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# Effective Targeting Criteria for Nutrition Improvement for Children Households in Kenya

**Nancy Nafula, Rose Ngugi and Samwel Kipruto**



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# Effective Targeting Criteria for Nutrition Improvement for Children among Households in Kenya

*By*

*Nancy Nafula, Rose Ngugi and Samwuel Kipruto*

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## Definition of Terms

Targeting	A method of delivering goods and or services to a select group of individuals or households, rather than to every individual or household in the population
Target population	Those individuals intended to receive goods, services or benefits under a particular programme or activity
Participant/beneficiary population	Those individuals who actually receive goods, services or benefits under a particular programme
screening	The identification and inclusion of eligible individuals or households for programme participation and the exclusion of the non-eligible.
Target indicator	A direct measure of a particular characteristic of the target population that is used to identify members of the target group
Proxy indicator	An alternative or substitute indicator that is closely associated with a target indicator and that can also be applied to identify members of a target population
Coverage or participation rate	The percentage of the target population that is actually included among the beneficiaries of a programme or activity
Under coverage	The proportion of the target group that is excluded from participation in the activity
Leakage	The proportion of the beneficiary population that does not belong to the intended target group. Leakage can also refer to the population of the total benefits that accrue to individuals or households who are not included in the target group
Errors of exclusion	The number of individuals who are eligible for participation but do not participate
Errors of inclusion	The number of individuals who are ineligible for participation but who do participate
Nutritional vulnerability	The presence of factors that place individuals or households at risk of becoming temporarily or permanently food-insecure or malnourished



## List of Acronyms and Abbreviations

ASAL	Arid and Semi-Arid Land
BMI	Body Mass Index
CBT	Community-based Targeting
CT-OVC	Cash Transfer for Orphan and Vulnerable Children
ESR	Enhanced Single Registry
FAO	Food and Agriculture Organization
FGT	Foster-Greer-Thorbecke
HHS	Households
HSNP	Hunger Safety Net Programme
HTM	Harmonised Targeting Methodology
KIHBS	Kenya Integrated Household Budget Survey
KPI	Key Intangible Performance Indicators
MDI	Multidimensional Deprivation Index
MPI	Multidimensional Poverty Index
MVI	Multidimensional Vulnerability Index
NASSEP	National Sample Survey and Evaluation Frame (NASSEP IV)
NICHE	Nutrition Improvement for Children through Cash and Health Education programme
NSNP	National Safety Net Programme
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OLS	Ordinary Least-Squares
OPHI	Oxford Poverty and Human Development Initiative
PLW	Pregnant and Lactating Women
PMT	Proxy Means Testing
PSNP	Productive Safety Net Programmes
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
WFP	World Food Programme

## Abstract

Evidence on the impact of social protection programmes has largely focused on poverty indicators with little focus on nutrition outcomes, which are equally important. Determining the most appropriate eligibility criteria for a targeted programme is one of the problems that policy makers are seeking answers for. Using KIHBS 2015/16, this study evaluates an effective targeting methodology and targeting criteria for a nutrition sensitive programme. Two approaches (Proxy Means Test - PMT and Multidimensional Poverty Index) were used to determine the welfare status of households. Ordinary Least Squares and correlation analysis is applied to the data to identify the eligibility criteria for addressing malnutrition among children from poor households.

The findings are as follows:

- a) PMT characteristics reveal that about 33.1 per cent of the population are poor. Both the MPI and Foster Greer and Thorbecke (FGT) methodology overestimate the poor (36.1% and 44.2%, respectively). The difference in the poverty estimates is interpreted as 18.8 per cent inclusion error and 28.2 per cent exclusion error.
- b) The 5th percentile of the population is the appropriate cut-off for the possible eligibility criteria to include poverty, households with children under five years, households with two to four children, households with breastfeeding mothers and lastly households with children under two, in that order. These criteria may be applied in isolation or combination of two or more depending on the programme objective and the available budget.
- c) When the selection is limited to households receiving cash transfers, like the case of the Nutrition Improvement for Children through Health and Education programme, the errors of inclusion are significantly higher and account for between 14.1 per cent and 20.7 per cent, having increased from between 12.4 per cent to 13.5 per cent for all the three eligibility criteria, i.e. poverty, under two years and breastfeeding mothers.

In conclusion, targeting the most nutritionally at-risk children would be dependent on the available budget and the objective of the programme. Thus the study recommends a child-nutrition improvement eligibility criterion that not only targets the households falling below the 5<sup>th</sup> percentile but also those with children under five years of age.







# Introduction

Targeting describes a range of mechanisms for identifying households or individuals who are defined as eligible for resource transfers and simultaneously screening out those who are defined as ineligible (Sabates-Wheeler, Hurrell and Devereux, 2015). It means including some people as beneficiaries and excluding others.

