The Republic of Sudan

Central Bureau of Statistics /
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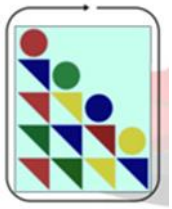
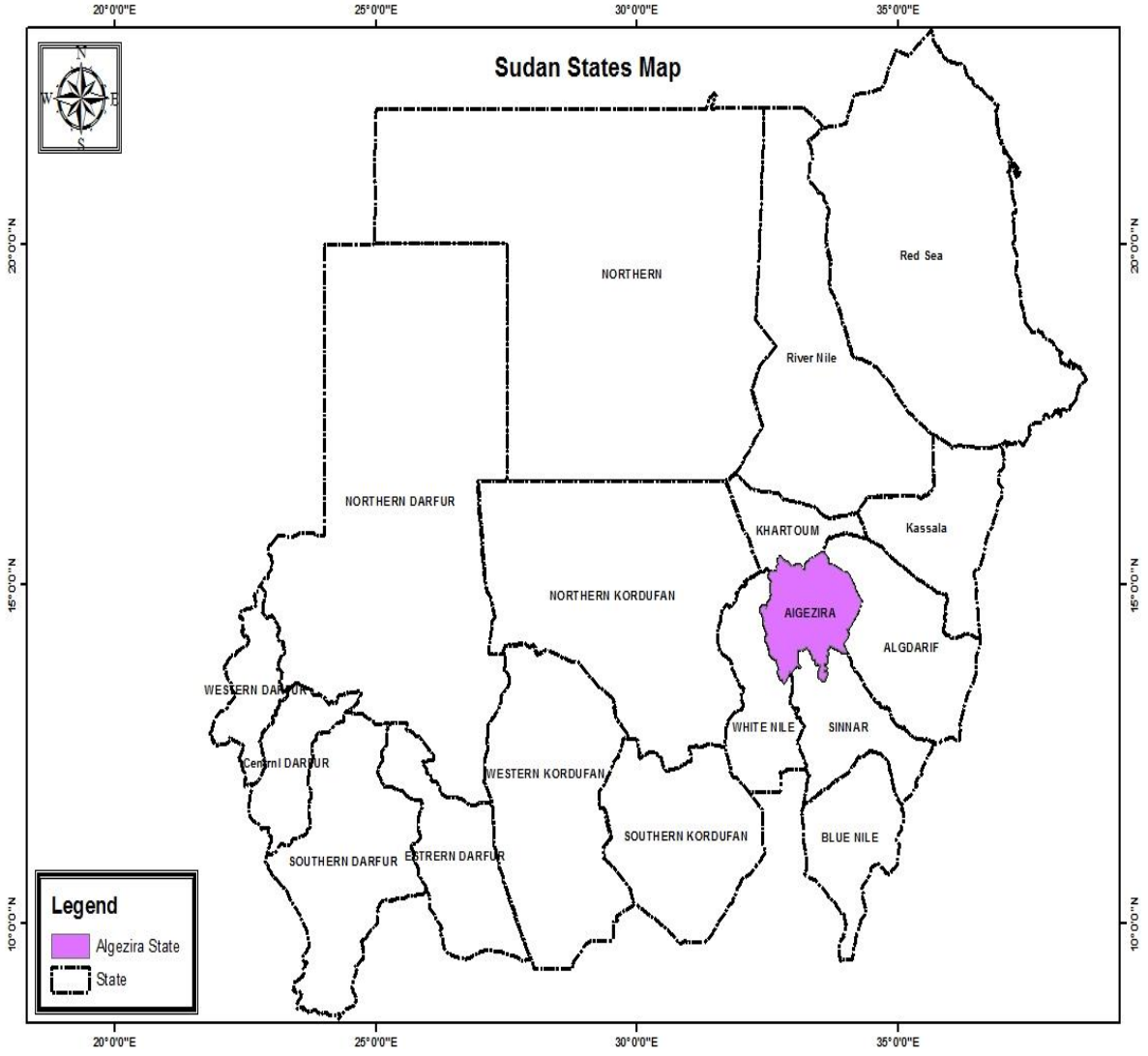
United Nations
Development Programme



Gezira State Pilot Multidimensional Poverty Survey, 2017

DRAFT FINAL REPORT

MAP OF SUDAN – GEZIRA STATE MAP INSCRIBED



CONTENTS

EXECUTIVE SUMMARY

This report presents Gezira State Pilot Multidimensional Poverty survey results. Based on the Oxford Poverty and Human Development Initiative (OPHI) methodology, a customized version of the Global OPHI called Alkire-Foster method , which allows for national or state customization , is used . The methodology uses three dimensions and teen indicators for the calculation of the MPI. The three dimensions are education, represented by two indicators; health, represented by two indicators too; and standard of living as the third dimension represented by six indicators. The two education indicators are school attendance and inability to read and write, while the two health indicators are nutrition and child mortality. The standard of living indicators are electricity, improved sanitation, safe drinking water, flooring, cooking fuel and assets ownership. Associated with each indicator is a minimum level of satisfaction, based on international consensus, called deprivation cut-off. These deprivation cut-offs were customized in the Alkire-Foster MPI methodology in which a household is considered multidimensionally deprived if it is deprived in $\geq$33.3% of the deprivation scores.

Based on the Alkire-Foster MPI methodology, survey data calculations showed that 22.4% (unweighted)and(24% weighted) of Gezira State households are multidimensionally deprived. A unique feature of the Gezira State MPI is that it can be decomposed into rural/urban divide as well as decomposition in terms of gender. In terms of geographical location, 10.8%, and 26.8% of the urban and rural households respectively are multidimensionally deprived .In terms of gender, 22.8% and 17.9% of the male headed households and female headed households are multidimensionally deprived. It is also shown that multidimensional deprivation increases with the increase in household size. Results show that child mortality cases are rare ranging between single children below 5 years of age death incidence in Al Gurashi Locality to 6 death incidences in Managil Locality.

Results also show that education contributes the most in terms of deprivation scores followed by health. It is worth noting that overall poverty performance based on Alkire-Foster methodology produced in this report and the poverty levels produced by the 2009 and 2014 household consumption and poverty surveys' methodologies s are not comparable. This is because different concepts and methodologies of poverty are used in these surveys.

Chapter 1. Introduction

It is a pleasure to undertake, for the first time, a state level pilot multidimensional survey in a joint endeavor with the UNDP, Sudan Office. The adoption of multidimensional poverty measurement, which is aligned with the sustainable development goals, has been widely recognized here in Sudan as an appropriate approach towards the implementation of development projects that add value to the development process strategies in the country. As such , Gezira State's Pilot Multidimensional Poverty Survey , which is intended to measure a multidimensional poverty index (MPI) for the State's is both a technically rigorous measure of poverty and a measure that has been designed to support current national and provincial policy priorities. It has been a genuine pleasure to collaborate with such a professional institution as the UNDP Sudan Office, and competent colleagues

In an era of globalization, UNDP Sudan's decision to measure and possibly use MPI, even be it at a state level as a threshold, showing the level and composition , and disaggregated by locality, gender, rural-urban and other levels of disaggregation, may be of interest to other states that are designing their MPI's using similar datasets.

Naturally, Gezira State's first MPI, does not contain all aspects relevant to poverty in the State due to data constraints .However, this powerful policy tool, still provides meaningful information and clear understanding of the poverty aspects that guide more effective policies and monitor progress. When data permit, it would definitely be strengthened to produce more value and wider impact .

This report does not only provide the levels of poverty, but also its composition by dimensions. From the perspective of policy design and implementation, the information ascertained from the MPI can be used to target poor people, deprived local communities and groups, allocate resources to produce the greatest policy impact possible and coordinate multi-sectoral policies, manage interventions and make evidence-based policy adjustments that may accelerate the impact. In this way, MPI is thought to complement monetary poverty both as a diagnostic tool and as a guide to effective policy.

It is our hope that other states are similarly approached by UNDP for the production of similar datasets that will help in the monitoring of the SDGs at the state level and for more down-to-earth interventions that would help improve our SDGs performance.

Since independence in 1956, Sudan has experienced diverse development paradigms, all are expected to contribute to the development of the country and welfare of the population. In such development exercises, different degrees of successes and failures have occurred in the courses which largely depend on the development philosophy adopted.

1.1 One-dimensional poverty measurement in the Sudan

As in many countries poverty in Sudan was traditionally measured by a monetary indicator. Using data from household budget surveys or household consumption expenditure surveys, monetary values of household consumption items, especially food items were calculated for surveyed households and compared against poverty lines below which individuals were deemed poor. Sudan had first experienced the measurement of poverty as such in 1968 when the country conducted its first Household Budget Survey. The exercise was repeated in 1978 when the Household Income and Expenditure Survey was conducted .During this period of the seventies and eighties of the last century, the issue of population welfare based on the welfare state doctrine of the Western

democracies has crept into the literature jargon of the development planners in the developing countries largely given impetus by the UN organizations and regional development agencies working in the field of economic development. Proxy variables are often used to measure population welfare and poverty . The poverty measurement exercises mentioned above used income and consumption expenditure as measurement instruments. Although economic development practioners are skeptic as to the use of income as a measure of welfare in the developing world, and they prefer the use of consumption expenditure instead, income is still being used by economists and development planners. The use is based on broadening the concept of income per se that meets the set purposes.

In 1996, Sudan had conducted Labor Force and Employment Survey, where data were collected on different ingredients that can be used as input for the measurement of poverty. Poverty lines were estimated based on the Cost of Basic Needs (Ravallion 1994); and tied to the minimum amount of Sudanese pounds needed to satisfy basic caloric requirements and basic needs for non-food goods and services .In this survey the concept of food calories was introduced for the first time in poverty measurement exercises in the Sudan. In 2009 Sudan dad conducted Expenditure Survey to be followed by a similar survey in 2014 although the two methodologies used differ.

The central element in the above mentioned surveys is that measurement was made on state level, and poverty was seen as a uni-dimensional phenomenon. With development of welfare paradigms and demographic changes that swept the developed as well as the developing countries, new levels of conceptualizing population welfare and poverty have been agreed upon. The World Summit in 1996 unanimously adopted that poverty should be handled as a multidimensional phenomenon. Since then, major and ambitious steps have been taken towards the measurement of multidimensional poverty phenomenon.

1.2 Multidimensional Poverty Measurement

Multidimensional poverty concept is simply based on the idea that poverty does not only depend on the deficiency in income or consumption expenditures. Rather, the concept of poverty encompasses, besides income or consumption, a wide range of deprivations which are embedded in different dimensions of human welfare.

Deprivation measurement depends on choosing the deprivation cutoffs, in order to identify the deprived (poor) and non-deprived (non-poor). A deprivation cutoff is a share of deprivations a person must have in order to be classified as deprived (poor). This is denoted as k (see Appendix 2) .A person is assigned a deprivation score according to his or her deprivations in the component indicators. The deprivation score of an individual is calculated by taking a weighted sum of the number of indicators in which the person is deprived; and it lies between 0 and 1. The score increases with the increase in the number of indicators in which a person is deprived till it reaches its maximum of 1 which means the person is deprived in all the indicators .A person who is not deprived in any indicator has a score of 0.

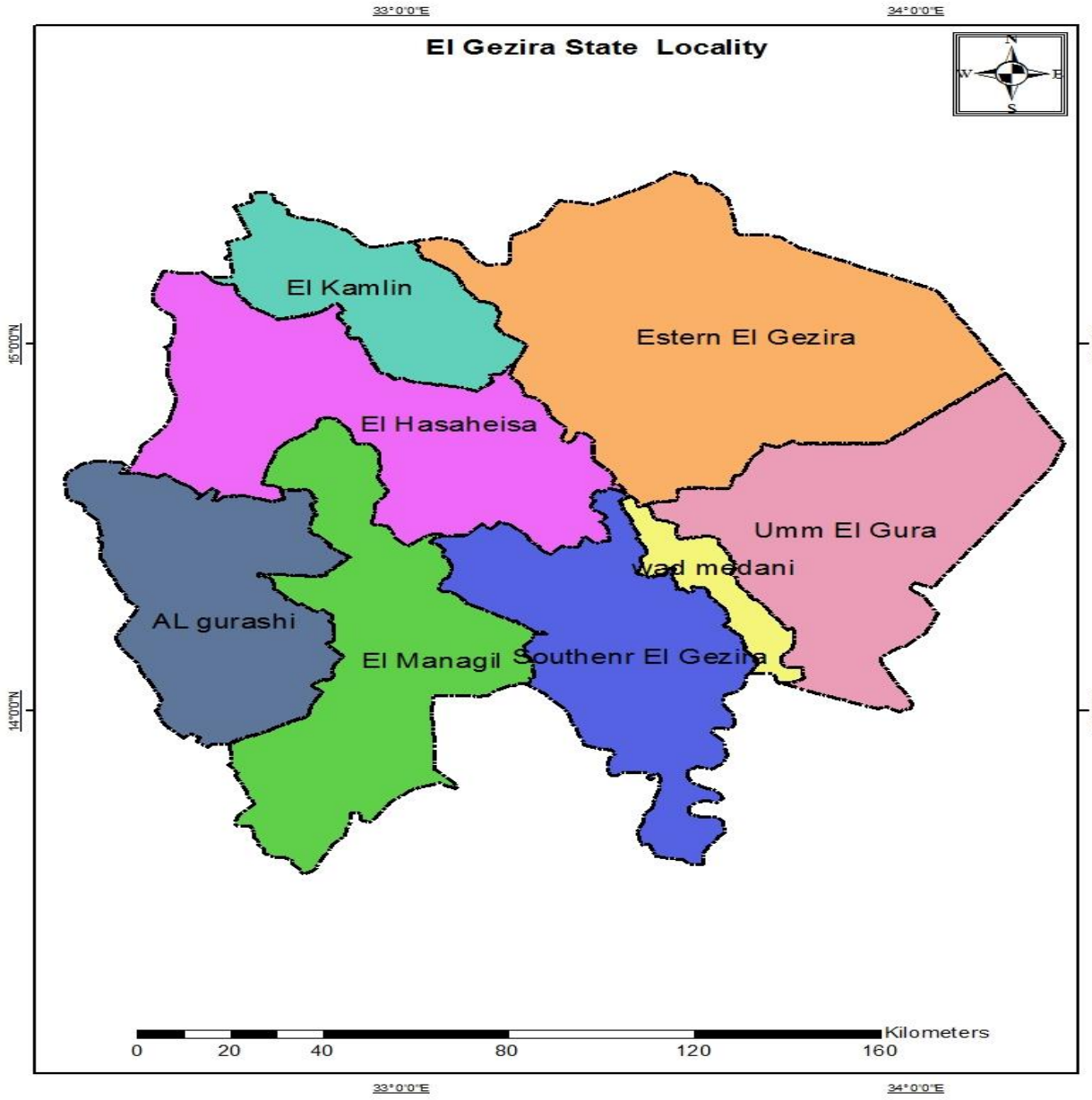
The present report uses the Alkire-Foster methodology of MPI. This method is a version of the Multidimensional Poverty Index (MPI) methodology developed by the Oxford Poverty and Human Development Initiative (OPHI) with the UNDP's Human Development Report Office, (Alkire and Santos 2010, UNDP 2010 and previous notes on methodology). The UNDP Global MPI is a measure of acute global poverty and belongs to the family of measures developed by Alkire and Foster (2007, 2011); Alkire, Foster, Seth, Santos, Roche and Ballon (2015). Theoretically, it is an application of the adjusted headcount, widely known in the uni-dimensional

or income/consumption-centered poverty headcount ratio. This methodology stipulates the determination of the unit of analysis (the household in this report) and the identification of the set of indicators and their cutoffs in which a person is considered deprived .The methodology summarizes the poverty profile in a weighted deprivation score. A person is considered multi-dimensionally poor if his/her deprivation score exceeds a pre-determined poverty cutoff. The MPI measures the **incidence** or headcount ratio of poverty H , which is the proportion of multi-dimensionally poor population, as well as the average **intensity (** A **)** of their poverty, i.e., the average proportion of indicators that describe the deprivation of the poor.

