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Determinants of Vulnerability to Livelihood Insecurity at Household Level: Evidence from Maphutseng, Lesotho

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Abstract

This study investigated the major factors that influence the vulnerability of a household to food insecurity in the context of a rural community in Mohale's Hoek. The study also traced the changes in the level of vulnerability of households to poverty between 2009 and 2013. Primary data was collected through the Household Vulnerability Index (HVI) survey of 2581 households in 2009 and 325 randomly sampled households in 2013. The Household Vulnerability Index developed by the Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN) was used to quantify the household vulnerability of household based on the capital assets of the Sustainable Livelihood Framework: social assets, physical assets, financial assets, natural assets and human assets. An ordinal regression was estimated for the categories of vulnerability based on the HVI score: Low vulnerability, Moderate vulnerability and High Vulnerability. The results indicate that the proportion of households with a high vulnerability have increased by 7.8 percent between 2009 and 2013. Parameter estimates of the ordinal regression model identify highly vulnerable households as households predominantly comprising of; (i) female heads and where the head is of an elderly age, (ii) two meals a day which are mainly wild fruits and inter-family food transfers, and (iii) limited land for cropping of staple foods. There is an urgent need to develop policies that are aimed at directly improving the livelihood of households in poverty stricken districts such Maphutseng as well as make the households more resilient to shocks.

Keywords: *Vulnerability, Agriculture, Lesotho*

Introduction

In recent years there has been increasing awareness that the analysis of food insecurity should be carried out in a dynamic context. It is essential not to just look at the current incidence of an inadequate nutritional outcome, but also to identify the individuals, households or the communities who are more at risk of suffering in the future. The main analytical concept that has been developed in

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order to address the issue of the future incidence of food insecurity is vulnerability analysis

However, vulnerability is an elusive concept. Its definition varies across disciplines, ranging from engineering to psychology to economics. In the development community, vulnerability has become an important concept used to guide the design, evaluation, and targeting of programs. In southern Africa, for instance, governments, NGOs, UN agencies, and other groups formed country-level Vulnerability Assessment Committees starting in 1999 to harmonize and improve methods of assessing vulnerability, with a focus on food aid (Frankenberger, Mock, & Jere, 2005)

Since then, practitioners have given greater emphasis to the multidimensionality of vulnerability, working with a variety of measures to capture the complexity of the concept. In order to understand vulnerability in Lesotho, the Committee for vulnerability assessment relied mainly on the Household Economic Approach of measuring vulnerability. The Household Economy Approach (HEA) is a livelihoods-based analytical framework developed by Save the Children UK in the early 90s designed to obtain information on how people access food and cash based on multi-level analysis (Lawrence et al., 2008). Itis drawn from anthropology and sociology, disaster management, and the sustainable livelihoods and food security strand of the economics literature. HEA is primarily used to predict the impact of national-level shocks and disasters across different wealth groups, seeking to answer the following questions: “Where is assistance needed, and of what type? Who needs it? How much is needed, when and for how long?

There are some limitations to the HEA, however. HEA analysis, unless disaggregated, does not reach to the individual or household level. HEA’s use of purposive sampling generates “a simplified data set, with only one 'typical' household defined in each wealth group,” which limits its power to predict household vulnerability with a high degree of granularity (Petty & Seaman, 2004).

In this study, we attempt to bridge this gap by providing a multidimensional approach to understanding individual household vulnerability using the Household Vulnerability Index developed by the Food, Agriculture and Natural Resources Policy Analysis Network. The HVI has been used before to provide a multidimensional analysis of vulnerability because it accords current best practices by using a sustainable livelihoods focus to analyse the dimensions of both vulnerability and coping. Additionally, it can be used for targeting purposes as well as population level analysis.

Vulnerability can be defined as the diminished capacity of an individual or group to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard. The Department for Internal Development (DFID) (2008) defines vulnerability as the susceptibility of individuals, households or communities to become poor or poorer as a result of events or processes that

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affect their livelihood systems. This means it is the understanding of the extent to which one is prone, at risk, or likely to be food insecure. The concept of vulnerability is relative and dynamic. Vulnerability is most often associated with poverty, but it can also arise when people are isolated, insecure and defenseless in the face of risk, shock or stress (Birkmann, 2006). Vulnerability at a national level has been investigated previously through different methods mainly: vulnerability as expected poverty (VEP), vulnerability as low expected utility (VEU) and vulnerability as uninsured exposure to risk (VER) (Hoddinott and Quisumbing 2003). However, these methods fail at a micro-level because of their limitation in accounting for the fact that people differ in their exposure to risk as a result of their social group, gender, ethnic or other identity, age and other factors. Physical, economic, social and political factors determine people's level of vulnerability and the extent of their capacity to resist, cope with and recover from hazards.

At micro-level, vulnerability is the susceptibility of individuals, households or communities to become poor or poorer as a result of events or processes that affect their main livelihood. According to Holzmann and Jorgensen (1999), a high percentage of households move into poverty due to temporary shocks such as illness or loss of employment that are reversed just one or two years later. However, literature on the determinants of vulnerability in the context of a rural setting only focuses on external factors which exacerbate the already existing situation. This study shows that the main sources of vulnerability at a micro level are; climate change, uncertain weather patterns, seasonality, crop and livestock pests and diseases.