Well-targeted programmes have proven to be a key tool to not only address the poverty challenge facing the poor and the most vulnerable households, but they also ensure that those excluded in the society are not left behind. This is the underlying objective of Sustainable Development Goals.

Specifically, SDG No. 2 targets to: (i) end hunger and ensure access by all people, in particular the poor and people in vulnerable situations; (ii) end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under five years, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons. This is to ensure that the vulnerable population also meet their food security and nutritional needs (FAO, 2015). Thus, in programmes that aim to produce nutrition improvements, targeting means limiting the intervention to the selected groups that are deemed most in need of those improvements.

Although many countries aspire to achieve universal social protection coverage for eligible populations, they have also limited coverage for social assistance depending on the objective of the programme (Premand and Schnitzer, 2021). By targeting the poor and increasing their ability to purchase food, social assistance programmes have continued to play a key role in addressing the problem of malnutrition at the national and global level. The beneficiary households tend to meet their social goals through investment in the health and nutritional needs of children and pregnant and lactating mothers.

Instruments such as nutrient fortification, food vouchers, promoting kitchen gardens, and social behaviour change have been introduced as cash-plus options to make social protection nutrition-sensitive (Devereux and Nzabamwita, 2018). Indeed, using both direct pathways to nutrition through cash transfers and indirect pathways through the cash plus components has been found to yield better nutrition outcomes.

Further, research has shown that for a cash transfer programme to be effective, it is important that households are identified based on a criterion that minimises both exclusion and inclusion errors (Stoeffler, Mills and Ninno, 2016; Merttens, et al., 2017). Selecting the most appropriate criteria is the key to minimising the errors when potential beneficiaries at the household or individual level are being screened (FAO, 2001). The criteria for targeting need to consider the key objectives of the programme being implemented. For instance, a nutrition-sensitive programme should include a relevant measure of nutrition as a criterion for targeting beneficiaries (World Food Programme, 2017).

Although in general, social protection programmes address nutrition challenges indirectly as the target groups who are poor often tend to be more predisposed to nutrition challenges, there is a likelihood that this may not be the case. For instance, Ethiopia's Productive Safety Net Programmes (PSNP) were found to have an impact on improving household food security and protecting households from negative coping strategies. They, however, had little effect on nutrition. To improve on this, the programme introduced several innovations, the most significant being targeting pregnant and lactating women (PLW) and caregivers of malnourished children to benefit from more nutrition-sensitive pilot project offering more direct support (Roelen, Devereux, Kebede and Ulrichs, 2017).

Implementing nutrition-specific programmes has a more immediate impact on malnutrition (Olney, et al., 2021), particularly where proper target identification is prioritized. For instance, investing in the early years, the first 1,000 days of life - between a woman's pregnancy and her child's second birthday, is critical for child survival; growth and development (Likhar and Patil, 2022; UNICEF, 2017). Older children five to nine years and adolescents (10-19 years) face significant transitions in their growth and a high rate of cognitive, social, and emotional development. In addition, they face social and nutritional challenges that impact their overall well-being. These criteria qualify for consideration where the programme's objective is to address developmental challenges. While this is the case, it is important that only those who are identified as poor and suffer or are at risk of suffering from growth and developmental deficiencies are identified and put on a nutrition-sensitive intervention programme.

The current social assistance approach to addressing the problem of nutritional requirements in Kenya is limited and only selects beneficiaries from the existing cash transfer programmes. Specifically, the nutrition-sensitive programme is currently implemented in five counties and targets children below two years of age and pregnant and lactating mothers. The selection of programme beneficiaries is only limited to those who are currently registered in a cash transfer programme. Further, the selection criteria for targeting the beneficiary households excludes those already suffering from malnutrition. It is possible that among the beneficiaries, some may not need nutritional intervention, yet they are on the programme. Similarly, some of the potentially at-risk households may have been excluded at the design stage or programme implementation stage. When a programme is not benefiting those in need, then it means that the resources are not being utilized efficiently.

In the context of this study, policy focus is to address malnutrition among households with children – a problem of a segment of the population. As such, effective targeting is key if the programme is to have greater impact.

Despite the importance of the targeting criteria in the success and effectiveness of a nutrition improvement programme, some programmes have relied on previous target groups or single incomprehensive targeting criteria. For Instance, the Nutrition Improvement for Children through Cash and Health Education (NICHE) programme beneficiaries were previously targeted for a cash transfer programme whose objective was poverty reduction. The targeting strategies for the social protection programme in Kenya are based on socio-economic criteria, such as poverty, consumption expenditure, asset ownership, among others. These characteristics are household-based and are intended to address poverty. This objective of poverty reduction may or may not necessarily have a nutrition focus. Alderman (2016) found that unconditional cash transfers and conditional cash transfers (tying conditions to health and school activities) have not delivered success in nutrition improvements commensurate to their success in poverty reduction.

