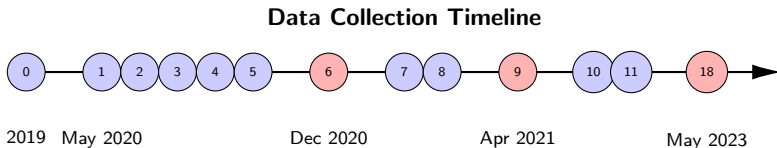
- How does food insecurity affect mental health?
- What role do weather shocks play in the relationship between food insecurity and mental health?
- Are the food insecurity's effects on mental health more pronounced for certain populations than others?

Hypotheses:

- **H1:** Food insecurity adversely impacts mental health outcomes.
- **H2:** Weather shocks exacerbate the adverse impact of food insecurity on mental health.
- **H3:** The combined effects of food insecurity and weather shocks vary by demographic and socioeconomic factors.

- **Living Standards Measurement Study (LSMS):**

- collected before Covid-19: Integrated Household Panel Survey (IHPS)
- collected during Covid-19: Longitudinal High-Frequency Phone Surveys (HFPS)



- **Global Drought Observatory (GBO):**

- temporal coverage: historical, real-time, and forecast data;
- spatial resolution: high resolution of 0.05° (5.5 km);
- data sources: integration of satellite imagery, in-situ station data.

Mental Health Indicators: In the Patient Health Questionnaire-8 (PHQ-8), a score of **10 or higher** is generally considered indicative of clinically significant depression.

The scoring categories for the PHQ-8 are as follows:

- **0–4:** Minimal depressive symptoms (not typically clinically significant).
- **5–9:** Mild depression (clinically significant; further assessment or intervention may be needed).
- **10–14:** Moderate depression (clinically significant; further evaluation or intervention may be needed).
- **15–24:** Severe depression (strong indication for immediate intervention or treatment).

Patient Health Questionnaire-8

Section 4B. Patient Health Questionnaire

INTERVIEWER

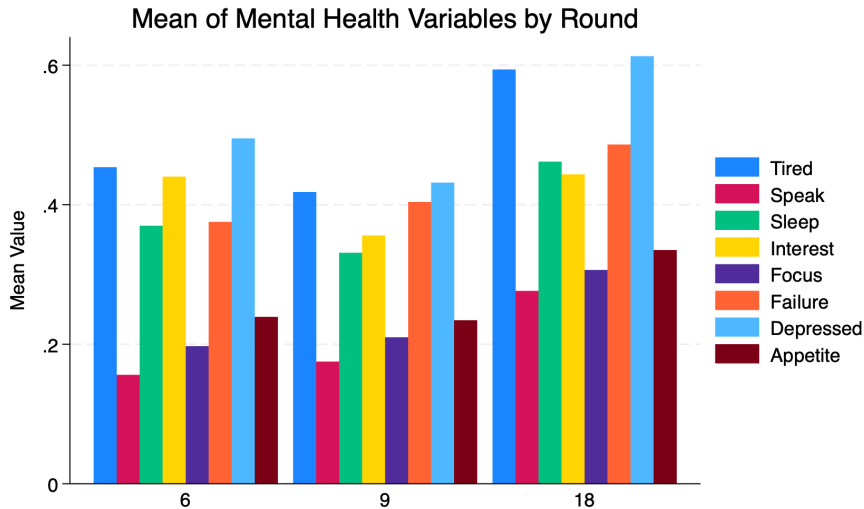
	1	2	3	4
<p>In the next set of questions, please answer "Not at all" or "Several days" or "More than half the days" or "Nearly every day".</p> <p>Over the last 2 weeks, how often have you been bothered by any of the following problems?</p>	<p>Little interest or pleasure in doing things</p> <p>Not at all1 Several days.....2 More than half the days.....3 Nearly every day...4</p>	<p>Feeling down, depressed, or hopeless</p> <p>Not at all1 Several days.....2 More than half the days.....3 Nearly every day...4</p>	<p>Trouble falling or staying asleep, or sleeping too much</p> <p>Not at all1 Several days.....2 More than half the days.....3 Nearly every day...4</p>	<p>Feeling tired or having little energy</p> <p>Not at all1 Several days.....2 More than half the days.....3 Nearly every day...4</p>

5	6	7	8
<p>Poor appetite or overeating</p> <p>Not at all1 Several days.....2 More than half the days.....3 Nearly every day...4</p>	<p>Feeling bad about yourself — or that you are a failure or have let yourself or your family down</p> <p>Not at all1 Several days.....2 More than half the days.....3 Nearly every day...4</p>	<p>Trouble concentrating on things, such as reading the newspaper or watching television</p> <p>Not at all1 Several days.....2 More than half the days.....3 Nearly every day...4</p>	<p>Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual</p> <p>Not at all1 Several days.....2 More than half the days.....3 Nearly every day...4</p>

