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Food Insecurity and COVID-19 as Drivers of Generalized Anxiety Disorder in Africa: Evidence from Four Countries

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Abstract

To produce national-level figures on the frequency of generalized anxiety disorder (GAD), exposure to COVID-19, and food insecurity (FI), and to investigate the extent to which continued dangers to human survival — particularly COVID-19 exposure and FI — are fueling the growing mental health problems in Africa. Data gathered through telephone interviews in Mozambique, Sierra Leone, Tanzania, and Uganda across 12 sequential survey rounds in 2021 (total n = 23,943) were analyzed to determine the prevalence of GAD. Researchers applied logistic regression and structural equation modeling to conduct a mediation analysis and uncover factors that increase or decrease risk.

In 2021, across all four countries, GAD affected 23.3% of respondents; the rate was highest in Mozambique at 40.2%, followed by 17.0% in Sierra Leone, 18.0% in Tanzania, and 19.1% in Uganda. Both contact with COVID-19 (ORadj. = 1.4; CI = 1.3–1.6) and food insecurity (ORadj = 3.2; CI = 2.7–3.8) independently and strongly predicted higher GAD levels. The link between food insecurity and GAD turned out to be markedly more powerful than the link with COVID-19 exposure. Long-lasting threats to people's survival play a key part in shaping mental health outcomes, above all for GAD. With such elevated anxiety levels present in the population, there is a clear need for efforts that reduce violence and improve access to social support. Policymakers should continue to treat food insecurity as a central target for action to reduce GAD, even as they address the effects of a pandemic.

Keywords: COVID-19, Anxiety, Food insecurity, Disorder

Introduction

Mental and behavioral disorders contribute 4.9% of the total burden measured in disability-adjusted life-years (DALYs). Among these, generalized anxiety disorder (GAD) is listed among the ten main contributors to years lived with disability (YLD) [1]. GAD first appeared as a diagnosis in the third edition of the Diagnostic and Statistical Manual (DSM) and is characterized by intense, difficult-to-manage worry that lasts for at least 6 months [2]. It frequently co-occurs with depression [3]. Treatments backed by strong evidence, such as cognitive behavioral therapy and medications from the SSRI or SNRI groups, help around 50% of those who receive them [3].

On a global scale, estimates suggest that 0.1% to 3.0% of the general population experience GAD for 30 days or more [4]. Larger cross-country studies and meta-analyses typically report lower figures in low- and middle-income nations [4]. Before the present research, a brief systematic review was undertaken using the PICOS approach [5] to examine existing literature on GAD prevalence in general African populations.

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Table 1. Studies on the prevalence rates of generalized anxiety disorder in the adult general population at the country level (selected studies - Africa, published between 1980 and 2023).

Study	Location	Data collection year	Sample size (N)	Sampling method	Prevalence period	Threshold	Mode of administration	Measurement instrument	Diagnostic criteria	Reported prevalence
Agberotimi *et al*. [6]	Nigeria	2020a	502	Snowball sampling	2-week period	≥ 5	Online self-administered	GAD-7b	DSM-5	49.6% (compared to 58.4% among healthcare professionals)
Ayazi *et al*. [7]	South Sudan	2010	1,200	Multistage random cluster sampling	Not reported	n.a.c	Structured interview	MINId	DSM-4	15.8%
Boateng *et al*. [8]	Ghana	2020a	811	Convenience sampling	2-week period	≥ 10	Online self-administered	GAD-7	DSM-4	23.1%
Bhagwanje e *et al*. [9]	South Africa	n.a.	81	Multistage random cluster sampling	Point prevalen ce	≥ 8	Self-report combined with a structured interview	SRQ-20e	DSM-4	3.7%
Elhadi *et al*. [10]	Libya	2020a	31,557	Convenience sampling	2-week period	≥ 15	Online and paper-based self-report	GAD-7	DSM-5	5.6%
Gureje *et al*. [11]	Nigeria	2001–2003	4,984	Multistage stratified cluster sampling	Lifetime / 12-month	n.a.	Structured interview	CIDIf	DSM-4	0.1%/0.0%
Hollifield *et al*. [12]	Lesotho	1986–87	356	Random sampling	1-month period	n.a.	Structured interview	NIMH DISg	DSM-3	6.2% (using DSM-III hierarchy, versus 12.9% without hierarchy)
Jenkins *et al*. [13]	Kenya	2013	1,157	Multistage random cluster sampling	1-week period	n.a.	Structured interview	CIS-Rh	ICD-10	1.6%
Matsungo and Chopera [14]	Zimbabw e	2020a	507	Convenience sampling	2-week period	≥ 10	Online self-administered	GAD-7	DSM-5	40.4%
Suliman *et al*. [15]	South Africa	2002–2004	4,351	Multistage stratified random sampling	12-month period	n.a.	Structured interview	CIDI	DSM-4	1.9%