The starting point of disaggregating vulnerability is the distinction between external and internal sides as proposed by Conway and Chambers (1989): "Vulnerability has two sides, an external side which risks, shocks and stress to which an individual is subject to; an internal side which is the defenceless, meaning lack of means to cope with damaging loss. Loss can take many forms – becoming or being physically weaker, economically improvised, socially dependent, humiliated or psychological harm".

This study focussed on understanding the major determinants of internal vulnerability because understanding the causes of weak adaptive capacity can be used in building the resilience of households so that they can attain food security. Baiyegunhi and Fraser (2010) analysed a panel dataset on a representative sample of 150 rural households interviewed in 2007 and 2008 in the Amathole District Municipality of the Eastern Cape Province of South Africa to empirically assess the dynamics of poverty and estimate the determinants of households' vulnerability to poverty. They concluded that age, level of education and occupation of the household head, dependency ratio, exposure to idiosyncratic risks and access to credit are statistically significant in explaining a households' vulnerability to poverty. In the same manner Edoumiekumo *et al* (2013) used a logistic regression model to show the major determinants of poverty in Bayelsa state Nigeria were household size, per

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capita expenditure on education, per capita expenditure on health and per capita expenditure on food. The marginal effect after tobit showed that together with the determinants of poverty households with more people between the ages of 15 and 60, female headed, primarily engaged in agriculture are considered the most vulnerable.

The results from Malawi National Vulnerability assessment confirm that female headed households are substantially poorer than male headed households. In addition, households whose heads are aged between 26 and 45 years appear to be richer by around 7.5 percent (compared to household heads aged 18-25). At other ages, the age of the household head is not significant, except for those having heads of 56 or more years of age in most rural areas and in urban areas. Also the number of children, participation of wage occupation, and distance from markets and access to agricultural credit were found to be significant in explaining the vulnerability to poverty of a household.

Jama (2011) investigated the determinants of vulnerability at Maphutseng Mohale's Hoek using the Analysis of Variance (ANOVA), Kruskal Wallis and Wilcoxon-Mann-Whitney tests and Principal Component Analysis to rank the order of the main determinants of vulnerability in Lesotho. The test revealed the determinants in the following order of significance: land ownership, land utilization for food production; number of children and adult meals; age, sex and type of employment of head of household; main source of income; household with debt and availability of second income source; and household receiving remittances. Nkondze (2013) used the Household Vulnerability Index to investigate the factors affecting households' vulnerability to climate change at Mpolongeni, Swaziland. Parameter estimates of the multinomial regression model show that the number of sick members, number of employed members, number of dependants, household size and the livestock index influence households to move from low vulnerability to moderate vulnerability or high vulnerability.

Methodology

Maphutseng is located in Mohale's Hoek District of Lesotho, 140km south of Maseru, the national capital, and 15km from Mohale's Hoek town. Geographically, Maphutseng can be divided into three parts: mountains, foothills and lowlands. The district is generally semi-arid and land degradation is a common feature in the area due to heavy run-off and poor land management practices (World Vision, 2008). This study area was chosen as part of the Strengthening Evidence Based Climate Change Adaptation Policies (SECCAP) programme which was implemented by FANRPAN and World Vision.

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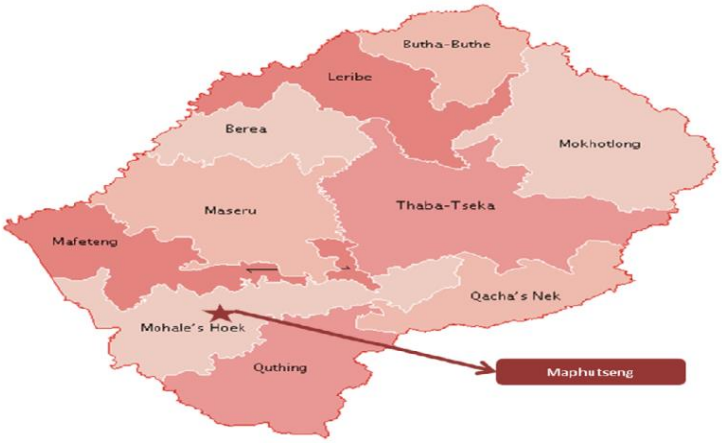

Figure 1: The location of Maphutseng

Sampling technique

A representative sample was first chosen using the method of sample size determination by Cochrane (1977) from a population of 2581 households. This was followed by a multistage cluster sampling technique together with a probability proportionate to size sampling technique in order to have a sample which is representative of the population including the three levels of vulnerability. The population of interest was thus first divided into sub-populations with similar homogeneous characteristics to form strata of the different levels of vulnerability: *Low Vulnerability, Moderate Vulnerability and High Level Vulnerability;* because the population was already divided in these three categories of the HVI. Then a sample was drawn from each stratum by means of probability proportionate to size sampling technique. The merits of this sampling design is that each strata could be studied independently of other formed strata - a fact which provides additional information about each stratum formed and may allow inter comparisons of different strata in which a deeper understanding on other strata would be enhanced since they are drawn from the same underlying population. Table 1 shows the sample sizes selected with regard to the levels of vulnerability.