A well-targeted programme can potentially deliver nutritional benefits in a more cost-effective way than an identical programme that is poorly targeted. The social assistance programme does not incorporate a nutrition component in the targeting processes, thus limiting the impact of the programme on intended nutritional outcomes. Re-engineering the targeting criteria to include nutrition components will potentially identify the poor households that are

nutritionally vulnerable and may have been excluded from the programme, or identify those households that are not nutritionally vulnerable and are included in the programme.

The main objective of this study was to propose an enhanced targeting criterion for a nutrition-sensitive programme for households with children using the KIHBS 2015/16 survey data. Specifically, the study sets out to:

- (i) identify target household using the poverty criteria;
- (ii) identify the targeting method and evaluate its effectiveness (inclusion and exclusion errors); and
- (iii) propose suitable criteria for targeting beneficiaries for a nutrition-sensitive cash transfer programme.

The rest of the paper is organized as follows: Section 2 highlights the situation analysis of targeting in Kenya; the targeting approach, targeting error and eligibility criteria from studies is presented in Section 3 while study methods and data are presented in Sections 4 and 5. Results and discussions are analyzed in Section 6 while Section 7 concludes.



# Situation Analysis of Targeting for Nutrition Improvement

## 2.1 The National Policy Environment

Tackling nutritional challenges requires a multisectoral approach. The Government of Kenya has put in place various policies, plans and programmes across the health, agriculture, education, and social protection sectors with the aim of addressing malnutrition. In the health sector, the Kenya Health Policy 2012-2030 recognizes the nutrition status of children and mothers as key determinants of health and calls for policy interventions in health financing and health education to address malnutrition. In the agriculture sector, the attainment of nutrition security is guided by the National Food and Nutrition Security Policy 2012, the Kenya National Nutrition Action Plan 2018-2022 which operationalizes the 2012 policy, and the Kenya Agri-nutrition Strategy 2020-2024. Since agriculture is one of the devolved functions in Kenya, County Governments have also developed County Nutrition Action Plans to offer local solutions to the challenges of malnutrition.

In the education sector, school feeding programmes have been established by development partners and the Ministry of Education since the 1980s. Government budgeting towards the school feeding programmes has also been increasing as development partners hand over more responsibilities to governments, signifying increased government commitments (WFP, 2018). Although the initial aim of the programmes was school retention and increased enrolment, they are now emerging as key interventions in addressing malnutrition. This is evident in the establishment of the National School Meals and Nutrition Strategy 2017-2022 which guides the provision of nutrition-sensitive school meals at national and sub-national levels (OCHA, 2018).

There is consensus among development partners and researchers that the provision of social protection provides a unique opportunity to tackle hunger and malnutrition (Alderman, 2015). Although the objectives of the Kenya National Social Protection Policy do not mention nutrition explicitly, addressing malnutrition is implied in the first objective that aims to protect Kenyans from the shock that may impact their consumption (Government of Kenya, 2011). Nutritional challenges are also addressed in the programmes under the policy, such as the cash transfer programmes to orphans and vulnerable children that cite improved nutrition as one of the key objectives of the cash transfer (Social Protection, 2022). Other social protection programmes such as the Hunger Safety Net Programme (HSNP) also, directly and indirectly, tackle malnutrition.

In Kenya, the integration of nutrition into social protection is envisioned in the Kenya Nutrition Action Plan (2018-2022) key result area 14, which aims to have nutrition in social protection promoted. The result area further provides strategies to achieve this by having explicit nutrition objectives, target criteria, and indicators incorporated in the social protection interventions as well as integrating nutrition education in social protection programmes. *The Cost of Hunger in Africa* study in Kenya, likewise, recommended that nutrition indicators be integrated into the targeting component of social protection programmes for vulnerable groups (Government of Kenya, 2019).

More deliberate programmes that leverage social protection to tackle malnutrition in Kenya are evident through the NICHE. Through this programme, nutritionally at-risk groups such as pregnant or breastfeeding women, or children under two are targeted among vulnerable households already recruited into the National Safety Net Programme (UNICEF, 2021). There are, however, inadequate nutrition-sensitive objectives and nutrition-sensitive criteria in the current Social Protection Policy in Kenya. Therefore, a category of poor people who are nutritionally at risk but do not fit in the three categories of vulnerability (orphanage, disability and old age) or are not in the four counties targeted by HSNP are likely to be left out of the social protection system.

