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Associations between Self-reported Food Insecurity and Safety and Mental Health Status in a Nationally Representative Sample of Young People in Kenya

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ABSTRACT

Associations between Self-reported Food Insecurity and Safety and Mental Health Status in a Nationally Representative Sample of Young People in Kenya

By Lauren Fink

Background: Studies on food insecurity in low-income countries primarily focus on nutritional outcomes, leaving a gap regarding non-nutritional outcomes such as mental health**.** The purpose of this study was to examine the relationship between food insecurity and mental health outcomes in Kenya, where a quarter of the population is food insecure.
Methods: Using data from a nationally representative sample of young people (ages 13-24), logistic regression models were employed to examine the association between food insecurity, water insecurity, and safety and mental health outcomes including anxiety, depression, and suicidality. Estimates were adjusted for several potential confounders including socio-economic status.
Results: Fewer than half of study participants lived in a household with consistent access to food, and half reported experiencing feelings of anxiety and/or depression at least some of the time. One in five study participants reported fair or poor health in general. A statistically significant relationship was observed between food insecurity and anxiety (adjusted OR 1.37 [95% CI: 1.07, 1.75]) and depression (aOR 1.38 [95% CI: 1.06, 1.81]) among females, but not among males. Among males, feeling unsafe in the community was significantly associated with depression (aOR 1.76 [95% CI: 1.13, 2.73]) and anxiety (aOR 1.98 [95% CI: 1.22, 3.21]), and predicted a 126% increased likelihood of fair or poor perceived health. Among females, feeling unsafe in the community was associated with depression (aOR: 1.25 [95% CI: 1.03, 1.73]) and anxiety (1.61 [95%CI (1.06, 2.42]), and associated with a 2-fold increased likelihood of suicidality and a 130% increased likelihood of self-reported fair or poor health.
Discussion: This study provides evidence to support the hypothesis that mental health outcomes are among the non-nutritional consequences of food insecurity. Similarly, the high prevalence of feelings of insecurity around personal safety among young people in Kenya has implications beyond the potential for injury. Our results suggest that simply feeling unsafe in one's community can have a dramatic impact on mental health as well as perceptions of health in general.

Associations between Self-reported Food Insecurity and Safety and Mental Health Status in a Nationally Representative Sample of Young People in Kenya

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"Their lives are marked by a free-floating, ontological, existential insecurity…

Those who suffer chronic deprivations are, not surprisingly, nervous and insecure."

Nancy Scheper-Hughes, *Death Without Weeping*

BACKGROUND

An estimated 805 million people, more than one out of every ten people worldwide, suffer from chronic under-nutrition; an alarming number that nevertheless reflects a reduction of more than 100 million people over the last decade (1). The benefits of this progress have not been equally distributed. One-fourth of the people in Sub-Saharan Africa continue to experience chronic under-nutrition, and progress in the region lags behind global trends (1). The already alarming global under-nutrition statistic only begins to capture the global burden of food insecurity, which is a broader concept encompassing current nutrition status as well as vulnerability to disruptions in access to adequate and appropriate food (2, 3). By this definition, one billion people are experiencing food insecurity (3).

As with any factor that increases mortality and decreases productivity, many stakeholders have sought to explain the mechanisms driving prevalence and distribution of food insecurity. In 1981, economist Amartya Sen offered a reconceptualization of famine that complicated the traditional tendency to point blame towards strictly environmental or supply-side factors. Sen exposed the implications of a world with sufficient food having a public health burden largely linked to insufficient food intake. Putting it briefly, Sen writes, "Starvation is the characteristic of some people not having enough to eat. It is not the characteristic of there being not enough food to eat" (4). Sen points out that even in famine situations there are distinct and identifiable groups that do not starve -- the wealthy, for example, or the military. The source of this "group contrast," according to Sen, is a difference in the ability to command food. In other words, famine, hunger, and food insecurity are marked by reduced entitlements to food, but not necessarily by reduced food availability.

The definition of food security continues to evolve (5), but, according to one commonly-referenced definition, food security is marked by the physical, social, and economic access of all people to sufficient, safe, and nutritious food which meets their dietary needs and food preferences for an active and healthy life (6). Another way to conceptualize food security is that it is a condition that occurs in the presence of four key dimensions: availability of an adequate quantity of diverse and appropriate foods, physical and economic access to those foods, market and environmental stability, and the ability to utilize food through, among other necessary entitlements, access to water and sanitation (1).