Table 1: The sample sizes with respect to the level of vulnerability

Stratum	Population of Stratum (N1)	Proportional Representation	Sample Size
Low Vulnerability	45	0.02	6
Moderate Vulnerability	2340	0.91	296
High Vulnerability	188	0.07	23
Total	2573	1	325

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Description of the Data

Livelihood data was collected in April 2009 using structured questionnaires from the 2581 household heads in Maphutseng. The face-to-face interviews covered the entire Area Development Programme (ADP). This data forms most of the analysis on household vulnerability to poverty. In addition, secondary sources provided information regarding validation of the results from the survey and Household Vulnerability Indices and this was done thorough in-depth interviews with the employees of World Vision Lesotho in Maphutseng ADP, Disaster Management Authority in Mohale's Hoek, District Extension Officer in Mohale's Hoek, and the National University of Lesotho. District level data from the Ministry Local Government was also consulted to validate the data collected in the study. Sampled data was later collected in 325 households from the population of 2581 households in 2009 and used to assess the changes in the level of vulnerability over time. The sampled data was collected through semi-structured questionnaires and interviews in a similar manner as in 2009.

The Household Vulnerability Index

The HVI tool was used to assess rural household vulnerabilities to poverty because of its ability to capture the aspects of vulnerability as mentioned by Conway and Chambers (1989).

Two major types of approaches were used in the development of the HVI. These were the principal component analysis and the Costa's fuzzy set approach to multidimensional analysis of poverty given composite indicators[1]. Though different, these approaches complement each other as far as model development is concerned. The principal component analysis served as a dimension reduction tool that was used to reduce a large set of variables and the fuzzy set approach was used to attach a score to these indicators given the extent, nature and severity of external shocks (climate change, droughts, HIV and AIDS) impact and calculated a compounded index to describe the level of vulnerability of each household.

The HVI follows the model of Conway and Chambers (1989) which defines vulnerability as a function of internal and external factors. The HVI assesses "external" vulnerability that is introduced by a defined shock or shocks, and "internal" vulnerability or inability of such a household to withstand shocks in general. It uses Fuzzy logic to assess a household's access to (i) natural assets such as land, soil and water; (ii) physical assets such as livestock and equipment; (iii) financial assets such as savings, salaries, remittances or pensions; (iv) human capital assets such as farm labour, gender composition and dependents; and (v) social assets such as information, community support, extended families and formal or informal social welfare support. Appendix 1

[1] Costa, M. (2002). *A Multidimensional Approach to the Measurement of Poverty: An Integrated Research Infrastructure in the Socio-Economic Sciences* IRISS Working Paper Series No. 2002-05; and Costa, M. (2003). *A Comparison Between One-dimensional and Multidimensional Approaches to the Measurement of Poverty An Integrated Research Infrastructure in the Socio-Economic Sciences* IRISS Working Paper Series No. 2003-02.

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shows how the HVI is calculated from the 15 variables assessed together. The score categorizes households into the low, medium and high vulnerable as in Table 2.

Table 2: **Description of different levels of vulnerability according to the HVI**

Category	Description	HVI Score	Category for ordinal regression
Low Vulnerability	Coping or resilient Household	0-42	3
Moderate Vulnerability	The household can cope after receiving assistance	43-75	2
High Vulnerability	Tragic – the household requires special intervention to attain food security	76-100	1

The HVI categorizes households into three classes according to their level of vulnerability which varies from 0 to 100, whereby zero is the least vulnerable household and 100 is the most vulnerable household. Table 2 describes the different levels of vulnerability as they are used in the HVI. The HVI was tested by investigating the impact of HIV and AIDS on agriculture and food security in seven (7) countries: Botswana, Lesotho, Namibia, South Africa, Swaziland, Zambia and Zimbabwe[2]. A re-run study was conducted in three countries: Lesotho, Swaziland and Zimbabwe[3] to refine the tool. All these studies confirmed that the HVI tool is useful for planning and policy development because it provides a yard-stick for determining the extent of certain social challenges and thus makes it possible to measure the progress of a particular development strategy or policy on a time series and linear scale. Based on the different vulnerability levels, elaborated above, specific relief or development packages were recommended to assist the affected households overcome their vulnerability.

Data Analysis

The HVI uses three levels of vulnerability: high vulnerability, moderate vulnerability and low vulnerability and such responses from households are coded 1, 2, and 3 in an ordinal regression model (Table 2). There is a clear ranking among the categories, but the differences among adjacent categories cannot be treated as the same. The ordinal nature of the outcomes has no implication on differences in the strength of the outcomes; the outcome associated with $y_i = 2$ is not twice as strong as that associated with $y_i = 1$. Therefore, the actual values taken by an ordinal dependent variable are irrelevant, so long as larger values correspond to stronger outcomes. However, it is not always possible to unambiguously identify outcomes as ordinal. Not

[2] http://www.fanrpan.org/themes/hiv_aids/
[3] http://www.fanrpan.org/themes/eachproject/?project=10

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treating an outcome variable as ordered, when in fact it is ordered, fails to impose a legitimate ranking on the outcomes and this omission may lead to a loss of efficiency, but it is unlikely to bias the estimates (Long, 1997). Treating an outcome variable as ordered, when in fact it is non-ordered, imposes a ranking on the outcomes that they do not possess and invokes the restrictive assumption of parallel slopes, which is likely to bias the estimates. Long (1997) states that for ordinal responses, ordinary linear regression is inappropriate because of the non-interval nature of the dependent variable. In addition, multinomial logit models, would fail to account for the ordinal nature of the dependent variable and thus not employ all of the information available in that variable. As a result, a multinomial regression was not used in this study but rather the ordered probit model of Aitchison and Silvey (1957) and McKelvey and Zavoina (1975).

