Brief on COVID-19 Households and Jobs Tracker Wave 1 & 2

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Summary

1. 47.7% of the population in Ghana was estimated to be affected by moderate or severe food insecurity and 9.5% to be severe food insecure in June 2020. This compares to 47.0% and 6.2% respectively for September 2020
2. In the period 2016-2017, it was estimated that 49.5% of the population was either moderately or severely food insecure and 7.8% severely food insecure.
3. In September 2020, the estimated moderate or severe food insecurity ranged from 56.2% in Upper East Region to 56.2% in Upper East Region.
4. In September 2020, the estimated severe food insecurity ranged from 5.8% in Northern Region to 11.6% in Ashanti Region.
5. In general, a decline in both moderate and severe food insecurity between June and September 2020 was observed. However, these differences fall within the margins of error.

Introduction

From June 10 to June 25, 2020 and from August 30 to September 22, The Ghana Statistical Service (GSS) collected data in two waves of a nationally representative telephone survey to gauge the effects of COVID-19 on households and jobs in Ghana. As part of this survey different questions on the theme of food (in)security were asked. This report presents the estimated prevalence of food insecurity in the national population of Ghana based on data collected by the GSS and analysed by the Food Security and Nutrition Statistics Team in the Statistics Division at Food and Agriculture Organization of the United Nations (FAO).

FIES

The Food Insecurity Experience Scale (FIES) is an experience-based metric of food insecurity severity that relies on people's direct responses to eight questions about their access to food. Based on their responses to the FIES Survey Module items, the individuals surveyed are assigned a probability of being in one of three classes, as defined by two globally-set thresholds: food secure or marginally insecure; moderately food insecure; and severely food insecure. This information is then used to produce SDG indicator 2.1.2 ("Prevalence of moderate or severe food insecurity ($FI_{mod+sev}$) in the population, based on the Food Insecurity Experience Scale"). $FI_{mod+sev}$ is the sum of the proportion of the population affected by moderate food insecurity plus the proportion classified as severely food insecure. As a separate indicator (FI_{sev}) is computed by considering only the severe food insecurity class. People experiencing moderate levels of food insecurity will typically eat low-quality diets and might have been forced, at times during the year (or reference period), to also reduce the quantity of food they would normally eat, while those experiencing severe levels would very likely have gone for entire days without eating, due to lack of money or other resources to obtain food. The questions are designed in such a way, that not a single question measures food insecurity on its own. Only the questions together give an indication of food insecurity.

People experiencing moderate food insecurity face uncertainties about their ability to obtain food and have been forced to reduce, at times during the year, the quality and/or quantity of food they consume due to lack of money or other resources. It thus refers to a lack of consistent access to food, which diminishes dietary quality, disrupts normal eating patterns, and can have negative consequences for nutrition, health and well-being. People facing severe food insecurity, on the other hand, have likely run out of food, experienced hunger and, at the most extreme, gone for days without eating, putting their health and well-being at grave risk. Figure 2 below illustrates the meaning of food security, moderate food insecurity and severe food insecurity, with each category shown as a proportion of the total population.