Under-nutrition is not the only identified outcome of food insecurity, yet studies on food insecurity in low- and middle-income countries focus almost exclusively on nutritional outcomes and anthropometric measurements. This nutritional focus can be attributed to both the biological link between food and nutrition and the fact that standard indicators of food insecurity at the national and regional level are mostly anthropometric in nature (2, 7). Anthropologists working in conditions of extreme resource deprivation have documented how food insecurity contributes to decreased physical health, psychosocial health, and holistic well-being (8, 9). The "madness of hunger," as Nancy Scheper-Hughes (1993) describes it, is an embodied experience of existential anxiety.

Ethnographic accounts of non-nutritional outcomes of food insecurity are substantiated by empirical evidence from recent studies. In a representative, community-based sample of Ethiopian adults, researchers found increased odds of neurological disorders, including seizures, movement abnormalities and vision dysfunction, among food insecure individuals, compared to food secure peers (10). In another community-based sample of Ethiopian adults, the authors

report that food insecurity was independently associated with symptoms of depression, anxiety, and post-traumatic stress (11).

Nationally representative studies strongly suggest a relationship between food insecurity or insufficiency and adverse mental health outcomes in the United States, Canada and South Africa (12-14). It is particularly important to consider the relationship between food insecurity and mental health among young people, as most mental disorders first present during adolescence.

This study focuses on Kenya, an East African nation of 39 million people, where 45% of the population is under the age of 15 (15). The hypothesized relationship between food insecurity and mental health disorders has serious implications for a nation that has both a high prevalence of food insecurity and a high burden of morbidity from mental illness. Standard anthropometric measurements indicate that 35% percent of Kenyan children under five years old are stunted, 16% are underweight, and 7% are wasted (16). As expected given the relationship between food insecurity and under-nutrition, about 10 million people -- more than a quarter of the population -- are chronically food insecure (17).

Researchers have documented a high burden of mental illness across the Kenyan population, including a high prevalence of depression among children, along with low levels of detection and treatment by care providers (18-20). Recent evidence from a random sample of 923 Kenyan University of Nairobi students suggests that the overall prevalence of moderate depressive symptoms is approximately 33.5% for male university students and 39.0% for female students (21).

Several contextual factors should be acknowledged for their relevance to food insecurity and mental health in Kenya. Eight percent of women and 4.3% of men in Kenya are infected

with HIV (15). In some Kenyan communities, kinship networks have been stretched far beyond capacity to care for the overwhelming number of children orphaned by AIDS (22). Bidirectional links have been established between food insecurity and HIV acquisition and disease progression, and mental health problems account for two out of three pathways driving this relationship, along with nutrition and behavior (23).

Other factors that must be considered include the traumatizing legacy of British colonialism and its corrupted and corruptible institutions (24). This legacy helped set the stage for a convergence of political and ethnic tensions that reached a tipping point following a contested election on December 27, 2007. After 59 days of physical and sexual violence, forced displacement, and ethnic persecution, 1,133 people were left dead (25, 26). The 2013 election resulted in a more muted violent response, but still claimed more than 400 lives and displaced an estimated 118,000 people (27). Political violence and forced migration have implications for both food security and mental health.

Like other countries in sub-Saharan Africa, Kenya is particularly vulnerable to climate change due to its dependence on agriculture and due to economic barriers to adaptation. A relationship has already been observed between low precipitation levels and the prevalence of child malnutrition, with grave implications given the "persistent patterns of warming and drying" in Kenya's climate (28). Another recent study based on farm household and Participatory Rural Appraisal data in various agro-ecological zones in Kenya found that households face challenges in adapting to climate change beyond the simplest and cheapest changes in planting decisions, due to their lack of resources (29). Climate change further fuels uncertainty surrounding food security, and this relationship could serve as part of a causal pathway linking climate change and mental health outcomes (30).

