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## Household food insufficiency and mental health in South Africa

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### Abstract

**Background**—Both mental illness and food insufficiency are common in low and middle income countries. However, there are limited data on the relation between food insufficiency and mental disorders, despite the potential relevance of such data for the development of policy-level interventions. The relationship between food insufficiency and mental disorders within a nationally representative sample of South African adults was examined.

**Methods**—A national survey of 4185 South African adults was conducted using the WHO Composite International Diagnostic Interview to generate psychiatric diagnoses. The survey included a widely used single-item measure of household food insufficiency. The independent effects of food insufficiency and demographic characteristics on 12-month and lifetime DSM-IV diagnosis were assessed using logistic regression.

**Results**—29% of respondents reported that their household ‘sometimes’ did not have enough to eat while 9% reported that they ‘often’ did not have enough to eat. After controlling for conventional socioeconomic and sociodemographic variables, food insufficiency was associated with having any 12-month (OR 1.44, 95% CI 1.1 to 1.9) and lifetime (OR 1.35, 95% CI 1.1 to 1.7) DSM-IV disorder.

**Conclusions**—In South Africa the prevalence of household food insufficiency is very high compared with studies conducted in the developed world, and is independently associated with having a 12-month and lifetime DSM-IV diagnosis. The relationship between food insufficiency and mental health has implications for reducing the burden of common mental disorders in South Africa since, unlike a number of major risk factors for mental illness, food insufficiency may be relatively amenable to intervention.

### BACKGROUND

Both mental illness and household food insufficiency are common in low and middle income countries, but their relationship is not well defined. Results from the South African

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Stress and Health Study (SASH), the first nationally representative study of psychiatric morbidity in South Africa, indicate that approximately 30% of adults have experienced a Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) disorder in their lifetime.<sup>1</sup> Food insecurity, the limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable way,<sup>23</sup> is also a major public health concern in the developing world. Of particular concern is food insufficiency, an extreme form of household food insecurity that refers to a condition in which household members sometimes or often do not have enough to eat.<sup>4-8</sup> Food insufficiency is comparable to the concept of 'food insecurity with hunger'.<sup>7</sup> Data from the South African General Household Survey (2007)<sup>9</sup> indicate that 6.3% of adults and 7.1% of children had gone hungry due to an inadequate amount of food available, while data from a nationally representative sample of children in South Africa estimated that, in 1999, 52% of households experienced hunger and 23% were at risk of hunger.<sup>10</sup> However, at the present time there are no available data on the prevalence of household food insufficiency in the South African population.

There are a number of potential negative consequences of household food insecurity and insufficiency. Food insufficiency can affect physiological mechanisms that are linked to an individual's nutritional status.<sup>11</sup> This was shown in a study by Dixon *et al*<sup>7</sup> who found that adults in food-insufficient households were more likely to have diets that could compromise their health than adults from food-sufficient families. They also had lower serum concentrations of critical nutrients, which can lead to an increased risk of a number of major chronic diseases.<sup>7</sup> Additionally, uncertainty about the availability of food, whether or not food insufficiency actually occurs, may affect the individual's social and mental well-being by creating feelings of aggravation, worry and depression concerning their food supplies.<sup>11</sup> However, a challenge when researching the consequences of food insecurity is to distinguish its health consequences from those of risk factors such as poverty and low socioeconomic status with which it commonly co-occurs.<sup>11,12</sup>

Research conducted predominantly in developed countries has reported an association between household food insecurity or insufficiency and a number of negative health outcomes. These include nutrient inadequacies in adults and adolescents,<sup>13,14</sup> poor self-reported health status,<sup>15</sup> heart disease, diabetes and high blood pressure.<sup>16</sup> Recently, Leyna *et al*<sup>17</sup> estimated the prevalence of reported food insufficiency and its associated sociodemographic factors and health indicators among 899 participants in rural Tanzania. The results indicated that age, lower education, being a peasant, poor self-rated health status and having health problems were associated with food insufficiency only in women.