Bold values indicate prevalence rates for the general population.
a) Peri-pandemic.
b) GAD-7, Generalized Anxiety Disorder scale, 7 items.
c) Not applicable.
d) Mini International Neuropsychiatric Interview.
e) Self-Reporting Questionnaire 20 items.
f) Composite International Diagnostic Interview.
g) National Institute of Mental Health Diagnostic Interview Schedule (United States).
h) Clinical Interview Schedule—Revised.

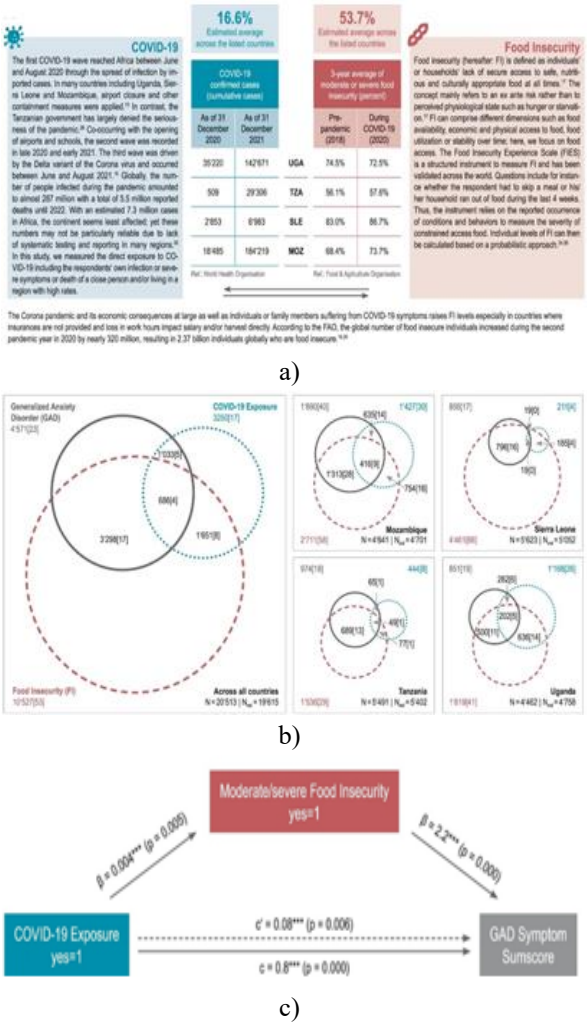
Table 1 summarizes nine such studies, which reported prevalence ranging from 0% up to 49.6% (further details available in Supplementary Material SI). Differences in how anxiety was measured and which diagnostic rules were applied help explain part of this wide range. Still, the majority of recent work has relied on the GAD-7 tool

from the Patient Health Questionnaire [16]. Even among these, reported rates vary sharply — from 5.6% in Libya to 49.6% in Nigeria — often because different threshold scores are used. In many parts of Africa, individuals facing mental health difficulties have little or no access to professional help. When judged purely by the number of available psychiatrists or clinical psychologists, the treatment gap lies somewhere between 75% and 99% [17, 18].

Beyond the personal pain endured by individuals and their loved ones, the wider consequences for society and economic progress are immense. Mental disorders frequently leave people unable to perform effectively in various aspects of life. Research in neuroeconomics also reveals that anxiety, especially GAD, alters how people make choices, which in turn affects larger group behaviors and social processes whenever its frequency climbs dramatically [19].