A more detailed presentation of the methodology can be accessed in Alkire and Santos (2013) and in Alkire and Foster (2011).

1.3 Purpose of Gezira State Pilot Multi-dimensional Poverty Survey for the Measurement of MPI

Gezira State was first chosen for the implementation of MPI survey for its population density and its rural/urban divide characteristics. It is also chosen because the State scored almost half (18.3%) of the national poverty Rate of (36.1%) in Sudan Household Consumption and Poverty Survey 2014, although it has significant health problem as ascertained from Sudan-MICS 2014 Survey. So the purpose of Gezira State MPI is to measure the multidimensional poverty intensity in terms of its components and correlates.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Chapter 2: Multidimensional Poverty Measurement

UNDP-OPHI Methodology and Alkire-Foster Methodology

This chapter presents the UNDP- OPHI methodology, as well as Alkire-Foster Methodology which provide the technical framework upon which this survey is based**.**

2.2 OPHI Methodology

The methodology used to measure multidimensional poverty is the internationally comparable measure of acute poverty widely known as the global MPI, developed by the Oxford Poverty and Human development Initiative (OPHI) at the University of Oxford together with the United Nations Development Programme Human Development Report Office. The MPI is a very versatile methodology that can be adjusted to incorporate alternative indicators, cutoffs and weights that might be appropriate in regional , national or sub-national (as our case here in this survey) contexts . Generally MPI complements the monetary measures of poverty by measuring the acute deprivations that people face simultaneously in the other dimensions which are seen to maintain dignified livelihood for an individual.

Currently there are two categories of MPI measures, these are:

1- Global Multidimensional Poverty Index. This is MPI calculated to reflect globally comparable data mostly at country levels. It compares the situation of countries s regards multidimensional poverty status.

2- Regional or national MPIs. These are measures created by using forms of the global method to better address local realities and needs subject to data availability. This is called Alkire-Foster method, which is used in this report.

The regional MPI adopted in this report, which is customized to meet Gezira State needs , uses three dimensions; namely, education, health and standard of living. Once the dimensions are stated, it is a prerequisite for the use of the dimension to determine its indicators. The Oxford global MPI uses two educational indicators, namely years of schooling and school attendance. For the purpose of Gezira State use , inability to read and write for adults of 18 years of age and over , is being used instead of years of schooling .School attendance is being kept for children of school age , i.e., below 18 years of age. The health dimension uses likewise two indicators, namely child mortality and nutrition. To cater for nutrition , stunting and wasting are used as proxies for malnutrition . The indicators of the standard of living dimension are electricity, improved sanitation, improved drinking water, flooring, cooking fuel and assets ownership. Each person is identified as deprived or non-deprived in each indicator whenever he/she fails to pass a specified deprivation cutoff. It is also worth noting that health and education indicators reflect achievements of all household members. This means each person's deprivation score in a household is constructed based on a weighted average of the total deprivations the household members experience using a nested weight structure,i.e, equal weight for the dimensions and equal weight for each indicator within a dimension. Finally, a poverty cutoff of 33.3% identifies a person as multi-dimensionally poor or multi-dimensionally non-poor whenever his/her poverty cutoff meets or exceeds, or otherwise, this threshold.

The selected deprivation cutoffs for each indicator in the standard of living dimension (except for the assets indicator of course) are based on the international consensus, as they follow the SDGs. This is explained as follows:

Water: A household has access to clean drinking water if the water source is any of the following: piped water, public tap, borehole or pump, protected well, protected spring or rainwater, and it is within a distance of 30 minutes' walking (round trip) . The distance condition is relaxed in this Gezira survey. If the household fails to meet these conditions, then it is considered deprived in access to safe drinking water.

Improved Sanitation. A Household has access to improved sanitation if it has any of these: Flush toilet, latrine, ventilated improved pit or composting toilet. The condition here is that these facilities are not shared. If the household does not satisfy these conditions, then it is considered deprived in sanitation.

Electricity .A household is considered deprived in electricity if it hs no access to electricity.

Flooring .Flooring material of bare soil , dung or sand categorizes a household as being deprived in flooring .

Cooking fuel. A household is considered deprived in cooking fuel if it uses dung, charcoal or wood for cooking

Assets. A household is considered deprived in an item if it does not own the following items: car, motorcycle/Rickshaw, bicycle, boat, luggage-carrying animal, and tractor.

2.3 Measurement Design

The Gezira State Pilot Multi-dimensional Poverty Survey (GSPMPS) utilizes the global MPI dimensions, indicators and cutoffs. The index is thus a weighted composite index of ten indicators in three dimensions. The choice of the indictors is determined by the State priorities and that the indicator belongs to the set of SDG indicator. This gives a wide opportunity for indicator choice within a dimension from a set of indicators comprising a dimension.

2.4 Unit of Identification and Analysis

The unit of identification refers to the entity that is being identified as poor on not poor; and this is usually a household or an individual within a household. In this report the unit of identification is the household, i.e., the household members' information is taken together. This allows for intra-household caring and sharing; for example educated household members read for others, or multiple household members being affected by a child's malnutrition. The purview also allows the measure to include indicators that are specific to certain age groups (for example school attendance).

The unit of analysis, on the other hand, which measures how the results are reported and analyzed, is the individual person. This means that, for instance, the headcount ratio is the percentage of people who are identified as poor.

2.5 Dimensions, Indicators, and Deprivation Cutoffs

The dimensions adopted for Gezira State Multi-dimensional Poverty Survey (GSPMPS) are chosen to align with the global Oxford MPI to secure a platform for the measurement methodology. The indicators, likewise, are chosen to be commensurate with the global Oxford MPI dimensions, and at the same time they are chosen to reflect the Country's and the State's context within data constraints. It is worth noting

here that global Oxford MPI uses years of schooling as an educational indicator, whereas in this report inability to read and write is used instead because it is perceived to reflect the strongest correlation with poverty. In fact wide discussion with experts determines the type of indicator that is most appropriate to be used in the construction of the MPI. Moreover, the global Oxford MPI uses flooring as a household indicator, whereas both flooring and roofing can be used, i.e., if a household is deprived in either flooring or roofing, the household is considered deprived in the housing indicator. Thus, there is a room for choice among a set of indicators within a specific dimension, depending only on the number of measurable indicators of the specific dimension.

The cutoffs, like the poverty line, in the uni-dimensional consumption or income poverty framework, determine those poor or non-poor. However, it is to be clearly stated that the cutoffs must be commensurate with the Oxford MPI methodology. Generally, the selection of the dimensions, indicators, deprivation cutoffs and weights, were agreed upon after wide discussion with experts within the CBS and academics as well as UNDP Sudan Office counterparts.

2.6 Weights and Deprivation Scores

The weights used in the (GSPMPS) assign one-third of the total weight to each of the three dimensions, education, health and standard of living. Each component indicator is equally weighted as in the global Oxford MPI. Health and education indicators each accrue one-sixth, and living standard indicators each accrue one-eighteenth. Accordingly, weights must add up to 100%.

The deprivation score is the sum of the weights of the indicators in which a person is deprived and shows the percentage of total deprivations that the person experiences.

2.7 MPI Poverty Cutoff

Alkire Foster measurement methodology uses a dual-cutoff strategy. It applies first a dimension-specific deprivation cutoff to each indicator. A Person is considered deprived in each indicator if the achievement of each indicator falls short of the specified deprivation cutoff.

For Gezira State Pilot Multidimensional Poverty Survey (GSPMPS) the main poverty cutoff is chosen to be at one-third of the indicators. In other words, a person who is deprived in $k \geq 33.33\%$ of the weighted indicators is identified as multi-dimensionally poor. Second, a single cross-dimensional poverty cutoff identifies whether each person is multi-dimensionally poor or not poor. A person is identified as poor if the weighted sum of his/her deprivations (his/her deprivation score) is exactly equal to or exceeds the poverty cutoff.

Detailed introduction to the methodology can be found in Appendix 2 .

Chapter 3: Data Analysis

This chapter provides detailed exposition of the (GSPMPS) results. We first present the estimated levels of the basic frequencies of the variables. These estimates, which show the individual deprivations, are appropriately weighted. Poor persons are identified here, as well as the poverty rate and intensity among them. Basically the chapter presents the level of multidimensional poverty in Gezira State, besides the headcount and intensity ratios. The results presented are disaggregated by household and individual characteristics as well as other characteristics as appropriate. The incidence of poverty (or poverty rate: the proportion of people identified as multidimensionally poor, H) and the intensity of poverty (or the average proportion of weighted indicators in which the poor are deprived, A) are shown along the overall MPI

Besides these core MPI indicators, the chapter presents, in sections, the contribution of each dimension and indicator in the overall MPI.

Section 3.1 Basic Frequencies

Table 3.1.0: Ability/ Inability to read and write and School Attendance.

Education			
		Count	%
Can (Name) read and write?	Yes	3400	83.9%
	No	653	16.1%
	Total	4053	100.0%
Is (name) currently Attending School?	Currently Attending	1358	33.5%
	Once Attended	2123	52.4%
	Never attended	569	14.0%
	Do not know	3	.1%
	Total	4053	100.0%

Table 3.1.0 shows education attainment with respect to ability/inability to read and write and school attendance. Currently attending, ascertained from school age children, is 33.5%. Once attended school is 52.4% which shows possibility of high school dropout.

Table 3.1.1 Type of Dwelling

Type of Dwelling			
		Count	%
Type of Dwelling	**Tent**	0	0.0%
	House made-up of mats of palm fronds	0	0.0%
	Tukul , Hut, mud House	3	0.4%

	Tukul, hut made-up of tree sticks	2	0.2%
	Apartment	0	0.0%
	villa	0	0.0%
	One-floor house made-up of mud	157	19.4%
	One-floor house made-up of bricks, concrete	639	78.8%
	Wooden house	2	0.2%
	Multi-story house	8	1.0%
	House under Construction	0	0.0%
	Total	811	100.0%

One-floor house made-up of bricks and concrete is the dominant type of dwelling. Other types are distributed as shown above in Table 3.1.1.Housing deprivation is evident which shows low standard of living .

Table 3.1.2 Type of Floor

Floor			
		Count	%
What is the Type of the floor?	**Ceramic**	102	12.6%
	Cemented floor	66	8.1%
	Block floor	121	14.9%
	earth	522	64.4%
	other	0	0.0%
	Total	811	100.0%

Type of floor in Gezira state dwelling units is mainly earth. Other types of dwelling floor contribute 35.6%. The dominant floor type captured here together with the type of dwelling shown in Table 3.1.1 depict the degree of deprivation experienced by the population as shown by these two indicators .

Figure 3.1.2 Type of Floor

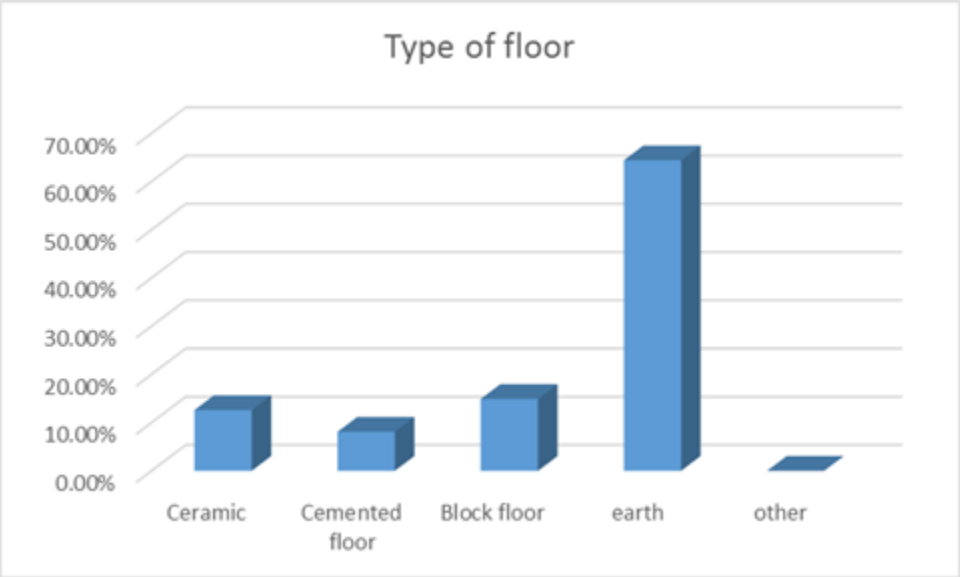


Table 3.1.3 Main Source of Drinking Water

Main Source of Drinking Water			
Source		Count	%
What is the main source of drinking water?	Purification station, house pipe extensions / outdoor water station	166	20.5%
	Water well with pipe extensions , outdoor water stations	495	61.0%
	Motorized water well with extensions / water stations	0	0.0%
	Motorized water well without extensions/ water stations	3	0.4%
	Water hand pump	44	5.4%
	Sand distillation with extensions network /outdoor water station	0	0.0%
	Surface water - well	0	0.0%
	Sud Without distillation / hafeer	0	0.0%
	Hafeer/Sud with Distillation	1	0.1%
	Turdah , Water pool, River without water purification facilities	99	12.2%
	Water spring/Naturally flowing water	0	0.0%
	Water transported by water tankers /Donkey-mounted Water barrels	3	0.4%
	Water from ground wells or rivers carried by water tankers	0	0.0%

	Total	811	100.0%

It is evident from Table 3.1.3 that most households use water wells with pipe extensions , outdoor water stations as the main source of drinking water(61%) , followed by purification stations , house pipe extensions , outdoor water stations(20.5%) . Other sources contribute very little or are not used at all .