There is limited research on the relationship between food insufficiency and specific types of mental disorders. Some research has been carried out on the links between household food insecurity or insufficiency and mental disorders, most of which has focused on non-representative community surveys of respondents, including women,<sup>18-21</sup> welfare recipients,<sup>22,23</sup> HIV positive individuals<sup>24</sup> and adolescents.<sup>25,26</sup> The measures used to determine the mental health status of the participants were often symptom inventories such as symptoms checklists<sup>27</sup> or the CES-D.<sup>21</sup>

Recent studies of nationally representative samples in the developed world confirm a relationship between food insufficiency and mental disorders.<sup>16,28</sup> For example, in a nationally representative study conducted in Canada, individuals from food-insufficient households had significantly higher odds of not only reporting poor/fair health, of having poor functional health, restricted activity and multiple chronic conditions, but were also more likely to be suffering from major depression and symptoms of distress.

In the developing world there has been little research that has considered the role of food insufficiency in shaping mental health. It is important to examine this association within developing countries because food insecurity is a highly prevalent feature of life within many developing regions, and knowledge about the consequences of food insecurity may impact the development of social policies to protect vulnerable segments of the population. Within developing countries, only a few community studies have investigated this relationship, none using a nationally representative sample.<sup>192729–31</sup> The purpose of the present study is therefore to use the SASH dataset to estimate the prevalence of household food insufficiency, to identify demographic and socioeconomic characteristics of households most likely to report food insufficiency, and to examine the relationship between food insufficiency and mental disorders.

## METHODS

The SASH study was undertaken as part of the World Mental Health Survey to investigate the prevalence of mental disorders in the South African context. The survey was conducted between January 2002 and June 2004. The rationale and survey methods have been described previously<sup>132</sup> and are briefly summarised here.

### Sample selection

The study population consisted of South Africans who resided in both households and hostels (single-sex migrant labourer group quarters) and were a minimum of 18 years old. The sample excluded those individuals living in institutions (including hospitals, prisons, mental health institutions and military bases). The sample was selected using a multistage area probability sample design. First, enumerator areas (EA, a unit of census administration) used in the 2001 national census were stratified according to province, location (rural/urban) and majority population group (Black, coloured, white or Indian); 960 EAs were selected from the resulting strata, with the number of EAs selected per stratum proportional to the estimated stratum population (minimum 1; maximum 85). Second, within each EA a random sample of five households was selected. The third stage consisted of a random sub-selection of a single adult respondent in each selected housing unit.

Up to three attempts were made to contact each respondent selected to participate. The overall response rate was 85%. The final sample consisted of 4185 individuals. The SASH survey was part of the World Mental Health Survey Initiative. The World Mental Health surveys typically range from 3000 to 5000 respondents, a number chosen to provide a nationally representative sample for prevalence estimates of common mental disorders. The SASH interviewers received intensive training for 1 week in centralised group sessions. The face-to-face interviews lasted approximately 3.5 h, although a number of interviews required more than one visit to complete. The interviews were conducted in one of seven languages: English, Afrikaans, Zulu, Xhosa, Northern Sotho, South Sotho, and Tswana.

### Measures

Demographic characteristics of the participants were collected using standard questionnaire items including age, race, marital status, years of education completed, employment, location (urban/rural), income, health (good vs fair/poor), number of children, number of assets and wealth. It is important to emphasise that race was assessed using the race groups as defined by the apartheid government (Asian, black, coloured, white). Our use of these categories is not intended to reify such categories, but rather to explore the differential health outcomes that are based in past political policies. Household income was divided into categories of R1–5000 (US\$1–476), R5001–16500 (US\$476–1570), R16501–97500 (US\$1570–9281), R97501+ (US\$9281+). Additionally, owing to missing data for the construct

of wealth, a separate category (missing wealth) indicates subjects missing wealth data because they refused to answer, answered 'don't know' or missed the question completely.

A modified version of the World Mental Health Composite International Diagnostic Interview was used to assess lifetime and 12-month DSM-IV disorders. These DSM-IV disorders included anxiety disorders (panic disorder, agoraphobia, social phobia, generalised anxiety disorder and post-traumatic stress disorder), mood disorders (major depressive disorder), substance use disorders (alcohol and drug abuse and dependence) and disorders associated with impulse control (intermittent explosive disorder (IED)).