Table: Summary of mental health measures and indicators

Variable	Obs	Mean	SD	Min	Max
Mentally ill (rawscore ≥ 10)	3789	0.0449	0.207	0.00	1.00
Mental health (rawscore)	3789	2.9335	3.283	0.00	24.00
Minimal depression	3789	0.7490	0.434	0.00	1.00
Mild depression	3789	0.2061	0.405	0.00	1.00
Moderate depression	3789	0.0367	0.188	0.00	1.00
Severe depression	3789	0.0082	0.090	0.00	1.00

Patient Health Questionnaire-8



Food Insecurity Measures: Food Insecurity Experience Scale (FIES) is used to assess the extent and severity of food insecurity at the household level.

- 1 **FIES raw scores:** responses to all eight questions are added to calculate a total FIES score. The total score ranges between **0** (completely food secure) and **8** (severely food insecure).
- 2 **Levels of food insecurity:**
 - mild food insecurity (Score = 1–3): Worry about food or reduced dietary quality.
 - moderate food insecurity (Score = 4–6): Reduced dietary quantity or skipped meals.
 - severe food insecurity (Score = 7–8): Experiencing hunger or going without food for an entire day.

Summary Statistics

Table: Summary of food insecurity measures and indicators

Variable	Obs	Mean	SD	Min	Max
FIES Rawscore	3789	4.1040	2.940	0.00	8.00
Mild food insecurity	3789	0.7707	0.420	0.00	1.00
Moderate food insecurity	3789	0.5946	0.491	0.00	1.00
Severe food insecurity	3789	0.3075	0.462	0.00	1.00
In the last 30 days.....					
Worried about food	3789	0.5756	0.494	0.00	1.00
Went w/out eating a whole day	3789	0.1668	0.373	0.00	1.00
Skipped meals	3789	0.5574	0.497	0.00	1.00
Food shortage	3789	0.4297	0.495	0.00	1.00
Went hungry	3789	0.4772	0.500	0.00	1.00
Poor nutrition	3789	0.6540	0.476	0.00	1.00
Ate limited variety	3789	0.6653	0.472	0.00	1.00
Ate less	3789	0.5780	0.494	0.00	1.00

Key Variables

Weather Shocks Indicators: Standardized Precipitation Index (SPI) is used to determine if there is a weather shock (drought or flood) by leveraging information on rainfall during the growing season (November to April of the following year).

Table: SPI categories, cumulative probabilities, and interpretations

SPI	Cumulative Probability	Interpretation
-2.0	0.0228	Extremely dry ($SPI < -2.0$)
-1.5	0.0668	Severely dry ($-2.0 < SPI < -1.5$)
-1.0	0.1587	Moderately dry ($-1.5 < SPI < -1.0$)
0.0	0.5000	Near normal
1.0	0.8413	Moderately wet ($1.0 < SPI < 1.5$)
1.5	0.9332	Very wet ($1.5 < SPI < 2.0$)
2.0	0.9772	Extremely wet ($SPI > 2.0$)

Summary Statistics

Table: Summary statistics for weather variables

VarName	Obs	Mean	SD	Min	Max
Rain share (%)	3,789	0.4152	0.073	0.28	1.00
Total rainfall (mm)	3,789	1,044.32	250.84	0.00	1,843.91
Flood	3,789	0.0792	0.270	0.00	1.00
Drought	3,789	0.3808	0.486	0.00	1.00
Average temperature (°C)	3,789	23.91	1.56	19.27	28.42
Long-term mean rainfall (mm)	3,789	954.35	167.06	0.00	1,524.83

Identification Strategy

Two-Way Fixed Effects

$$\begin{aligned} Mental_Health_{ijt} = & \alpha_0 + \alpha_1 Food_Insecurity_{it} + \alpha_2 Weather_Shocks_{it-1} \\ & + \alpha_3 (Food_Insecurity_{it} \cdot Weather_Shocks_{it-1}) \\ & + \Theta X_{it} + \mu_i + \epsilon_{it} \end{aligned}$$

Where:

- $Mental_Health_{ijt}$: mental health status of the individual j in the household i at time t .
- $Food_Insecurity_{it}$: household-level food security status for household i at time t .
- $Weather_Shocks_{it-1}$: binary indicator of weather shocks (e.g., droughts, floods) for the household i at time $t - 1$.
- X_{it} : vector of control variables (e.g., household size, consumption expenditure, employment status, Covid-19 exposure).
- μ_i : household fixed effects controlling for time-invariant characteristics of household i .
- ϵ_{it} : error term that captures unobserved shocks or random variation at time t .