In combination with inherited tendencies [20], female gender, and patterns learned from parents [21], difficult life experiences and medical conditions that raise a person's susceptibility have been found to elevate the chances of developing GAD [22]. Using data from a 12-year follow-up study, Zhang *et al*. [23] demonstrated that both short-term and long-term negative events independently increased the risk of GAD. It is well known that sudden life-threatening situations, recognized as trauma, can build up and lead to posttraumatic stress disorder [24]. In much the same manner, prolonged dangers to survival can accumulate, disrupt emotional balance and thinking patterns, and damage mental well-being by pushing general anxiety higher. This investigation estimates the prevalence of GAD and examines how multiple ongoing survival threats interact in Sub-Saharan Africa (SSA).

In recent times, the mental health emergency unfolding in SSA — defined by climbing rates of psychological disorders and major shortfalls in care — has overlapped with the hazard of catching SARS-CoV-2 [25] as well as rising food insecurity (FI) [26, 27]. The possibility of infection and the lack of reliable food supplies both serve as constant pressures on staying alive. **Figure 1a** supplies key facts on COVID-19 and FI throughout SSA.



a)

b)

c)

Figure 1. (a) Fact sheet COVID-19 and food insecurity (Life with Corona—Africa, Mozambique, Sierra Leone, Tanzania, Uganda, 2021); (b) overlap between generalized anxiety disorder, COVID-19, and food insecurity, Venn diagrams (Life with Corona—Africa, Mozambique, Sierra Leone, Tanzania, Uganda, 2021); (c): determinants of generalized anxiety disorder, mediation model (Life with Corona—Africa, Mozambique, Sierra Leone, Tanzania, Uganda, 2021).

Across the world, the COVID-19 outbreak led to a marked rise in anxiety [8, 28]. A broad study that included 58 nations and exceeded 100,000 participants during March and April 2020 showed that higher numbers of reported COVID-19 cases were tied to stronger anxiety symptoms [29]. Furthermore, restrictions such as staying isolated or keeping physical distance from others were connected to greater anxiety and mood instability among those who remained indoors

[29]. An analysis that reviewed data from 204 countries found that the pandemic placed a particularly heavy emotional strain on women and people in younger age brackets [30]. Investigations carried out in the SSA area likewise report increased anxiety during the time of the COVID-19 crisis [8, 28].

A fresh systematic review looking at the connection between food insecurity and psychological well-being in Africa uncovered a clear dose-response pattern [31]. Recent work exploring the pathways suggests that food insecurity harms mental health immediately by blocking the satisfaction of a core human need and by producing doubt about whether that need can be met later [32]. Additional routes, such as missing nutrients that influence brain performance or the feeling of reduced economic position caused by food insecurity, were shown to matter less [31–33]. The basic tie between food insecurity and mental health is further confirmed by research by Jones *et al*., who observed a strong relationship that remained consistent across cultural backgrounds and economic levels [34].

This research provides updated information on the prevalence of GAD and the factors associated with it in African settings. To achieve this, we rely on fresh telephone survey records that offer GAD prevalence estimates based on DSM-5 standards, along with direct measures of COVID-19 exposure and food insecurity, drawn from ordinary adults living in four African low- and middle-income nations — Mozambique, Sierra Leone, Tanzania, and Uganda. We then explore if the pandemic damaged mental health both straight away and through other routes by checking whether food insecurity acts as an intermediary between COVID-19 exposure and GAD.

Materials and Methods

Study design and setting

As part of the broader Life with Corona (LwC) initiative [35], the LwC-Africa component collected telephone-based data from adults aged 17 years or older residing in Mozambique, Sierra Leone, Tanzania, and Uganda throughout 2021 [36]. Conducting face-to-face conversations during the active COVID-19 outbreak would have raised safety concerns for both the people asking the questions and those answering them. Furthermore, switching to web-based questionnaires in these resource-limited nations could have distorted the findings by unintentionally excluding anyone without reliable internet service. To address these issues, phone calls were selected as the primary approach, given that many residents in the region own mobile devices, and this method offers a wider reach without heavy restrictions. The four nations were deliberately selected for their differences in location, population profiles, and strategies for managing the COVID-19 situation (e.g., [25, 37]).