Table 3.1.4 Type of Lightening

Lightening			
		Count	%
What is the main source of lightening?	None	45	5.5%
	Public electricity	746	92.0%
	Private electricity generator	1	0.1%
	Gas	2	0.2%
	Gas lamb	2	0.2%
	Kerosene lamb	15	1.8%
	Wood fire	0	0.0%
	Straw/hay	0	0.0%
	candle	0	0.0%
	Solar	0	0.0%
	Biogas	0	0.0%
	Total	811	100.0%

Table 3.1.4 shows that the majority of households (92%) use public electricity as a source of lightening. If there is no public electricity then there will be no source of lightening for the household.

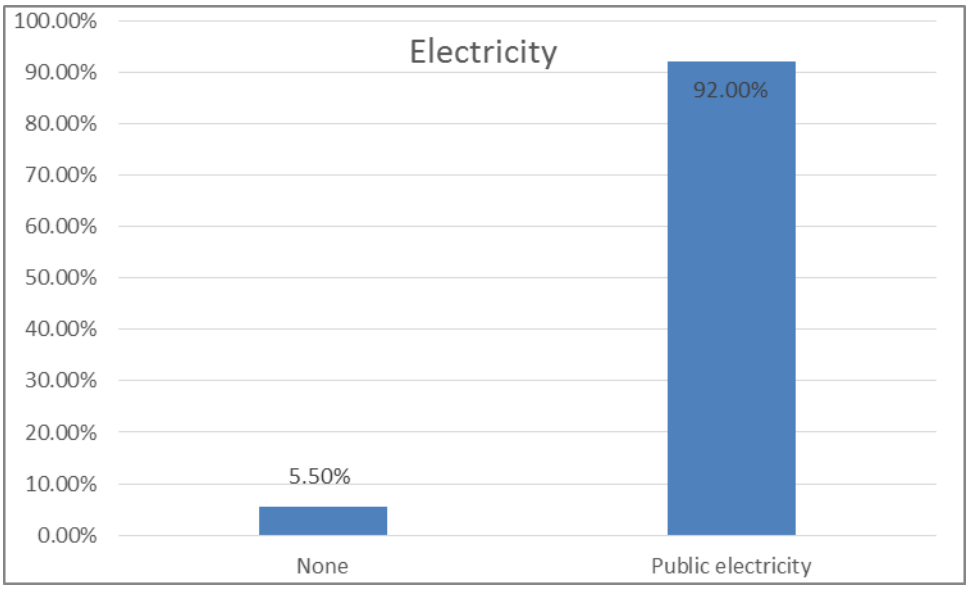


Table 3.1.5 Type of Cooking Fuel

Cooking Fuel			
		Count	%
What is the main source of cooking fuel?	Fire wood	57	7.0%
	Charcoal	51	6.3%
	Gas	683	84.2%
	Electricity	3	0.4%
	Kerosene	0	0.0%
	Cow rung	17	2.1%
	grass	0	0.0%
	biogas	0	0.0%
	None	0	0.0%
	Total	811	100.0%

Table 3.1.5 Shows that Gas is the dominant source of cooking fuel (84.2%) followed by fire wood and then charcoal. Electricity is used as the main or dominant source of lightening, but it is rarely used as a cooking fuel.

Figure 3.1.5 Type of Cooking Fuel

Table 3.1.6 Sanitation

Sanitation			
		#	%
What is the type of WC?	Private ordinary WC	451	55.6%
	Common ordinary WC	138	17.0%
	Private siphon WC	75	9.2%
	Common Private WC	10	1.2%
	Septic tank	14	1.7%
	Public water sanitation system	0	0.0%
	bucket	0	0.0%

Table 3.1.6 shows that the main type of sanitation is the private ordinary WC (55.6%) followed by common ordinary WC. It is interesting to see that no sanitation type is used by the households' accounts for 15.2% of the households. This is one of the reasons why Gezira State is being selected for the pilot survey for MPI.

Figure 3.1.6 Sanitation

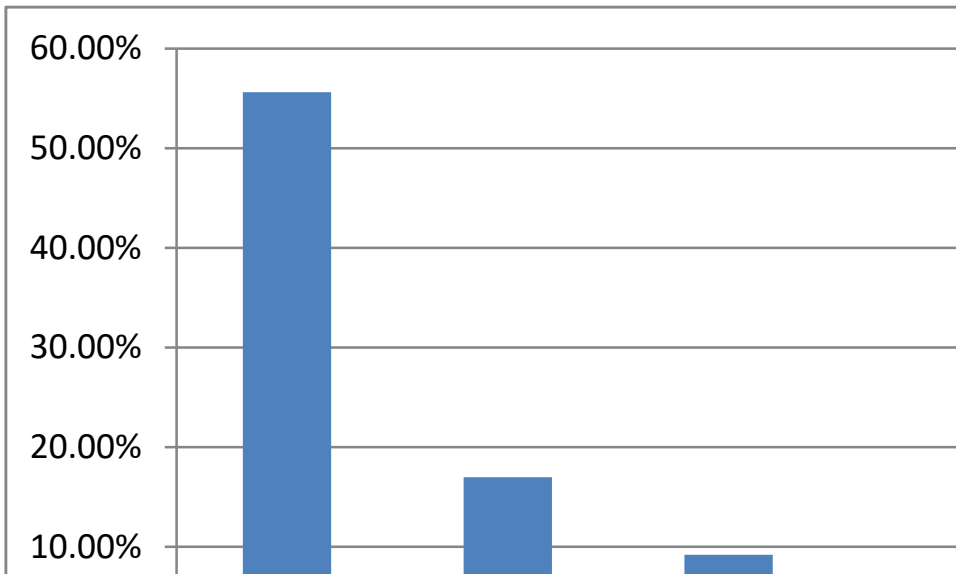


Figure 3.1.7 Household Assets

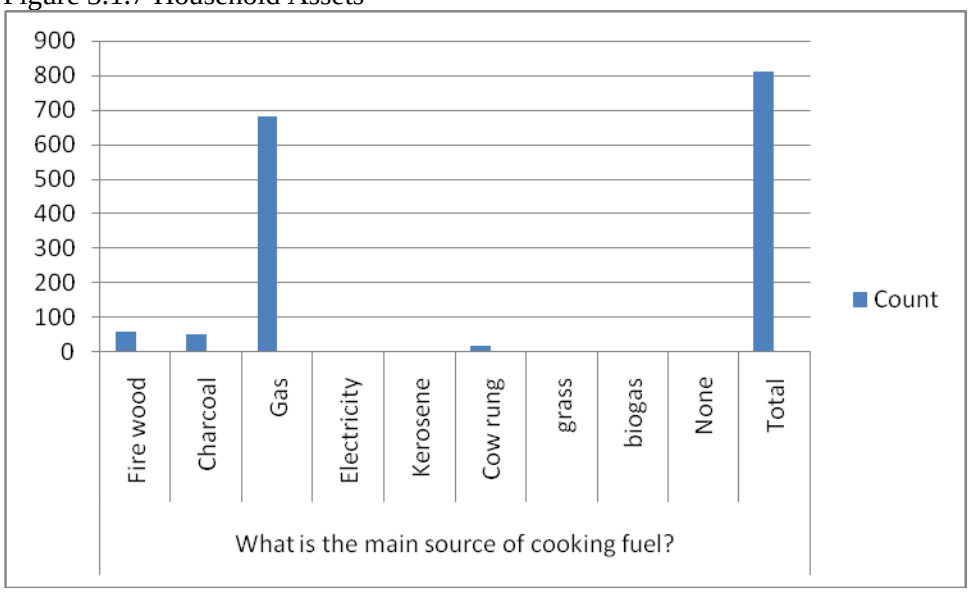


Table 3.1.8 House Tenure

House Tenure			
Type of house tenure		Number	%
What is the type of house tenure?	Own property	709	87.4%
	Rented	34	4.2%
	Allocated by job position	33	4.1%
	Gift	35	4.3%
	Total	811	100.0%

Table 3.1.8 shows that 87.4% of the households own their dwellings as their own property .Other types of tenure are almost the same in prevalence, ranging between 4.1% for the dwelling being allocated by virtue of job position to 4.3% for the dwellings being obtained as a gift.

Figure 3.1.8 House Tenure

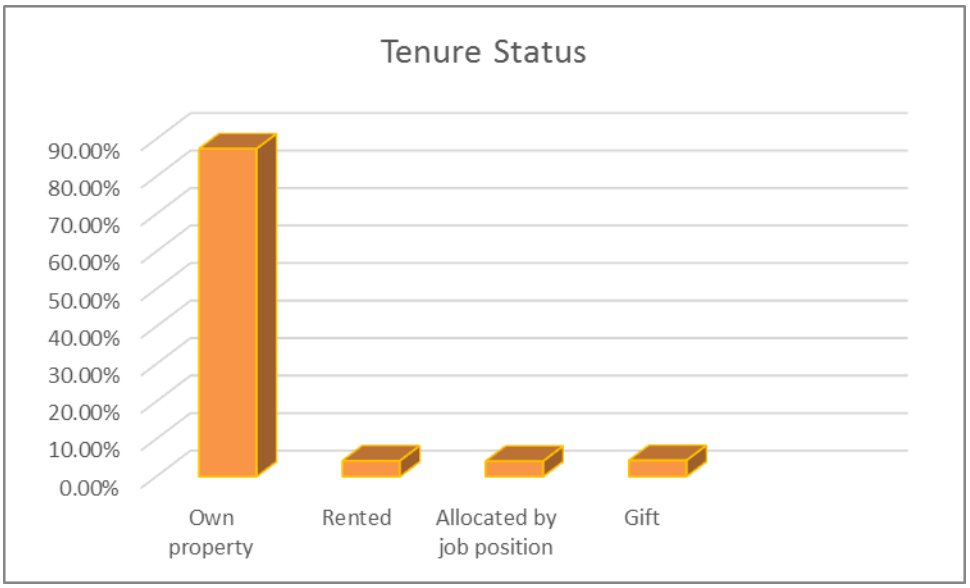
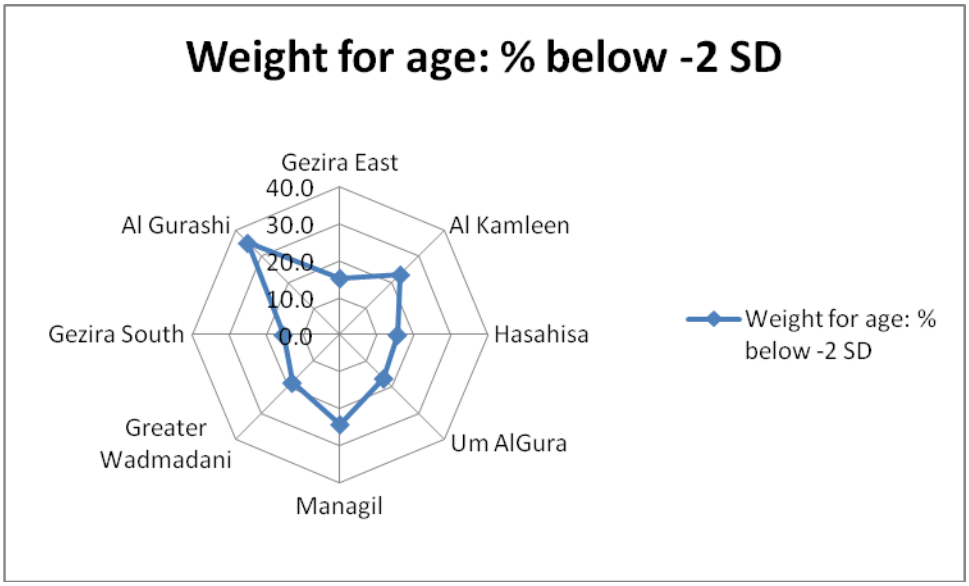


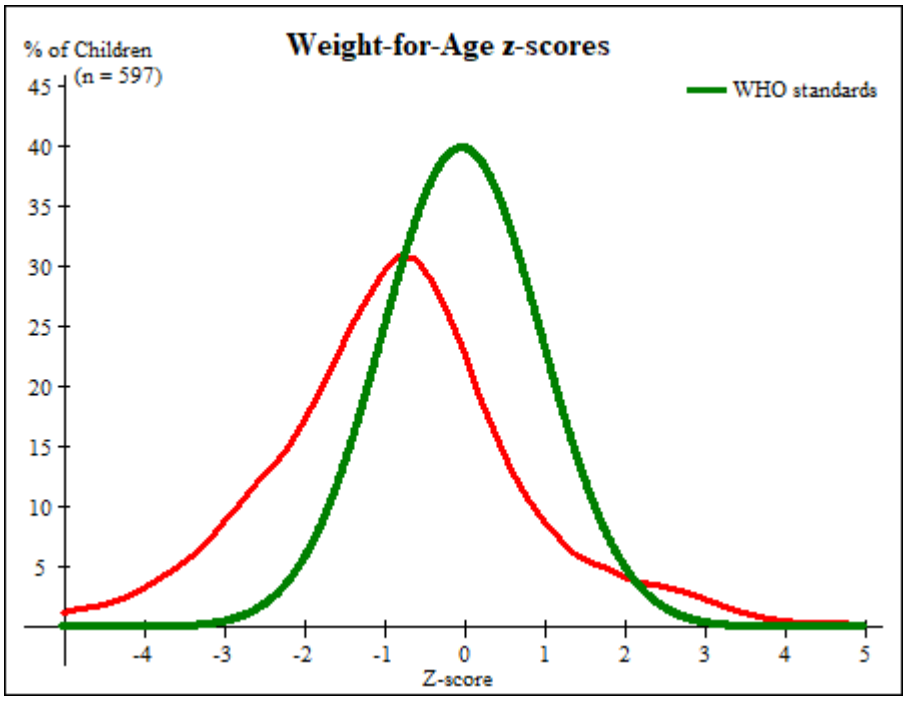
Table 3.1.10 : Child malnourishment
Percentage of under-five children who are severely or moderately undernourished, Gezira , 2017