Food insufficiency was defined narrowly as restricted household food stores or too little food intake among either adults or children in the household,<sup>5</sup> and was operationalised using the question: 'Which of the following describes the amount of food your household has to eat: enough to eat, sometimes not enough to eat, or often not enough to eat?' This single-item measure, which is widely accepted as a valid measure of food insufficiency, is often used in surveys in which it is not feasible to administer a lengthy questionnaire.<sup>833</sup> Other studies have shown that respondents who report that their household 'sometimes' or 'often' does not have enough to eat are less likely to report consuming recommended dietary allowances for various foods and are more likely to have very low serum concentrations of critical nutrients.<sup>47</sup> A recent validation study showed that a single-item measure of food insufficiency (similar to the SASH food insufficiency item) had acceptable sensitivity, specificity and reliability when compared with the US Department of Agriculture Household Food Security Scale (18 items; considered to be the gold standard in the USA<sup>3435</sup>). In the present study, respondents were categorised into three levels for analysis: never food insufficient, sometimes food insufficient and often food insufficient.

### Analysis of data

Data were analysed using SUDAAN. All analyses were adjusted for non-response by using weights to make the sample comparable to the population distribution in the South African census. Cross-tabulations were used to determine whether differences existed between food insufficiency and demographic variables and food insufficiency and DSM-IV diagnosis, both 12-month and lifetime. In addition, we developed two multiple logistic regression models of food insufficiency on DSM-IV diagnosis. The first model estimated 12-month DSM-IV diagnoses and the second model estimated lifetime DSM-IV diagnoses. The results of the regression models were reported as ORs with 95% CIs.

## RESULTS

The demographic characteristics and socioeconomic characteristics of the study sample are shown in table 1. The 4185 respondents were predominantly female (60%) and were unemployed (69%); 76% were black, 13% coloured, 4% Indian/Asian and 7% white. A majority of the participants lived in an urban area (58% vs 42%). Only 37% of the respondents had more than a high school education and 49% were married.

Of the 4185 respondents, 29% reported that their household 'sometimes' did not have enough to eat, while 9% reported that they 'often' did not have enough to eat. A number of demographic correlates of food insufficiency were found. Income ( $\chi^2=127$ ,  $p<0.01$ ), employment, ( $\chi^2=78.1$ ,  $p<0.01$ ) and education ( $\chi^2=198$ ,  $p<0.01$ ) were inversely related to food insufficiency. Levels of food insufficiency were higher for black and coloured subjects than for white subjects and Indians, increased with age ( $\chi^2=7.5$ ,  $p<0.01$ ) and were higher in rural than in urban areas ( $\chi^2=28.5$ ,  $p<0.01$ ). Gender, age and marital status were not found to be associated with food insufficiency.

In bivariate analyses, food insufficiency was associated with having any 12-month DSM-IV diagnosis ( $\chi^2=16.2$ ,  $p<0.01$ ). More specifically, food insufficiency was associated with having a 12-month anxiety disorder ( $\chi^2=17.5$ ,  $p<0.01$ ), but not a 12-month substance use disorder, mood disorder or IED. Although there appears to be an association between having any lifetime DSM-IV diagnosis and food insufficiency, this association was only marginally significant ( $\chi^2=6.2$ ,  $p=0.0514$ ). However, there was a significant association between food insufficiency and having a lifetime DSM-IV anxiety disorder ( $\chi^2=13.9$ ,  $p<0.01$ ; table 2).

### Variables associated with a 12-month DSM-IV diagnosis

After adjusting for the effects of demographic and socioeconomic characteristics, a number of variables were reported to be associated with having a mental disorder, including food insufficiency. Respondents who reported that they 'sometimes' did not have enough food were more likely than respondents in food-sufficient households to have any 12-month DSM-IV disorder (OR 1.38, 95% CI 1.0 to 1.8) or an anxiety disorder (OR 1.78, 95% CI 1.3 to 2.4) (table 3). Similarly, respondents who reported that they 'often' did not have enough to eat were more likely to have any 12-month DSM-IV disorder (OR 2.15, 95% CI 1.5 to 3.1) and anxiety disorder (OR 2.30, 95% CI 1.4 to 3.8) but were also more likely to have a substance use disorder (OR 1.95, 95% CI 1.1 to 3.4) than food-sufficient respondents (table 3).

