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A COMPARATIVE ANALYSIS OF HOUSEHOLD FOOD SECURITY MEASURES IN RURAL ZIMBABWE

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Abstract

Despite development of numerous food security measures for humanitarian emergency programs, there is limited research on which food security measures complement each other. A comparative analysis of household food security measures, that is, household hunger scale, food consumption score, and consolidated approach for reporting food security indicators, utilizing Zimbabwe Vulnerability Assessment Committee 2014 Rural Livelihoods Assessment data, was conducted in Zimbabwe. According to the results, the household hunger score produced the least levels of food insecurity, followed by the consolidated approach for reporting food security indicators while the food consumption score produced the highest food insecurity prevalence. The consolidated approach for reporting food security indicators is recommended for supporting long-term chronic food insecurity interventions and the household hunger score for food security assessments to inform emergency relief. Further research is required to refine and contextualize the food consumption score cut-off points to rural Zimbabwe.

Keywords: *Comparative analysis; Emergency programs; Food security; Household food security measures; Zimbabwe Vulnerable Assessment Committee*
JEL Codes: *Q1, Q18*

1. Introduction

Poor conceptualizations of food security as well as its measurement have been blamed for poor policy designs and their performance since diagnosis and response are driven by measurement (Webb et al., 2006).Food security, a common currency in the development discourse in the 1970s has evolved from being just about food supply and availability to being complex and multi-dimensional to include utilization, access, and stability (Cafiero, Melgar-Quiñonez, Ballard, & Kepple, 2014; Coates, 2013; Committee on Food Security, 2012; Connolly-Boutin and Smit 2016; FAO, 2008; Maxwell, Coates, & Vaitla 2013). This complexity of the food security concept has presented challenges on its measurement despite progress made to reach international consensus on what it is and the importance of its sound and viable measurement (Barret, 2010; Headey & Ecker, 2012; Webb et al., 2006). However, the resurgence of food security—a critical concept used by development agencies and policy-makers for economic and humanitarian needs assessment emergency programs—on the international development agenda has brought to the fore the need to improve its measurement (Barrett, 2010; Coates, 2013; Connolly-Boutin & Smit, 2016; Headey & Ecker, 2012;

Hendricks, 2015; Pinstrup-Andersen, 2009; Schindler, Graef, König, & Mchau, 2016; Webb et al., 2006).

Given the importance of food security, it is necessary to identify appropriate measures that complement each other to capture all the important facets of food security (Cafiero et al. 2014; Coates, 2013; Desiere, D'Haese1, & Niragira, 2015; Maxwell et al., 2013). Different aspects of household level food security have been captured using food consumption score (FCS), household hunger scale (HHS), and consolidated approach for reporting food security indicators (CARI) (Ballard, Coates, Swindale, & Deitchler, 2011; Heady & Ecker, 2013; Maxwell et al., 2013; WFP, 2009). The FCS, a dietary diversity indicator, has the ability to measure consumption of macro and micronutrients as well as predict economic status and malnutrition levels (WFP, 2009; Heady & Ecker, 2013; Maxwell et al., 2013). Although FCS is simple and cost-effective in tracking temporal dimension of food security, and displays substantial sensitivity to shocks, research has shown that it can misclassify food insecurity (Brinkman, de Pee, Sanogo, Subran, & Bloem, 2010; Headey & Ecker, 2013; Headey & Ecker, 2012).

The second measure, the HHS, is an experiential/perception-based indicator that utilizes household food deprivation experiences where reactions captured from a survey and summarized on a scale capture the most severe food security behaviors (Ballard et al., 2011; Maxwell et al., 2013). The HHS is a derivative of the household food insecurity access Scale (HFIAS), and recognizes additional important subsets of measures that capture food consumption related behaviors (Maxwell et al., 2013). Finally, the CARI combines the FCS, the household poverty measure, and household assets endowments to measure a household's current food security status as well as its coping capacity and hence its vulnerability or resilience to potential future shocks (Maxwell et al., 2013).

Despite development of these indicators (i.e., FCS, HHS, and CARI) to measure different food security aspects, research on the current use of these measures remains limited. To date, comparative analyses of different common food security measurements such as coping strategies index (CSI), reduced coping strategies index (RCSI), household food insecurity and access scale (HFIAS), HHS, FCS, and household dietary diversity scale (HDDS) have been conducted (De Cock et al., 2013; Desiere et al., 2015; Faber, Schwabe, & Drimie, 2009; Heady & Ecker, 2013; Kennedy et al., 2010; Maxwell et al., 2013; Maxwell et al., 2014). Extant research indicates that combining indicators improves food security measurement since indicators differ in the aspects of food security they capture; but it is important to know which indicators are suitable for which applications (Maxwell et al., 2013; Maxwell et al., 2014). Since food security is multidimensional, there is need for valid and reliable measurement of food security where more than one suitable indicator is selected (Cafiero et al., 2014; Desiere et al., 2015; Maxwell, Vaitla, & Coates, 2014). Thus, there is need for more research in this area (Maxwell et al., 2013; Maxwell et al., 2014).