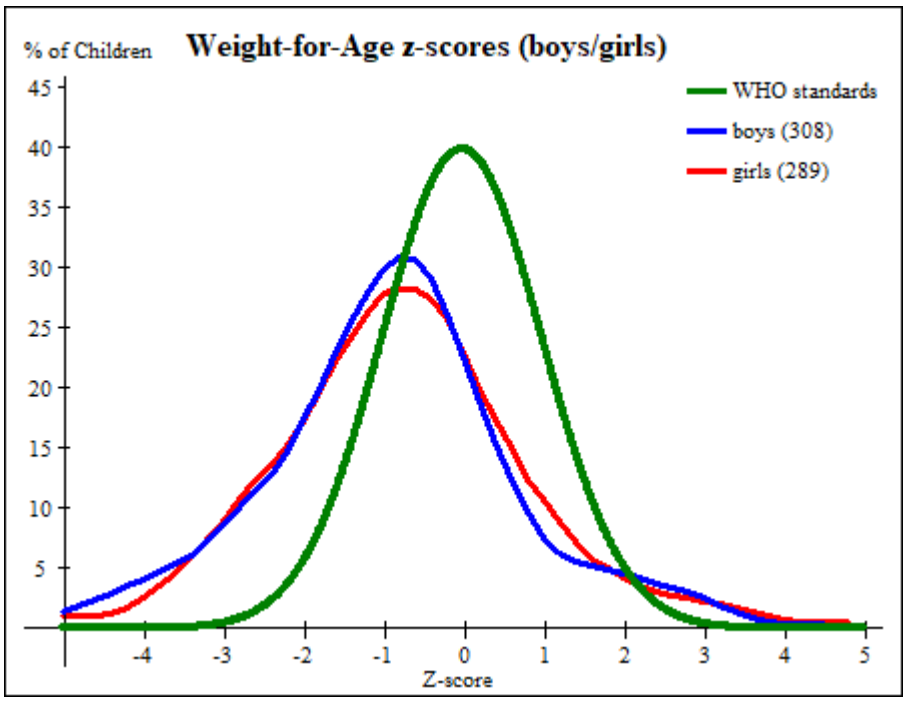
		Weight for age: % below -2 SD	Weight for age: % below -3 SD*	Height for age: % below -2 SD	Height for age: % below -3 SD**	Weight for height: % below -2 SD	Weight for height: % below -3 SD***	Weight for height: % above +2 SD
Locality	Gezira East	15.4	6.4	24.4	11.5	9.0	3.8	6.4
	Al Kamleen	23.1	12.8	38.5	16.7	12.8	5.1	2.6
	Hasahisa	15.5	6.0	13.1	6.0	20.2	10.7	8.3
	Um Al Gura	16.7	0.0	33.3	20.8	20.8	8.3	12.5
	Managil	24.2	7.4	49.5	26.3	9.5	3.2	11.6

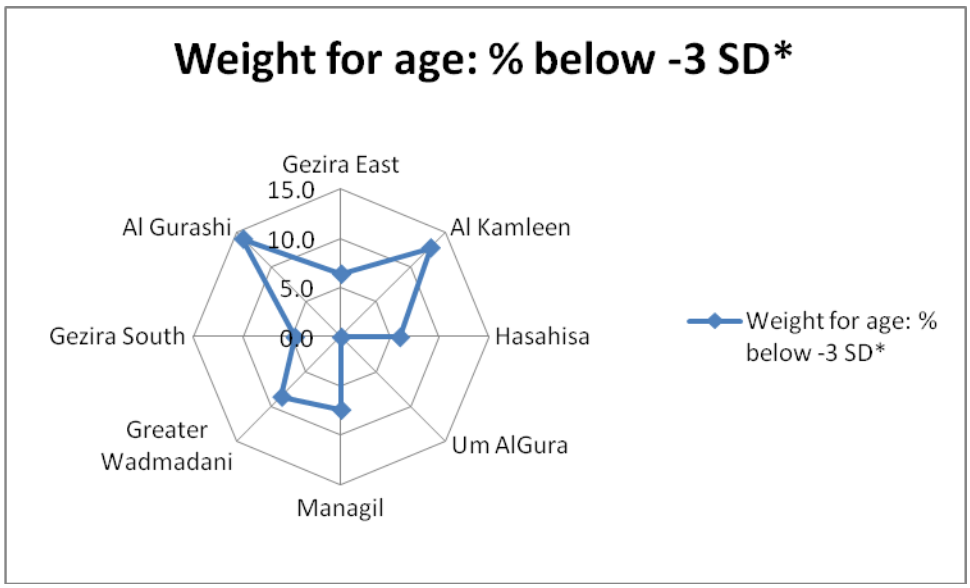
	Greater Wad Madani	18.3	8.5	25.6	15.9	19.5	8.5	8.5
	Gezira South	15.3	4.7	30.6	14.1	9.4	3.5	11.8
	AlGurashi	35.2	14.1	45.1	26.8	22.5	12.7	11.3
Age	0-5 months	1.8	1.8	5.5	3.6	21.8	12.7	12.7
	6-11 months	14.7	5.9	16.2	8.8	17.6	5.9	7.4
	12-17 months	9.3	5.6	40.7	20.4	13.0	5.6	14.8
	18-23 months	29.9	16.4	49.3	25.4	16.4	9.0	11.9
	24-35 months	25.2	8.4	35.5	23.4	10.3	6.5	5.6
	36-47 months	23.5	10.4	33.9	13.9	15.7	7.0	7.0
	48-59 months	25.2	6.1	36.6	18.3	13.0	3.8	8.4
child sex	female	20.1	8.0	32.2	17.0	15.9	7.3	8.7
	male	21.1	8.1	32.8	16.9	13.6	6.2	9.1

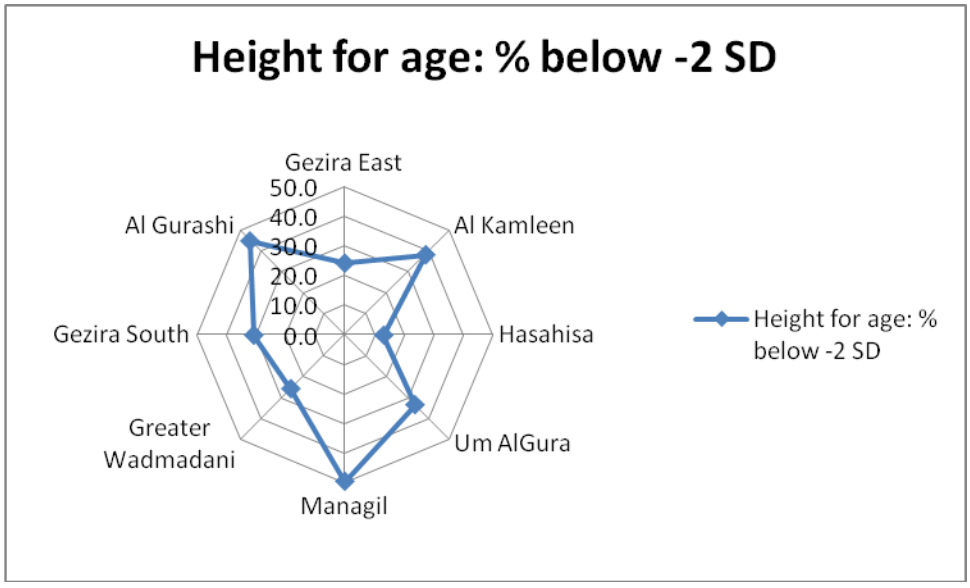
Table 3.1.10: Child Malnourishment shows the levels of stunting, wasting and underweight by locality, gender and age of the child. Disparities are evident across localities, gender and age .

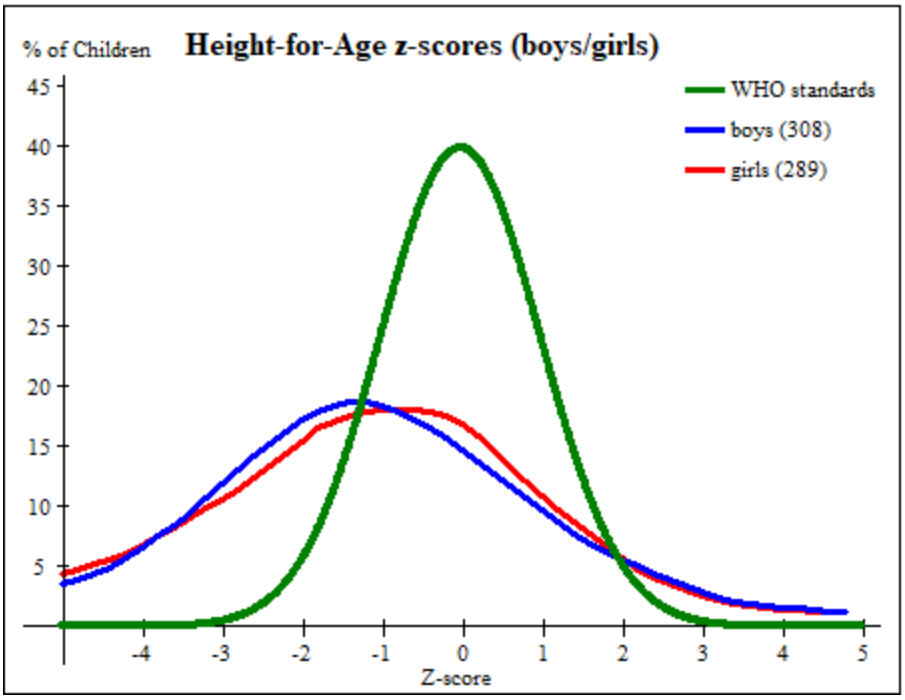


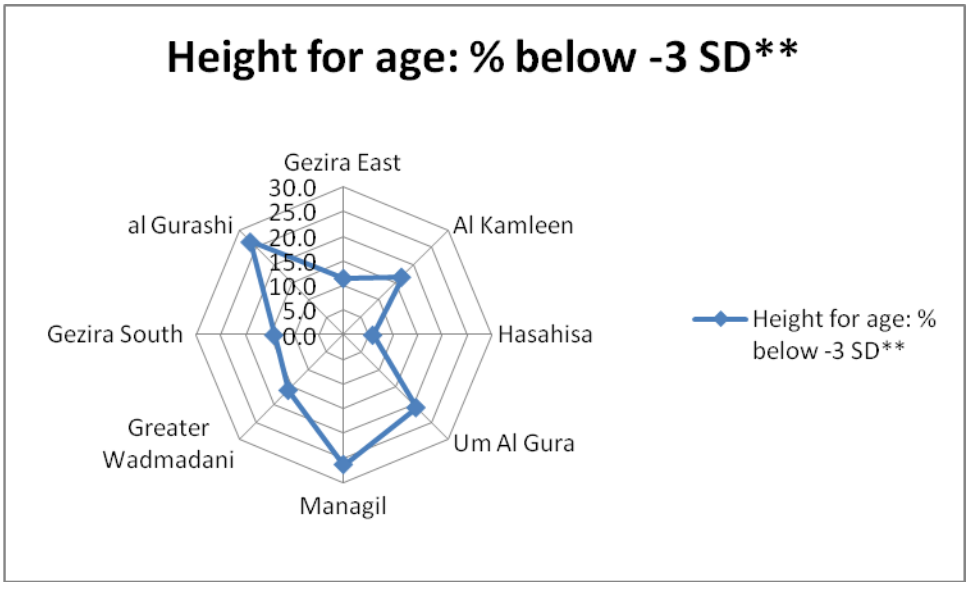

Weight-for-Age z-scores
% of Children
(n = 597)
WHO standards
45
40
35
30
25
20
15
10
5
-4
-3
-2
-1
0
1
2
3
4
5
Z-score

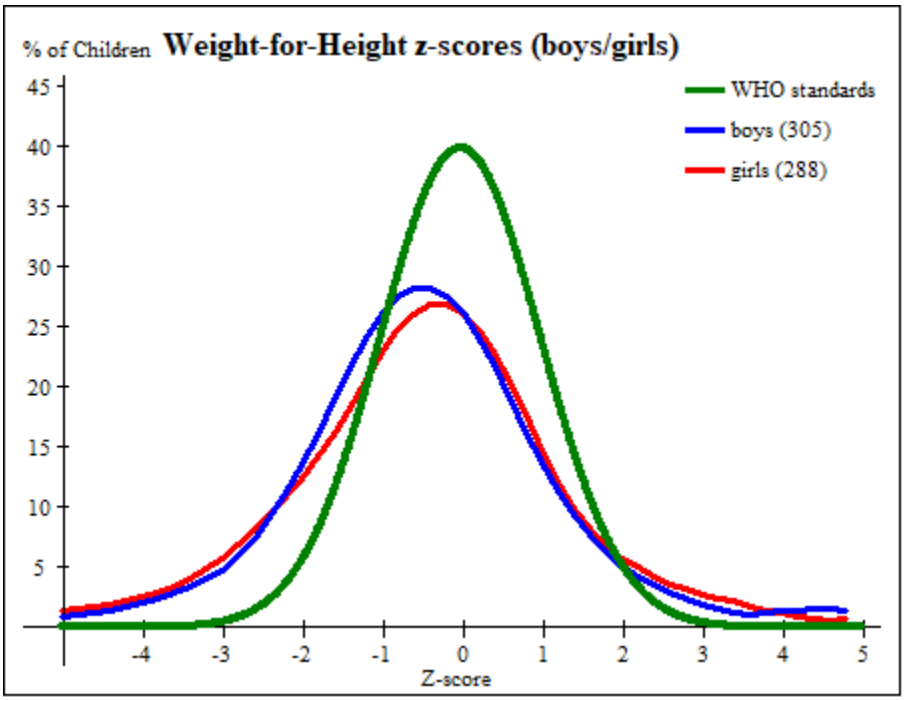

Weight-for-Age z-scores (boys/girls)
% of Children
WHO standards
boys (308)
girls (289)
45
40
35
30
25
20
15
10
5
-4
-3
-2
-1
0
1
2
3
4
5
Z-score

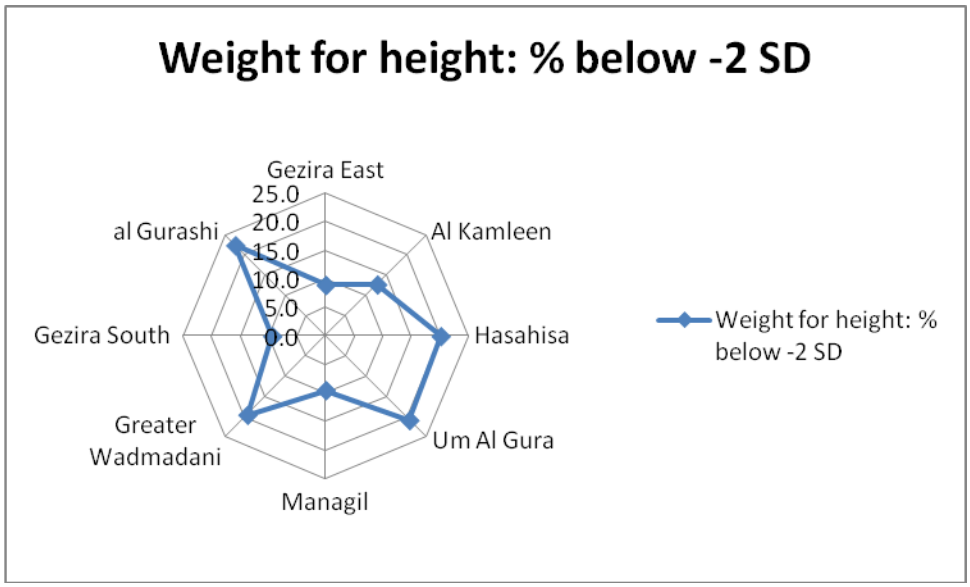

Weight for age: % below -3 SD*
Gezira East
15.0
10.0
5.0
0.0
Al Kamleen
Hasahisa
Um AlGura
Managil
Greater Wadmadani
Gezira South
Al Gurashi
Weight for age: % below -3 SD*