Procedure

Data collection took place through 12 distinct survey waves running from January through December 2021. A non-governmental body (BRAC International, operating in Sierra Leone, Tanzania, and Uganda), together with a local research firm (Intercampus in Mozambique), handled the process. They drew upon extensive internal records of mobile phone numbers collected from ongoing and past projects. Within each wave, respondents were randomly selected, and the final sample in each country was adjusted to reflect national distributions by gender, age, and urban or rural residence, to include around 500 newly selected participants per country each month. The overall number of people interviewed was set in line with standards found in previously published work [36]. Before any questions began, verbal agreement to participate was obtained from everyone by reading a standard consent script aloud at the start of the call. This script outlined the aims of the survey and guaranteed that personal details would remain confidential. It also informed respondents that they could decline to answer specific items or end the conversation entirely at any point. Calls were placed only during daytime hours from the professional call centers run by the survey teams.

In most cases, two or three contact attempts were needed to secure a completed interview. Whenever a selected person could not be reached after repeated tries, another individual who fit the same demographic criteria was substituted. Matching patterns observed in related telephone surveys [38], the participation rate was near 50%, mainly due to disconnected or inactive phone lines and unanswered calls. Interviews lasted an average of 16.5 minutes. Ethical approval for the whole project was granted by the review committee at UNU-WIDER.

Participants

In total, 23,943 adults completed the interviews (Mozambique: 6000; Sierra Leone: 6217; Tanzania: 6033; Uganda: 6033). To improve national representativeness and sharpen the accuracy of country-specific prevalence figures, adjustments were

subsequently made using age-, gender-, and urban/rural-residence-specific weights [39]. The adjusted sociodemographic profiles, along with comparisons between the four countries, are displayed in **Table 2**.

Table 2. Socio-demographic characteristics by country (Life with Corona—Africa, Mozambique, Sierra Leone, Tanzania, Uganda, 2021).

Variable	Post-stratified sample (n = 24,282)					Unweighted sample (n = 24,282)				
	Mozambique (n = 6,000)	Sierra Leone (n = 6,228)	Tanzania (n = 6,021)	Uganda (n = 6,033)	p-value	Mozambique (n = 6,000)	Sierra Leone (n = 6,228)	Tanzania (n = 6,021)	Uganda (n = 6,033)	p-value
Female respondent, yes = 1										
Proportion	52%	51%	51%	51%	0.997	53.8%	58.7%	57.1%	49.9%	0.000
Age of respondent										
Mean	32.9	33.3	36.1	33.9	0.000	33.2	36.3	39.1	37.7	0.000
SD[a]	10.1	8.8	12.1	12.3		10.2	8.5	11.16	11.9	
Education of the respondent in years										
Mean	11.8	7.0	8.8	9.4	0.000	11.9	8.2	8.8	9.3	0.000
SD	3.3	5.4	2.8	3.6		3.4	5.5	3.10	3.8	
Respondent is married										
Proportion	63.5%	76.4%	62.8%	71.0%	0.000	63.7%	82.6%	66.6%	79.9%	0.000
Number of household members over 60 years										
Mean	0.2	0.6	0.3	0.3	0.195	0.2	0.5	0.3	0.3	0.195
SD	0.5	0.8	0.6	0.6		0.5	0.7	0.6	0.7	
Number of household members under 18 years										
Mean	2.5	2.8	2.1	3.2	0.000	2.4	2.8	2.00	3.6	0.000
SD	1.8	1.6	1.3	2.2		1.7	1.5	1.4	2.2	
SES[b] index										
Mean	1.0	−1.6	−0.5	−1.0	0.000	1.2	−0.8	0.3	−0.7	0.000
SD	1.6	1.5	1.6	1.3		1.6	1.7	1.6	1.4	
Rural household, yes = 1										
Proportion	66.0%	59.0%	73.0%	76.0%	0.067	45.8%	14.9%	20.08%	53.8%	0.000

Note: Values are means and standard deviations or proportions. T-tests were used for comparison of continuous variables, and Pearson's $\chi 2$ tests were used for comparisons of proportions. The number of non-missing values is indicated in brackets.

Italic values indicate the number of non-missing values.

a) Standard deviation.

b) Socioeconomic status.

Measures

Trained field staff carried out the computer-assisted telephone interviews. The preparation lasted 4 days and covered key concepts, practice sessions with simulated interviews, guidance on the computer-assisted telephone interview (CATI) procedures, testing the questionnaire in advance, and group review meetings afterward. The questionnaire, originally written in English, was translated into Luganda, Runyankole, Acholi, Lusoga, Kiswahili, Krio/Creole, and Portuguese. The accuracy of these translations for each country was confirmed through repeated practice interviews conducted by enumerators who were native speakers of the local languages, as well as through pilot testing of the full survey before launch.