Model Specification

The HVI Score takes 3 categories which are naturally ordered: low vulnerability, moderate vulnerability and high vulnerability.

$y^* = x'\beta + \varepsilon,$ where y^* is unobserved and ε is assumed to follow a certain symmetric distribution with zero mean such as the normal or logistic distribution.

What we observe is

$y = 0 \quad if\ y^* \leq \mu_0\ (\mu_0 = 0)$
$y = 1 \quad if\ 0 \leq y^* \leq \mu_1$
$y = 2 \quad if\ \mu_1 \leq y^* \leq \mu_2$

Y is observed 3 ordered categories, and the μ's $(\mu_1, \mu_2, \mu_3 \geq 0\ and \mu_1 < \mu_2 < \mu_3\ )$ are unknown(unobserved) threshold (cutpoint) parameters, separating the adjacent categories to be estimated with β,

The probit link function is used

$Pr(y = 1/x) = Pr(\mu_0 \leq x'\beta + \varepsilon < \mu_1/x)$

$Pr(y = 1/x) = Pr(\mu_0 - x'\beta \leq \varepsilon < \mu_1 - x'\beta/x)$ Subtracting $x'\beta$ within the inequality

$P(x_0 \leq z \leq x_1) = \Phi(x_1) - \Phi(x_0)$ The probability that a random variable is between two values is the difference between the cdf evaluated at these values. Therefore

$Pr(y = 1/x) = Pr(\varepsilon < \mu_1 - x'\beta/x) - Pr(\varepsilon \leq \mu_0 - \beta/x)$
$\mathrm{F}(\mu_1 - x'\beta) - \mathrm{F}(\mu_0 - x'\beta)$

An ordered logit model is the result of assuming that ε is logistically distributed, while an ordered probit model is the result of assuming that ε is normally distributed.

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Therefore the probability of any observed outcome y = j given x is given by

$$\Pr(y = j/x) = F(\mu_j - x'\beta) - F(\mu_{j-1} - x'\beta)$$

The formulas for the ordered Probit used in this study are

$$\Pr(y = 0/x) = \Phi(-x'\beta) \; since \; \Phi(\mu_0 - x'\beta) = \Phi(-\infty - x'\beta) = 0$$
$$\Pr(y = 1/x) = \Phi(\mu_1 - x'\beta) - \Phi(-x'\beta)$$
$$\Pr(y = 2/x) = \Phi(\mu_2 - x'\beta) - \Phi(\mu_1 - x'\beta)$$

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$$\Pr(y = J/x) = 1 - \Phi(\mu_{J-1} - x'\beta)$$

An issue in the ordinal-outcome model is whether the β estimates are invariant to the thresholds. That is, the effects of an x should be constant regardless of the choice of response category the of HVI (is known as the parallel lines assumption)-

Estimation Procedure

Let β be the vector with parameters from the structural model, with the intercept β_0 in the first row, and let μ be the vector containing the threshold parameters. Either β_0 or μ_1 is constrained to 0 to identify the model. Then $\Pr(y = j/x, \beta, \mu) = F(\mu_j - x'\beta) - F(\mu_{j-1} - x'\beta)$

The probability of observing whatever value of y was actually observed for the ith observation is

$$p_i = \begin{cases} \Pr\,(y_i = 1/x_i, \beta, \mu) & if\; y = 1 \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots & \\ \Pr\,(y_i = m/x_i, \beta, \mu) & if\; y = m \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots & \\ \Pr\,(y_i = J/x_i, \beta, \mu) & if\; y = J \end{cases}$$

If the observations are independent, the likelihood equation is

$$L(\beta, \mu/y, x) = \prod_{i=1}^{N} p_i$$

$$L(\beta, \mu/y, x) = \prod_{j=1}^{J} \prod_{y_i=j} Pr(y_i = j/x, \beta, \mu) = \prod_{j=1}^{J} \prod_{y_i=j} [F(\mu_j - x'\beta) - F(\mu_{j-1} - x'\beta)]$$

$\prod_{y_i=j}$ indicates multiplying over all cases where y is observed to equal j.
Taking logs, the log likelihood is

$$lnL(\beta, \mu/y, x) = \sum_{j=1}^{J} \sum_{y_i=j} [F(\mu_j - x'\beta) - F(\mu_{j-1} - x'\beta)]$$

Each of the N observations is treated as a single draw from a multinomial distribution, and in this case the multinomial distribution has three outcomes. Suppose that of the N persons, N_1 were not deprived, N_2 were mildly deprived

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and N_3 were severely deprived. Then the likelihood of observing the sample, which is simply the product of the probability of the individual observations, is

$$L = [Pr(y=1)]^{N_1}\,[Pr(y=2)]^{N_2}\,[Pr(y=3)]^{N_3}$$

$$= \left[F(\mu_1 - x'\beta)\right]^{N_1}\left[F(\mu_2 - x'\beta) - F(\mu_1 - x'\beta)\right]^{N_2}\left[1 - F(\mu_2 - x'\beta)\right]^{N_3}$$

The equation can be maximized with numerical methods to estimate the β's and the μ's.