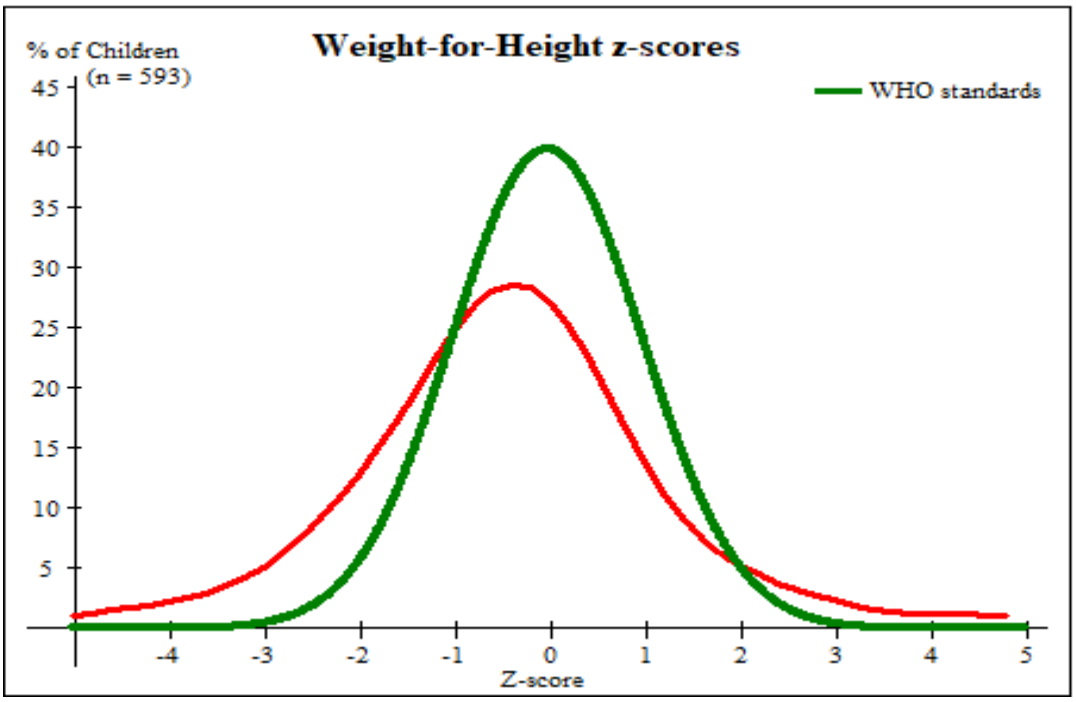

Height for age: % below -2 SD
Gezira East
50.0
40.0
30.0
20.0
10.0
0.0
Al Kamleen
Hasahisa
Um AlGura
Managil
Greater Wadmadani
Gezira South
Al Gurashi
Height for age: % below -2 SD

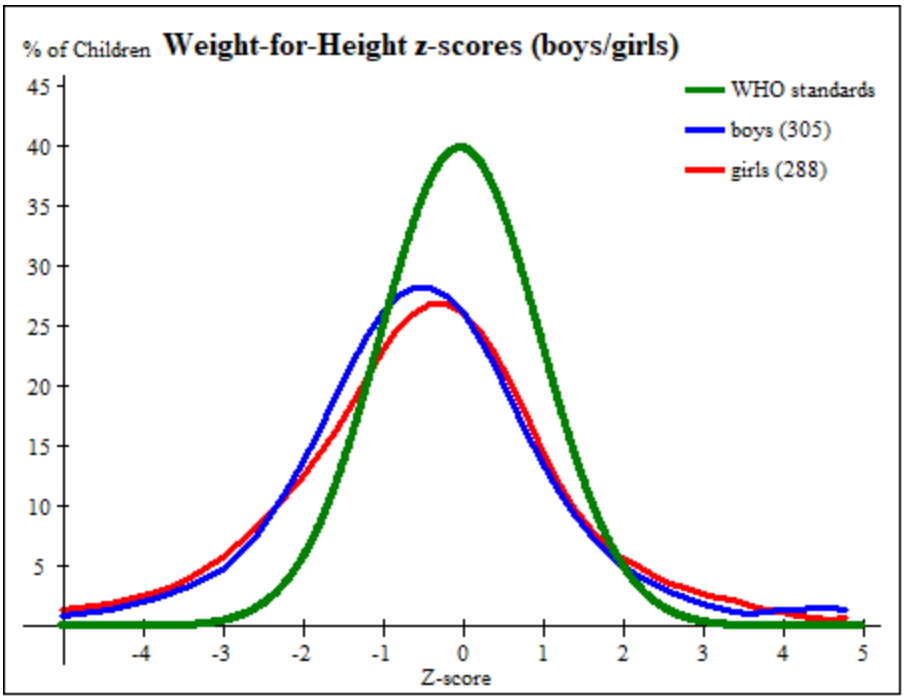

% of Children
Height-for-Age z-scores (boys/girls)
WHO standards
boys (308)
girls (289)
45
40
35
30
25
20
15
10
5
-4
-3
-2
-1
0
1
2
3
4
5
Z-score


Height for age: % below -3 SD**
Gezira East
Al Kamleen
Hasahisa
Um Al Gura
Managil
Greater Wadmadani
Gezira South
al Gurashi
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Height for age: % below -3 SD**


% of Children
Weight-for-Height z-scores (boys/girls)
WHO standards
boys (305)
girls (288)
45
40
35
30
25
20
15
10
5
-4
-3
-2
-1
0
1
2
3
4
5
Z-score


Weight for height: % below -2 SD
Gezira East
Al Kamleen
Hasahisa
Um Al Gura
Managil
Greater Wadmadani
Gezira South
al Gurashi
25.0
20.0
15.0
10.0
5.0
0.0
Weight for height: % below -2 SD


Weight-for-Height z-scores
% of Children
(n = 593)
WHO standards
45
40
35
30
25
20
15
10
5
-4
-3
-2
-1
0
1
2
3
4
5
Z-score


% of Children
Weight-for-Height z-scores (boys/girls)
WHO standards
boys (305)
girls (288)
45
40
35
30
25
20
15
10
5
-4
-3
-2
-1
0
1
2
3
4
5
Z-score

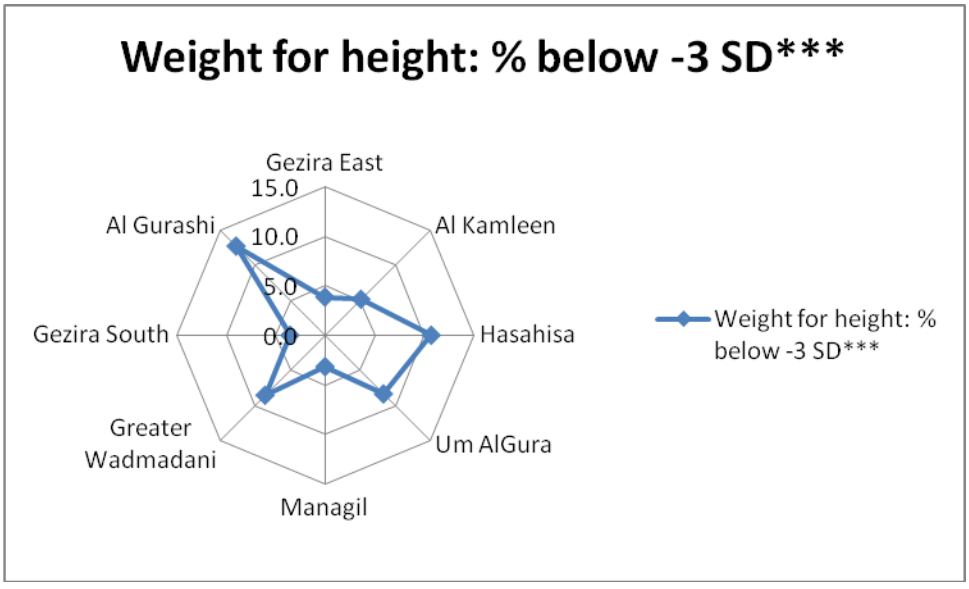

Weight for height: % below -3 SD***
Gezira East
15.0
10.0
5.0
0.0
Al Kamleen
Hasahisa
Um AlGura
Managil
Greater Wadmadani
Gezira South
Al Gurashi
Weight for height: % below -3 SD***

Table 3.1.11 : Child malnourishment by Household Sex, Age and Capacity to Read and Write.				
		children Nutritional Status		
		Not malnourished	Malnourished	Total
Sex of the head of Household	male	85.2%	14.8%	100.0%
	female	92.5%	7.5%	100.0%
Age Group of Head of Household	15 - 19	100.0%	0.0%	100.0%
	20 - 24	100.0%	0.0%	100.0%
	25 - 29	80.8%	19.2%	100.0%
	30 - 34	71.2%	28.8%	100.0%
	35 - 39	70.2%	29.8%	100.0%
	40 - 44	73.5%	26.5%	100.0%
	45 - 49	90.7%	9.3%	100.0%
	50 - 54	90.1%	9.9%	100.0%
	55 - 59	97.2%	2.8%	100.0%
	60 - 64	91.8%	8.2%	100.0%
	65+	94.7%	5.3%	100.0%
Ability to read / write	yes	87.1%	12.9%	100.0%
	no	80.1%	19.9%	100.0%

Table 3.1.11 shows the malnourishment with respect to household sex, age and ability/inability to read and write. It is evident that malnourishment is the highest among male headed households, and households in the wider age group 25-44 years. The latter result may be attributed to unemployment. Inability to read and write pushes households toward poverty due to capability failure.

Table 3.1.12 : Multidimensional Deprivation(poverty) Status by Locality ,Geographical Location and Household Size			
		Deprivation(poverty) Status	
		Not Deprived (non-poor)	Deprived (poor)
		%	%
Gezira 8 Localities	Gezira 8 Localities	77.6%	22.4%
Geographical Location	Urban	89.2%	10.8%
	Rural	73.2%	26.8%
Locality	Eastern Algazira	91.4%	8.6%
	Alkamleen	65.1%	34.9%
	Alhasahisa	84.2%	15.8%
	Um Algura	87.5%	12.5%
	Almanagil	51.3%	48.7%
	Greater Wadmadani	88.9%	11.1%
	Southern Algazira	92.9%	7.1%
	Algurashi	56.7%	43.3%
Household size	1 - 3	81.3%	18.7%
	4 - 6	78.6%	21.4%
	7 - 9	77.8%	22.2%
	10 and above	63.2%	36.8%

Table 3.1.12 shows that multidimensional deprivation increases with the increase in household size. This is expected as an individual in a household shares the household's deprivation scores and hence increases the headcount ration.

Table 3.1.13 Deprived Household Heads Classified by Gender, Age and Educational Attainment

		Deprivation Status		
		Headcount Not Deprived	Headcount Deprived	Total
Gezira 8 Localities	Gezira 8 Localities	77.6	22.4	100.0
Sex of head of household	Male	77.2	22.8	100.0
	Female	82.1	17.9	100.0
Age group	15 - 19	100.0	0.0	100.0
	20 - 24	100.0	0.0	100.0
	25 - 29	65.4	34.6	100.0
	30 - 34	73.1	26.9	100.0
	35 - 39	66.0	34.0	100.0
	40 - 44	68.1	31.9	100.0
	45 - 49	82.4	17.6	100.0
	50 - 54	79.2	20.8	100.0
	55 - 59	94.4	5.6	100.0
	60 - 64	82.4	17.6	100.0
	65+	78.7	21.3	100.0
Educational Attainment	Currently attending school	87.5	12.5	100.0
	Ever attended	84.2	15.8	100.0
	Never Attended	45.3	54.7	100.0
	Do not know	100.0	0.0	100.0

Table 3.1.13 above shows that although poverty or deprivation is higher among male headed households, there are irregularities in deprivation levels in terms of age groups. As regards education, individuals who never attended school have the highest level of deprivation. This is expected because of their low human capital attainment.

Table 3.1.14 : headcount ratios and Indicator contribution to total multidimensional poverty Headcount Ratio				
Dimensions	Indicators	Headcount Ratio	Weight	Contribution to total Headcount Ratio
Education	Adult in a household >=18 years of age who cannot read and write	0.2	1/6	0.27
	Child School Attendance	0.12	1/6	0.17
Health	Nutrition	0.11	1/6	0.15
	Mortality	0.01	1/6	0.03
Living Standards	Electricity	0.07	1/18	0.04
	Water	0.14	1/18	0.06

	Sanitation	0.16	1/18	0.07
	Floor	0.21	1/18	0.11
	Cooking Fuel	0.08	1/18	0.05
	Assets	0.11	1/18	0.05

Multidimensional poverty can be computed as the weighted sum of the weighted headcount ratios. The Table above shows the contribution of each indicator to total headcount ratio. Each individual of 18 years of age or above in a household with less than 5 years of schooling is considered deprived. In addition, each child of school years of age who is not currently attending school is considered deprived. The contribution of each indicator is shown in the table above.
As regards health indicators, the indicators used for analysis are nutrition indicators (stunting and wasting using anthropometric measurements with standard WHO cutoff points) in addition to under 5 child mortality. A household which has an under five child dead is considered deprived in that indicator. It needs to be noted that although floor headcount ratio ranking is the highest among the indicator ratios, its contribution to total headcount ratio is commensurate with its headcount ratio ranking, because of its weight(see Appendix 2) .