1.1 Purpose and Objectives of the Study

The purpose of this current study was therefore, to compare household food security measures in the rural areas of Zimbabwe using data from the Zimbabwe Vulnerability Assessment Committee (ZimVAC)'s 2014 rural livelihoods assessment. The ZimVAC is an inter-sectoral multi-agency mandated by the Government of Zimbabwe to regularly generate and provide the government and its development partners with reliable information for planning and programming in order to improve and strengthen rural and urban livelihoods (ZimVAC, 2015). It is also an integral part of the Southern Africa Development Coordination Regional Vulnerability Assessment Committee (SADC-RVAC), a multi-agency consortium, which supports up-to-date vulnerability assessments and risk mapping in the region (SADC, 2012).

The way food security is measured is crucial in providing answers to practical questions such as what types of people are food-insecure, and where do they live?, what is the effect of different government policies on the incidence and depth of poverty and food insecurity?, and who should be eligible for benefits such as food aid or cash hand-outs? It is within this context that this research was designed to compare three measures (i.e., HHS, FCS, and CARI) used by the ZimVAC 2014 to determine household food security status among rural livelihoods. The following questions guided this study:

1. How does the measurement of household food insecurity prevalence obtained with HHS, CARI and FSC compare? To what extent do they tell the same ''story'' about household food insecurity and classify households similarly?
2. What are the strengths and limitations of each of these household food security measurements?
3. What are the programming implications of these household food security measures to household food security improvement responses?
4. What are the potential costs of relying on an arbitrary selection of single indicators to classify household food-insecurity in Zimbabwe?

2. Method

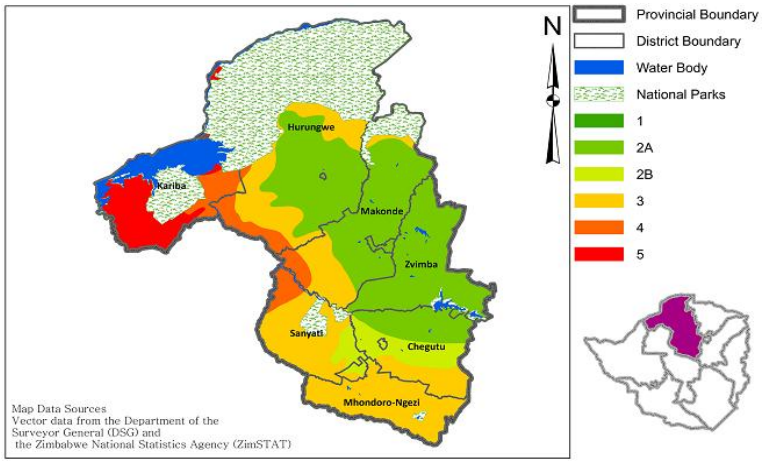
2.1. Study Area

The study was carried out in Mashonaland West and Matabeleland South rural provinces located in the north-western and southern Zimbabwe with approximately 1,542,000 and 744,000 people in 2014, respectively (Figures1 and 2). Mashonaland West province was selected to represent staple cereal surplus provinces while Matabeleland South represents staple cereal deficit provinces. Agriculture is the main source of livelihood for rural households in both provinces, although crop production is prominent in Mashonaland West while livestock and remittances from outside Zimbabwe are greater in Matabeleland South. The difference in the livelihoods between the two provinces is largely due to differences in agro-ecology with Mashonaland West receiving higher mean annual rainfall amounts and experiencing fewer and less severe dry spells and droughts compared to Matabeleland South (Vincent & Thomas, 1960). Agro-ecological zone 1 receives above 1,000mm of annual rainfall, zone 2 averages between 750 and 1,000mm, zone 3 between 650 and 800mm while the dry agro-ecological regions 4 and 5 that covers most Matabeleland South province receive less than 650mm of rainfall (Vincent & Thomas, 1960).

2.2. Data collection

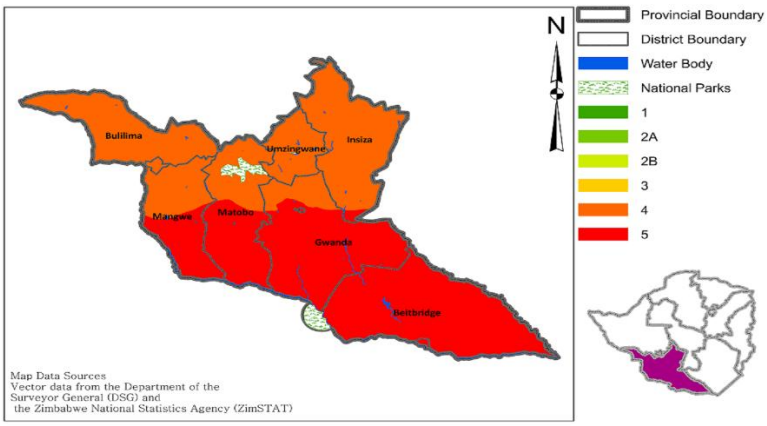
The study obtained primary household level data for the two selected rural provinces from the 2014 ZimVAC rural livelihood assessment survey data set (ZimVAC, 2014). The data were collected in May 2014 by four enumerators in each of the country's 60 rural districts of Zimbabwe over a period of 15 days during harvesting time. The 2014 harvest was good throughout the country with low production areas like Matabeleland South having above normal crop harvest.

The ZimVAC 2014 rural household survey sample was determined using the WFP technical guidelines on sampling for vulnerability assessments (WFP, 2004). The sample design aimed for estimating household food insecurity prevalence at 95% level of confidence, power level of 80% and a margin of error of not more than 10% at district level. Hence, districts were the survey sampling and reporting domains. Average prevalence of food insecure households in rural Zimbabwe was estimated at 20% based on previous ZimVAC rural assessments.