The Dependent Variables

The dependent variables were inspired by the findings of Jama (2011) in Maphutseng and they will be estimated as follows;

Table 3: **Description of variables**

Variable	**Description**
Sex of Household Head	1 Male, 0 Female
Employment of Household Head	1 Employed,0 Unemployed
Age of Household Head	Continuous
Household Size	Continuous
Meals Per Day Children	Continuous
Meals Per Day Adults	Continuous
Food Diversity Index	Continuous-0 Min–Low Diversity,1MaxHigh Diversity
Remittances Received	1 Yes, 0 No
Access to Crop Extension Service	1 Yes, 0 No
Total Land Size Amount	Continuous in Hectares
Maize Planted Last Season	1 if Area Planted is 1 hectare or more. 0 Otherwise

Results and Discussion

Distribution of Households by Villages

The Maphutseng Area Development Programme (ADP) comprises of 6 community councils and 22 small villages. All the villages differ in terms of the level of infrastructure available, access to basic services and prevailing conditions of poverty. Within the ADP, villages within the mountain areas tend to be small and scattered while larger settlements are found in the foothills and the lowlands.

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Table 4: Distribution of households by villages in Maphutseng

Village	Frequency	Percent
Braakfontein	21	0.8
Ha Sekoati	605	23.4
Mapotsane	391	15.1
Mootsinyane	464	18
Setanteng	545	21.1
Ha Thaba Bosiu	370	14.3
Others	185	7.2
Total	2581	100

The census of the entire ADP was conducted in the year 2009 and 2581 households were captured. From Table 4, it was evident that the majority of the population in Maphutseng lived on the Eastern side of the ADP namely; Ha Sekoati, Mootsinyane and Setanteng, constitute 65 percent of households in Maphutseng. Ha Sekoati, which is located at the entry of the Maphutseng valley from the Main South 1 highway, boasted the highest populace of 23.4 percent of Maphutseng households followed by Setanteng and Mootsinyane respectively.

The Household Vulnerability Index Scores for Maphutseng

Table 5 presents adaptive capacity values for the entire Area Development Project (ADP) of Maphutseng computed using the Household Vulnerability Indices based on their entitlements. The results reveal that in 2009, 2 percent of the households had a high adaptive capacity and low vulnerability, whilst the majority of households (91 percent) in the moderate adaptive capacity category face transitory or temporary vulnerability which makes them slide in and out of chronic poverty situations whenever they are exposed to shocks that impact on their livelihoods. In addition, 7 percent of the households are in the high vulnerability category, and require the greatest investment. The high vulnerability population is living in chronic poverty, and requires specially packaged and targeted social protection interventions to get them out of this situation.

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Table 5: **The level of vulnerability over time: 2009-2013**

HVI Score	2009 (%)	2013 (%)	%Change
Low Vulnerability*	2	7.4	5.4
Moderate Vulnerability**	91	77.8	-13.2
High Vulnerability***	7	14.8	7.8
Total	100	100	0

Notes: **These are Households with a HVI score between 0 and 42. ** These are Households with a HVI score between 43 and 75. *** These are Households with a HVI score between 76 and 100*

The level of vulnerability of households in Maphutseng changes over time. Figure 2 shows the distribution of HVI scores for households across the different level of vulnerability. It is evident that vulnerability scores of households follow a normal distribution with the majority of household having a moderate vulnerability. The results presented in Table 5 indicate that the proportion of households with low vulnerability has increased from 2 percent of the total population to 7.4 percent of the total population between 2009 and 2013. At the same time the number of households with moderate vulnerability has decreased from 91 percent of the total population to 77.8 percent. This shows that the proportion of households with a moderate vulnerability has declined by 13.2 percent. However, those with high vulnerability have increased by 7.8 percent from 7 percent in 2009 to 14.8 percent in 2013.

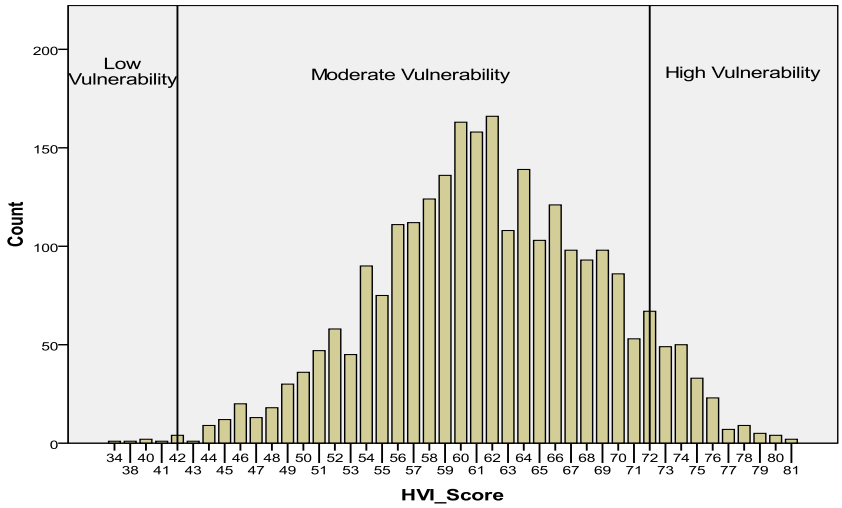

Figure 2: A histogram showing the distribution of the HVI Scores for Households at Maphutseng in 2009