Table 3.1.15: Household Assets

Asset ownership		Count	%
Car	No	711	87.70%
	Yes	100	12.30%
Motorcycle/Rickshaw	No	778	95.90%
	Yes	33	4.10%
Bicycle	No	759	93.60%
	Yes	52	6.40%
Boat	No	811	100.00%
	Yes	0	0.00%
Luggage carrying animal	No	674	83.10%
	Yes	137	16.90%
Tractor	No	802	98.90%
	Yes	9	1.10%
	Total	811	100.00%

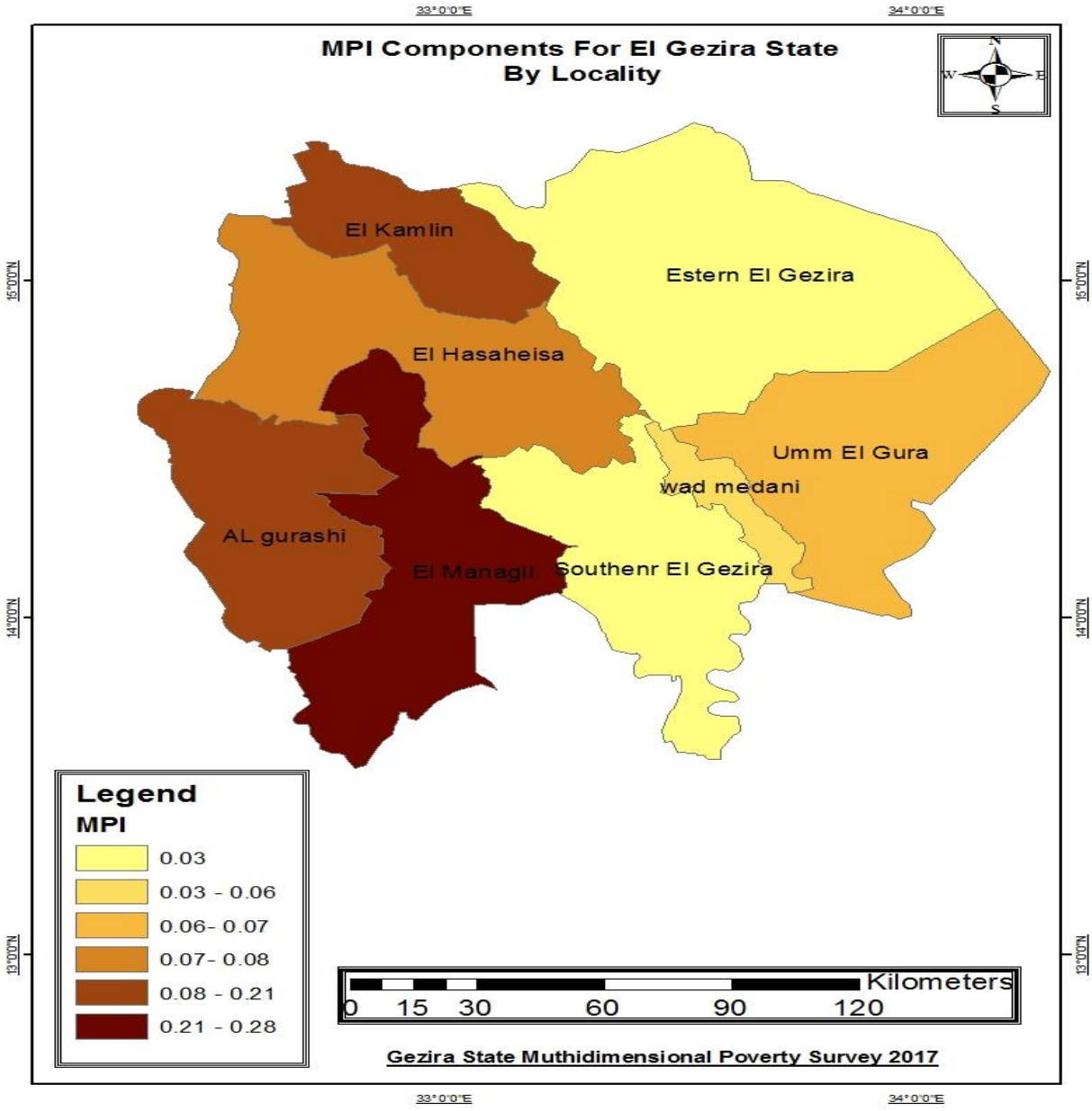
Table 3.1.15 above shows household's ownership or otherwise of households assets of car, Motorcycle/Rickshaw, bicycle, boat, luggage-carrying animal, and tractor. A household which admits ownership of the particular asset, i.e, says yes, is not considered deprived in the said asset, otherwise it is considered as deprived.

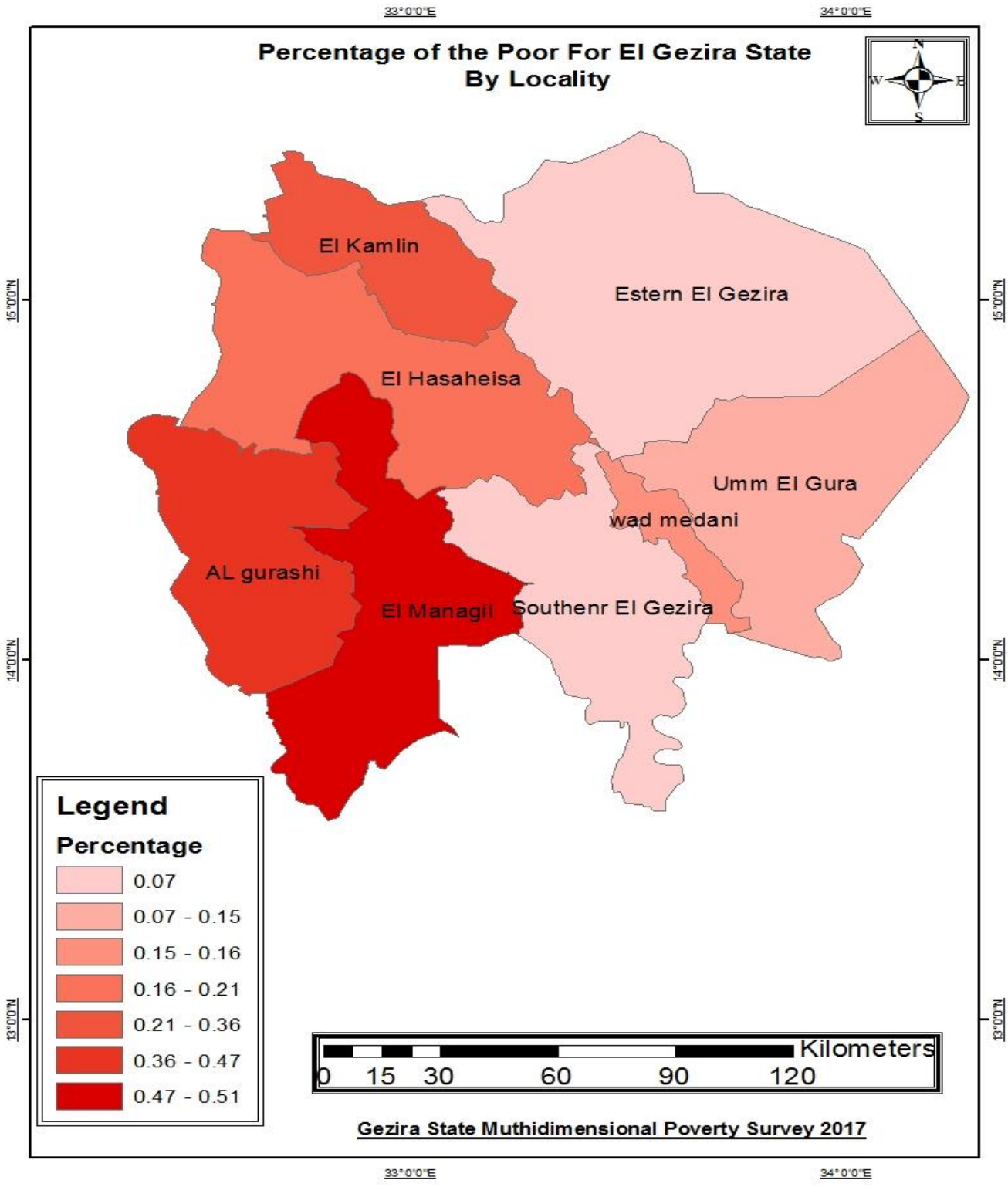
Section 3.2 Multidimensional Poverty Status in Gezira State: Indicators and Indices

TABLE 3.2.0 Incidences, Intensity, and Multidimensional Poverty Index (MPI),

MPI by Locality				
		MPI	Headcount ratio(H)	Intensity of poverty(A)
Locality	Eastern Algazira	.03	.07	.43
	Alkamleen	.20	.36	.55
	Alhasahisa	.08	.20	.42
	Um Algura	.07	.15	.47
	Almanagil	.28	.50	.56
	Greater Wadmadani	.06	.16	.38
	Southern Algazira	.03	.07	.36
	Algurashi	.21	.47	.44
Gezira State		0.12	0.24	0.48

Table 3.2 shows the MPI levels by locality, as well as the multidimensional headcount ratio and the intensity of the multidimensional deprivation experienced by multidimensionally deprived individuals. The wide disparity in MPI scoring and headcount ratios among localities is evident .The deprivation intensity ranges between 36% in Southern Algezira to 56% in Managil Locality as the most hit locality in terms of both headcount ratio and intensity of deprivation.


MPI Components For El Gezira State
By Locality
33°0'0"E
34°0'0"E
15°0'0"N
14°0'0"N
13°0'0"N
N
W
E
S
El Kamlin
Estern El Gezira
El Hasaheisa
Umm El Gura
wad medani
AL gurashi
El Managil
Southenr El Gezira
Legend
MPI
0.03
0.03 - 0.06
0.06- 0.07
0.07- 0.08
0.08 - 0.21
0.21 - 0.28
0 15 30 60 90 120
Kilometers
Gezira State Muthidimensional Poverty Survey 2017


33°0'0"E
34°0'0"E
Percentage of the Poor For El Gezira State
By Locality
N
W
E
S
El Kamlin
Estern El Gezira
El Hasaheisa
Umm El Gura
wad medani
AL gurashi
El Managil
Southenr El Gezira
15°0'0"N
14°0'0"N
13°0'0"N
Legend
Percentage
0.07
0.07 - 0.15
0.15 - 0.16
0.16 - 0.21
0.21 - 0.36
0.36 - 0.47
0.47 - 0.51
Kilometers
0 15 30 60 90 120
Gezira State Muthidimensional Poverty Survey 2017

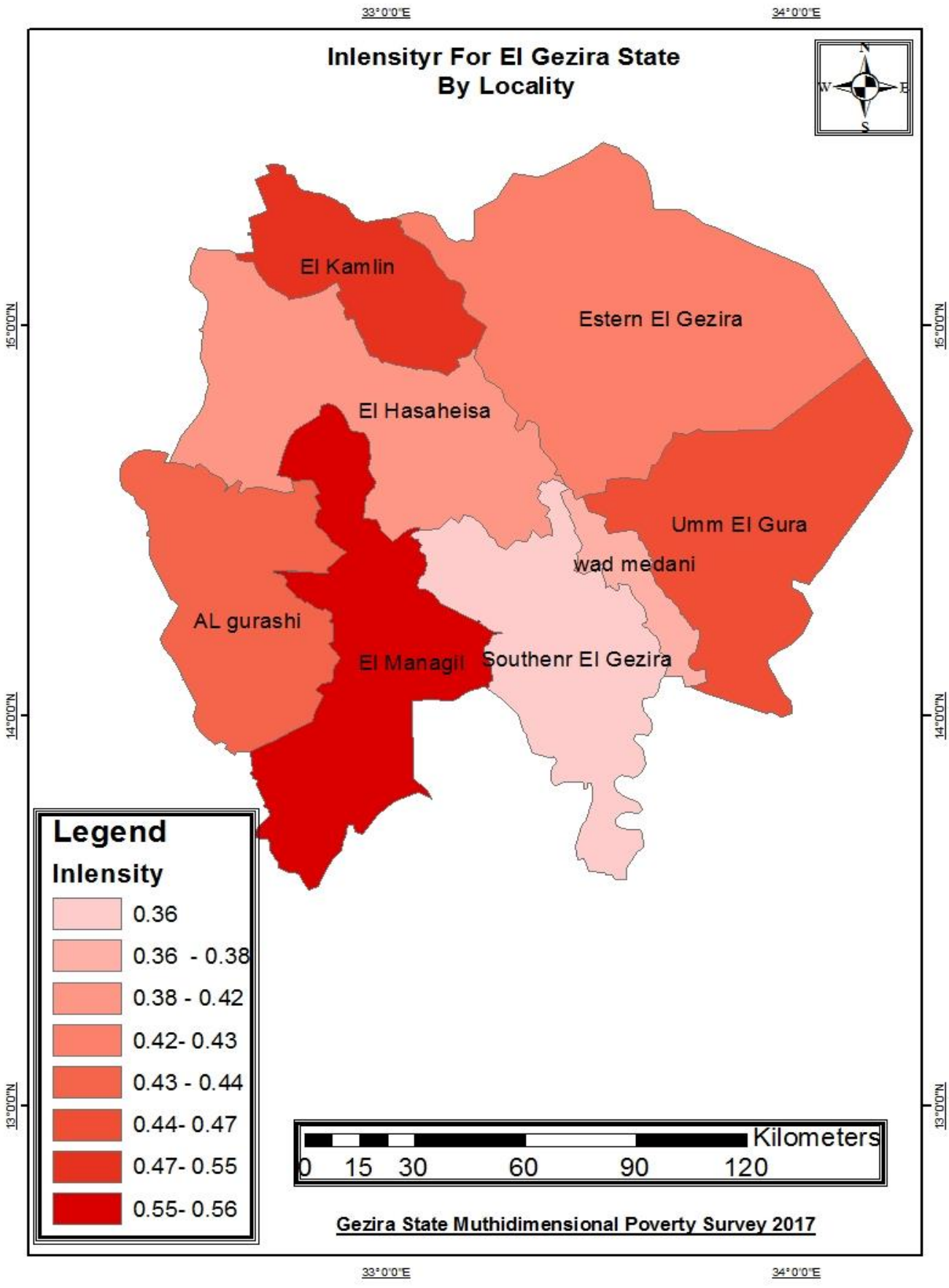

Inlensityr For El Gezira State
By Locality
N
W
E
S
33°0'0"E
34°0'0"E
15°0'0"N
14°0'0"N
13°0'0"N
El Kamlin
Estern El Gezira
El Hasaheisa
Umm El Gura
wad medani
AL gurashi
El Managil
Southenr El Gezira
Legend
Inlensity
0.36
0.36 - 0.38
0.38 - 0.42
0.42- 0.43
0.43 - 0.44
0.44- 0.47
0.47- 0.55
0.55- 0.56
Kilometers
0 15 30 60 90 120
Gezira State Muthidimensional Poverty Survey 2017

Figure 3.2.0 Household MPI by Locality

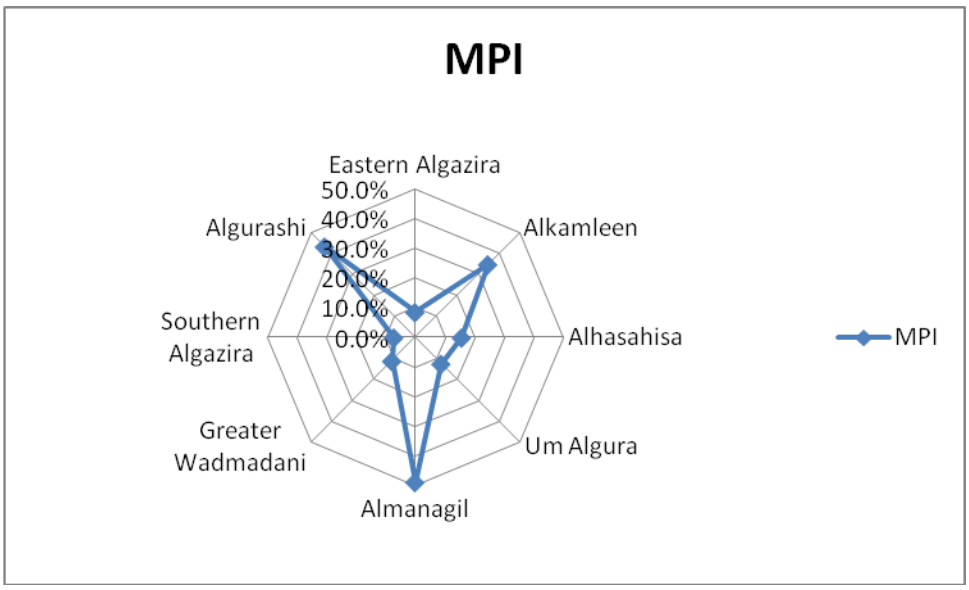


Table 3.2.1: Deprivation (Poverty) Incidence by Rural/Urban Divide

	Location	Population Share (%)	Headcount
Cutoff ≥33.3% of k	Rural	72.7%	10.8%
	Urban	27.3%	26.8%

Source: (GSPMPS), 2017/18

Table 3.2.1 shows the incidence, intensity and MPI by Rural/Urban divide. For information on the Cutoff ≥33.3% of k see Appendix 2. Urban MPI is more than twice the level in the rural areas .The population share seems to have no salient effect on the level of MPI attained .