Preliminary Findings

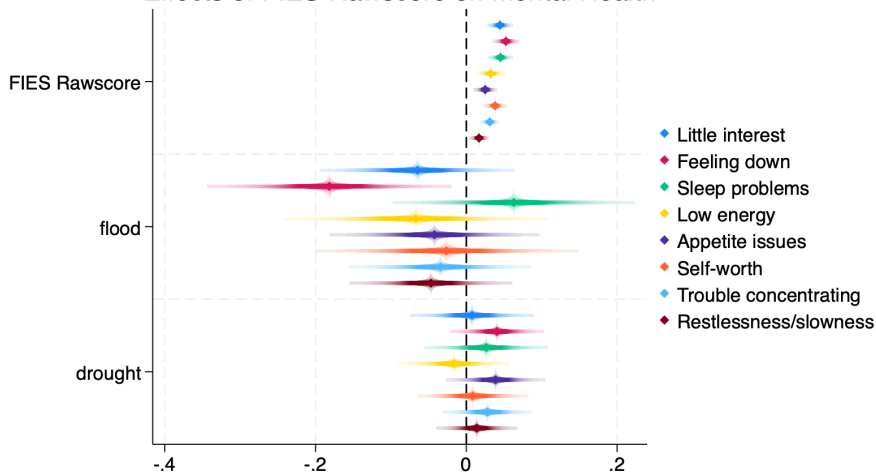
Table: Effects of FIES under weather shocks on mental health

Dependent variable: Mental Health Rawscore					
	(1)	(2)	(3)	(4)	(5)
FIES Rawscore	0.074*** (0.008)	0.074*** (0.008)	0.065*** (0.008)	0.074 (0.008)	0.074 (0.008)
Drought		0.045 (0.030)	0.044 (0.047)		
FIES X Drought			0.022** (0.010)		
Flood				-0.091 (0.063)	
FIES X Flood					-0.006 (0.022)
Controls	Yes	Yes	Yes	Yes	Yes
Household Fixed Effects	Yes	Yes	Yes	Yes	Yes
Round Fixed Effects	Yes	Yes	Yes	Yes	Yes
Obs	3405	3405	3405	3405	3405

Notes: Standard errors are in parentheses. Level of significance: $*p < .10$, $**p < .05$, $***p < .01$.