The purpose of this study was to test the hypothesis that under-nutrition is not the only outcome of food insecurity. Thus, we explored mental health implications of food insecurity. There is a gap in the literature regarding the extent to which observed relationships might be isolated from poverty in general and from other forms of insecurity (2). We chose to examine the issue of food insecurity while controlling for water insecurity, an asset-based SES indicator, and feelings of safety in the community. In another addition to the existing literature, this study offers a nationally representative perspective focused on young people, both males and females. The inclusion of males is important. Out of 27 studies related to food insecurity and mental health reviewed by Weaver & Hadley, 11 focused exclusively on women and none focused exclusively on men, suggesting a gap in the literature (2). To our knowledge, this is the first study to examine non-nutritional outcomes of food insecurity in a nationally representative Kenyan sample.

METHODS

This study uses data from a nationally representative cross-section of Kenyan youth captured in the Violence Against Children Survey (VACS) conducted in 2010 through collaboration between the United Nations Children's Fund (UNICEF), Centers for Disease Control and Prevention (CDC), and the Kenyan Ministry of Health. The survey instrument collected data relevant to prevalence, risk and protective factors, and consequences of interpersonal violence against children, including information related to food security and mental health status.

Sampling

The multi-sector Technical Working Group reviewed the questionnaire, and trained Kenyan staff administered it during private face-to-face interviews using pencil and paper. Survey administrators conducted the survey in 13 languages: English, Borana, Kalenjin, Kikamba, Somali, Mijikenda, Meru, Masai, Luo, Luhya, Kiswahili, Kikuyu, and Kisii. The information collected is not personally identifiable. A "split sample" approach, in which different enumeration areas were used for males and females, protected respondent confidentiality for sexual violence related questions.

The study employed a three-stage cluster methodology. Stage one involved 238 clusters randomly selected from National Sample Survey and Evaluation Program (NASSEP) IV frame and randomly assigned as a male or female cluster. During stage two, an average of 35 households were selected per cluster using equal probability systematic sampling. At stage three, one eligible participant aged 12-24 years (male or female according to cluster) was selected using the Kish method (31). Survey administrators administered two surveys at each chosen household: one to the head of household, and the other to the participant selected during

the third stage of the cluster sample. When the participant was also the head of household, the same individual answered both surveys.

Measurement

During the head of household interview, the household's socioeconomic status was assessed through interviewer observations and a series of questions about asset ownership. The index included the following assets: electricity, radio, telephone, paraffin lamp, iron (for clothing), watch, bicycle, and car. One point was allotted for ownership of each asset. The "head of household" questionnaire also included questions related to household food and water insecurity (see Panel 1). This experience-based measure offers a more sensitive estimate of insecurity than anthropometric approaches would allow (7). Heads of households, who were sometimes but not always the same person as the "youth participant" who answered the questionnaire about personal experiences, were asked how often over the past 12 months they had encountered problems in obtaining enough food for the household. The youth participants answered all other survey questions used in this analysis (see Panel 2).

To determine anxiety level, individuals were asked how often during the past 30 days they felt "nervous, tense, or worried." Depression was evaluated by asking how often the youth felt "so sad or unhappy that nothing could cheer you up." Suicidality was assessed on the basis of two questions: one asking whether the youths had ever attempted to "take their own lives," and the other asking whether they had ever thought about ending their lives. In addition to the explicit mental health outcomes of anxiety, depression, and suicidality, perceived "health in general" was included in the analysis to account for potential somatization of distress in addition to other non-nutritional health outcomes.

Statistical Analysis

Data were cleaned and prepared for public use before this analysis began, and SAS 9.4 (SAS Institute, Cary NC) was used for data management. SAS survey procedures and SAS-callable SUDAAN 11.0.1 were used to incorporate sample weights and the complex sample design during analysis. Weighted percentages were used to generate nationally representative estimates. For data reported as weighted percentages, the un-weighted absolute number of participants is also reported. Due to the sample design, percentages and absolute numbers do not perfectly correspond in the tables.