FIGURE 3.2.1 Distribution of the Deprived Population by Rural/Urban Areas, 2017/18

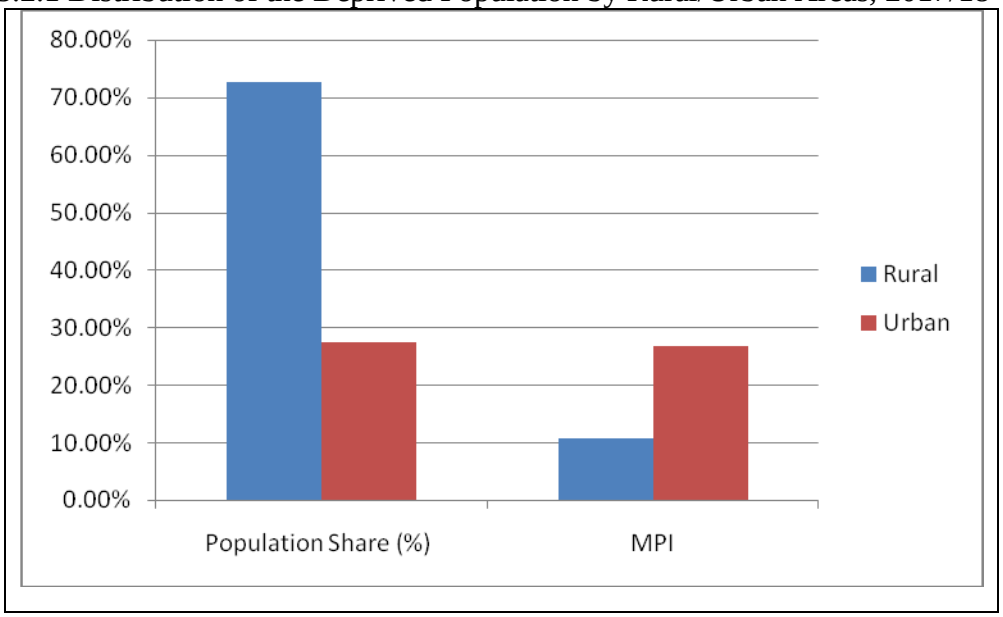


Table 3.2.2: Multi-Dimensional Poverty Index by Household Gender /Household Size

Gender of Household Head	MPI	Headcount Ratio (H, %)	Intensity (A, %)
Female-headed Households	0.08	0.17	0.5
Male-Headed Households	0.12	0.25	0.48
Household Size 1 - 3	0.08	0.19	0.45
Household Size 4 - 6	0.11	0.21	0.5
Household Size 7 +	0.13	0.27	0.47

Table 3.2.2 shows that MPI is less among the female-headed households compared to the male-headed households. The MPI Measure also increases with the increase in household size; headcount ratio also increases with increase in household size. Intensity behaves differently as regards household size. The

table also shows that intensity of deprivation is the heaviest upon female-headed households although the headcount ratio of female-headed households is less than the headcount ratio of the males.

Figure 3.2.2 MPI by Household Size

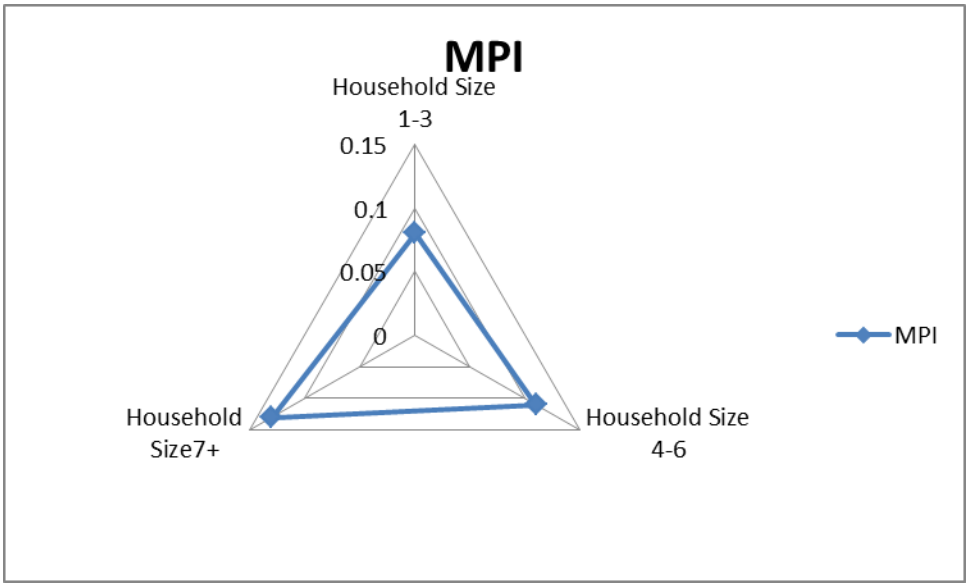


Figure 3.2.2.0 Headcount Ratio by Household Size

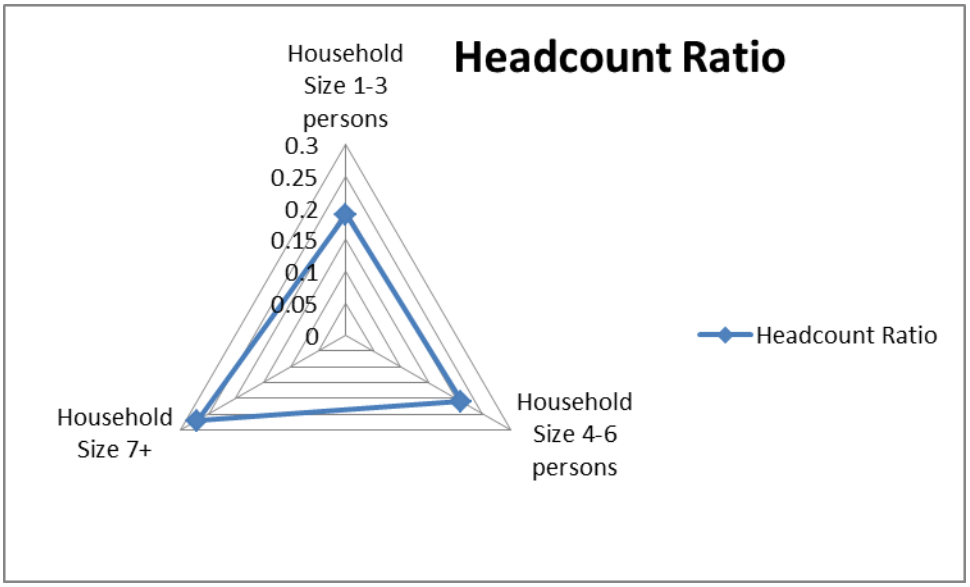


Figure 3.2.2.1 Intensity of Deprivation by Household Size

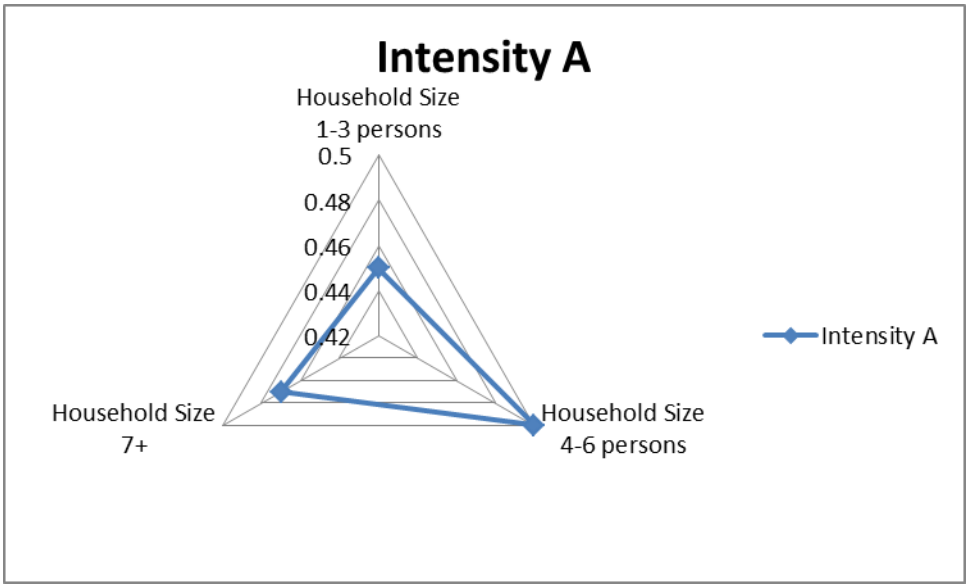


Table 3.2.3: The Composition of MPI by dimension and Indicator

Dimension	Indicator	Estimate of the Indicator
Education	An adult of 18 years of age and over (>=18) in a household who cannot read and write	0.27
	Child School Attendance	0.17
Health	Nutrition	0.16
	Mortality	0.02
Standard of Living	Electricity	0.03
	Water	0.06
	Sanitation	0.07
	Floor	0.10
	Cooking Fuel	0.04

	Assets	0.05

The table 3.2.3 above shows the composition of MPI by dimension and indicator. Education indicators scored the highest level as expected followed by health indictors. The score itself amounts to the contribution of the indicator to total MPI score (see Appendix 2).

Table3.2.4: MPI by Age Group the Head of the Household. Distribution of Household Heads by Gender, Age, Educational Attainment

		Deprivation Status based on Cutoff ≥33.3% of k		
		% Headcount Not Poor	% Headcount poor	Total
Gezira 8 Localities	Gezira 8 Localities	77.6	22.4	100.0
Sex of head of household	Male	77.2	22.8	100.0
	Female	82.1	17.9	100.0
Age group of the Head of the HH	15 - 19	100.0	0.0	100.0
	20 - 24	100.0	0.0	100.0
	25 - 29	65.4	34.6	100.0
	30 - 34	73.1	26.9	100.0
	35 - 39	66.0	34.0	100.0
	40 - 44	68.1	31.9	100.0
	45 - 49	82.4	17.6	100.0
	50 - 54	79.2	20.8	100.0
	55 - 59	94.4	5.6	100.0
	60 - 64	82.4	17.6	100.0
	65+	78.7	21.3	100.0
Educational Attainment	Currently attending school	87.5	12.5	100.0
	Ever attended	84.2	15.8	100.0
	Never Attended	45.3	54.7	100.0
	Do not know	100.0	0.0	100.0

It is evident from Table 3.4.4 that male headed households are more deprived than female headed households. There is irregularity in deprivation levels in terms of age group; and lack of education is a major cause of multidimensional deprivation. Younger heads of households encounter less poverty incidence. This result may be attributed to the fact that young males and females at this age group (15-24) are mostly found in schools and higher education institutions. In other words, family formation at this age group is very rare, that is why it has not been captured.

Table 3.4.5: Under- 5 Mortality by Locality

Locality	Mortality Rate
Gezira East	15 per100,00
Kamleen	10 per 100,000
Hasahesa	Less than 1 per 100,000
Um AlGura	Less than 1 per 100,00
Managil	30 per 100,000
Greater Wad Medani	25 per 100,000
Gezira South	15 per 100,000
Al Gurashi	5 per 100.000

Table 3.4.5 shows the under -5 mortality rates by locality. Managil and Greater Wad Medani localities scored the highest mortality rates compared to other localities. The great disparity in the under-5 mortality rates is evident.

Table 3.5.6 under 5 Mortality by Rural/Urban Divide and Gender

Urban/Rural Divide	Urban	5.0%
	Rural	95.0%
Gender	male	55.0%
	Female	45.0%
	Total	100.0%

It is evident from Table 3.4.5 that under 5years of age child mortality is wide spread in the rural areas (95%) compared to urban (0.05%). In terms of gender, the brunt of mortality is the heaviest among the male than female children. The rates in Managil and Greater Wad Medani need further scrutiny.

Chapter 4: Conclusion

The Central Bureau of Statistics –Sudan Government and UNDP-Sudan Office have jointly implemented a pilot multidimensional poverty survey in Gezira State with the purpose of testing tablet-based survey data collection together with the utilization and testing of Big Data procedures. It was also intended to collect household-based data for the measurement of SDGs and locality-level multidimensional poverty measures. The exercise provided ample opportunity for capacity building for the benefit of CBS staff.

The Gezira-State Pilot Multidimensional Poverty Survey, 2017 was unique in its formulation with respect to two aspects. First, it was unique with respect to its conceptualization .it is the first time that a multidimensional poverty survey being undertaken and successfully implemented in Sudan, although it was on a state and sub-state levels . Second, the survey was also unique that it produced locality level SDGs and multidimensional poverty measures. Formerly SDGs are produced on the national and state levels only.

The locality level indicators show great disparities. These disparities are hidden when only state level and national level indicators are ascertained. The results show that going down to below state level scrutiny of development indicators provide ample opportunity for targeting deprived local populations and communities .