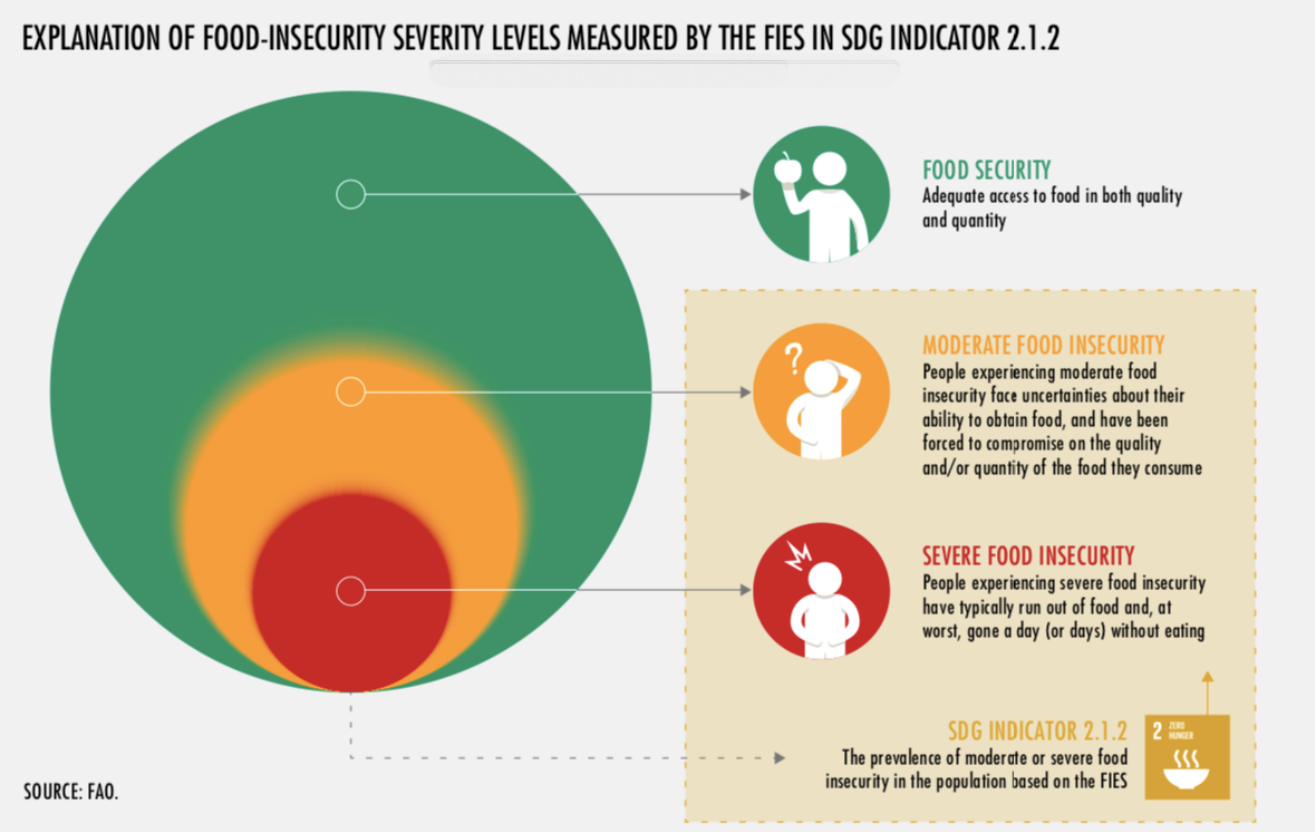

Figure 1: Visual explanation of Food Insecurity from the FAO.

The principles underlying experience-based food security measurement have a long history grounded in ethnographic studies conducted to understand the experience of food insecurity. Research revealed that food insecurity, as seen from the perspective of individuals and households, is characterized by uncertainty and anxiety regarding food access and changes in food consumption, commonly leading to a less balanced, lower quality diet.

With increasing severity of the food insecurity condition faced, the quantity of food consumed also decreases, as portion sizes are reduced, meals are skipped and at its most severe, people are forced to go without eating for entire days. These dimensions of the experience of food insecurity appear to be common across cultures, thus paving the way for a common, internationally valid, measurement scale. The FIES is a standardized, globally valid, experience-based food security scale, developed by FAO as the consolidation of decades of experience with the use of similar tools in several countries. The key innovation of the FIES methodology is that it produces food insecurity prevalence estimates:

1. whose validity and reliability can be formally assessed
2. that can be compared across countries.

The strength and rigor of the analytic approach, coupled with the long-tested robustness of the specific questions included in the FIES survey module, make it capable of producing reliable food insecurity prevalence estimates across a wide spectrum of countries in terms of languages, culture, and socio-economic conditions, even in countries with very low or very high rates of food insecurity. This makes it ideal as the basis for indicators to be used in the context of a universal agenda such as the 2030 Agenda for Sustainable Development.

One limitation of the results collected in the telephone survey in the Households and Jobs tracker, is that they uses a reference period of 30 days (prior to the call), as compared to 12 month reference period that is usually used in FIES questionnaires and to measure SDG indicator 2.1.2.

Food Insecurity in Ghana

Data have been validated by the Food Security and Nutrition Statistics Team at FAO, by testing adherence to the Rasch model's assumption and have been found to conform to quality standards required for reliable estimation of the prevalence of food insecurity in the population (see Methodology section below). Figure 2 shows the values of $FI_{mod+sev}$ and FI_{sev} in Ghana in June 2020 and Figure 3 for a comparison between the situation in as captured by the Ghana Living Standards Survey Round Seven (GLSS7) in 2016/2017, June 2020 and September 2020. For the calculation of regional estimates, the former 10 regions of Ghana were used. This was done 1) to maintain an adequate sample size at the regional level and 2) to facilitate comparison between food insecurity during the GLSS7 and the current release. The GLSS7 is a nationally representative (in person) survey that was conducted in 2016 and 2017.