GAD based on DSM-5 criteria was assessed using the 7-item generalized anxiety disorder scale (GAD-7) [16]. Each of the seven items (for example, feeling nervous, anxious, or on edge; being unable to stop or control worrying; worrying too much about various matters) was scored from 0 (not at all) to 3 (nearly every day) depending on how often the symptom had occurred in the past 2 weeks. A total score ranging from 0 to 21 was computed to reflect the overall severity of symptoms. Drawing on a systematic review and meta-analysis by Plummer and colleagues that reported a sensitivity of 0.83 and specificity of 0.84 [40], we applied a cut-off score of 8 to identify probable cases of GAD. Although country-specific validation studies for the nations in this research are not yet available, the GAD-7 is a well-established tool that has been validated in several

(African) settings [41]. We acknowledge the need for culturally tailored validation and therefore strongly recommend additional research to test and refine mental health screening instruments for use in varied African contexts.

COVID-19 exposure was assessed through four yes/no (1/0) questions that asked whether the participant had been infected with the Coronavirus, had come into contact with anyone showing clear symptoms of COVID-19, believed they lived in a region with many cases, or knew someone who had died as a result of Coronavirus infection. Because testing capacity remained limited across most African countries [42], we relied on participants' own perceptions of exposure. As with other sensitive survey topics, responses about COVID-19 exposure may be influenced by biases such as social desirability, fear of stigma, or concerns about discrimination. For calculating prevalence, we created a summary score by adding up all "yes" (1) responses; exposure was classified as present if the respondent answered yes to at least one of the four questions.

FI was assessed using the Food Insecurity Experience Scale (FIES) [43], a widely adopted and validated instrument. The eight items examine experiences and actions linked to problems obtaining enough food (such as worrying about running out of food, consuming less varied or nutritious meals, skipping meals, or having no food left) over the previous 4 weeks. They are answered with yes (1) or no (0). Following the probabilistic method recommended by FAO [43, 44], we determined each respondent's status with respect to a policy-relevant threshold for moderate or severe food insecurity.

In addition, data were gathered on sociodemographic variables (gender, age, years of schooling, and marital status), whether the household was located in a rural or urban setting, household composition, and an indicator of socio-economic status (hereafter, the SES index). The SES index was derived through Principal Component Analysis to condense multiple household variables into a single measure (see Supplementary Material SII). This method reflects overall living conditions and helps avoid common problems associated with direct income or spending data [45]. Higher values on the SES index correspond to greater asset ownership, improved infrastructure, and better housing quality.

Statistical analysis

Prevalence estimates for GAD diagnosis, as well as for COVID-19 and FI exposure, were calculated using frequencies and percentages, with post-stratification weights applied to adjust for age, gender, and urban/rural location. Cases were dropped from analysis if data were missing for any of the primary variables (missing values: nGAD-7 = 1; nCOVID-19 = 3,576; nFI = 230). To investigate the links between the pandemic, food insecurity, and the likelihood of GAD, logistic regression models were fitted. In addition, a mediation analysis was conducted using structural equation modeling [46] to test the hypothesis that food insecurity mediates the relationship between COVID-19 exposure and GAD. To ensure the mediation model reached full convergence, country-fixed effects were omitted; only region and survey-wave dummies were included. The validity of mediation analysis depends on several core assumptions, such as the absence of multicollinearity, limited measurement error (particularly in the mediator variable), adequate control for omitted variables through relevant confounders, and approximate linearity. These key assumptions were satisfied in the present data, supporting the appropriate use of mediation analysis here. All statistical analyses were conducted in Stata version 17.