Source: Department of Surveyor General (2008)

Figure 1. Mashonaland West Province Agro-ecological Regions by District



Source: Department of Surveyor General (2008); Zimbabwe National Statistics Agency (2008).

Figure 2. Matabeleland South Province Agro-Ecological Regions by District

The minimum target sample size of 164 households per district was set given the desired confidence and precision levels when a Two-Stage Cluster sampling aiming for not more than 20% minimum detectable differences amongst districts was used. In order to guarantee this minimum sample size a 10% contingency was added to the districts' minimum sample size. Each district was considered a strata and each ward a cluster in which an enumeration area (EA) or villages was randomly selected. In each district 15 wards (hence, 15 EAs) were chosen using systematic random sampling, and then 12 households were sampled from each EA using systematic random sampling resulting is 180 households being sampled in each district.

This study extracted all relevant data from the 2014 rural livelihoods assessment data using the select cases option in SPSS. This created a sample of households from the two selected provinces (Table 1). In Gwanda district of Matabeleland South one household was lost whereas in Insiza district one household was fortuitously added. Consequently, the two provinces were

represented by 1,260 households each. A summary description of the sample used in this study is presented in Table 2.

Table 1. Sampled Households in Mashonaland West and Matabeleland South Provinces in 2014

Mashonaland West		**Matabeleland South**	
Districts	**Sampled Households**	**Districts**	**Sampled Households**
Chegutu	180	Beitbridge	180
Hurungwe	180	Bulilima	180
Kariba	180	Mangwe	180
Makonde	180	Gwanda	179
Zvimba	180	Insiza	181
Mhondoro-Ngezi	180	Matobo	180
Sanyati	180	Umzingwane	180
Total	**1260**	**Total**	**1260**

Source: ZimVAC, 2014.

Table 2. Household Demographic Summary

	Mashonaland West	**Matabeleland South**
Average household size	5 members	6 members
Adequate agricultural labor	56%	56%
Household head age	47 years	53 years
Household head over 60 years old	25%	34%
Household head gender	70 % male	60 % male
Widowed households	15%	24%
Household head with at least Primary education	74%	69%
Households with at least Secondary education	34%	22%
Households with at least one Orphan	27%	27%
Household with at least one Chronically ill members	6%	6%
Households with at least one Mentally/physically challenged member	6%	6%

2.3. Household Food Security Measurements Computations

Using the selected sample of 2, 520 households from the two provinces and adapted SPSS syntaxes, HHS, FCS, and CARI values for each household were computed.

2.3.1. Food Consumption Score

The FCS used by ZimVAC is based on the WFP guidance (WFP, 2008). The FCS for each household was computed by summing up the products of the consumption frequency for each food group and its corresponding assigned nutritional weight. As such, the FCS is a composite measure of dietary diversity, food frequency, and relative nutritional importance of different

food groups. Data on these parameters were collected for each household using a 7-day recall. The food frequency was measured as the number of days a particular food group was consumed in the seven days. Table 3 shows the food groups and weighting applied to each based on their respective nutritional values. The FCS for each household was computed by summing up the products of the consumption frequency for each food group and its corresponding weight. Household FCSs equal to and below 21 were categorized as poor, those between 21.5 and 35 as borderline, and the ones above 35 as acceptable (WFP, 2008).

Table 3. FCS Food Items, Food Groups and Nutritional Weights

	Food Item Examples	**Food Groups**	**Weight**
1	Maize, maize porridge, rice, sorghum, millets, bread and other cereals Cassava, potatoes and sweet potatoes, other tubers, plantains	Main Staples	2
2	Beans, peas, groundnuts and cash nuts	Pulses	3
3	Vegetables, leaves	Vegetables	1
4	Fruits	Fruits	1
5	Beef, goat, poultry, pork, eggs and fish	Meat and fish	4
6	Milk, yogurt and other dairy products	Milk	4
7	Sugar and sugar products, honey	Sugar	0.5
8	Oils, fats and butter	Oil	0.5
9	Spices, tea, coffee, salt, fish powder, small amounts of milk for tea	Condiments	0

2.3.2. Household Hunger Scale

The ZimVAC 2014 used the Household Hunger Scale as per the United States of America International Development (USAID) funded Food and Nutrition Technical Assistance(FANTA) project guidance. The HHS was derived from the Household Food Insecurity Access Scale (HFIAS),itself a derivative of the United States household food security survey module, in order to develop a cross-cultural food access indicator applicable to a developing country context (Ballard et al., 2011). Based on the idea that "the experience of household food deprivation causes predictable reactions that can be captured through a survey and summarized in a scale" (Ballard et al., 2011), the HHS is based on the following three questions:

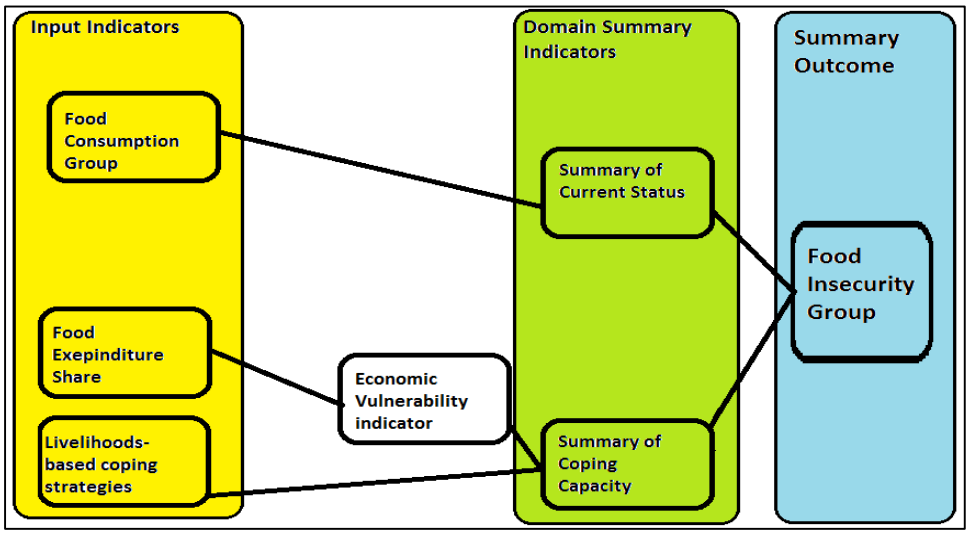
1. In the past [4 weeks/30 days], was there ever no food to eat of any kind in your house because of lack of resources to get food?
2. In the past [4 weeks/30 days], did you or any household member go to sleep at night hungry because there was not enough food?
3. In the past [4 weeks/30 days], did you or any household member go a whole day and night without eating anything at all because there was not enough food? (Ballard et al., 2011).

A "yes" or "no" response was recorded for each of the three questions. In case of a "yes" response, the frequency of the occurrence was recorded as one of the following options: 1 = Rarely (1–2 times in the 30 days); 2 = Sometimes (3–10 times in the 30 days); or 3 = Often (more than 10 times in the 30days) (Ballard et al., 2011). The HHS score for each household is computed by first allocating a score value of: 0 to every "no" response to each of the three questions; 1 to every "yes" response to each of the three questions where the frequency of occurrence was either code 1 or 2; 2 to every "yes" response to each of the three questions where the frequency of occurrence was coded 3 (Ballard et al., 2011). The values for each of

the three questions were summed up to obtain a household score ranging from 0 to 6 with the higher scores indicating poorer household food access status(Ballard et al., 2011).

2.3.3. Household Food Consumption Score

CARI combines current household food access indicators with measures of household coping capacity like economic vulnerability and asset depletion to determine the level of food insecurity within a given population (WFP, 2015). In the 2014 ZimVAC rural livelihoods assessment each household's consumption status was determined using the FCS derived as described above. Each household's coping capacity was determined using the household's food expenditure share and their livelihood coping strategies. Figure 3 shows the analysis framework that determined each household's CARI food access status in the ZimVAC 2014. The domain indicators were recoded into the CARI four-point groups as shown in Table 4.



Source: (WFP, 2015)

Figure 3. Flow chart of the CARI console used in the ZimVAC 2014

Table 4. Indicator Coding Used in the ZimVAC 2014

Domain		**Indicator**	**Food Secure (1)**	**Marginally Food Secure (2)**	**Marginally Food Insecure (3)**	**Severely Food Insecure (4)**
Current status	Food Consumption	Food Consumption Group	Acceptable		Borderline	Poor
Coping capacity	Economic Vulnerability	Food Expenditure share	<50%	50%-65%	65%-75%	>75%
	Assets Depletion	Livelihoods Coping indicator	None	Employed stress strategies	Employed crisis strategies	Employed emergency strategies

Correlation analyses between and amongst the HHS, CARI and FCS were conducted to compare and analyze the food insecurity prevalence obtained by each of the three food security measures in the two selected rural provinces—Mashonaland West and Matabeleland South. The three household food security measures were also compared to a set of household characteristics and other indicators known from the literature to significantly correlate with household food security such as household size, income/expenditure, household assets holdings, income source vulnerability, and household head's marital status, education level as well as presence of a chronically ill, physically/mentally challenged member in the household.

3. Results

3.1. Household Food Security Measures

3.1.1. Food Consumption Score

The FCS for Mashonaland West averaged at 45.2 while that for Matabeleland South was 51.7. Independent –group's t-test of the FCSs for the two provinces indicated that the Levene's test of the variable had a probability of 0.770. Accordingly, assuming equal variance between the FCSs for the two provinces, the t-test for the variable indicated that $p<0.05$, suggesting that the FCS for Mashonaland West was significantly lower than that for Matabeleland South province.

Table 5. Food Consumption Score Food Security Status by Province

	Proportion of households in Food Consumption Score Category		
Province	Poor	Borderline	Acceptable
Mashonaland West	12%	26%	62%
Matabeleland South	4%	22%	74%
Overall	8%	24%	68%

Mashonaland West (38%) had significantly higher food insecurity (poor and borderline FCS) prevalence compared to Matabeleland South (26%) ($p<0.05$) (Table 5).

3.1.2. Household Hunger Scale

The SPSS data explore output for the HHS variable grouped by province at 95% confidence interval suggested that the average HHS score for Mashonaland West (0.76) households was significantly greater than that for the households in Matabeleland South (0.43). The HHS measure estimated that 18% of the households in the two provinces were food insecure (with moderate or severe hunger) and 2% were severely food insecure (Table 6). The level of food insecurity prevalence in Mashonaland West (23%) was significantly higher compared to that in Matabeleland South province (13%) ($p<0.05$).