The main association of interest for this study is the relationship between food insecurity and mental health outcomes. Other measures of insecurity (water availability and perceived safety in community) were included in the analysis for comparison and to isolate the effect of food insecurity from water insecurity and insecurity around personal safety. Logistic regression was used to estimate the relationship between measures of insecurity and measures of mental health outcomes. Potential confounders (age, youth's head-of-household status, household socio-economic status, youth's marriage status, level of education in household, and each of the other two forms of measured insecurity) were examined for model fit using stepwise regression selection with inclusion criteria $p < 0.05$. To maximize comparability, we ultimately adopted a uniform final model that includes the main association of interest as well as age, youth's head-of-household status, household socio-economic status, youth's marriage status, and each of the other two forms of measured insecurity.[1]

[1] More information about stepwise models and model selection is available in the appendices, and more information about study design and sampling is available in the VAC Report available online < http://www.unicef.org/esaro/VAC_in_Kenya.pdf >

RESULTS

Table 1 is a summary of key socio-demographic characteristics of the sample. The household response rates were 90.3% for households in female clusters and 89.6% for households in male clusters; the individual response rates were 94.0% females and 89.8% males. A total of 1,227 females and 1,456 males completed the individual survey. Approximately equal numbers of younger-age-group (13-17 years) and older-age-group (18-24 years) individuals participated. Approximately three out of four households own a radio, slightly over one-fifth have electricity, and roughly one in three own a bicycle (16). Asset index scores were normally distributed within the sample around a mean score of 3.8 on a scale from 0 to 8. Twenty-three percent of households participating in this study reported that at least one individual from the household had attended college or university, while 60% of both males and females had completed primary school or higher education, and only 4.0% of females and 2.4% of males had never attended school.

Table 2 is a summary of self-reported food insecurity, safety, and mental health status. A little over half of female respondents are reportedly living in a food insecure household, in which the head of household responded that he or she had "problems getting enough food" sometimes, often, or always over the past 12 months. Extreme food insecurity, in which getting enough food is "always" a problem, affected 6.20% (95% CI: 4.00, 9.49) of females and 4.21% (95% CI: 2.66, 6.60) of males. Males were slightly more likely to be living in a food insecure household. Slightly more than one in five females report that they do not feel safe and secure in their communities, as do slightly fewer than one in five of their male peers.

Moderate mental health outcomes, including feeling anxious or depressed some of the time, were very common in this sample. More severe outcomes, such as feeling anxious or

depressed often or always, were less commonly observed. Fifteen percent of females reported attempting or ideating suicide, compared to only 7.11% of males. Females reported being in poor or fair health 23.24% of the time, compared to only 15.56% among males.

A statistically significant relationship was observed between food insecurity and both anxiety and depression among females, but not among males (Table 3). In the case of "health in general," the gender-based pattern is reversed. The odds of feeling depressed were 1.33 (95% CI: 1.03, 1.73) times higher among food insecure females compared to food secure females. No association between food insecurity and depressive symptomology was observed among males in our sample (table 3). Food insecurity also predicted anxiety among females (adjusted OR 1.37 [95% CI: 1.07, 1.75]), but not among males (table 3). Conversely, the odds of reporting fair or poor health in general over the past 30 days were 1.38 (95% CI: 1.06, 1.81) times greater among food insecure males compared to non-food insecure males. Among females, no significant relationship was observed between food insecurity and health in general. All odds ratios were adjusted for potential confounding by age, head of household status, marriage status, and other forms of insecurity including water insecurity, community safety, and socio-economic status.

Among males, feeling unsafe in the community was significantly associated with depression (OR 1.76 [95% CI: 1.13, 2.73]) and anxiety (OR 1.98 [95% CI: 1.22, 3.21]), and predicted a 126% increased likelihood of fair or poor perceived health. Among females, feeling unsafe in the community was associated with depression (OR: 1.25 [95% CI: 1.03, 1.73]) and anxiety (1.61 [95%CI (1.06, 2.42]), and associated with a 2-fold increase in suicidality risk and a 130% increased likelihood of fair or poor perceived health. Again, odds ratios are adjusted for age, head of household and marriage statuses, and other measures of insecurity including food insecurity, community safety, and socio-economic status.

DISCUSSION

This study provides evidence to support the hypothesis that mental health outcomes are among the non-nutritional consequences of food insecurity. Overall, interviewers obtained a very high individual and household response rate among eligible participants. This reflects a strong survey design, well-trained interview staff, and a national willingness to participate. Considering the sample design and response rate, we are confident that the sample interviewed was representative of 13 to 24 year olds in Kenya. Comparisons with the Demographic and Health Survey (DHS) further support this assumption. In both samples, approximately three out of four households own a radio, slightly over one-fifth have electricity, and roughly one in three own a bicycle (16). The proportion of individuals in our sample who had never attended school was also approximately equivalent to the estimated proportion among similar age groups reported in the DHS.