In terms of contribution to MPI, education contributed the highest contribution to multidimensional poverty in Gezira State, followed by health and the standard of living. Under-five child mortality shows great disparities across localities. Likewise child malnutrition indicators show great disparities across localities. Indicators show that gender-wise divide of indicators as well as urban/rural divide are of great importance for policy analysis and intervention purposes.

The exercise opened the door for a new world for SDGs monitoring, which emphasizes the importance of lower level administrative units as the most appropriate areas for MPI and SDGs measurements and platforms intervention purposes.

Since this survey is envisaged and implemented as a pilot survey, similar exercises in other states or regions, using the same methodology, may help strengthen the gains so far obtained. Last but not the least , there are undoubtedly management lessons learned from this survey that need to be picked out and carefully heeded .

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Appendices:

Appendix 1: Questionnaire (See CBS Survey Team)

Appendix 2: MPI Methodology and Properties

1.1 Methodology

Suppose that at a particular point of time, there are n people in Gezira State and their well-being or welfare achievement is evaluated using d indicators. Let us denote the achievement of person i in indicator j by $x_{ij} \in R$, for i =1,2,..., n, and j = 1,2,……, d. The achievements of n persons in d indicators is denoted by $n \times d$ matrix X. Each indicator is assigned a weight based on the value of a deprivation relative to other deprivations. The relative weight attached to each indicator j is the same across all persons and is denoted by w_j, such that $w_j \rangle 0$ and $\sum_{j=1}^{d} w_j = 1$,i.e, weights add up to 1, or 100 or 100% . In a uni-dimensional analysis, persons are identified as poor as long as they fall short of meeting a threshold called 'the poverty line', and not poor otherwise. In a multidimensional analysis based on a counting framework, as in the case of adjusted headcount ration, a person is identified as poor or not poor in two steps. In the first step, a person is identified as poor or not poor in each indicator subject to a deprivation (poverty) cutoff. Let us denote the deprivation cutoff for indicator j by z_j, and the total deprivation cutoffs are summarized by vector Z. Any person i is deprived in any indicator j if $x_{ij} < z_j$, and not deprived if $x_{ij} \geq z_j$.

We assign a *deprivation status score* g_{ij} to each person in each dimension based on the deprivation status. If person i is deprived in indicator *j*, then g_{ij} = 1; and g_{ij} = 0, otherwise. The second step uses the weighted deprivation status scores of each person in all d indicators to identify the person as poor or not. An overall *deprivation score* $c_i \in [0,1]$ is computed for each person by summing the deprivation status scores of all *d* indicators, each multiplied by their corresponding weight , such that $c_i = \sum_{j=1}^{d} w_j g_{ij}$. A person is identified as poor if $c_i \geq k$, where $k \in (0, 1]$, and non-poor, otherwise. The deprivation scores of all *n* persons are summarized by vector C. After identifying the set of poor and their deprivation scores, we obtain the adjusted headcount ratio (M_0). Many countries refer to this as the MPI or Multidimensional Poverty Index. The focus axiom requires that while measuring poverty the focus should remain only on those identified as poor. Here it is worth noting that in

the multidimensional context, there are two types of focus axioms. One is a deprivation focus, which requires that any increase in already non-deprived achievements should not affect a poverty measure. The other is a poverty focus, which requires that any increase in the achievements of non-poor persons should not affect a poverty measure (See Bourguignon and Chakravarty (2003) and Alkire and Foster (2014). This entitles us to obtain the censored deprivation score vector $C(k)$ from C, such that c_i (k) = c_i if $c_i \geq k$, *and* $C_i(k) = 0$, otherwise. The M_0 is equal to the average of the censored deprivation scores, i.e, in the multidimensional context, there are two types of focus axioms. One is a deprivation focus, which requires that any increase in already non-deprived achievements should not affect a poverty measure. The other is a poverty focus, which requires that any increase in the achievements of non-poor persons should not affect a poverty measure. See Bourguignon and Chakra arty (2003) and Alkire and Foster (2014).

M_0 = MPI = $1 = \frac{1}{n}\sum_{i=1}^{n} c_i(k)$.

1.2 Properties of MPI

It is worthwhile to outline some of the features of M_0 useful for policy analysis. First, M_0 can be expressed as a product of two components, namely the proportion of those who are multi-dimensionally poor (H), and the average of the deprivation scores among the poor(A). This can be expressed as such, $M_0 = MPI = \frac{q}{n} \times \frac{1}{q}\sum_{i=1}^{n} c_i(k) = H \times A$. Note that q is the number of the poor persons in the community. This feature is interesting in terms of policy implications. A certain reduction in M_0 can be obtained either by reducing H or by reducing A. This difference cannot well be understood by merely looking at M_0. If a reduction in M_0 occurs merely as a result of a reduction in the number of people who are marginally poor, then H decreases but A may not. On the other hand if a reduction in M_0 is a result of a reduction in the deprivation of the poorest of the poor, then A decreases but H may not. This is the first feature.

The second feature of M_0 is that if the entire population is divided into m mutually exclusive and exhaustive groups , then M_0 can be expressed as a weighted average of the M_0 values of m - subgroups where the weights are the respective population shares. We denote the achievement matrix, the population, and the adjusted headcount ratio of sub-group l by (x^l), (n^l), and $M_0(x^l)$, respectively. Then the overall M_0 can be expressed as $M_0 = MPI = \sum_{i=1}^{n} \frac{n^l}{n_i} M_0(x^l)$, where (x^l) = achievement matrix, (n^l) = the population, and $M_0(x^l)$ = the adjusted headcount ratio of subgroup l. This feature is known as the sub-group decomposability and is useful for understanding

the contribution of the different sub-groups to overall poverty levels. Thus it is evident that the contribution of a sub-group to overall poverty depends on the poverty level of that sub-group and the population share of that sub-group.

The third feature of M_0 is that it can be expressed as an average of the censored headcount ratios of indicators weighted by their relative weight. The censored headcount ratio of an indicator is the proportion of the population that is multidimensionally poor and is simultaneously deprived in that indicator. Let us denote the censored headcount ratio of indicator j *by* h_j. Then M_0 can be expressed as $M_0 = MPI = \sum_{j=1}^{d} w_j h_j = \sum_{j=1}^{d} w_j \left[\frac{1}{n} \sum_{i=1}^{n} g_{ij}(k) \right]$; where $g_{ij}(k) = g_{ij}$ if $c_i \geq k$, and $g_{ij}(k) = 0$ otherwise. Similar relationships can be established between A and deprivations among the poor. Let us denote the proportion of poor people deprived in indicator j by h_j^p. Then, dividing both sides of the above relationship by *H*, we find $A = \frac{MPI}{H} = \sum_{j=1}^{d} w_j \frac{h_j}{H} = \sum_{j=1}^{d} w_j h_j^p$. Breaking down poverty in this way allows an analysis of multidimensional poverty to show clearly how different indicators contribute to poverty and how their contributions change over time. To show this further let us denote the contribution of indicator j to M_0 by Φ_j. Then the contribution of indicator j to M_0 is given by $\Phi_j = w_j \frac{h_j}{MPI} = w_j \frac{h_j^p}{A}$.

Decomposing by Dimension and Indicator:

Another feature of MPI is that it can be decomposed into its component indicators as well as in terms of rural/urban divide and population sub-groups. This is shown as follows:

$MPI = \frac{n_u}{n} MPI_u + \frac{n_R}{n} MPI_R$, where n_u is the sample size in the urban areas and n_R is the sample size in the rural areas, while MPI_u and MPI_R are the MPI in the urban and rural areas respectively .When we decompose MPI by population subgroups, MPI in each subgroup can be obtained which amounts to the contribution of that subgroup to total MPI.

Decomposition by indicators is likewise similar. The censored headcount ratio is obtained by dividing the number of people deprived in that particular indicator by the total number of population, or total sample size. The sum of all the censored headcount ratios gives the total headcount ratio of the state, region, country. This can be explained as follows:

$MPI = w_1 CH_1 + w_2 CH_2 + ... + w_{10} CH_{10}$ where w_1 is the weight of indicator 1 and CH_1 is the censored headcount ratio of indicator 1, and so on and so forth for the other indicators. The sum of the weights of the indicators must add up to 1.

The contribution of each indicator to overall MPI or poverty is thus, simply given by

$$MPI = \frac{w_i CH_i}{MPI} \text{X100}$$

Whenever the contribution to poverty of a certain indicator widely exceeds its weight, this suggests that there is a relative high deprivation in this indicator in the state or country or region. In other words, the poor are more deprived in this indicator than in others.

Appendix 3: Survey Sample Statistics

Descriptive Statistics

				Bootstrap[a]			
						95% Confidence Interval	
		Statistic	Std. Error	Bias	Std. Error	Lower	Upper
Weight of Under Five years of age Children	N	597		0	0	597	597
	Mean	11.3962	.14234	.0065	.1409	11.1209	11.6786
	Std. Deviation	3.47787		.00151	.09614	3.29846	3.66726
	Variance	12.096		.020	.669	10.880	13.449
	Skewness	.041	.100	-.001	.105	-.148	.261
	Kurtosis	-.245	.200	-.007	.272	-.681	.347
Valid N (listwise)	N	597		0	0	597	597

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Descriptives

			Statistic	Std. Error
Weight of Under Five years of age Children	Mean		11.3962	.14234
	95% Confidence Interval for Mean	Lower Bound	11.1166	
		Upper Bound	11.6757	
	5% Trimmed Mean		11.3969	
	Median		11.4000	
	Variance		12.096	
	Std. Deviation		3.47787	
	Minimum		3.00	
	Maximum		25.00	

	Range	22.00	
	Interquartile Range	5.15	
	Skewness	.041	.100
	Kurtosis	-.245	.200

Descriptive Statistics

				Bootstrap[a]			
						95% Confidence Interval	
		Statistic	Std. Error	Bias	Std. Error	Lower	Upper
Height of Children Under Five years of age	N	597		0	0	597	597
	Mean	84.603	.5913	.027	.579	83.498	85.766
	Std. Deviation	14.4468		-.0332	.3447	13.7242	15.0857
	Variance	208.709		-.840	9.936	188.354	227.578
	Skewness	-.268	.100	.001	.076	-.412	-.119
	Kurtosis	-.552	.200	.001	.139	-.781	-.244
Valid N (list wise)	N	597		0	0	597	597

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Descriptives

					Bootstrap[a]			
							95% Confidence Interval	
			Statistic	Std. Error	Bias	Std. Error	Lower	Upper
Height of Children Under Five years of age	Mean		84.603	.5913	.005	.585	83.516	85.809
	95% Confidence Interval for Mean	Lower Bound	83.441					
		Upper Bound	85.764					
	5% Trimmed Mean		84.949		.002	.614	83.782	86.187
	Median		85.000		.270	.990	84.000	87.800
	Variance		208.709		-.419	10.095	188.318	229.341
	Std. Deviation		14.4468		-.0188	.3502	13.7229	15.1440

	Minimum	37.0					
	Maximum	114.0					
	Range	77.0					
	Interquartile Range	22.2		.4	1.0	20.8	24.6
	Skewness	-.268	.100	.000	.074	-.413	-.126
	Kurtosis	-.552	.200	.000	.141	-.788	-.242
a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples							

Descriptive Statistics

				Bootstrap[a]			
						95% Confidence Interval	
		Statistic	Std. Error	Bias	Std. Error	Lower	Upper
Weight for age: % below -2 SD	N	597		0	0	597	597
	Minimum	0.00					
	Maximum	100.00					
	Mean	20.6030	1.65670	-.0224	1.6756	17.2529	23.7856
	Std. Deviation	40.47915		-.06962	1.22647	37.81567	42.61275
	Variance	1638.562		-4.130	98.794	1430.025	1815.847
	Skewness	1.457	.100	.008	.128	1.234	1.738
	Kurtosis	.124	.200	.039	.382	-.478	1.023
Weight for age: % below -3 SD*	N	597		0	0	597	597
	Minimum	0.00					
	Maximum	100.00					
	Mean	8.0402	1.11381	-.1336	1.1058	5.6951	10.2178
	Std. Deviation	27.21426		-.28586	1.73632	23.19441	30.31357
	Variance	740.616		-12.467	93.138	537.981	918.912
	Skewness	3.094	.100	.062	.292	2.634	3.833
	Kurtosis	7.598	.200	.471	1.893	4.952	12.736
Valid N (listwise)	N	597		0	0	597	597
a. Unless otherwise noted, bootstrap results are based on 597 bootstrap samples							

Descriptive Statistics

			Bootstrap[a]			
					95% Confidence Interval	
	Statistic	Std. Error	Bias	Std. Error	Lower	Upper

Height for age: % below -2 SD	N	597		0	0	597	597
	Minimum	0.00					
	Maximum	100.00					
	Mean	32.4958	1.91847	-.0690	1.8683	28.8026	36.0134
	Std. Deviation	46.87520		-.06848	.70733	45.32227	48.04416
	Variance	2197.284		-5.916	66.027	2054.108	2308.241
	Skewness	.749	.100	.005	.092	.584	.939
	Kurtosis	-1.443	.200	.017	.141	-1.664	-1.123
Height for age: % below -3 SD**	N	597		0	0	597	597
	Minimum	0.00					
	Maximum	100.00					
	Mean	16.9179	1.53569	-.0025	1.5682	13.8947	19.9411
	Std. Deviation	37.52245		-.06098	1.39609	34.61809	39.98927
	Variance	1407.935		-2.627	104.066	1198.413	1599.143
	Skewness	1.769	.100	.009	.152	1.508	2.093
	Kurtosis	1.134	.200	.054	.553	.276	2.388
Weight for height: % below -2 SD	N	597		0	0	597	597
	Minimum	0.00					
	Maximum	100.00					
	Mean	14.7404	1.45212	.0794	1.4948	12.0603	17.9229
	Std. Deviation	35.48052		.01634	1.48738	32.59385	38.38660
	Variance	1258.867		3.368	105.204	1062.359	1473.531
	Skewness	1.994	.100	.002	.170	1.677	2.336
	Kurtosis	1.984	.200	.036	.692	.815	3.468
Weight for height: % below -3 SD***	N	597		0	0	597	597
	Minimum	0.00					
	Maximum	100.00					
	Mean	6.7002	1.02414	.0354	1.0333	4.8576	8.8777
	Std. Deviation	25.02346		-.02418	1.79242	21.51607	28.46604
	Variance	626.173		1.998	89.382	462.941	810.316
	Skewness	3.472	.100	.025	.340	2.899	4.210
	Kurtosis	10.091	.200	.289	2.449	6.425	15.779
Valid N (listwise)	N	597		0	0	597	597

a. Unless otherwise noted, bootstrap results are based on 597 bootstrap samples