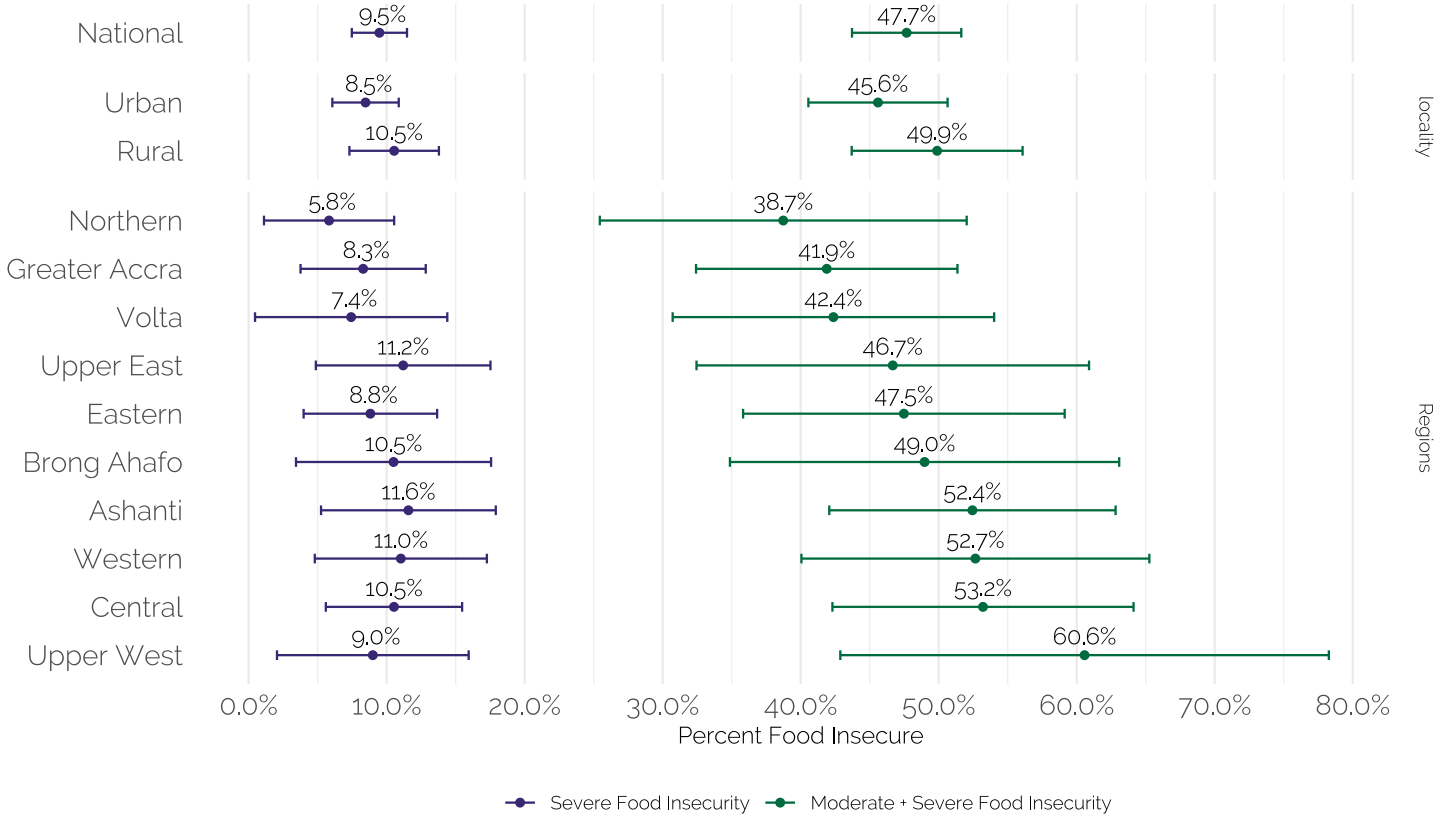

Figure 2: Prevalence rates (%) of food insecurity in the total population in Ghana, June 2020. Error bars indicate a 90% confidence interval.

Results show that 47.7% of the population in Ghana in June 2020 was affected by moderate or severe food insecurity. This corresponds to individuals living in households where at least one individual aged 15 or more has very likely been forced, at times during the 30 day period, to reduce the quality of their diet, due to a lack of money or other resources, and had at least a fifty percent probability of also having reduced the quantity of food consumed. This figure includes the 9.5% estimated to be affected by severe food insecurity, which represents individuals living in households where the respondent has almost surely reduced the quantity of food consumed and had at least a fifty percent probability of having gone for an entire day without eating, because of lack of means to get food.

In June 2020, because of the COVID-19 pandemic, most COVID-19 restrictions were still in place. By September 2020, most COVID restrictions were lifted and the case numbers were considerably lower than in June 2020. In general, a decline in both moderate and severe food insecurity between June and September was observed.

Different regions are estimated to have different levels of food insecurity. The estimated moderate or severe food insecurity in June 2020 ranged from 38.7% in Northern Region to 60.6% in Upper West Region. At the same time, the estimated severe food insecurity in June 2020 ranged from 5.8% in Northern Region to 11.6% in Ashanti Region. Urban areas (45.6% $FI_{mod+sev}$ and 8.5% FI_{sev}) experience less food insecurity than rural areas (49.9% $FI_{mod+sev}$ and 10.5% FI_{sev}).

The biggest difference between the two waves of the tracker survey was observed in Upper West Region. However, these differences fall within the margins of error. The biggest decline in food in estimated food insecurity between the GLSS7 and the trackers was observed in Northern Region.