Concerns about personal safety in the community appear to be a particularly prevalent form of insecurity. Around one in five young people, slightly more females than males, report that they do not feel safe and secure in their communities. It would be interesting to compare these results to a sample taken a few more years removed from the election violence of 2007-2008. A population-based cluster survey of 956 Kenyan adults found substantial increases in sexual and physical violence during nearly two months of unrest, including an approximately 35-fold increase in intimate partner and opportunistic violence across the nation (26). It is possible that the observed insecurity surrounding personal safety was related to ongoing ethnic and political tensions.

Food insecurity is also prevalent. Extreme food insecurity, in which getting enough food is “always” a problem, impacted one in twenty study participants. Fewer than half of females

and only 33.76% of males lived in a household with consistent access to food. This study also suggests disconcerting rates of mental distress among Kenyan youth. Half of the population reports experiencing feelings of anxiety and/or depression at least some of the time. For an age group that is expected to be relatively healthy, the proportion of the population experiencing fair or poor health in general, about one in five, is also alarming.

The results of our multivariate logistic regression (Table 3) provide evidence to support the hypothesis that nutritional outcomes are not the only negative impact of food insecurity in this population. Food insecurity appears to significantly increase the risk of anxiety and depression among females, and to decrease overall health as perceived among males. These increased risks appear to be independent of other forms of insecurity including water insecurity and feeling unsafe in the community, and appear to be relevant for both young heads of households and young people who are not heads of their households. Due to the nature of the sample design and measurement, these results provide an exploratory view; further investigation including more sensitive measures would help to confirm the relationship.

Feeling unsafe in the community, a "condition" affecting approximately one in five young people in this sample, was significantly associated with almost all adverse mental health outcomes in both males and females, and particularly strong associations were observed between feeling unsafe and reporting fair or poor health in general. These results highlight the public health importance of not just freedom from harm, but freedom from fear of potential harm.

Our results suggest potential sex-based distinctions in the relationship between food insecurity and all of the measured mental health outcomes. The relationship between food insecurity and mental health outcomes was only observed in females. Possible reasons may relate to developmental differences between males and females in the manifestation of mental

health issues; females in general experience higher internalization symptoms such as anxiety and depression, and manifest mental health outcomes at an earlier age (33-37). It may also be that females are more likely to be aware of the food situation in their homes, due to their exposure to cooking and other household responsibilities (38). Future research with more homogenous sub-groups within Kenya would be helpful towards exploring these hypotheses, as nuanced and diverse culturally determined gender roles need to be examined.

This study had several limitations. It is difficult to compare results regarding prevalence of health outcomes to worldwide estimates due to the single-question, non-diagnostic measurements used. Although care was taken to follow a rigorous translation protocol, it remains possible that some meanings did not translate perfectly into each of the 13 languages in which the survey was conducted. The primary author conducted secondary analysis of data collected for a different purpose, and thus measurements were not carefully designed for a close examination of food insecurity and mental health outcomes. The food insecurity measure is only sensitive to predictability of food access, and only at the household level. It fails to capture sufficiency of food intake, quality of food including safety, potential problems with method of acquisition, and within-household distribution of resources (39).

Further investigation is warranted to determine the extent to which and the mechanisms through which food insecurity might contribute to the burden of mental illness and sub-pathological distress among young people in Kenya. Future research could also examine whether the relationship is present across the lifespan. Regional studies would be helpful towards understanding the distribution of the problem, while qualitative studies could contextualize the relationship between food insecurity and mental health within the lived experience of individuals.

The results of this study may not surprise those who have lived with the "madness of hunger" or the trauma of chronic insecurity. The high prevalence of food insecurity in Kenya is alarming for reasons that extend beyond its nutritional implications. Though causation cannot be determined in this cross-sectional study, the observed association suggests that mental health programming should be viewed from a nutrition-sensitive lens, while nutrition-specific interventions may do well to incorporate a psychosocial component. Similarly, the high prevalence of feelings of insecurity around personal safety among young people in Kenya has implications beyond the potential for injury. Our results suggest that simply feeling unsafe in one's community can have a dramatic impact on mental health as well as perceptions of health in general. This study offers statistical evidence toward a better understanding of the relationship between insecurity and health.

