Global Food Security xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Global Food Security

journal homepage: www.elsevier.com/locate/gfs

Food security measurement and governance: Assessment of the usefulness of diverse food insecurity indicators for policy makers

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ARTICLE INFO

Keywords:
Food security governance
SMART criteria
Program evaluation
Food insecurity

ABSTRACT

Improving food security governance depends largely on the identification of food insecurity (FI) indicators that are useful for policy makers to improve their targeting and monitoring efforts. We conducted electronic searches and reviewed the authors' files to identify peer reviewed journal articles that have previously synthesized the literature on FI indicators. We developed a consensus survey tool to assign SMART scores (i.e., utility) for each of 12 FI indicators examined for 5 alternative scenarios. Our findings indicated strong agreement across 4 raters for the top FI indicator choice for each scenario and strongly suggested that the evidence-based decision making methodology developed was helpful to eliminate FI indicators for further consideration. Future studies are needed to confirm our findings and, most importantly, to document if our decision-making tool helps improve food security governance in different contexts.

1. Introduction

The Food and Agriculture Organization (FAO) definition holds that "food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996). Food insecurity (FI) is a complex household managed process that moves through distinct coping phases along a food (in)security continuum, starting with food security and ending with severe FI or hunger (Radimer et al., 1992). Four dimensions comprise the FI process: food availability, food access, food utilization, and food stability (FAO, 1996).

FI is a key determinant of nutrition insecurity and poor physical, psychosocial, cognitive and mental health outcomes (Jones et al., 2013; Gubert et al., 2016). Undernourishment is experienced by 795 million people globally and is thus a major public health concern (FAO, 2015a, 2015b). While this "generic" estimate of FI provides a good sense of the global magnitude of the problem, policy makers must have access to more specific measures for program targeting, monitoring and governance. Indeed, measuring FI is quite complex (Coates, 2013), often requiring the use of different indicators (FAO, 2013; Maxwell et al., 2013) since each indicator is capable of measuring different dimension (s) of FI but hardly the entire complex construct.

FAO describes food security governance as "relating to formal and informal rules and processes through which interests are articulated and decisions relevant to food security in a country are made, implemented, and enforced on behalf of members of a society" (FAO, 2011, p. 17). Effective food security governance requires a broad, systems thinking, problem-solving approach that addresses the complexity of food security, spans national, regional, and local levels, and is adaptable across time. When governments neglect to tackle the crisis situations and structural factors that contribute to FI, they also fail to address and affect FI (Candel, 2014). Multi sectorial coordination and cooperation between governmental and non-governmental institutions/organizations involved with food security governance is one vital component required to address the complex drivers influencing FI (Candel, 2014). Indeed, in addition to resources and "good democratic values", "coherence, coordination, and dealing with ideational pluralism and a broad range of actors are widely considered to be crucial elements of a good governance approach" (Candel, 2014).

FI monitoring is critical for the development and sustainability of adequate food security governance from the local to the global level (Pérez-Escamilla, 2012). Existing FI indicators have the strong potential to help answer key policy questions as well as to monitor progress and governance. The utility of different indicators for food security policy-making and governance requires in-depth knowledge of what they measure, what it takes to measure them (including cost), as well as

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http://dx.doi.org/10.1016/j.gfs.2017.06.003
Received 2 May 2017; Accepted 23 June 2017
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other properties including their validity and speed at which they can be collected. Thus, it is important for governments to understand how to make informed, evidence-based decisions about which suite of indicators may be most appropriate for answering specific policy questions that are relevant for food security governance. The SMART criteria *(specific, measurable, achievable/attainable, relevant,* and *time-bound)* have been used extensively to develop and select process as well as outcome indicators for program monitoring and evaluation. Given the large number of FI indicators available, decision makers have a daunting task of deciding which indicators will yield the best information needed to improve food security governance. Recently, the SMART criteria have been proposed as a basis for evaluating the suitability of various indicators for measuring and monitoring FI as well as FI vulnerability (Perez-Escamilla, 2012; Camanzi et al., 2013) and poverty (Desiere et al., 2015). Yet, it remains to be elucidated how to assess which FI indicators are best for answering specific policy or programmatic questions for food security governance. The objectives of this article are: a) to summarize the principles behind different FI indicators, and b) to describe an innovative SMART-driven protocol that can be tested for use by teams of experts in the field to select the best FI indicator(s) to use based on different food policy or programmatic scenarios.