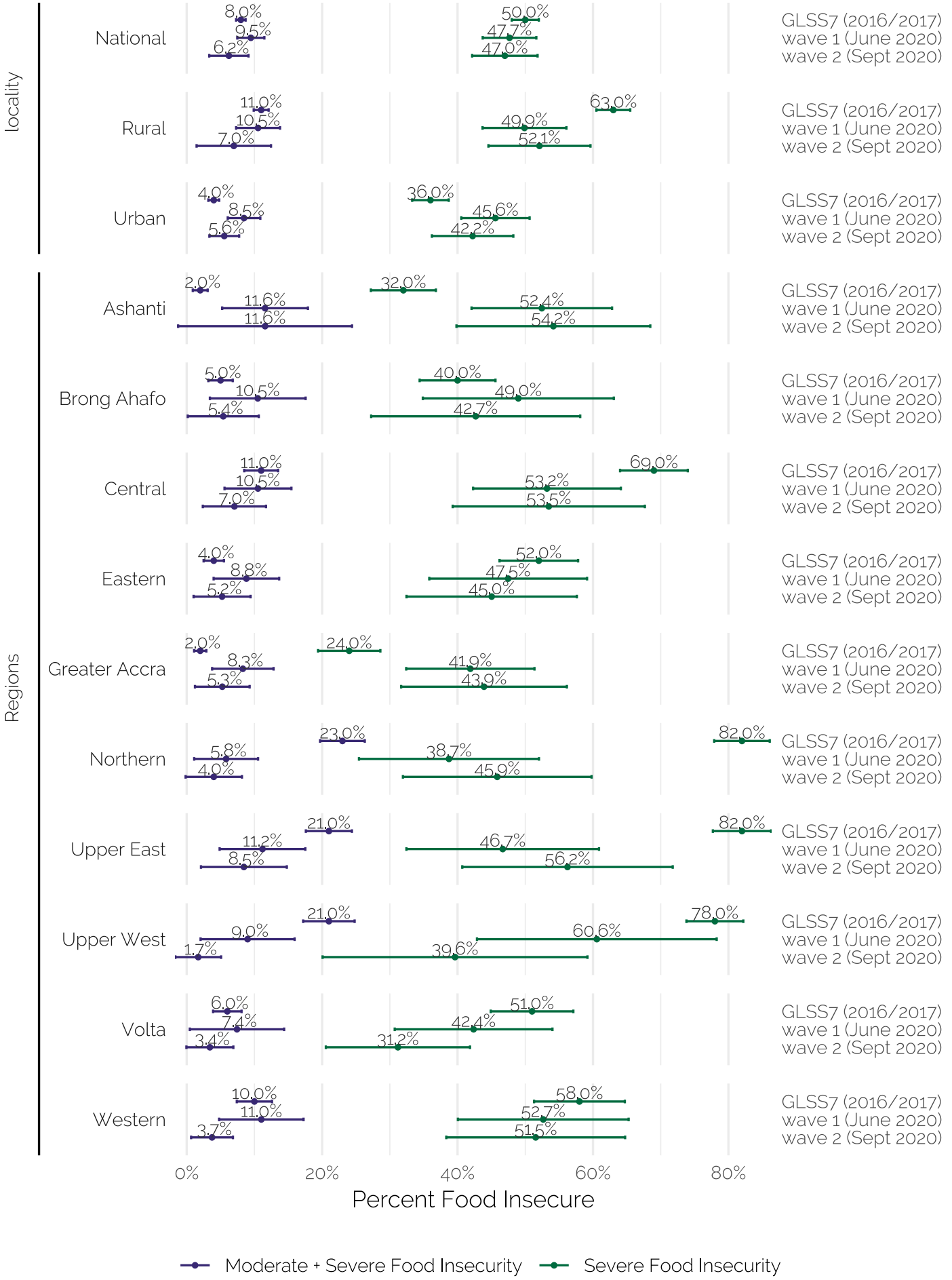

Figure 3: Prevalence rates (%) of food insecurity in the total population in Ghana, in 2016/2017, June 2020 and September 2020. Error bars indicate a 90% confidence interval.

Methodology

Key Concepts

A survey module composed of eight questions, or "items," was used to collect data on the occurrence of conditions and experiences that are typical of a household or an individual facing "food insecurity" (see Table 3 on final page). Each FIES question refers to a different experience and is linked to a different level of severity of food insecurity, which is treated as a measurable "latent" trait. So a concept essential to experience-based food insecurity scales is that the items (questions) and the respondents (individuals or households) are positioned on the same underlying scale of severity of food insecurity (Figure 4).

Figure 4: Food insecurity along a continuum of severity.

Data, in the form of binary ("yes"/"no") responses, are analysed through the one-parameter logistic model (also known as the Rasch model) from the field of psychometrics. The probability of a respondent answering "yes" to a FIES item is modelled as the logistic function of the distance along the scale between the severity of the respondent's condition and the severity of the item. The more severe a respondent's food insecurity status is, the higher the probability they will respond affirmatively, as shown in Formula 1.

