Computed variables at respondent level

We are providing food insecurity measurement data elements at the individual respondent level. These data elements are obtained by fitting the one-parameter logistic model (Rasch Model) to the dichotomous responses given to the 8 questions in the Food Insecurity Experience Scale (FIES) survey module, and by using an equating procedure to express them on a common metric.

Responses to each of the eight individual FIES questions are also provided, but the use of the responses to individual questions for food security analysis is discouraged. By combining the information contained in the responses to all questions, a proper measure of food insecurity can be obtained. Such a measure has less measurement error, is more robust, and can be made comparable across countries.

The following *respondent-level* data elements are <u>computed</u> from the FIES module:
- **"Raw score":** is the sum of affirmative answers given by respondents to each of the FIES questions. There are nine possible raw scores, integers ranging from 0 to 8
- **"Raw_score_par"** and **"Raw_score_par_error":** the raw score (associated to each respondent) parameter provides information on the severity of a respondent's food insecurity, given the number of FIES questions they have affirmed. These variables include the respondent severity parameter and the corresponding error, both expressed in the metric of the FIES global reference scale, and thus are comparable across countries, and directly comparable with the global thresholds used for classification into classes of food insecurity severity (approximately -0.31 for moderate or severe food insecurity, and 1.88 for severe food insecurity). Raw score parameters are a *linearized*, *interval-level* transformation of the raw score. They can be used in analyses that require interval-level measurement. Within a country, raw score parameters are the same for all cases that reported the same raw score but this is not true across countries due to differences in equating each country's measures to the global standard.

  They are obtained as the conditional maximum likelihood estimates of the "person parameters" under the assumptions of the Rasch measurement model. As the conditional maximum likelihood estimation approach does not allow for estimation of parameters and errors for raw scores 0 and 8, a special treatment is necessary for these cases. FAO has developed a dedicated protocol to associate a measure of parameter and error to raw score 8.

- **"Prob_Mod_Sev"**: this is the individual probability of belonging to the class of "moderate or severe food insecurity" (ranging from 0 to near 1), or in other words, being at least moderately food insecure. As for the raw score parameters, within a country they are the same for all respondents reporting the same raw score. As a food insecurity measure, the probabilities take into account data measurement error and recognize that reporting a given raw score is not sufficient to associate an exact measure of food insecurity severity to the respondent, so that there may be a whole range of severities associated with a given raw score. It can be thought of as the proportion of people in the population represented by the sampled person whose true food insecurity severity exceeds the threshold that defines moderate food insecurity. Such a threshold is set at the severity level of the item, "In the past 12 months did you eat less than you thought you should...." on the FIES global standard scale. The value is based on adjustment of respondent severity parameters to the FIES global standard, so is intended to be comparable across countries. The probability of moderate or severe food insecurity for cases with raw score zero will be presented as zero. Values for raw score 8 will be based on FIES standard methods used to calculate national prevalence rates. This data element will be missing for cases with missing responses to any of the FIES questions.

- **"Prob_sev"**: this is the individual probability of severe food insecurity (0 to near 1). It is similar to the probability of moderate or severe food insecurity except that the threshold is more severe, i.e. at the severity level of "In the past 12 months did you go a whole day without eating...." on the FIES global reference scale.

Computing the prevalence of food insecurity in the adult and total population

Prevalence of food insecurity in the adult population

The weighted mean of the variables "Prob_Mod_Sev" and "Prob_sev" using the post-stratification sampling weights (variable "wt" in the data) is used to calculate the country-level prevalence rate of moderate or severe food insecurity, and severe food insecurity only, in the adult population for each country.

The formulas to obtain the two indicators are reported below:

$$F_{mod+sev}^{ad} = \frac{\sum_{i=1}^{n} p_{mod+sev,i} w_i}{\sum_{i=1}^{n} w_i}$$

at moderate or severe level, and

$$F_{sev}^{ad} = \frac{\sum_{i=1}^{n} p_{sev,i} w_i}{\sum_{i=1}^{n} w_i}$$

at severe level, where $p_{mod+sev,i}$ and $p_{sev,i}$ are variables "Prob_Mod_Sev" and "Prob_sev" for individual i in the sample, w_i is the variable "wt" for individual i in the sample and n is the sample size for a given country and a given year.

Prevalence of food insecurity in the total population

As only individuals aged 15 or more are sampled in the Gallup World Poll, the prevalence estimates directly produced from this these data refer to the population 15 years and older (see previous section). In order to arrive at the prevalence (of all ages) in the population, an estimate is required of the prevalence of people living in the households where at least one adult is estimated to be food insecure. This involves different steps, detailed below.

Step 1. Estimate an approximate "children weight" for each sampled adult as:

$$w_i^{child} = \frac{w_i}{N_i^{ad}} N_i^{child}$$

where N_i^{ad} and N_i^{child} are the number of adults (aged 15 years or older) and the number of children below 15 in the household where individual i belongs (variables "N_adults" and "N_child" in the dataset). As only one adult is sampled in each household reached by the Gallup World Poll, dividing the post-stratification weight by the number of eligible adults in that household creates an approximate household sampling weight. Multiplying it by the number of children living in the same household gives an estimate of the number of children represented by the sampled adult.

Step 2. Calculate the weighted average of $p_{mod+sev,i}$ and $p_{sev,i}$ using the children weights, obtaining the prevalence at moderate or severe, and severe only, levels of children living in a household where at least one adult is food insecure ($F_{mod+sev}^{child}$ and F_{sev}^{child}).

Step 3. Compute the number of food insecure adults and children by applying the prevalence rates to the corresponding country population.

For the adult population, the formulas are

$$Pop_{mod+sev}^{ad} = F_{mod+sev}^{ad} * Pop^{ad}$$

at moderate or severe level, and

$$Pop_{sev}^{ad} = F_{sev}^{ad} * Pop^{ad}$$

at severe level, where Pop^{ad} is the population of 15 years or older in a given country.

For the child population, the formulas are

$$Pop^{child}_{mod+sev} = F^{child}_{mod+sev} * Pop^{child}$$

at moderate or severe level, and

$$Pop^{child}_{sev} = F^{child}_{sev} * Pop^{child}$$

at severe level, where Pop^{child} is the population of 14 years or younger in a given country.

<u>Step 4.</u> Sum the adult and child food insecure populations at each level of severity obtained at the previous step, and divide the sum by the total population in the country, to obtain the prevalence of individuals in the population who live in households where at least one adult is food insecure.

At moderate or severe level, this will be obtained as:

$$F^{tot}_{mod+sev} = \frac{Pop^{ad}_{mod+sev} + Pop^{child}_{mod+sev}}{Pop^{ad} + Pop^{child}}$$

while at severe level it is computed as:

$$F^{tot}_{sev} = \frac{Pop^{ad}_{sev} + Pop^{child}_{sev}}{Pop^{ad} + Pop^{child}}$$

Computing the population numbers of food insecure adults and individuals

The population number of food insecure adults is computed by applying the prevalence of food insecure adults to the adult population in a country (see Step 3 of the previous section, first two formulas).

The population number of food insecure individuals (all ages) is computed by applying the prevalence of food insecurity in the total population (Pop^{tot} in the formulas below) to the population in a country, as follows:

$$Pop^{tot}_{mod+sev} = F^{tot}_{mod+sev} * Pop^{tot}$$

at moderate or severe level, and

$$Pop^{tot}_{sev} = F^{tot}_{sev} * Pop^{tot}$$

at severe level.