Additionally, female participants had an increased likelihood of having a 12-month DSM-IV anxiety disorder (OR 1.85, 95% CI 1.4 to 2.4) and mood disorder (OR 1.98, 95% CI 1.3 to 3.0) and were less likely to suffer from a substance use disorder (OR 0.27, 95% CI 0.2 to 0.4) than men. Compared with white respondents, black respondents were more likely to suffer from a 12-month DSM-IV anxiety disorder (OR 2.50, 95% CI 1.1 to 5.8) and less likely to suffer from an impulse disorder (OR 0.31, 95% CI 0.0 to 0.4), while Indians were less likely to suffer from a substance use disorder (OR 0.06, 95% CI 0.0 to 0.4). Living in an urban location was positively associated with having an anxiety disorder (OR 1.44, 95% CI 1.0 to 2.0) and IED (OR 2.46 95% CI 1.1 to 5.7), and each additional year of education decreased the odds of having an IED (OR 0.88, 95% CI 0.8 to 1.0) (table 3). Finally, participants who reported fair/poor health were more likely to have any DSM-IV disorder (OR 2.33, 95% CI 1.8 to 3.0), in addition to an anxiety disorder (OR 2.70, 95% CI 2.0 to 3.8), mood disorder (OR 2.70, 95% CI 2.0 to 3.7), substance use disorder (OR 1.82, 95% CI 1.1 to 3.0) and IED (OR 2.89, 95% CI 1.5 to 5.4). Similar patterns of results were found when investigating the association between lifetime DSM-IV diagnosis and food insufficiency (table 4).

## DISCUSSION

The main results of this study are that: (1) 38% of South Africans report that their households are food-insufficient; (2) after controlling for conventional socioeconomic and sociodemographic variables, food insufficiency was associated with an increased risk of having a 12-month and lifetime DSM-IV diagnosis of anxiety disorder; and (3) respondents who reported that their household 'often' did not have enough food were also more likely to have a 12-month and lifetime substance use disorder than those who were food-sufficient.

High rates of food insecurity and food insufficiency have been reported in Tanzania<sup>17</sup> and Ethiopia.<sup>27,37</sup> For example, a recent study conducted in rural Ethiopia with 902 participants found that 33% of respondents were food-insecure.<sup>27</sup> However, these studies were not national in scope and, to our knowledge, this is the first nationally representative study to document household food insufficiency in sub-Saharan Africa. The finding that 38% of South Africans reported household food insufficiency indicates a significant public health burden. To place this finding in perspective, nationally representative studies in the

developed world estimated that only 2.3% of Canadians reported food insecurity with any type of hunger,<sup>38</sup> while 4.1% of American households had ‘very low food security’ (conceptually similar to food insufficiency) in 2007.<sup>39</sup>

Second, data from this population-based representative sample revealed that food insufficiency was associated with having a 12-month DSM-IV diagnosis. Therefore, the 38% of South Africans who experience household food insufficiency not only face the risk of physical health problems associated with an inadequate diet and nutritional deficiencies, but also the risk of having a mental illness. This finding is consistent with results of previous community-based studies<sup>18202340</sup> and the nationally representative studies conducted in the developed world.<sup>1628</sup> Of note, the pattern of results for the association between lifetime DSM-IV diagnosis and food insufficiency was almost identical with the findings for the 12-month DSM-IV outcome.

Respondents who reported food insufficiency were more likely to have a 12-month DSM-IV disorder—and specifically an anxiety disorder—than those who were food-sufficient. This analysis did not observe a significant increase in risk for major depressive disorder, which is inconsistent with previous research reporting an association between food insecurity and depression.<sup>1927</sup> As anxiety disorders are more common than depressive disorders in our sample, it is possible that the finding of an association of food insecurity with anxiety but not with depressive disorders simply reflects a false negative in the latter case. An alternative explanation might be that, in an African setting where food insecurity is widespread, there is more resilience to associated depression than in other contexts. Nevertheless, given that anxiety and depressive disorders are so often comorbid, and given that previous literature has shown that food insecurity is linked with both of these groups of disorders, the former explanation seems more persuasive.

Finally, respondents who reported that they ‘often’ did not have enough food were more likely to have a 12-month and lifetime substance use disorder than those who were food secure. Similar findings were reported in a study conducted in Canada assessing food insecurity among 1213 HIV-positive patients, where participants who reported ever having used recreational injection drugs and ever having had alcohol or drug treatment were more likely to be food insecure.<sup>24</sup> Another study conducted in the USA compared food insecurity among 41 low-income Puerto Rican female out-of-treatment drug users and 41 matched controls. The results indicated that drug users were more likely than the controls to experience food insecurity according to the Radimer/Cornell scale.<sup>41</sup> It could be that drug users prefer purchasing drugs than food when funds are available.