Table 6. Household Hunger Scale Food Security Status by Province

	Proportion of households in Household Hunger Scale Category		
Province	**Little or no hunger**	**Moderate hunger**	**Severe hunger**
Mashonaland West	77%	19%	4%
Matabeleland South	87%	12%	1%
Overall	**82%**	**16%**	**2%**

3.1.3. Consolidate Approach to Reporting Food Security Indicators (CARI)

About 25% of the sampled households in the two selected provinces were food insecure (marginally or severely food insecure) and 4% of these were severely food insecure (Table 7). Approximately 45% of all food secure households were marginally food secure (Table 7). The prevalence of food insecure households in Mashonaland West (33%) was significantly higher than that for Matabeleland South (18%) ($p<0.05$) (Table 8).

Table 7. ZimVAC 2014 Rural Livelihoods Assessment CARI Console

Domain		**Indicator**	**Food Secure (1)**	**Marginally Food Secure (2)**	**Marginally Food Insecure (3)**	**Severely Food Insecure (4)**
Current status	Food Consumption	Food Consumption Group	63%		28%	9%
Coping capacity	Economic Vulnerability	Food Expenditure share	50%	21%	12%	17%
	Assets Depletion	Livelihoods Coping indicator	71%	10%	8%	11%
Food Security Index			**41%**	**34%**	**21%**	**4%**

Table 8. CARI Food Security Classification by Province

Province	**CARI Food Security Final Classification**			
	Food secure	**Marginally food secure**	**Moderately food insecure**	**Severely food insecure**
Mashonaland West	38%	30%	26%	6%
Matabeleland South	44%	38%	17%	1%
Overall	**41%**	**34%**	**21%**	**4%**

3.2. Comparing the Three Measurement

Following Maxwell et al. (2013)'s approach the three household food security measures were converted into binary categories of "food secure" and "food insecure" as shown in Table 9.

Figure 4 depicts the result of binary classification of household food insecurity prevalence for the two provinces separately as well as combined together. Consistently across the two provinces, the FCS measure gave the highest levels of food insecurity followed by the CARI measure. The HHS measure gave the lowest levels of food insecurity prevalence. This ranking of the measures may not be surprising given that HHS is constructed from questions that capture the most extreme forms of insecurity (Maxwell et al., 2013). Clearly, the three measures were giving different food security statuses to a significant proportion of the households.

Table 9. Classification Systems of Food Security Measures

Indicator	Original Category	Original qualitative label	Converted binary classification
FCS	1	Poor	Food Insecure
	2	Borderline	
	3	Acceptable	Food Secure
CARI	1	Food secure	Food Secure
	2	Marginally food secure	
	3	Moderately food insecure	Food Insecure
	4	Severely food insecure	
HHS	1	Little or no hunger	Food Secure
	2	Moderate hunger	Food Insecure
	3	Severe hunger	

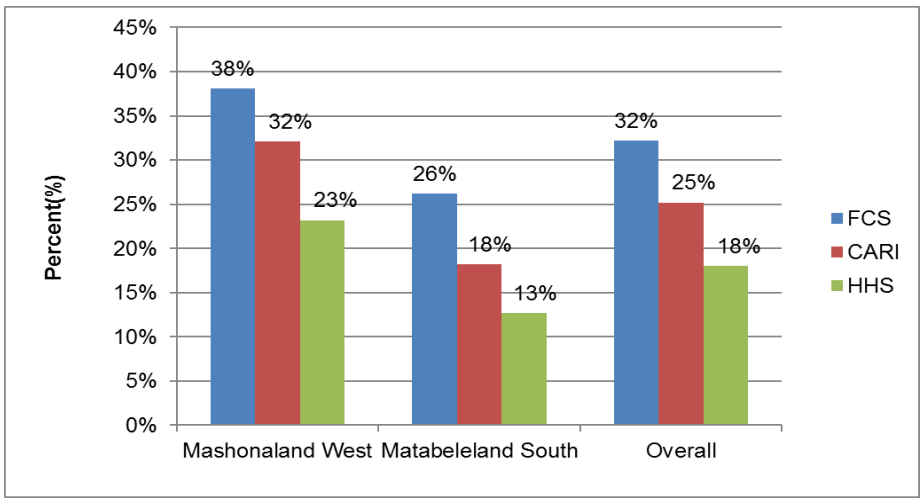


Figure 4. Comparison of Household Food Insecurity Prevalence by the Three Measures

Pairwise comparison of household food security status based on the converted binary classification of the HHS and FCS indicated that about 25% of the households deemed food secure by the HHS were classified as food insecure by the FCS. Conversely, 37% of the households classified as food insecure by the HHS were categorized as food secure by the FCS. Pairwise comparison of household food security classifications by the FCS and CARI produced the least number of households misclassified by either food security measure (see Table 10).

Table 10. Cross-Classification of Binary Categories of FCS and CARI for All the Two Provinces

		CARI		
	Household Food Security Status	Food Secure	Food Insecure	Total
FCS	Food Secure	86.50%	12.40%	67.90%
	Food Insecure	13.50%	87.60%	32.10%
	Total	100.00%	100.00%	100.00%

The cross-classification of the binary categories of CARI and the HHS produces the highest levels of misclassifications. About 69% of the households classified by CARI as food insecure were deemed food secure by the HHS. Not only is this explained by the huge disparity in the levels of food insecurity prevalence estimated by the two measures in the two provinces, but by the fact that the HHS is a stricter measure of severe levels of food insecurity. Additionally, A Cohen's κ was run to determine if there was agreement amongst the food security measures on how they classified the sampled households as either food secure or food insecure. The results of this analysis are shown in Table 11.