The probability of receiving an affirmative answer ("yes") to the j-th question by the i-th respondent in a sample is given by:

$$\text{Prob}\left(X_{i,j} = \text{"Yes"}\right) = \frac{\exp\left(a_i - b_j\right)}{1 + \exp\left(a_i - b_i\right)}, \forall i, j \qquad (1)$$

where a_i and b_j represent, respectively, the position of the respondent and of the item on a one-dimensional scale of severity.

Statistical Validation and Parameter Estimation

The relative position of items and respondents on the scale of severity is expressed by their respective estimated parameters, the mean severity level and of the related standard error that can be associated with each item and that can be assigned to each respondent, based on patterns of responses.

Note that the order of the FIES items in terms of the severity they reflect is not given a priori, but is instead revealed by the relative ranking of the estimated item parameter. Under the truth of the Rasch measurement model, the severity of a given experience of food insecurity, relative to that of other experiences depends on the frequency with which people respond affirmatively to that item, which in turn is determined by the specific conditions of the population considered. The rationale behind this is that more severe experiences are expected to be reported less often than less severe ones. This is akin to a relatively difficult test question eliciting a smaller proportion of correct answers than easier (less severe) ones do.

A respondent's raw score (an integer number with a value between zero and eight), that is, the sum of affirmative responses given to the eight FIES questions, is the simplest statistic that can be computed using the FIES. For data that pass the statistical validation tests, the raw score in itself can be considered already an ordinal measure of food insecurity severity, with lower raw scores corresponding to less severe food insecurity. The respondent parameter, on the other hand, provides an interval measure of the severity of food insecurity and is the proper metric to use to produce indicators of food insecurity that are formally comparable across countries and contexts.

Statistical validation is the assessment of whether the measure obtained is valid and reliable enough for the intended policy and research uses. Statistical validation assesses the quality of the FIES data collected by testing their consistency with the assumptions of the Rasch model. This analysis involves the interpretation of several statistics that reveal 1) if there is any item that does not perform well in a given context, 2) the possible presence of additional dimensions captured in the data, 3) cases with highly erratic response patterns, 4) items that may be redundant, and 5) the proportion of total variance in the data that is accounted for by the measurement model.

Computation of SDG indicator 2.1.2

Across different countries and subpopulations, the same FIES item may be associated with a different level of severity due to specific interpretations of the question as the result of nuances in adaptation and translation of the item in the local language, or to actual differences in the way food insecurity is experienced and managed in diverse cultures and livelihood systems. Moreover, as the Rasch model is defined in terms of differences in severity levels only, the "zero" of the measurement scale is not identified (one could add an arbitrary constant to all measures, without changing any of the differences).

By convention, the origin of the measurement scale is thus set to the average of the item's severities, which is specific to each application. This means that estimated item and respondents' parameters cannot be immediately compared across applications of the FIES, and that each application of the FIES generates a different, somehow arbitrary scale of food insecurity.

Before comparing measures obtained in different contexts, it is thus necessary to refer them to a reference scale (similarly to what happens with temperature measures, where one can use one of several references such as the Celsius, Fahrenheit, or Kelvin scales). The FIES global reference scale has been established by FAO, based on data collected between 2014 and 2019 in about 150 different countries in the world.

While reliable classifications of food insecurity in a country could be obtained for any arbitrary threshold of severity, to calculate internationally comparable estimates of the prevalence of food insecurity, classes of food insecurity must be defined by standard thresholds set at the same level of severity in all countries. To achieve that, the standard thresholds that permit estimation of the two FIES-based indicators described below are set at the severity of two FIES items on the global FIES global reference scale [1].

The equating procedure ensures that these standard thresholds are mapped to the national scales, and respondents are then assigned probabilistically to common food insecurity classes, given their raw scores. The probabilities of being at least moderately food insecure, or in other words, beyond the "moderate" threshold, and of being severely food insecure, are determined by assuming that a respondent reporting a certain raw score belongs to a group within which food insecurity severity is distributed normally, centred on the severity level corresponding to the estimated respondent parameter, with a standard deviation equal to the estimated standard error. The prevalence of food insecurity in the population is then given by the weighted sum of the raw score-specific probabilities. The weighted proportions of individuals living in a household reporting each raw score in the population are used as weights.

Two FIES-based indicators can be used for national and global monitoring purposes. Note that the first indicator is an estimate of the sum of the moderately food insecure and the severely food insecure segments of the population.