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The results indicate that 7.8 percent of households who were moderately vulnerable to poverty in 2009 have joined the households who were highly vulnerable to poverty. Internal household specific shocks such as death of a household head, unemployment of household head and migration of the most economically productive households could be amongst other factors contributing to the declining capacity to adapt to external shocks on key livelihoods and subsequently increasing the vulnerability to food insecurity and poverty. The results also show that between 2009 and 2013, 5.4 percent of the moderately vulnerable became less vulnerable. The data showed that livestock ownership of this household had increased and thus improving the ownership of physical capital which can be used to buffer against shocks on their livelihoods.

Factors that influence the vulnerability level for a household.

The dependent variable is an ordinal outcome of the three levels of vulnerability coded as follows; 1=High Vulnerability, 2=Moderate Vulnerability and 3=Low Vulnerability. Table 6 shows the results from an ordered probit model for 2581 households at Maphutseng. The Brant (1990) Test of proportion was undertaken for all variables and the results indicated that all variables do not proportionately affect the three categories of vulnerability except for access to extension services. The likelihood ratio chi-square of 24.18 with a p-value of 0.0000 tells us that our model as a whole is statistically significant, as compared to the null model with no predictors.

The age of the household head

The results in Table 6 depict that for each additional year of age of the household head, the odds of being in a low vulnerability category reduced by 0.98 times as compared to being in both the moderate vulnerability and high vulnerability holding all other variables in the model constant. The result shows that as the household head gets older in Maphutseng, the vulnerability status of the household increases thus implying that households with younger household heads are more likely to have a low vulnerability status as compared to a moderate and a high vulnerability status. The reason being the average age of a household head at Maphutseng is 52.

The diversity of the food consumed by the household

In addition, Table 6 shows that households who consume diverse food units in a week, which in the context of Maphutseng included consumption of wild vegetables, are more likely to have a high vulnerability status as compared to household with relatively diverse food units. Each additional unit to the food diversity score (see Appendix 1 for calculation of the food diversity index) is associated with 8 percent (odds ratio = 0.085871) decrease in the odds of having a low vulnerability as compared to a moderate and high vulnerability. In the context of a Maphutseng, consuming diverse food units is sign of coping strategy since it shows that there is no sustainability in food patterns of a household. LVAC (2008) supports this point by indicating that vulnerable

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households in Mohale's Hoek use intra-family food transfers and collection of wild fruits.

Table 6: **Diversity of the food consumed by the household (Ordinal Probit Model)**

Category	Odds Ratio	Std. Err.	Z
Total Land Size Amount	1.166802	0.071468	2.52***
Meals Per Day Children	1.244155	0.129025	2.11**
Meals Per Day Adults	1.280242	0.190802	1.66*
Sex of Household Head	3.13097	0.703328	5.08***
Employment of Household Head	1.010906	0.03033	0.36
Age of Household Head	-0.98253	0.005623	-3.08***
Food Diversity Index	-0.085871	0.056866	-3.71***
Household Size	1.143098	0.053211	2.87***
Remittances Received	-0.824002	0.212387	-0.75
Access to Extension Service – Crops	3.650585	1.050734	4.5***
Harvested Staple Food	3.411445	1.146323	3.65***
Observations	2581		
Thresholds 1	-3.28384	0.788773	
Thresholds 2	4.99132	0.817008	

***P≤.01, ** ≤.05, * ≤.10

The gender of the household

Table 6 shows the proportional odds ratio for the gender of the household head and its implication on the vulnerability to poverty of the entire household given that all other variables in the model are held constant. The results reveal the odds of the household having a low vulnerability status as compared to a moderate and high vulnerability status are 3.13 times greater for households where the head of the household is male as compared to households where the head of the household is a female, ceteris paribus. The results indicate that the male headed households are less likely to be vulnerable to poverty as compared to female headed household. The data revealed that 42 percent of all household heads in Maphutseng are female-headed. In addition, 30 percent of all household heads in Maphutseng are widowed due to death of a male spouse while 6.5 percent have never married before. World Vision (2008) indicates that the high prevalence of female-headed in Maphutseng Area Development Programme is due to the death of the male household head from HIV/AIDS and other diseases (World Vision, 2008). Yamano and Jayne (2002) found that households losing a male adult are affected significantly by reduced

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land devoted to high-value-added crops. The effect of the loss of a male adult means that the coping strategies for such families in times of food insecurity are limited. This view is confirmed by Chapato and Jayne (2008) who investigated 5,420 rural households in Zambia, to measure the impacts of HIV/AIDS-related prime-age mortality on livelihoods. They concluded that the death of a male household head increases the vulnerability of the household since their key livelihood systems such as land and household property are usually seized in family disputes and unsettled debts like medical expenses. Land grabbing in family disputes was found to exacerbate the prevailing levels of vulnerability to poverty. In such cases women are considered to be minors and the other male relatives promise to be custodians of the land until the children of the widow reach adulthood.