Results and Discussion

After applying post-stratification adjustments, the final sample included 20,513 adults. Overall, 23.3% of them scored high enough on the GAD-7 to indicate probable Generalized Anxiety Disorder. The rates differed markedly by country: Mozambique had the highest at 40.2%, while Sierra Leone was 17.0%, Tanzania 18.0%, and Uganda 19.1%. Reports of any COVID-19 exposure were most common in Mozambique (30.4%) and Uganda (26.2%), but remained much lower in Tanzania (8.2%) and Sierra Leone (4.2%). Across all participants, moderate or severe food insecurity affected an estimated 53.7%. This problem was most widespread in Sierra Leone (88.3%), followed by Mozambique (57.7%), Uganda (40.8%), and Tanzania (28.4%). The Venn diagrams in **Figure 1b** highlight a clear overlap where many individuals experienced GAD together with COVID-19 exposure and food insecurity.

Logistic regression results **(Table 3)** confirm that both COVID-19 exposure and food insecurity act as important risk factors for GAD. People who reported any COVID-19 exposure had 1.7 times the odds of GAD (CI = 1.4–2.0; P = 0.000). Those facing moderate or severe food insecurity had 2.9 times the odds of individuals with

reliable access to food (CI = 2.4–3.4; P = 0.000). These models adjusted for personal background factors, geographic region, country differences, and the specific survey wave. In the fully adjusted analysis, the link between food insecurity and GAD proved more than twice as strong (adj. OR = 3.1; CI = 2.6–3.7; P = 0.000) as the link with COVID-19 exposure (adj. OR = 1.4; CI = 1.3–1.6; P = 0.000). Having more young children or adolescents in the household raised the odds of GAD slightly (OR = 1.1; CI = 1.1–1.1; P = 0.000), while greater socio-economic resources offered protection (OR = 0.8; CI = 0.8–0.9; P = 0.000).

Table 3. Logistic regression of the determinants of generalized anxiety disorder (Life with Corona—Africa, Mozambique, Sierra Leone, Tanzania, Uganda, 2021).

Generalized anxiety disorder (GAD)	Crude model		Adjusted model	
	Odds Ratio (95% CI)	P-value	Odds Ratio (95% CI)	P-value
Exposure to COVID-19 (yes = 1)	1.7 (1.4, 2.0)	0.000	1.4 (1.3, 1.6)	0.000
Experiencing moderate to severe food insecurity (yes = 1)	2.9 (2.4, 3.4)	0.000	3.1 (2.6, 3.7)	0.000
Female participant (yes = 1)	—	—	1.2 (1.0, 1.3)	0.059
Participant age	—	—	1.0 (1.0, 1.0)	0.260
Years of education of the participant	—	—	1.0 (1.0, 1.0)	0.777
Married status (yes = 1)	—	—	0.9 (0.7, 1.0)	0.098
Household members aged over 60 (count)	—	—	1.0 (0.9, 1.1)	0.998
Household members aged under 18 (count)	—	—	1.1 (1.1, 1.1)	0.000
Socioeconomic status (SES) index	—	—	0.8 (0.8, 0.9)	0.000
Rural residence (yes = 1)	—	—	1.0 (0.9, 1.1)	0.961
Intercept (constant)	0.1 (0.1, 0.2)	0.000	0.2 (0.1, 0.3)	0.000
Sample size (N)	20,513		20,472	

Note: Logistic regression (odds ratios). Post-stratification weights were applied to all estimates; the adjusted model also accounts for region, country, and survey round.

The mediation analysis **(Table 4 and Figure 1c)** demonstrated a clear overall influence of COVID-19 exposure on GAD symptoms (β = 0.08, P = 0.000). It also established a meaningful connection between COVID-19 exposure and subsequent food insecurity (β = 0.04, P = 0.005), as well as a strong relationship between food insecurity and the total GAD symptom score (β = 2.2, P = 0.000). A direct pathway from COVID-19 exposure to higher GAD scores remained evident even after accounting for the mediator (direct effect: β = 0.8, P = 0.000). Importantly, a statistically significant indirect effect through food insecurity was observed (β = 0.1, P = 0.005). This indirect component accounted for approximately 9.4% of the total effect of COVID-19 exposure on GAD, and its magnitude was roughly 0.1 times the size of the direct effect.

Table 4. Mediation analysis of the determinants of generalized anxiety disorder (Life with Corona—Africa, Mozambique, Sierra Leone, Tanzania, Uganda, 2021).