1. **$FI_{mod+sev}$**: The proportion of the population experiencing moderate and severe food insecurity (SDG indicator 2.1.2)
2. **FI_{sev}**: The proportion of the population experiencing severe food insecurity

Data

The data used to estimate the prevalence rates presented in this report were collected by the Ghana Statistical Service through the 2020 COVID-19 Households and Jobs rapid telephone survey. Phone numbers of respondents were collected through the contact details of an earlier nationally representative survey (Ghana Living Standards Survey Round Seven, GLSS7). A stratified sample has been derived using the contact details from this 2016/2017 GLSS7 (which included approximately 15,000 households throughout Ghana). The households that participated in the GLSS7 and reported one or more phone numbers were included in the sampling frame. From this frame, 7,999 households were sampled. For the first wave in June 2020, 3,265 households eventually completed the survey of which 2,060 were also interviewed for another module of the survey. Due to inter-wave attrition of households in the panel, for the second wave of the survey in September was completed by 2,578 households. For both waves, geographical propensity weights were computed for the different enumeration areas. This means that, for the calculation of the weights, only the location (region and rural vs urban) of the household during the GLSS7 and the response probability of households in those areas have been used. The weights constructed in this way represent the total number of households estimated in Ghana.

FIES data was first collected through the Ghana Living Standards Survey Round Seven (GLSS7) 2016/17 and published in 2019. The results obtained from the analysis of GLSS7 showed a prevalence of moderate or severe food insecurity of 49.5% and a prevalence of severe food insecurity of 7.8%.

Validation

As mentioned above, the data have been validated by the Food Security and Nutrition Statistics Team at FAO, by testing adherence to the Rasch model's assumption and have been found to conform to quality standards required for reliable estimation of the prevalence of food insecurity in the population. Table 1 reports the estimated parameters and infits[2] for the FIES item in Ghana, using the data collected in June 2020 through the first wave of the COVID-19 Households and Jobs Tracker Survey. Other validation statistics, including the outfits, Rasch Reliability (0.73), and residual correlations were also checked.

[1] The FIES global standard scale is a set of item severity values that has been created based on results from over 140 countries covered by the Gallup World Poll in 2014, 2015, 2016, 2017,2018 and 2019. The severity on the global standard scale of the 5th item shown in the survey module in Annex I (termed "ATELESS") separates mild from moderate food insecurity, while the severity of the 8th item ("WHLDAY") separates moderate from severe levels.

[2] The infit statistics are commonly used to assess how well responses to items correspond to the Rasch-model assumptions (or "fit" the model). They are chi-square-type statistics that compare the misfit of each item with the extent of misfit expected under model assumptions. The expected value of each item's infit statistic is 1.0 if the data conform to Rasch model assumptions. Values above 1.0 indicate that the item discriminates less sharply than the average of all items in the scale. An infit between 0.7 and 1.3 is considered acceptable and indicates that the item discriminates equally well (i.e. it is equally linked to the measure of food insecurity) compared to the rest of the items in the scale.

Table 1: Estimated severity parameters for the FIES items in Ghana and corresponding infit statistics.

Question	Item Severity Parameter					Infit Statistic	
	June 2020	September 2020	GLSS7 (2016/17)	June 2020 after adjustment	September 2020 after adjustment	June 2020	September 2020
Q1. WORRIED	-1.11	-1.43	-1.83	-1.64	-1.88	1.20	1.16
Q2. HEALTHY	-0.75	-1.04	-1.29	-1.12	-1.38	1.09	1.06
Q3. FEWFOOD	-1.20	-1.15	-1.96	-1.77	-1.52	0.85	0.96
Q4. SKIPPED	-0.50	-0.50	-0.56	-0.75	-0.66	0.95	0.88
Q5. ATELESS	-0.91	-0.86	-0.87	-1.35	-1.14	0.82	0.85
Q6. RUNOUT	0.36	0.44	0.13	0.52	0.59	1.03	1.11
Q7. HUNGRY	0.87	0.84	1.66	1.26	1.11	0.87	0.85
Q8. WHLDAY	3.31	3.70	4.72	4.86	4.89	1.06	1.07

Tables 2 below reports the estimated respondent parameters and corresponding standard errors. Respondent severity parameters and standard errors estimated for Ghana using the FIES data are used to derive the probabilities of being food insecure at moderate or severe, and severe levels (P_1 and P_2). So, for example, a household with a sum score of 6 (9% of household), has a 99% probability of being moderately or severely food insecure and a 4% probability of being severely food insecure in June and 2% of being food insecure in September 2020. Similarly, a household with a sum score of 8, has a 100% probability of being moderately or severely food insecure and a 75% probability of being severely food insecure in June 2020 and 71% in September of the same year. In other situations and countries these percentages might be different.