Table 11. Cohen Kappa Coefficients for HHS, CARI and FCS

The Food Secure Measure Pairs	Kappa Coefficients	Significance Levels(p)
FCS vs HHS	0.292	0.0001
CARI vs HHS	0.342	0.0001
CARI vs FCS	0.679	0.0001

As a rule of thumb, values of Kappa below zero represent no agreement, 0 to 0.2 slight agreement, 0.21 to 0.4 fair agreement, 0.41 to 0.6 moderate agreement, 0.61 to 0.80 substantial agreement, 0.61 to 0.80 substantial agreement, and 0.81 to 1.0 almost perfect agreement. (Landis &Koch, 1977). There was fair agreement between FCS and HHS, and CARI and HHS (κ=0.292 and 0.342, p<0.0005). Agreement was moderate between CARI and FCS (κ=0.679, p<0.005).

3.2.1. Correlations amongst the Three Household Food Security Indicators

The correlation amongst the three food security measures was examined using the Spearman's rho; a statistic used to examine non-parametric relationship. All the three measures were significantly correlated at p=0.01 level (Table 12). The correlation between HHS and the other two measures was relatively weak; between 13% and 14% of the variance in HHS was associated with the variance in FCS or CARI. The FCS was negatively correlated to HHS and CARI. As expected, given the fact that the FCS is a component of CARI, the two were relatively strongly co-related(r=-0.728); variance in one was associated with about 52% of the variance in the other.

Table 12. Spearman's *rho* Correlations Between Food Security Measures

Indicator	Parameter	HHS	FCS	CARI
HHS	Correlation Coefficient	1	-0.359**	0.379**
	N	2520	2520	2520
FCS	Correlation Coefficient	-0.359**	1	-0.728**
	N	2520	2520	2520
CARI	Correlation Coefficient	0.379**	-0.728**	1
	N	2520	2520	2520

** Correlation is significant at the 0.01 level (2-tailed).

3.2.2. The relationship between the Three Household Food Security and Household Characteristics and Socio-Economic Status

The Chi-square test showed no significant relationship between all the three food access measures and household size (p>0.05). However, significant relationships existed between the three food security measures and household marital status (Figure 5), and with household head education level (Figure 6) as well as presence of at least an orphan or a chronically ill member in the household (Figure 7).