Pathways/Effects	Coefficient (β)	P-value
Impact of COVID-19 on food insecurity (FI)	0.04	0.005
Effect of food insecurity on anxiety score	2.2	0.000
Direct influence of COVID-19 on anxiety score	0.8	0.000
Indirect effect (unstandardized, Monte Carlo estimation)	0.08	0.006
RIT (ratio of indirect to total effect)	9.4%	—
RID (ratio of indirect to direct effect)	0.1	—
Total observations	20,513	

Note: Mediation analysis using structural equation modeling (SEM) and the Stata package "medsem" [46] following the approach described in Zhao *et al*. Post-stratification weights were applied to all estimates; the model is adjusted for respondents' characteristics, region, and survey round. Dependent variable: anxiety score; Independent variable: COVID-19; Mediator: food insecurity.

The present research reports an overall estimated prevalence of 23.3% for GAD across Mozambique, Sierra Leone, Tanzania, and Uganda. In addition, 8.4% of respondents indicated direct exposure to COVID-19, while 16.4% experienced moderate-to-high levels of food insecurity. Among those with GAD, 16.8% faced food insecurity, and 8.4% reported COVID-19 exposure, with 3.5% of all participants encountering both ongoing stressors simultaneously. Consistent with these patterns, logistic regression analyses demonstrate that COVID-19 exposure, especially food insecurity, is associated with an increased likelihood of developing GAD. A greater number of household members below 18 years of age and lower socio-economic status also emerged as risk factors. In contrast, gender and most other background

characteristics showed no statistically meaningful association. The mediation analysis indicates that food insecurity, as an existing long-term threat to survival, serves as an additional pathway that converts pandemic-related stress into heightened GAD symptoms.

The peri-pandemic GAD prevalence figures obtained here — 40.2% in Mozambique, 17.0% in Sierra Leone, 18.0% in Tanzania, and 19.1% in Uganda — were derived using the GAD-7 scale with a cut-off of ≥ 8, in accordance with the recommendations of Plummer and colleagues [40]. These results align with the wide range observed in earlier comparable investigations. For instance, Boateng *et al*. reported 23.1% in Ghana [8], and Matsungo *et al*. found 40.4% in Zimbabwe [14], both employing a GAD-7 cut-off of ≥ 10. In Nigeria, Agberotimi and colleagues reported that 49.6% used a lower GAD-7 threshold of ≥5 [6]. By contrast, a large-scale survey of over 30,000 participants that applied a stricter cut-off of GAD-7 ≥ 15 identified only 5.6% in Libya [10]. For context outside Africa, Jia *et al*. reported 23.6% in the United Kingdom with a cut-off of ≥ 8 [47], while Solomou and colleagues observed 23.1% in Cyprus using GAD-7 ≥ 10 [48]. All pandemic-era studies referenced above used online self-report administration of the GAD-7 and were conducted in 2020. To gain a clearer picture of GAD occurrence in Africa, additional high-quality epidemiological and longitudinal investigations are required, including proper validation through clinical diagnostic interviews conducted by specialists. Furthermore, it remains to be seen whether GAD symptoms linked to COVID-19 will ease as the pandemic recedes, and this warrants dedicated follow-up research.

Importantly, the GAD prevalence patterns observed in this study closely correspond to the official records of confirmed COVID-19 cases published by the WHO. Reported exposure levels were relatively modest in Tanzania (8.2%) and Sierra Leone (4.2%), compared with higher figures in Uganda (26.2%) and Mozambique (30.4%). Similarly, the estimated food insecurity rates mirror those issued by FAO, and the relative ranking of the four countries is the same: Sierra Leone (88.3%), Mozambique (57.7%), Uganda (40.8%), and Tanzania (28.4%). Nevertheless, apart from Mozambique, the food insecurity figures obtained here are noticeably lower than the FAO estimates, as elaborated in the limitations section below.

In line with prior research [23], the current findings indicate that both COVID-19 exposure and food insecurity independently serve as significant risk factors for GAD, with $P < 0.05$ as the threshold for statistical significance. The direct influence of moderate or severe food insecurity — a pre-existing ongoing threat — substantially outweighs that of COVID-19 exposure (ORCov-19 = 1.7 versus ORFI = 2.9). While COVID-19 exposure roughly doubles the risk of GAD, moderate or severe food insecurity triples it. Whether this difference stems from the preceding nature of food insecurity or from the greater intensity of the threat deserves closer examination in future work. Crucially, the results also show that moderate or severe food insecurity partially mediates the relationship between COVID-19 exposure and GAD, accounting for 9.4% of the total effect. As expected, a larger number of dependents under 17 years of age increased GAD risk, while higher socio-economic status offered protection. Surprisingly, no elevated risk was detected for women, despite this being a commonly reported factor in many other GAD studies [49]. This observation may suggest that gender differences in anxiety risk diminish when persistent survival threats intensify; however, targeted additional analyses are needed to explore this possibility more thoroughly.