Jama (2012) also found that in Maphutseng the gender of the household head is a key determinant in analyzing the adaptive capacity of the household to shocks on the key livelihood systems. This is because female household heads are more likely to be vulnerable to shock on their key livelihoods as compared to male headed households which have a diversified spectrum of coping strategies. Yamano and Jayne (2002) support the view that death of a male household head leads to low levels of crop production because female-headed households face low levels of crop production. The main reasons for this are: firstly a reduction in household size may exacerbate labour shortages, forcing households to cut back on land cultivated or switch to less labour intensive crops. Secondly, the death of an adult may also entail a loss of agricultural husbandry, management, and marketing knowledge, requiring changes in crop mix. Even in households that are able to attract new members, the skills of the new members who are likely to be older children may not match the skills of the deceased. Thirdly, crop mix and the intensity of input application may change because of cash constraints imposed on the households after incurring the loss of an adult member. Certain crops require greater use of capital such as purchasing farm inputs and rental of animal traction services. Fourthly, and especially in cases where the male household head dies, the widow and her dependents may have insecure land tenure rights and thus lose part or all of the land formerly cultivated by the family.

The number of meals per day for the household

Lesotho Vulnerability Assessment Committee LVAC (2008) demonstrated that the number of meals[4] a household has is a key determinant of a household's vulnerability because reduction of food consumed by adults indicated that household is experiencing food shortage. The results from Table 6 show that the number of meals per day of a household impacts the level of vulnerability. This is because the number of meals determines the severity of coping strategies. The results in Table 6 prove that as the number of meals a

[4] In this study a meal is referred to as an occasions in a day when a member of a household consumes a reasonably large amount of food.

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household has per day increases, the households' odds of being in a low vulnerability category increases. Table 7 confirms that in Maphutseng both adults and children consume an average of two and three meals per day respectively.

Table 7: Number of times household had something to eat the day before the census

Number of Meals per day	Adults Percentage	Children Percentage
0	0.4	3.9
1	8.5	2.8
2	50	21.7
3	37.9	50.7
4	3.2	21
Mean	2.35	2.82

One would expect them to have three square meals as is perceived normal in almost all societies. That shows greater levels of household vulnerability in the community. In the case of natural disasters, such as drought, many assets will be lost, specifically livestock succumbing to disease or starvation and sales of livestock. This disposal of all assets ensures current survival, but severely jeopardizes the future security and the livelihood system of the household. Questionably, the average number of meals taken by children is greater than by adults. This could be evidence of coping strategies being employed by the adults: reduction of food consumption when experiencing shock to their livelihood.

The size of the household

The results depicted in Table 6 indicate that as the size of the household increases by an additional member the household is likely to have a lower vulnerability as compared to both moderate vulnerability and high vulnerability. Literature on household size is not conclusive, some postulate that an increase in household size decreases vulnerability while others postulate that it increases vulnerability of the household to shocks on its key livelihood systems (see for example Regassa (2011) and Zerai1 and Gebreegziabher (2011). For instance, in some countries, it is generally understood that children participate in various social, cultural, religious, and economic activities. In traditional subsistence agrarian economy, particularly in patriarchal society like in most communities of Lesotho, children are considered as very instrumental economical resources of a family unit who generate income to the household. In addition, food crop production in the Maphutseng is relatively labour intensive, especially during weeding and harvesting operations providing an advantage to larger households. It is against this background that Regassa (2011) found that there is positive relationship between household size or number of children and the level of coping strategies used in a family. However,

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Zerai1 and Gebreegziabher (2011) tend to think otherwise stating that large households are more vulnerable to food insecurity because in most cases the dependents are usually unemployed or in school, thus increasing the demand in food and other household resources.

Access to extension services

The ordinal regression results presented in Table 6 indicate that having access to extension services increase chances of a household being in a low vulnerability as compared to both the moderate and high vulnerability category. Households with access to extension services are more likely to have higher yields as compared to households that do not have access to extension services. Hassan et al (2013) supports this view by indicating that extension services increase productivity by providing the communities with the following: farmer awareness, farmer knowledge through testing and experimenting; farmer adoption of climate-smart technologies or practices; changes in farmers' productivity. Access to crop extension services is critical in rural communities like Maphutseng because climate change is projected to affect global agriculture which millions of small holder farmers depend on, as their basic livelihoods. As a result farmers who have access to extension services are less sensitive to climate change due to the fact that extension service is needed in interpretation of weather data and evidence based scientific knowledge is effectively disseminated to farmers through climate information and support services to rural communities (Cherotich et al, 2012).

Total land size and use

As the total land that a household has for cropping increases by one hectare, the odds of that household being in low vulnerability as compared to being in both the moderate and high vulnerability category increase by 1.16 times. In the same way if the household had planted maize in one or more hectares the odds of the household being in the low vulnerability increase by 3.41 times as compared to house who planted less than one hectare of maize.