PANELS AND TABLES

Panel 1: Questions used to define household experience of food and water insecurity.

Food Insecurity: How often during the last 12 months did you have problems in getting enough food for the household: never, sometimes, often, or always?

Water Insecurity: How frequently is water available from [previous identified household water source]? Is it always available, usually available, occasionally available, or infrequently available?

Panel 2: Questions used to define youth's personal experience of perceived safety and mental health outcomes.

Perceived safety: "I feel safe and secure in my community." Do you strongly agree, agree, disagree or strongly disagree?

Anxiety: About how often during the past 30 days did you feel nervous, tense or worried? Would you say none of the time, some of the time, most of the time or all of the time?

Depression: During the past 30 days, about how often did you feel so sad or unhappy that nothing could cheer you up? Would you say none of the time, some of the time, most of the time or all of the time?

Suicidality*:* The next two questions ask about things that have ever happened to you. Have you ever had thoughts of ending your life? Have you ever made an attempt to take your own life?

Table 1: Demographic data from a 2010 nationally representative survey of Kenyan youth aged 13-24 years

	Females (n=1239)*		Males (n=1456)*	
Age Group				
13-17 years	546	(44.35% [40.70, 48.07])	746	(47.23% [42.92, 51.59])
18-24 years	681	(55.65% [51.93, 59.30])	710	(52.77% [48.41, 57.08])
Highest Education Level in Household				
None	34	(2.28% [0.95, 5.38])	20	(1.14% [0.31, 4.07])
Primary[a]	435	(30.45% [26.90, 34.25])	429	(30.37% [25.97, 35.16])
Secondary[b]	505	(43.85% [38.03, 49.84])	656	(48.42% [44.17, 52.69])
College or University	238	(23.35% [18.24, 29.37])	305	(20.07% [16.26, 24.51])
Current Marital Status				
Currently married or cohabitating				
13-17 years	14	(1.94% [0.19, 3.68])	119	(0.16% [0.00, 0.35])
18-24 years	357	(44.06% [38.08, 50.03])	3	(13.93% [10.35, 17.51])
Ever married or cohabitating				
13-17 years	20	(3.57% [1.32, 5.84])	8	(0.62% [0.12, 1.11])
18-24 years	403	(51.10% [45.19, 57.00])	145	(17.59% [13.57, 21.60])
Head of Household (HOH) Status				
HOH	96	(7.98 % [5.74, 11.01])	154	(8.65% [6.50, 11.44])
Not HOH	1129	(92.02% [88.99, 94.26])	1299	(91.35% [88.56, 93.50])

Data are 95% (CI) [a]Includes post-primary training [b] Includes post-secondary

Table 2: Measures of insecurity and self-reported mental health outcomes from a 2010 nationally representative survey of Kenyan youth aged 13-24 years