The relationship between food insufficiency and mental health has implications for reducing the burden of common mental disorders in South Africa. Mental disorders and their associated psychosocial disabilities are a source of considerable morbidity and impose a significant drain on national resources.<sup>42</sup> If food insufficiency is a contributing or causal factor in mental illness, preventing it might reduce the risk of onset or recurrence of these costly and disabling illnesses. Many of the major risk factors for mental illness that have been identified in the literature such as low socioeconomic status and genetic factors cannot be readily modified. However, food insufficiency is relatively amenable to intervention. Nutrition education programmes could include mental health screening and mental healthcare providers could screen for food insecurity as part of the psychosocial evaluation. Non-governmental organisations and governmental programmes presently active in South Africa providing food assistance, including the distribution of food parcels, could be used more effectively.

Several limitations of this study must be considered when interpreting these findings. First, although our theoretical perspective suggests the hypothesis that food insufficiency leads to psychiatric disorder, it must be emphasised that the cross-sectional design of our study and many other studies on this topic<sup>182243</sup> does not provide information about the causal direction of associations. Although it might be argued that household food insufficiency predisposes individuals to poor mental health, the reverse could also be true. Prospective research in the USA provides support for a bidirectional relationship, where food insecurity predicted depression and depression predicted food insecurity.<sup>29</sup> Second, despite the evidence suggesting that food insufficiency increases HIV risk transmission behaviours and susceptibility to HIV once exposed,<sup>44</sup> and that people living with HIV/AIDS (PLWHA) are twice as likely to suffer from a psychiatric disorder than the general population,<sup>45</sup> an analysis of the association between HIV and food insufficiency was not conducted owing to low self-reported prevalence rates. However, the covariate for self-reported health status should capture some of the variation that may be related to HIV status. Finally, since data were not collected from non-respondents, we know very little about the 15% who refused to participate in the SASH study.

Nevertheless, these data are the first to describe the association between food insufficiency and diagnostic mental health outcomes in a nationally representative population in a low or middle income country. These findings suggest that secure access to food may have health impacts that extend beyond nutritional outcomes to mental health status. These findings also demonstrate the necessity to continue efforts to prevent food insecurity in order to improve the health of South Africans. Our findings highlight the need for more research to better delineate the mechanisms and to test the effects of nutritional interventions.

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Table 1

## Demographic correlates of food insufficiency

	N	Food secure	Sometimes insufficient	Insufficient
Total				
N	4185	2558	1238	389
%		62.3	28.7	9.0
Gender				
Male	1666	63.9 (2.2)	27.6 (1.9)	8.5 (1.2)
Female	2519	61.0 (1.6)	29.7 (1.4)	9.4 (0.9)
$\chi^2$ (p value)		3.0 (0.2265)		
Race				
Black	3183	55.6 (2.1)	33.8 (1.7)	10.6 (1.0)
Coloured	554	75.5 (2.4)	19.0 (1.9)	5.5 (1.2)
White	295	92.1 (2.5)	6.2 (2.7)	1.7 (0.8)
Indian	153	87.0 (4.5)	8.8 (3.0)	4.2 (3.3)
$\chi^2$ (p value)		93.3 (0.0000)		
Age				
18–34	2107	62.1 (2.0)	29.5 (1.7)	8.4 (0.9)
35–49	1221	63.9 (2.2)	26.7 (1.8)	9.4 (1.1)
50–64	624	63.0 (2.5)	28.0 (2.1)	9.0 (1.4)
65+	233	54.0 (4.5)	33.6 (4.1)	12.5 (2.6)
$\chi^2$ (p value)		7.5 (0.2962)		
Marital status				
Unmarried	2129	60.5 (1.8)	29.7 (1.4)	9.8 (1.1)
Married	2056	64.1 (2.0)	27.7 (1.9)	8.2 (1.0)
$\chi^2$ (p value)		4.1 (0.1400)		
Education				
None	318	41.2 (3.9)	43.1 (3.3)	15.7 (2.7)
Grade 1–7	874	44.4 (2.6)	38.6 (2.2)	17.1 (1.9)
Grade 8–11	1442	60.4 (2.0)	31.1 (1.9)	8.4 (1.1)
Grade 12	913	71.3 (2.4)	23.5 (2.1)	5.2 (0.9)
Grade 13+	638	84.0 (2.2)	12.9 (1.7)	3.1 (1.0)
$\chi^2$ (p value)		198 (0.0000)		
Income				
0	609	40.3 (3.2)	41.4 (3.2)	18.2 (2.4)
1–1500	960	51.1 (2.5)	35.0 (2.1)	13.9 (1.7)
1501–16500	895	66.1 (2.0)	29.0 (2.0)	4.9 (0.9)
16501–97500	891	73.6 (2.6)	21.3 (2.2)	5.1 (0.9)
97501+	830	72.6 (2.7)	21.5 (2.4)	6.0 (1.0)
$\chi^2$ (p value)		127 (0.0000)		
Employment				