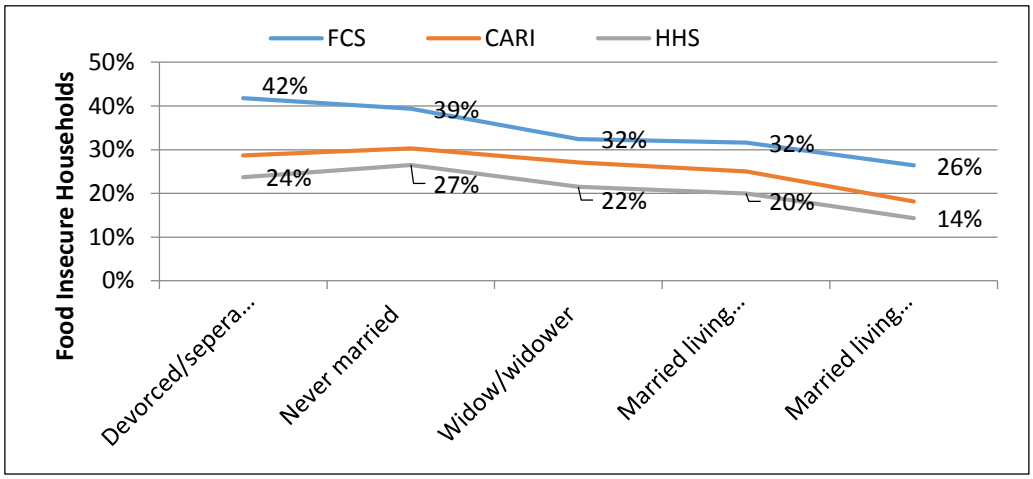


Figure 5. Food Insecure Household by Household Head's Marital Status

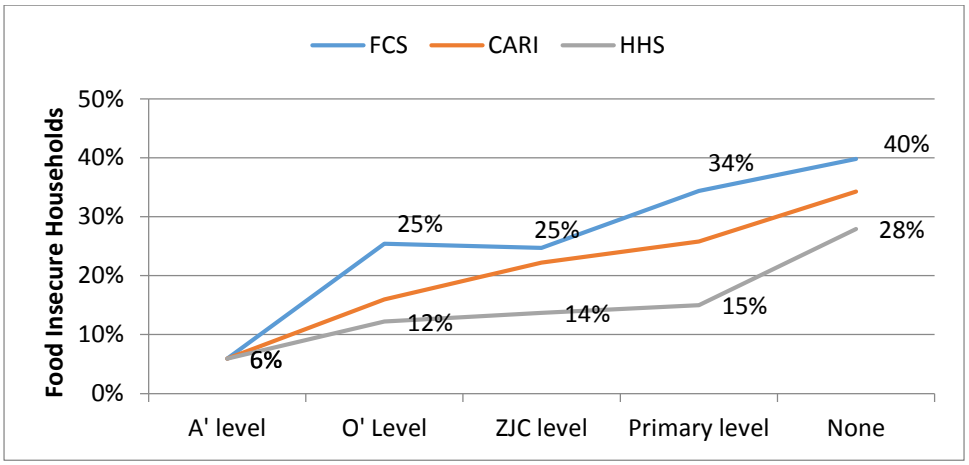


Figure 6. Food Insecure Households by Household Head's Education Level

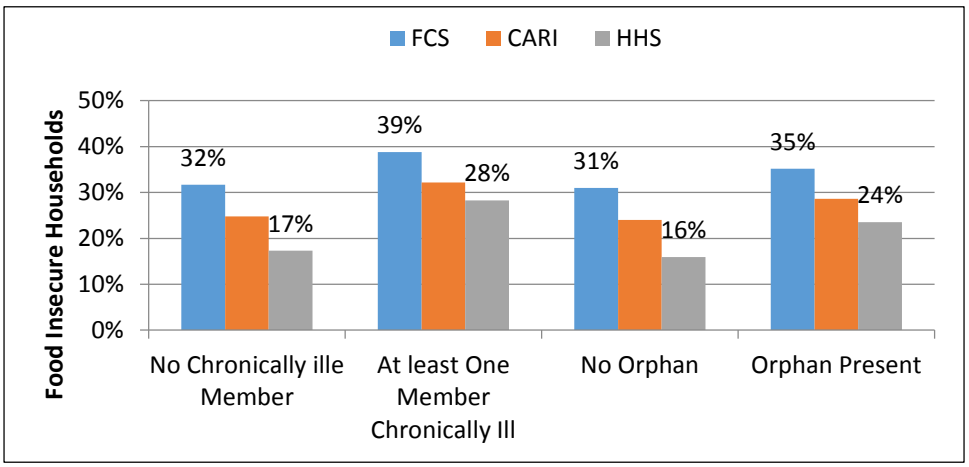


Figure 7. Food Insecurity and Presence of least an orphan or a chronically ill member

All the three food security measures indicated that married headed families were less likely to be food insecure compared to single headed families. Widowers/widows whom most safety net interventions prioritize in their targeting were considered to be generally better off than those that were single. Only the FCS food security measure considered household heads that were divorced or separated to be more vulnerable to food insecurity than single household heads. The majority of household heads in these two most food insecure categories were women.

All the three food access measures indicated that the presence of either an orphan or a chronically ill member in a household increased its vulnerability to food insecurity. This is theoretically expected given the tendency of the two phenomena to increase household dependence ratio.

3.2.3. The relationship between the Three Household Food Security Measures and Income Sources and Income Levels

All the three food security measures indicated that food insecurity increases with improved income sources reliability (Figure 8). The Pearson's Chi-square indicated that all the three relationships were significant (p<0.05). The analysis, however, indicates that the HHS measure was relatively insensitive between medium and good income sources reliability. As expected all three measures estimated decreasing levels of food insecurity with increasing household expenditure which, itself, is a good proxy for household income (Figure 9). However, the rate of decrease in the food insecurity prevalence diminishes as expenditure (or income level) increases and never reaches zero.

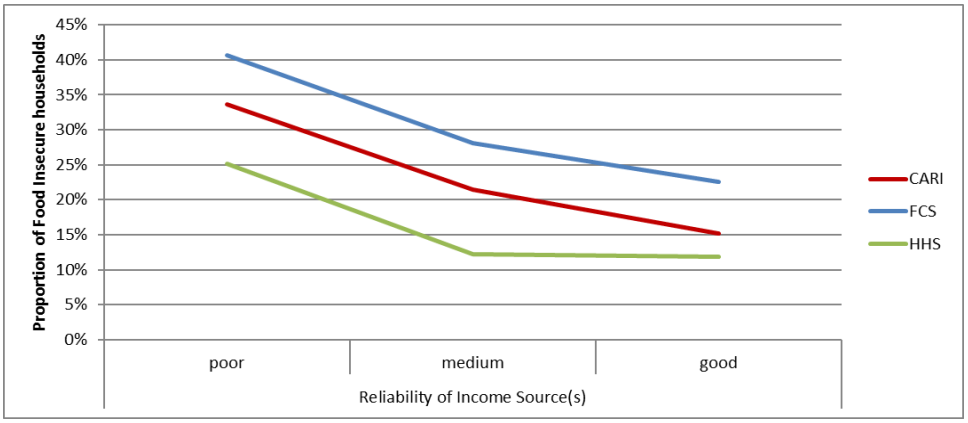


Figure 8. Household Food Security Measures Compared to Income Reliability

4. Discussion

While similar, the three food security measures compared in this study are unique in what they are measuring as illustrated by each producing different food insecurity prevalence estimates for the same population. As such, it would be inappropriate to classify households as food insecure without the use of multiple indicators measuring different aspects of food security. This is because food security measurement is multi-dimensional with different indicators capturing different aspects implying more than one indicator is required (De Cock et al., 2013; Cafiero et al., 2014; Maxwell et al., 2014).