It is important to recognize several constraints of the present study. Because the data are cross-sectional and observational, the analyses can identify associations but cannot establish causal relationships. In addition, the sampling approach that relied on mobile phone contacts may have led to an underestimation of food insecurity prevalence. Between 2019 and 2021, the proportion of adults aged 17 years or older who owned a cell phone was approximately 79% in Uganda, 75% in Tanzania, 76% in Sierra Leone, and 62% in Mozambique [50]. People without access to a mobile phone are likely to experience higher levels of food insecurity, suggesting that true GAD prevalence in the broader population is also higher. Nevertheless, by statistically adjusting for household composition and wealth, the models help reduce potential bias in the reported associations. A further limitation concerns the use of self-report tools such as the GAD-7, which do not permit full differential diagnosis but instead supply supportive information. That said, validation research has demonstrated acceptable sensitivity and specificity for the GAD-7 when compared with gold-standard clinical interviews [40].

Conclusion

Two central messages emerge from this analysis. First, the data indicate that between 2 and 4 out of every 10 adults in Mozambique, Sierra Leone, Tanzania, and Uganda experienced excessive, difficult-to-control worry during the COVID-19 pandemic — a substantial share of the population. Second, ongoing stressors such as COVID-19 exposure and moderate or severe food insecurity, with food insecurity playing the more prominent role, significantly elevate the risk of GAD. What implications does this hold for how the pandemic was experienced in Africa, for long-term development outcomes, and for guiding policy decisions?

Anxiety typically triggers behavioral tendencies toward avoidance or self-protection. Although heightened anxiety may encourage greater adherence to infection-control measures (e.g., [48, 51]), it can also contribute to elevated GAD rates and other negative outcomes. For example, a meta-analysis involving 72,585 participants [52] found that individuals with GAD showed a higher lifetime likelihood of committing intimate partner violence. Studies on intergenerational effects indicate that mothers with elevated anxiety tend to show reduced engagement with their children [53], while others report lower warmth and increased control or criticism [54]. Additional transgenerational research consistently points to elevated GAD rates among offspring. Laboratory experiments further suggest that people with GAD are more inclined to accept unfair outcomes and display weaker emotional reactions to them [55]. As a result, collective social mechanisms for correcting injustice may weaken, while safety and stability within families could decline. These dynamics point toward possible rises in everyday violence at both community and household levels, as well as further waves of displacement. Such considerations highlight key focus areas for development initiatives during and after the pandemic, including efforts to reduce violence within families and communities and to strengthen social support systems.

Furthermore, the findings emphasize the harmful consequences of multiple concurrent persistent stressors on GAD risk. Unlike earlier research that has emphasized immediate life-threatening events (psychological trauma), genetic factors, or health conditions, the current work expands the perspective to encompass ongoing survival threats. This broader view opens up a wider set of policy options: policies that guarantee everyone's ability to satisfy basic needs would alleviate these prolonged stressors and generate important multiplier benefits. Consequently, the results have direct practical relevance for strengthening food assistance programs, since food security is a foundational element of resilience, especially when other threats to human well-being emerge. Interventions targeting food insecurity are also more feasible to implement at scale across entire populations [56]. Therefore, even amid major global health emergencies like the COVID-19 pandemic, tackling food insecurity, a major contributor to GAD, should be given high priority by decision-makers.

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Ethics Statement: The studies involving humans were approved by the ethical commission of UNU-WIDER. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from participants or their legal guardians/next of kin, as data were collected via a mobile phone survey. Before the interview, informed oral consent was obtained from all participants by reading the consent statement aloud at the start of each interview. The statement contains information regarding the purpose of the interview and the confidentiality of their personal information. The statement also contains information about the respondent's right to refuse to answer any individual question or to refuse to participate in the entire interview.

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