	N	Food secure	Sometimes insufficient	Insufficient
Unemployed	2907	56.6 (1.7)	32.1 (1.5)	11.3 (1.1)
Employed	1278	74.7 (2.5)	21.3 (2.3)	4.0 (0.6)
$\chi^2$ (p value)		78.1 (0.0000)		
Location				
Rural	1755	51.0 (2.8)	36.3 (1.9)	12.7 (1.5)
Urban	2430	69.4 (2.1)	23.9 (2.0)	6.7 (1.0)
$\chi^2$ (p value)		28.5 (0.0000)		

Values are percentages with SEs in parentheses.

**Table 2**

## Food insufficiency and lifetime and 12-month DSM-IV diagnoses

		Food secure	Sometimes insufficient	Insufficient
<b>12-Month disorders</b>				
All DSM-IV				
No	3501	64.0 (1.7)	28.0 (1.5)	8.0 (0.8)
Yes	684	53.8 (3.2)	32.3 (2.8)	13.9 (2.0)
$\chi^2$ (p value)			16.2 (0.0007)	
Anxiety disorder				
No	3835	63.5 (1.7)	28.0 (1.4)	8.5 (0.8)
Yes	350	48.5 (3.7)	37.1 (3.2)	14.4 (2.7)
$\chi^2$ (p value)			17.5 (0.0005)	
Mood disorder				
No	3971	62.8 (1.7)	28.3 (1.4)	8.8 (0.9)
Yes	214	52.3 (5.4)	35.7 (4.6)	12.0 (3.0)
$\chi^2$ (p value)			3.7 (0.1636)	
Substance use				
No	3978	62.4 (1.7)	29.0 (1.5)	8.6 (0.9)
Yes	207	60.6 (4.0)	24.0 (3.0)	15.5 (3.2)
$\chi^2$ (p value)			5.5 (0.0709)	
Explosive disorder				
No	4120	62.2 (1.7)	28.8 (1.4)	9.0 (0.9)
Yes	65	68.4 (7.7)	23.5 (7.5)	8.1 (3.4)
$\chi^2$ (p value)			0.6 (0.7300)	
<b>Lifetime disorders</b>				
All DSM-IV				
No	2915	64.0 (1.9)	27.8 (1.7)	8.2 (0.9)
Yes	1270	58.5 (2.3)	30.8 (1.7)	10.7 (1.3)
$\chi^2$ (p value)			6.2 (0.0514)	
Anxiety disorder				
No	3517	64.0 (1.8)	27.3 (1.5)	8.7 (0.8)
Yes	668	53.2 (2.8)	36.4 (2.3)	10.5 (1.7)
$\chi^2$ (p value)			13.9 (0.0019)	
Mood disorder				
No	3764	62.8 (1.7)	28.4 (1.5)	8.8 (0.9)
Yes	421	57.6 (3.5)	31.7 (2.9)	10.8 (2.0)
$\chi^2$ (p value)			2.2 (0.3338)	
Substance use				
No	3694	62.2 (1.7)	29.1 (1.5)	8.7 (0.9)
Yes	491	63.4 (2.9)	25.7 (2.3)	10.9 (1.6)
$\chi^2$ (p value)			3.0 (0.2306)	
Explosive disorder				

		<b>Food secure</b>	<b>Sometimes insufficient</b>	<b>Insufficient</b>
No	4082	62.2 (1.7)	28.7 (1.4)	9.1 (0.9)
Yes	103	66.8 (5.7)	27.6 (5.7)	5.6 (2.2)
$\chi^2$ (p value)			2.2 (0.3378)	

Values are percents with SEs in parenthesis.