	Females (n=1239)*		Males (n=1456)*	
Measures of Security				
Food security (Frequency of "problems getting enough food," past 12 months)[a]				
Never problems	538	(47.06% [39.79, 54.46])	540	(33.75% [28.56 , 39.37])
Sometimes problems	523	(39.35% [34.28, 44.65])	682	(50.84% [45.79, 55.86])
Often problems	92	(7.38% [5.77, 9.41])	153	(11.20% [8.95, 13.94])
Always problems	69	(6.20% [4.00, 9.49])	60	(4.21% [2.66, 6.60])
Water security (Water availability at "usual drinking water" source)[a]				
Water always available	686	(55.23% [47.63, 62.60])	856	(62.00% [55.12, 68.44])
Water usually available	242	(20.34% [15.82, 25.76])	324	(21.00% [17.56, 24.91])
Water occasionally available	247	(21.04% [16.05, 27.09])	234	(15.47% [10.24, 22.68])
Water infrequently available	49	(3.38% [1.76, 6.40])	26	(1.53% [0.72, 3.21])
Perceived safety[b]				
Feels safe	940	(76.59% [72.38, 80.33])	1207	(80.36% [77.70, 82.78])
Does not feel safe	270	(23.41% [19.67, 27.62])	229	(19.64% [17.22, 22.30])
Mental Health Outcomes				
Feeling Anxious[b]				
Never	651	(49.34% [44.72, 53.98])	730	(48.91% [44.46, 53.39])
Sometimes	487	(43.61% [39.55, 47.77])	643	(47.35% [42.93, 51.81])
Often	73	(5.93% [4.51, 7.76])	67	(3.45% [2.56, 4.64])
Always	10	(1.12% [0.52, 1.74])	6	(1.12% [0.37, 3.27])
Feeling Depressed[b]				
Never	592	(45.43% [40.47, 50.48])	702	(48.73% [44.62, 52.85])
Sometimes	552	(47.01% [42.76, 51.30])	687	(47.00% [43.28, 50.75])
Often	71	(3.80% [2.43, 5.89])	48	(6.99% [4.67, 10.34])
Always	8	(0.57% [0.18, 1.77])	8	(0.47% [0.17, 1.33])
Suicidality[b]				
Ever	1056	(15.02% [11.13, 19.98])	1332	(7.11% [5.44, 9.24])
Never	161	(84.98% [80.02, 88.87])	112	(92.89% [90.76, 94.56])
Perceived health "in general", past 30 days[b]				
Good, very good, excellent	945	(76.76% [73.21, 79.97])	1214	(84.44% [81.97, 86.63])
Fair or poor	279	(23.24% [20.03, 26.79])	233	(15.56% [13.37, 18.03])

* Data are absolute value (weighted % [95% CI])

[a] From head of household questionnaire. [b] From respondent questionnaire.

Table 3. Adjusted odds ratios for self-reported mental health outcomes among Kenyans aged 12-24, comparing three different kinds of insecurity

	Food Insecurity		Water Insecurity		Safety in Community	
	AOR (95% CI)†	p-value	AOR (95% CI)	p-value	AOR (95% CI)	p-value
Feeling depressed past 30 days						
Females	1.33 (1.03, 1.73)*	0.0318	1.11 (0.90, 1.34)	0.352	1.25 (1.03, 1.73)	0.2025
Males	1.06 (0.87, 1.29)	0.5741	0.96 (0.79, 1.16)	0.6499	1.76 (1.13, 2.73)*	0.0126
Feeling anxious past 30 days						
Females	1.37 (1.07, 1.75)*	0.0121	1.12 (0.93, 1.35)	0.2294	1.61 (1.06, 2.42)*	0.0131
Males	1.07 (0.87, 1.32)	0.5013	0.91 (0.75, 1.11)	0.3423	1.98 (1.22, 3.21)*	0.0056
Ideating and/or attempting suicide, lifetime						
Females	1.21 (0.87, 1.69)	0.2574	1.12 (0.68, 1.86)	0.6475	2.03 (1.38, 2.97)*	0.0003
Males	0.98 (0.65, 1.47)	0.9225	1.05 (0.80, 1.39)	0.7193	1.59 (0.89, 2.83)	0.1157
Poor or fair "health in general", past 30 days						
Females	1.07 (0.80, 1.45)	0.6877	1.21 (0.97, 1.50)	0.0985	2.30 (1.53, 3.47)*	<.0001
Males	1.38 (1.06, 1.81)*	0.0180	0.86 (0.64, 1.15)	0.3061	2.26 (1.40, 3.65)*	0.0009

† Covariates included in model to control for potential confounding: Age, HOH status, SES index, marriage status, education in household, and each of the other two forms of insecurity. For more information on model selection, see appendices.

* Significant at p>0.05

Appendix A. Results of stepwise model selection. Cutoff for inclusion p < 0.05

Outcome	**Females**		**Males**	
	In Model	Dropped	In Model	Dropped
Anxiety	Perceived safety in community, food insecurity, water insecurity, age at survey, marriage status	SES index, household education level, head of household status	Perceived safety in community, water insecurity, SES index, marriage status	Food insecurity*, age at survey, household education level, head of household status
Depression	Food insecurity, SES index, age at survey, marriage status	Household education level, head of household status, water insecurity, perceived safety in community	Perceived safety in community, age at survey, household education level	Food insecurity*, water insecurity*, SES index, head of household status
Suicidality	Perceived safety in community, water insecurity, SES index, age at survey, household education level	Food insecurity*, marriage status, head of household status	Marriage status, water insecurity, perceived safety in community	Food insecurity*, SES index, head of household status, household education level, age at survey
Health in General	Perceived safety in community, SES index	Food insecurity*, age at survey, water insecurity*, marriage status, household education level, head of household status	Perceived safety in community, food insecurity, SES index, age at survey	Head of household status, household education level, marriage status, water insecurity*