2. Methodology

We conducted electronic searches and reviewed the authors' files to identify peer reviewed journal articles that have previously synthesized the literature on FI indicators. Given its depth and breadth, Jones et al.'s (2013) classification of FI indicators was used as the primary article to select and group indicators. Subsequently the following modifications were made: (a) indicators of dietary consumption were added because they have been commonly used to assess food and nutrition security (Perez-Escamilla et al., 2008), which includes measuring food access, food consumption and addressing individual dietary intake at national and local level; (b) the recently launched Food Insecurity Experience Scale (FIES) was added as an experienced-based FI measure being promoted for use globally (Ballard et al., 2013; FAO, 2015b); (c) the Household Economy Approach as well as global FI monitoring warning systems and vulnerability indicators were excluded since they are beyond the objectives of this paper. The final classification system included three overarching themes: a) National Level Estimates of FI; b) Measuring Household Food Access; and c) Measuring Food Utilization, where anthropometry was considered a proxy. National Level Estimates of FI indicators included the prevalence of undernourishment, Global Hunger Index, and Global Food Security Index. Household Food Access indicators included: Household Consumption and Expenditure Surveys, Dietary Consumption Indicators (dietary records, 24-h recalls, food frequency questionnaires), Dietary Diversity Measures (Food Consumption Score, Household Dietary Diversity Score), Measures Based on Participatory Adaptation (Coping Strategies Index), and Experience-Based Food Insecurity Scales (United States Household Food Security Survey Module, Household Food Insecurity Access Scale, Household Hunger Scale, Latin American and Caribbean Household Food Security Scale, and Food Insecurity Experience Scale). Finally, anthropometry (i.e., weight-for-height, height-for-age, weight-for-age, BMI-for-age) was included as an indicator measuring food utilization (recognizing that anthropometric measures are affected by factors beyond food access and consumption). In the results section, each indicator is described in detail including the advantages, disadvantages, and applications.

The authors of this article followed a consensus process to develop a survey tool to assign the SMART score (i.e., utility) for each of the FI indicators examined for five alternative scenarios (see Table 1). First, definitions from UNICEF were adapted to develop an operational definition of each of the SMART criteria (White and Sabarwal, 2014) and a generic question was developed to describe each SMART criterion further (see Table 2). The SMART criteria were then used to evaluate whether indicators were *specific, measurable, achievable/attainable, relevant,* and *time-bound* in relation to each of the five scenarios. For each scenario, each FI indicator was independently ranked on a scale of 0 (doesn't meet criteria at all) to 3 (highly meets criteria) according to the SMART criteria, by the four authors all of whom have expertise in FI measurement and policy (RPE, BR, MG, and AHF). Experience based scales were collapsed into one category and ranked as a collective indicator since all the scales are derived from the U.S. Household Food Security Survey Module (Bickel et al., 2000; Hamilton et al., 1997). Rankings were conducted in Surveymonkey©, where each scenario was presented and then each FI indicator was ranked independently by each co-author according to how well it met the criteria of being specific, measurable, achievable/attainable, relevant, and time-bound for each scenario (Web Appendix presents the specific responses recorded by each co-author through SurveyMonkey©). For each scenario, the average of each of the SMART criteria rankings were calculated across the 4 experts (i.e., article co-authors) for each indicator. Then the average was taken across the SMART criteria to arrive at a total average score for each indicator for each scenario. Cutoff values were set at $< 25\%$ and $> 75\%$ of the average total scores to determine the least applicable and most applicable indicators, respectively, for each scenario.

In separate analyses, for each scenario, the mean of the rankings for all SMART criteria for each FI indicator were determined for each ranking individual. For each scenario and for each ranking individual, the indicators were then sequentially ordered from highest to lowest value, with the highest mean value being ordered as 1. If there were equal values for two or more indicators, they received equal ranking. This classification allowed for the assessment of the degree of agreement in the ranking of the indicators between the experts.

3. Results

3.1. Food security indicators literature review

This section presents the key features of the food insecurity indicators considered in this manuscript. A comparative summary is presented in Table 3.

3.1.1. National level estimates of FI

3.1.1.1. Prevalence of undernourishment. The **Prevalence of Undernourishment (PoU)** is one of the indicators most extensively used by FAO to assess FI. FAO has produced estimates of the PoU and of the Number of Undernourished (NoU) since 1974. The State of Food Insecurity report (SOFI) has been published since 1999 (Hunger Map) (Wanner et al., 2014). The PoU is based on the availability and adequacy of the dietary energy supply relative to dietary energy requirement of the average individual in the population (Cafiero et al., 2014) using a complex statistical method based on the concept of food deprivation. More specifically, this indicator is calculated using 4 parameters: 1) the mean level of dietary energy consumption (DEC); 2) a cut-off point defined as the Minimum Dietary Energy Requirement (MDER); 3) the coefficient of variation (CV) as a parameter accounting for inequality in food consumption (insufficient amount of food to provide energy for an active life); and 4) a skewness (SK) parameter accounting for asymmetry in the distribution (Wanner et al., 2014). The PoU is affordable even to low income countries and can be used to monitor trends at the national level. It has disadvantages including: a) the quality of the food supply and utilization data used to determine the indicator can be poor, unreliable and take long to collect (Carletto et al., 2013; RCNA, 2012); b) it assumes that the "average population calorie consumption is equivalent to the average dietary energy supply" (Jones et al., 2013); c) dietary quality is not taken into account; d) the method

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