Table 3

ORs (with 95% CI) for 12-month DSM-IV disorders (N=4064)

Variables	Any DSM-IV disorder	Anxiety disorder	Mood disorder	Substance disorder	Impulse disorder
Food insufficient					
Sometimes	1.38 (1.0 to 1.8)*	1.78 (1.3 to 2.4)****	1.34 (0.9 to 2.1)	0.91 (0.6 to 1.4)	1.02 (0.5 to 2.1)
Often	2.15 (1.5 to 3.1)****	2.30 (1.4 to 3.8)****	1.40 (0.7 to 2.7)	1.95 (1.1 to 3.4)*	1.18 (0.4 to 3.3)
Female	1.00 (0.8 to 1.2)	1.85 (1.4 to 2.4)****	1.98 (1.3 to 3.0)***	0.27 (0.2 to 0.4)****	0.74 (0.4 to 1.3)
Age	0.99 (1.0 to 1.0)	1.00 (1.0 to 1.0)	0.99 (1.0 to 1.0)	0.99 (1.0 to 1.0)	0.98 (1.0 to 1.0)**
White (reference)					
Black	1.44 (0.7 to 2.8)	2.50 (1.1 to 5.8)*	1.13 (0.4 to 3.5)	1.28 (0.7 to 2.3)	0.31 (0.1 to 0.7)**
Coloured	1.60 (0.8 to 3.1)	2.15 (0.9 to 5.1)	1.69 (0.6 to 5.1)	1.21 (0.7 to 2.2)	0.36 (0.1 to 1.3)
Indian	0.96 (0.5 to 2.0)	1.03 (0.3 to 3.5)	1.87 (0.5 to 6.3)	0.06 (0.0 to 0.4)**	0.46 (0.2 to 1.4)
Log of income	1.00 (0.9 to 1.1)	1.08 (1.0 to 1.2)	0.92 (0.8 to 1.1)	0.99 (0.9 to 1.1)	1.14 (0.9 to 1.4)
Married	0.83 (0.7 to 1.0)	0.90 (0.7 to 1.2)	0.94 (0.7 to 1.3)	0.74 (0.4 to 1.3)	0.55 (0.2 to 1.3)
Years of education	0.99 (1.0 to 1.0)	1.01 (1.0 to 1.1)	0.98 (0.9 to 1.0)	1.01 (1.0 to 1.1)	0.88 (0.8 to 1.0)*
Employed	1.19 (0.9 to 1.5)	0.81 (0.6 to 1.1)	1.23 (0.8 to 2.0)	1.27 (0.9 to 1.9)	1.05 (0.6 to 1.7)
Urban	1.23 (0.9 to 1.6)	1.44 (1.0 to 2.0)*	1.31 (0.9 to 1.8)	1.02 (0.6 to 1.6)	2.46 (1.1 to 5.7)*
Assets (eg, car/house)	1.03 (1.0 to 1.1)	1.04 (1.0 to 1.1)	1.03 (1.0 to 1.1)	1.03 (1.0 to 1.1)	1.09 (1.0 to 1.2)*
Wealth (reference)					
Debt	1.15 (0.8 to 1.6)	0.94 (0.6 to 1.5)	1.49 (1.0 to 2.3)	1.06 (0.6 to 1.9)	1.76 (0.7 to 4.2)
Missing wealth	0.79 (0.6 to 1.0)	0.81 (0.6 to 1.2)	1.08 (0.7 to 1.7)	0.65 (0.4 to 1.1)	0.69 (0.3 to 1.4)
Fair/poor health (self-report)	2.33 (1.8 to 3.0)****	2.75 (2.0 to 3.8)****	2.70 (2.0 to 3.7)****	1.82 (1.1 to 3.0)*	2.89 (1.5 to 5.4)****
No of children aged <18 years	1.01 (1.0 to 1.1)	0.95 (0.9 to 1.0)	1.05 (1.0 to 1.1)	1.01 (0.9 to 1.1)	1.10 (1.0 to 1.3)

\* p≤0.05,

\*\* p≤0.01,

\*\*\* p≤0.001.