Conclusion

This study used an index assessment to investigate the level of vulnerability to poverty in Maphutseng and the results reveal that both chronic and acute poverty levels are widespread and severe in Maphutseng. The results also showed that level of vulnerability in the community changes with time. In 2009, 7 percent were highly vulnerable as compared to 91 percent who were moderately vulnerable and 2 percent who had a low vulnerability. The figures changed four years later with 14 percent being highly vulnerable because they are experiencing chronic poverty which lowers their adaptive capacity while 77.8 percent of households are moderately vulnerable. The moderately vulnerable households are the ones that face acute poverty and they declined by 13.2 percent with 5.4 joining household not experiencing poverty while the 7.8 percent shifting into chronic poverty.

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For agencies involved in social protection, there is a need to identify and map households which are highly vulnerable to poverty as potential beneficiaries. This study identifies them as households which are female headed because of loss of a productive male household and the fact that female headed households tend to be disadvantaged in terms of access to land, livestock, other assets, and extension services in Lesotho. Another contributing factor is that most female headed households in Mohale's Hoek have a higher dependency ratio in spite of the smaller average size of the household. In this study, we further reveal that households where the household head is of an elderly age are more vulnerable to poverty as compared to household where the household head is of a younger age. In addition, the households where the household members have at most two meals a day which will be mainly wild fruits and inter-family food transfers are identified as the most vulnerable, and those with limited land for cropping of staple foods. Contrary to popular belief, employment does not influence the level of vulnerability of a household in the context of rural Lesotho. This is because rural households in Lesotho depend mostly on the environment and natural resources as the main source of livelihood.

Implications

Understanding the spectrum of principal determinants of vulnerability improves the chances of designing appropriate and effective interventions for development relief. Moreover, it provides an opportunity for targeting the most deserving households, particularly in light of the current reduction in flow of aid from developed countries.

The results from this study highlighted the need to improve accessibility of extension services and promoting equitable distribution of land. Also crucial was the need for the Ministry of Agriculture and Food Security to develop appropriate strategies for promoting the utilization of available land so as to address food insecurity which is the main cause of vulnerability in Maphutseng.

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References

Birkmann, J. (2006). Measuring vulnerability to promote disaster-resilient societies: Conceptual frameworks and definitions. *Measuring vulnerability to natural hazards: Towards disaster resilient societies*, 9-54.

Brant, R (1990). Assessing Proportionality in the Proportional Odds Model for Ordinal Logitic Model, *Biometrics*, Vol 46 No. 4 (Dec, 1990), pp. 1171-1178.

Journal of Agricultural Extension
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http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae
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Chapato A and Jayne T S. 2008. Impact of AIDS-related mortality on farm household welfare in Zambia. *Economic Development and Cultural Change* 56: 327–374

Cherotich, V. K., O. Saidu, et al. (2012). "Access to climate change information and support services by the vulnerable groups in semi-arid Kenya for adaptive capacity development." *African Crop Science Journal* 20(2): 169-180.

Cochran*, W. G. (*1977), *Sampling Techniques,* Third Edition, New York: John Wiley

Department for Internal Development (DFID), (1999). *Sustainable Livelihoods Guidance Sheets*. Department for International Development, Natural Resources Policy and Advisory Department (UK).

Disaster Management Authoritry (2008) *Lesotho Vulnerability Assessment Committee Report for 2008,* Maseru, Lesotho.

Frankenberger, T. R., Mock, N., & Jere, P. (2005). Vulnerability Assessment Methodology Review Synthesis: The Southern Africa Development Community: Food, Agriculture and Natural Resources, Regional Vulnerability Assessment Committee (SADC-FANR RVAC).

Jama M N. (2003) *Determinants of Household Vulnerability among Rural Communities in Maphutseng Area Development Programme of Lesotho*. A dissertation submitted in fulfillment of the requirements of the Masters in Rural Development (MRDV) Degree, Centre for Rural Development and Poverty Alleviation, University of Venda.

Hassan F M, Imai, K D, Sato, T. (2013) *Impacts of Agricultural Extension on Crop Prodcuvity, Poverty and Vulnerability: Evidence from Uganda*. RIEB Discussion Papers, Kobe University

Lesotho Vulnerability Assessment Committee (LVAC) (2013) *The Lesotho Food Security and Vulnerability Monitoring Report 2013.* Government Printing Maseru.

Petty, C., and Seaman, J. (2004). A New Household Economy Method for Assessing Impact of Shocks. Field Exchange, 23, 10-12.

Regassa N (2011) Small holder farmers coping strategies to household food insecurity and hunger in Southern Ethiopia, Ethiopian *Journal of Environmental Studies and Management* Vol. 4 No.1 201.

World Vision (2008) *The Programme Provision Design Document Phase 1: Maphutsing Area Development Programm*e. Maseru, Lesotho.

Yamano, T and Jayne T S. (2005). *Workign-Age Adult Mortality and Primary School Attendance in Rural Kenya*. Economic Development and Cultural Change, University of Chicago Press, Vol (53).

Journal of Agricultural Extension
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http://journal.aesonnigeria.org
http://www.ajol.info/index.php/jae
Email: editorinchief@aesonnigeria.org

Zerai, B, and Zenebe G, 2011, 'Effect of Nonfarm Income on Household Food Security in Eastern Tigrai, Ethiopia: An Entitlement Approach', *Food Science and Quality Management*, 1:1-22.