Table 2: Estimated severity parameters for each raw score and weighted proportion of cases for each raw score

Raw score	Severity Parameter (SE)[1]		P_1 [2]		P_2 [3]		Proportion of households	
	June 2020	September 2020	June 2020	September 2020	June 2020	September 2020	June 2020	September 2020
0	-3.22 (1.48)	-3.32 (1.48)	0.00	0.00	0.00	0.00	0.38	0.38
1	-2.44 (1.10)	-2.52 (1.11)	0.11	0.13	0.00	0.00	0.09	0.09
2	-1.50 (0.87)	-1.59 (0.87)	0.31	0.36	0.00	0.00	0.07	0.06
3	-0.85 (0.80)	-0.89 (0.81)	0.61	0.69	0.00	0.00	0.06	0.09
4	-0.18 (0.80)	-0.23 (0.82)	0.87	0.90	0.00	0.00	0.06	0.08
5	0.47 (0.86)	0.48 (0.88)	0.96	0.98	0.00	0.00	0.07	0.09
6	1.37 (1.01)	1.39 (1.05)	0.99	0.99	0.04	0.02	0.09	0.09
7	2.72 (1.34)	2.87 (1.42)	1.00	1.00	0.39	0.34	0.11	0.09
8	4.10 (1.48)	4.28 (1.48)	1.00	1.00	0.75	0.71	0.06	0.04

[1] SE = Standard Error
[2] P_1 = probability to be moderately or severely food insecure
[3] P_2 = probability to be severely food insecure

A national scale was already available as a result of the FIES data collected through the GLSS7 (2016/17) survey. Because of this, instead of calibrating the FIES global standard on the scale derived by the COVID-19 Households and Jobs Tracker Survey, FAO calibrated the latter directly on the scale determined using the GLSS7 2016/17 survey, using the same thresholds. The alignment of the scale estimated in Ghana with the COVID-19 Households and Jobs Tracker Survey was good and consistent with the scale estimate using the GLSS7 2016/17 survey. Using the data collected with the COVID-19 Households and Jobs Tracker Survey and estimating the Rasch model on it, the severity levels associated with 7 items were found to be well aligned with the corresponding levels on the GLSS7 survey reference scale. Figure 5 shows the item severity parameters as estimated in Ghana through the GLSS7 survey, plotted against the COVID-19 Households and Jobs Tracker Survey Wave1 scale adjusted to the same mean and standard deviation of common items. In Figure 6 the item severity of wave 1 (June 2020) is compared to the item severity of wave 2 (September 2020).

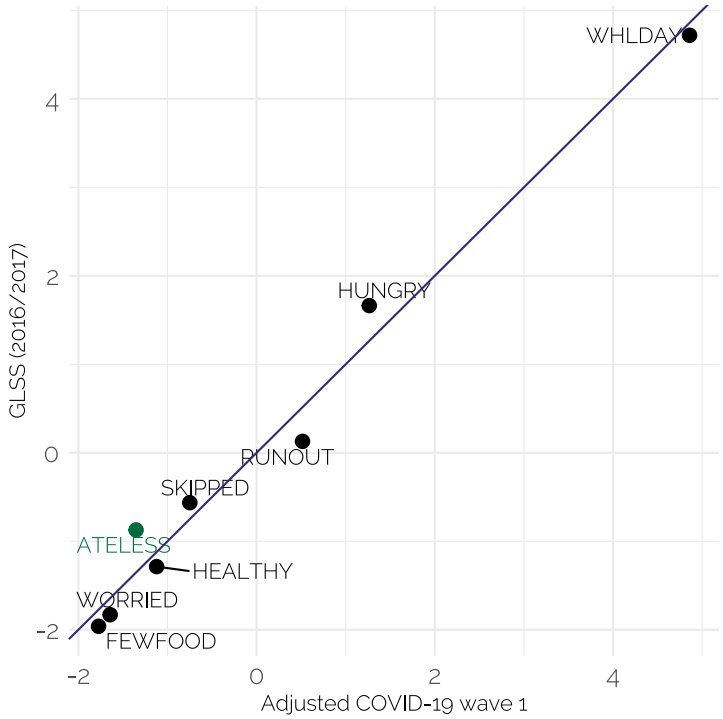

Figure 5: FIES scale estimated with the GLSS7 in 2016/17 against the FIES scale estimated in Ghana in June 2020, after adjustment.

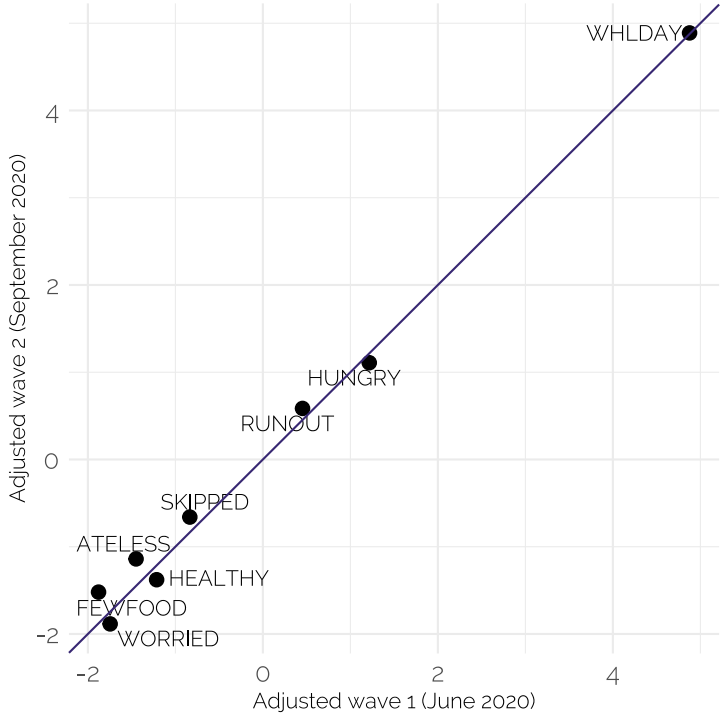

Figure 6: comparing Item Severity between the two waves of COVID-19 tracker (June 2020 to September 2020)