Table 4

ORs (with 95% CI) for lifetime DSM-IV disorders (N=4064)

Variables	Any DSM-IV disorder	Anxiety disorder	Mood disorder	Substance disorder	Impulse disorder
Food insufficient					
Sometimes	1.29 (1.0 to 1.6)*	1.68 (1.3 to 2.2)***	1.20 (0.9 to 1.6)	1.01 (0.7 to 1.4)	1.34 (0.8 to 2.4)
Often	1.58 (1.1 to 2.2)**	1.60 (1.1 to 2.3)**	1.31 (0.9 to 2.0)	1.55 (1.0 to 2.4)*	0.99 (0.4 to 2.4)
Female	0.86 (0.7 to 1.0)	1.63 (1.3 to 2.0)***	1.71 (1.3 to 2.3)***	0.26 (0.2 to 0.3)***	0.69 (0.5 to 1.0)*
Age	0.99 (1.0 to 1.0)	0.99 (1.0 to 1.0)	0.99 (1.0 to 1.0)	1.00 (1.0 to 1.0)	0.97 (0.9 to 1.0)*
White (reference)					
Black	1.21 (0.7 to 2.1)	1.92 (1.0 to 3.8)	1.13 (0.4 to 3.3)	1.02 (0.6 to 1.8)	0.48 (0.2 to 1.0)*
Coloured	1.40 (0.8 to 2.4)	1.42 (0.7 to 2.9)	1.13 (0.4 to 3.0)	1.50 (0.8 to 2.7)	0.53 (0.2 to 1.3)
Indian	0.77 (0.4 to 1.4)	0.92 (0.4 to 2.4)	1.03 (0.3 to 3.1)	0.39 (0.1 to 1.0)*	0.42 (0.2 to 1.1)
Log of income	1.02 (1.0 to 1.1)	1.05 (1.0 to 1.1)	0.98 (0.9 to 1.1)	1.01 (0.9 to 1.1)	1.11 (0.9 to 1.3)
Married	0.85 (0.7 to 1.0)	0.92 (0.7 to 1.2)	0.72 (0.6 to 0.9)*	0.75 (0.6 to 1.0)*	0.83 (0.4 to 1.6)
Years of education	1.01 (1.0 to 1.0)	1.01 (1.0 to 1.0)	0.97 (0.9 to 1.0)	1.02 (1.0 to 1.1)	0.90 (0.8 to 1.0)*
Employed	1.16 (1.0 to 1.4)	0.80 (0.7 to 1.0)*	1.15 (0.8 to 1.7)	1.25 (1.0 to 1.6)	1.15 (0.7 to 1.9)
Urban	1.17 (0.9 to 1.5)	1.47 (1.2 to 1.9)**	1.22 (0.9 to 1.6)	1.08 (0.8 to 1.5)	1.99 (1.1 to 3.6)*
Assets (eg, car/house)	1.02 (1.0 to 1.1)	1.04 (1.0 to 1.1)**	1.05 (1.0 to 1.1)*	1.01 (1.0 to 1.1)	1.11 (1.0 to 1.2)**
Wealth (reference)					
Debt	0.87 (0.6 to 1.2)	0.83 (0.6 to 1.2)	1.06 (0.8 to 1.4)	0.80 (0.5 to 1.2)	1.51 (0.8 to 2.9)
Missing wealth	0.60 (0.5 to 0.7)***	0.63 (0.5 to 0.9)**	0.70 (0.5 to 1.0)*	0.61 (0.4 to 0.9)**	0.61 (0.3 to 1.1)
Fair/poor health (self-report)	2.52 (2.1 to 3.1)***	2.36 (1.9 to 2.9)***	2.41 (1.8 to 3.2)***	1.85 (1.3 to 2.6)***	1.92 (1.2 to 3.0)**
No of children aged <18 years	1.04 (1.0 to 1.1)*	1.02 (1.0 to 1.1)	1.08 (1.0 to 1.1)**	1.05 (1.0 to 1.1)	1.10 (1.0 to 1.2)

\* p&lt;0.05,

\*\* p&lt;0.01,

\*\*\* p&lt;0.001.