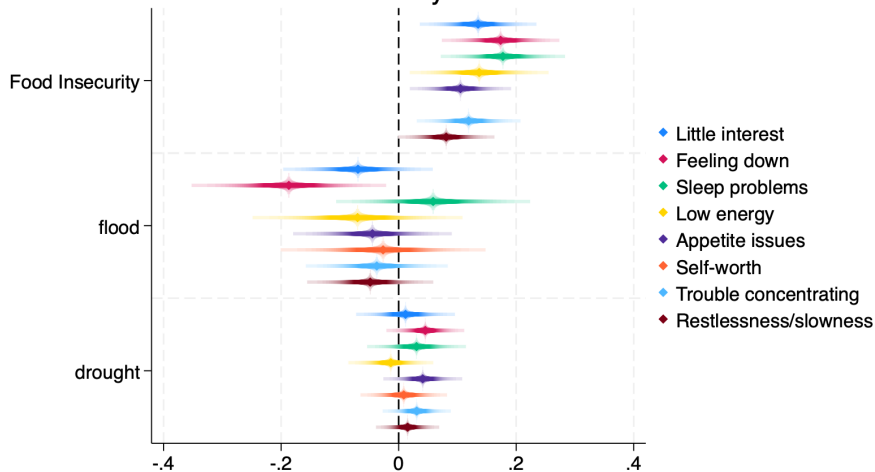
Preliminary Findings

Effects of FIES Rawscore on Mental Health



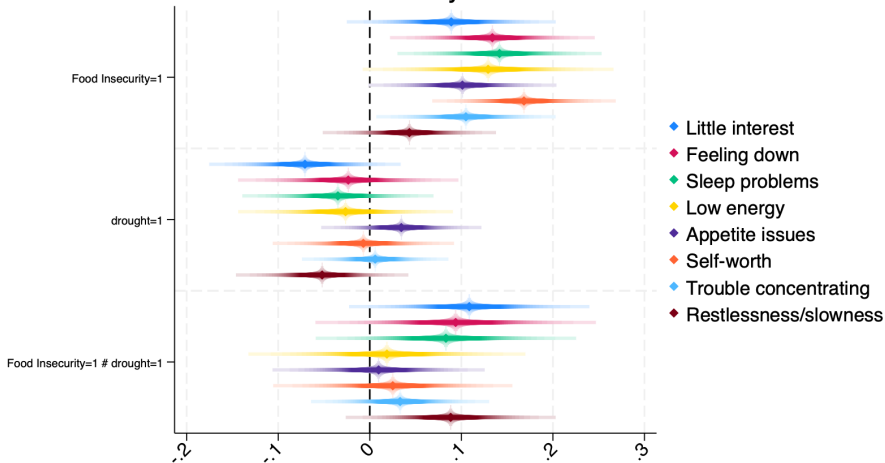
Preliminary Findings

Effects of Food Insecurity on Mental Health



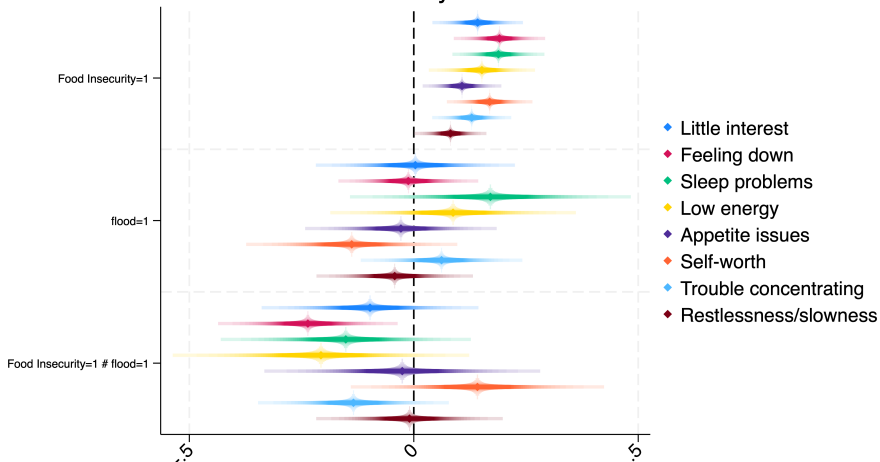
Preliminary Findings

Effects of Food Insecurity on Mental Health



Preliminary Findings

Effects of Food Insecurity on Mental Health



Preliminary Findings

Table: Effects of FIES under drought on mental health by gender

Dependent variable: Mental Health Rawscore								
	Respondent's Gender				Household Head's Gender			
	Female	Female	Male	Male	Female	Female	Male	Male
FIES x Drought	0.125** (0.060)	0.122* (0.065)	-0.022 (0.049)	0.056 (0.045)	0.179** (0.021)	0.100** (0.043)	-0.005 (0.045)	0.031 (0.103)
Constant	7.448*** (1.816)	7.106 (83.679)	3.404** (1.490)	60.345* (35.401)	9.441*** (2.284)	-0.464 (35.228)	3.696** (1.337)	186.342* (94.418)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	No	Yes	No	Yes	No	Yes	No	Yes
Round FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1324	1189	2081	1986	680	649	2725	2717

Notes: Standard errors are in parentheses. Level of significance: * $p < .10$, ** $p < .05$, *** $p < .01$.

Preliminary Findings

Table: Effects of food insecurity under drought on mental health by wealth quantile

Dependent variable: Mental Health Rawscore					
	(1)	(2)	(3)	(4)	(5)
FIES x Drought	-0.389** (0.185)	0.134 (0.134)	0.046 (0.097)	0.166** (0.067)	0.135** (0.062)
Constant	-155.013 (221.368)	49.053 (109.069)	-2.029 (86.393)	49.863 (67.285)	39.607 (59.019)
Controls	Yes	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	Yes	Yes	Yes
Round FE	Yes	Yes	Yes	Yes	Yes
Observations	198	384	654	993	1263

Notes: Standard errors are in parentheses. Level of significance: * $p < .10$, ** $p < .05$, *** $p < .01$.

Conclusions and Limitations

1 Conclusions

- We found that food insecurity is correlated with poorer mental health outcomes.
- Not only does food insecurity adversely affect mental health, but weather shocks can further exacerbate these mental health burdens.
- Female-headed households, female respondents, and poorer households are more vulnerable.

2 Limitations

- Reverse causality: mental health issues may not only be a result of food insecurity but could also contribute to it. For instance, individuals suffering from mental health issues might be less able to engage in productive activities, increasing their likelihood of experiencing food insecurity.
- Omitted variable bias: there might be unobserved factors that simultaneously influence food insecurity, mental health, and the effects of weather shocks.

- Exploring the causal relationship between food insecurity and mental health
 - Instrumental variable (IV) approach: identify instruments that are correlated with food insecurity but not directly with mental health outcomes.
 - Propensity score matching (PSM): compare similar households in terms of observable characteristics to isolate the effects of food insecurity.
- Nonlinearities and threshold effects
 - Investigate whether certain levels of food insecurity or severity of weather shocks trigger disproportionately large mental health impacts.
- Farmers' mental health and agricultural productivity

Thank you!

*For questions please email me at
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