After this adjustment, the prevalence rates of both the GLSS7 survey and the COVID-19 Households and Jobs Tracker Survey Wave 1 can be computed using the same thresholds for moderate or severe, and severe food insecurity, derived using the GLSS7 survey and equal to -1.7 and 4.6. The columns P_1 and P_2 in Table2 correspond to the probability of being beyond these two values, respectively, if the severity of respondents is distributed normally around the estimated severity parameter, with standard deviation equal to the estimated standard error. By multiplying P_1 and P_2 by the weighted proportion of represented households for each raw score (final columns Table 2), and summing the resulting weighted probabilities, the yearly prevalence rates of food insecurity at moderate or severe, and severe levels (respectively) for the total household population are obtained.

Weights

As the COVID-19 Households and Jobs Tracker Survey Wave1 is designed to be representative at the household level, post-stratification household sampling weights are provided. To obtain the prevalence rates at the level of the total population, an approximation is derived through the following steps:

1. Individual sample weights are calculated as

$$pd_i^{ind} = pd_i^{hh} \cdot HS_i \quad (2)$$

   Where pd_i^{ind} is the individual sample weight, pd_i^{hh} the household weight provided by the survey and HS_i is the number of members in the household i.
2. P_1 and P_1 are weighted by the distribution calculated in the previous step.
3. These are then summed to obtain the prevalence rates of the population living in a situation of food insecurity.

Margin of Error

Figure 2 includes margins of error around the food insecurity estimates. Sampling and measurement variability (margin of error) around prevalence rates estimates was evaluated as follows.

1. **Sampling variability**: the sampling error is obtained using the complex survey design information. The procedure entails Taylor series linearization estimation. As in Ghana data was collected with telephone survey interviews, the geographical stratification variable and population clusters within strata (primary sampling units or PSUs) are included in the calculation.
2. **Measurement variability**: The extent of uncertainty around the measure (i.e. measurement error) is calculated considering that within each raw score, the variance in the proportion with true severity beyond a set threshold is given by $\frac{p(1-p)}{n}$, where p is the proportion estimated by the method used to estimate prevalence and n is the number of unweighted cases in the considered raw score. These variances are then summed across raw scores and weighted by the square of the respective share, i.e. the proportion of weighted cases in the raw score.
3. **Calculation of the total margin of error** : because sampling and measurement errors are considered independent, they are combined to obtain the global prevalence standard error as follows:

$$SE_{tot} = \sqrt{(\text{Sampling Error})^2 + (\text{Measurement Error})^2} \quad (3)$$

   Margin of error (%) at the 90% level are then calculated as $SE_{tot} \cdot 1.645 \cdot 100$.

FIES Questions

These are the eight questions that were included in the COVID-19 Households and Jobs Tracker Wave 1 questionnaire, that were used to estimate the FIES.

Table 3: FIES questions

Question ID	Question	Answer categories
Note	Now, I would like to ask you some questions about food. During the last 30 days, was there a time when:	NA
Q1. WORRIED	You, any other adults or any children above 15 years old in your household, were worried about not having enough food to east because of a lack of money or other resources?	0: No 1: Yes
Q2. HEALTHY	You, any other adults or any children above 15 years old in your household, *were unable to eat healthy and nutritious/preferred foods* because of a lack of money or other resources?	0: No 1: Yes
Q3. FEWFOOD	You, any other adults or any children above 15 years old in your household, *ate only a few kinds of foods* because of a lack of money or other resources?	0: No 1: Yes
Q4. SKIPPED	You, any other adults or any children above 15 years old in your household, *had to skip a meal* because of a lack of money or other resources?	0: No 1: Yes
Q5. ATELESS	You, any other adults or any children above 15 years old in your household, *ate less than you thought* you should because of a lack of money or other resources?	0: No 1: Yes
Q6. RUNOUT	Your household *ran out of food* because of a lack of money or other resources?	0: No, 1: Yes
Q7. HUNGRY	You, any other adults or any children above 15 years old in your household, *were hungry but did not eat* because of a lack of money or other resources?	0: No 1: Yes
Q8. WHLDAY	You, any other adults or any children above 15 years old in your household, *went without eating for a whole day* because of a lack of money or other resources?	0: No 1: Yes

Partners

This project comes from a continuous cooperation between GSS, UNICEF and The World Bank with technical support from Innovations for Poverty Action (IPA). For this specific release, FAO cooperated in the estimation of the FIES.