* For stepwise regression adjusted odds ratio estimates in Table 5, food insecurity, water insecurity, and perceived safety in community were added back into the models if they dropped out during stepwise selection. Insignificant controls were left out of final models.

Appendix B. Comparison of candidate models

Outcome	Sex	Fully Adjusted Model[a]	Stepwise Regression[b]	Final Model[c]
			Food Insecurity	
Depression	Female	1.33 (1.03, 1.71)	1.33 (1.03, 1.73)	1.33 (1.03, 1.73)
	Male	1.05 (0.86, 1.30)	0.98 (0.81, 1.19)	1.06 (0.87, 1.29)
Anxiety	Female	1.37 (1.06, 1.76)	1.41 (1.12, 1.78)	1.37 (1.07, 1.75)
	Male	1.06 (0.86, 1.31)	1.06 (0.87, 1.29)	1.07 (0.87, 1.32)
Suicide	Female	1.28 (0.93, 1.77)	1.28 (0.92, 1.76)	1.21 (0.87, 1.69)
	Male	0.97 (0.64, 1.47)	0.89 (0.60, 1.32)	0.98 (0.65, 1.47)
Health in General	Female	1.04 (0.77, 1.41)	1.28 (0.92, 1.76)	1.07 (0.78, 1.45)
	Male	1.41 (1.08, 1.84)	1.38 (1.06, 1.81)	1.38 (1.06, 1.81)
			Water Insecurity	
Depression	Female	1.08 (0.89, 1.32)	1.10 (0.90, 1.34)	1.10 (0.90, 1.34)
	Male	0.97 (0.80, 1.18)	0.98 (0.83, 1.17)	0.96 (0.79, 1.16)
Anxiety	Female	1.11 (0.93, 1.33)	1.12 (0.93, 1.33)	1.12 (0.93, 1.35)
	Male	0.92 (0.75, 1.12)	0.92 (0.76, 1.11)	0.91 (0.75, 1.11)
Suicide	Female	1.09 (0.66, 1.81)	1.09 (0.65, 1.83)	1.12 (0.68, 1.86)
	Male	1.07 (0.81, 1.41)	0.97 (0.72, 1.31)	1.05 (0.80, 1.39)
Health in General	Female	1.22 (0.98, 1.51)	1.21 (0.98, 1.50)	1.21 (0.97, 1.50)
	Male	0.86 (0.64, 1.16)	0.84 (0.62, 1.13)	0.86 (0.64, 1.15)
			Community Safety	
Depression	Female	1.25 (0.88, 1.77)	1.26 (0.89, 1.79)	1.25 (0.89, 1.78)
	Male	1.79 (1.13, 2.84)	1.90 (1.22, 2.97)	1.76 (1.13, 2.73)
Anxiety	Female	1.68 (1.11, 2.55)	1.61 (1.06, 2.42)	1.69 (1.12, 2.56)
	Male	2.02 (1.23, 3.33)	1.99 (1.23, 3.22)	1.98 (1.22, 3.21)
Suicide	Female	1.92 (1.30, 2.82)	1.91 (1.30, 2.82)	2.03 (1.38, 2.97)
	Male	1.68 (0.93, 3.06)	1.71 (0.97, 3.03)	1.59 (0.89, 2.83)
Health in General	Female	2.34 (1.55, 3.54)	2.30 (1.53, 3.45)	2.30 (1.53, 3.47)
	Male	2.30 (1.41, 3.74)	2.16 (1.33, 3.52)	2.26 (1.40, 3.65)

[a] Controlling for age, youth's head-of-household status, household socio-economic status, youth's marriage status, level of education in household
[b] Controlling for variables listed in Appendix A. – slightly different for each association, identified using stepwise selection
[c] Controlling for age, youth's head-of-household status, household socio-economic status, youth's marriage status

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