Of the three food security measures, the HHS epitomizes the shift from objective to subjective measures, discerned by Maxwell et al. (2014), as it seeks to capture individuals' or their household members' expressions, perceptions, and responses to food insecurity. The other two measures, on the contrary, remain largely objective measures focusing on food consumption patterns, food quality, quantity of food intake, and coping capacities of household livelihoods. The HHS is used to assess the prevalence of household food insecurity and hunger and to detect changes over time, typically in the context of development programs (Ballard et al., 2011). Given its focus on detecting severe food insecurity and therefore greater efficiency in identifying households at increased risk of dying from hunger, the HHS may be the food security measure of choice in emergency situations where time consuming assessments may not be possible and food assistance resource levels dictate strict selection and targeting (Ballard et al., 2011; Maxwell et al., 2013). The simplicity of the three basic questions upon

which HHS is built may undermine repeated use of the measure in protracted emergencies as respondents may easily adopt negative deviance in their responses, thereby compromising the efficient attachment of appropriate household food security statuses.

Dietary diversity measures, all proxy indicators of diet quality, may be used as stand-alone measures or to complement other indicators for purposes of assessment, targeting, monitoring, and evaluation (WFP, 2008). However, once combined into the CARI, the composite indicator may be more preferred to inform interventions aimed at addressing poverty and chronic food insecurity. Nevertheless, the utility and context specificity of the two measures, FCS and CARI, in determining household food security status may benefit from identification of appropriate cut-off points for different socio-economic contexts for the rural Zimbabwean societies.

All the three food security measures usually depend on one respondent to answer the questions on behalf of all other household members. The appropriate respondent should be a household member with good knowledge about all the facets of the household's livelihoods including food preparation and meals and the food security experiences of other household members, especially young children. However, in many contexts, the extent to which a respondent's experiences of food security align with those of others in the household is unclear.

5. Conclusion and Recommendations

Review of literature on food security and its measurement demonstrates that the generally established consensus on the definition and concept of food security is not matched by similar consensus on the measurement of the phenomenon (Barret, 2010; Headey & Ecker, 2012; Webb et al., 2006). Over the years, the definition of food security has increased in complexity to embrace greater facets of livelihoods and other related concepts like poverty, hunger, malnutrition, vulnerability, and resilience (Barret, 2010; Headey & Ecker, 2012; Webb et al., 2006). This increased complexity has not helped many developments in policy practice and measurement of food security, which it has tended to push towards the simpler elements of the concept to remain pragmatic.

The threes household food security measures (FCS, CARI and HHS) used by ZimVAC in the 2014 rural livelihoods assessment are no exception to this general limitation. However, the development of CARI is promising in many respects. The composite indicator incorporates multiple dimensions of food security and yet retains great simplicity (WFP, 2015). Concepts of poverty, coping capacity, food consumption patterns, energy intake, and food diversity are all incorporated into one simple household food security measure (WFP, 2015). This makes the indicator attractive. It may be critical to empirically assess how sensitive this measure is to trends, seasonality, and shocks.

The comparative analysis of FCS, CARI, and HHS in Matabeleland South and Mashonaland West rural communities proves the three measures to be consistent. The FCS gives the highest level of food insecurity, followed by CARI while the HHS gives the least food insecurity prevalence. The relative order of food insecurity prevalence by the FCS and the HHS measures found in this study is consistent with the findings by Maxwell et al. (2013) in rural Ethiopia. Maxwell et al. (2013) reminded us that:

The prevalence estimates that each indicator(food security measure) provides are a function not so much of the objective "truthfulness" of the indicators themselves (in their continuous quantitative formulation), as they are of the cut-off points assigned to the different categories and the ways in which categories are constructed. (pp 22)

Though significantly correlated with other household food security determinants such as expenditure levels, household head education levels, presence of an orphan and/or a chronically ill member (all proxies for household dependency), the three measures, however,

showed rather low levels of correlation to these indicators. This may be a cause for concern as this may suggest there are other important food security determining factors not sufficiently accounted for in the food security measures.

Based on the current comparative analysis, this study recommends using the HHS in emergency situations to inform programs to primarily save lives, since it is designed to pick up only the most-severe behaviors in response to household food insecurity. The CARI is recommended for livelihoods resilience programming with poverty reduction and addressing chronic food insecurity as its key objectives. This recommendation is made in full recognition of the need to contextualize the cut-off points used in the FCS for the Zimbabwe rural communities. The point to emphasize here is that choice of one measure, if necessary, has to be informed by the prevailing socio-economic context within which the food security assessment is being undertaken as well as the main purpose for the assessment.

In the event that one assessment is fortunate to have all three food security measures, this study follows Maxwell et al. (2013) in recommending cross-classifying households through the three measures. The absence of a gold standard on household food security measures makes it difficult to validate externally each of the measures compared in this study.

6. Constraints and limitations

The ZimVAC 2014 rural livelihoods data was at household level and as such is not immune to weaknesses arising from memory failure, biases, and choice of survey instrument (Beegle, De Weerdt, Friedman, & Gibson, 2012). Sometimes the interviewee may not know accurately all relevant socio-economic activities by all household members because of memory loss or the activities may happen away from home. By its very design the survey is unable to illuminate on intra-household dynamics. The analysis of this study, thus considers the household as a unit that pools its resources and makes its key decisions as one. The ZimVAC 2014 rural livelihoods assessment is a cross-sectional survey done once a year; therefore, it is limited in its ability to bring out seasonal influences on household's socio-economic situation.

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