## 2.2 Targeting Criteria for Social Protection

Nutrition is one of the priorities when designing social protection programmes in developing countries, with policy shifting from focusing resources on the poor, to focusing resources on other vulnerabilities such as nutrition (Grosh, Leite, Wai-Poi and Tesliuc, 2022). Bangladesh, Djibouti, and Tanzania's social safety nets, for instance, have targeted the nutritionally vulnerable population in their national safety net programmes. Djibouti Social Safety Net Programme has an explicit objective to improve nutrition by targeting nutritionally vulnerable populations such as pregnant/lactating women and children zero to two years (within the first 1,000 days of life (World Food Programme, 2017)).

The rationale for targeting lactating women, pregnant women, and children under two years is that the prenatal period and the first two years (first 1,000 days) of life represent the most critical period in the cognitive and physical development of the child. It should be noted that the first 1,000 days are from the start of the mother's pregnancy until when the child is two years old. Social protection programmes that aim at preventing malnutrition are more effective than those that target already malnourished children, therefore, the first 1,000 days present an opportunity to take necessary actions to prevent malnutrition.

This targeting is similar to the NICHE programme that is currently running in Kenya, with the only difference being that the NICHE programme is riding on the infrastructure of the already existing cash transfer programmes. By drawing beneficiaries from the already existing registry of beneficiaries, which was developed without nutrition considerations, NICHE potentially leaves out eligible households. The Enhanced Single Registry (ESR) in Kenya was developed considering the socio-economic indicators in a multistage process combining community-based targeting (CBT) and Proxy Means Testing (PMT).

## 2.3 Beneficiary Selection Process for Social Assistance Programmes in Kenya

Kenya uses a Harmonized Targeting Methodology (HTM) for all its social assistance programmes. The methodology deploys several targeting strategies in a multi-stage approach (Republic of Kenya, 2018). As each intervention is bounded by the area in which it operates, geographic targeting is the first stage. Geographical targeting is used on a wider scope to identify areas with high incidences of poverty and or food insecurity, for example Hunger Safety Net Programme (HSNP), which is implemented in four ASAL counties of Wajir, Marsabit, Mandera and Turkana.

Targeting for social assistance programmes in Kenya combines CBT and PMT. The combination of CBT with PMT helps to correct targeting errors, prevent fraud, and address other dimensions of poverty not captured by PMT (Devereux, 2021). Specifically, CBT increases accountability while PMT validates the welfare status of the selected households. Other mechanisms are categorical targeting (orphans and vulnerable children, older people, and people living with severe disabilities) and self-targeting in public-works projects.



# Targeting Approaches, Targeting Errors and Eligibility Criteria

The process of targeting is made up of many stages of decision-making at design and implementation. It involves information gathering and analysis of the food and nutrition situation, the benefits, and the costs of programming and implementation. In addition, the magnitude of the inclusion and exclusion errors and the final eligibility criteria are critical for a successful targeting approach. This section discusses literature around targeting and definition of eligibility criteria.

## 3.1 PMT

PMT is becoming a popular targeting mechanism in developing countries even as social protection practitioners search for the most effective targeting method. In PMT, a set of proxies that best explain welfare is used, with each proxy being assigned a weight based on its estimated impact on household expenditure. The proxies include demographic characteristics (age of household members, household size), human capital characteristics (education of household head and enrolment of children in school), housing characteristics (floor type, roof type), durable goods (refrigerators, cars, televisions) and productive assets such as land and livestock (Kidd and Wylde, 2011).

While choosing the variables to be used in PMT, the verifiability of the variable and its correlation to household welfare (consumption level) is taken into consideration. Small assets that can be easily removed or concealed are not included in a PMT model. The coefficients of the PMT model determine the extent to which each variable affects household consumption. There is need for a poverty line or an assumption of the percentage of households with the lowest consumption of the representative population (bottom 20% or 30%) of the poor. PMT scores (predicted household consumption welfare) for every household in the survey dataset is calculated.

A list of all households below poverty line according to consumption levels, is compared with the list of all households below poverty line according to PMT scores. If a household is included in the consumption-based list, but not in the PMT based list, then it has been erroneously excluded. In this case, the household was poor, but the PMT model has not identified it as such. If a household was not identified as poor according to its consumption levels measured by the household survey, but the PMT model has identified such household as poor, then it has been erroneously included, as the household was not poor, but the PMT model considered it poor (Grosh and Baker, 1995).

In Kenya, the household variables considered in the PMT model are collected using a harmonized targeting tool. The variables are checked for correlation with consumption, and those without correlations are dropped. Correlated variables are then subjected to a stepwise regression model to determine their significance, and those with no significant relationship with consumption are removed. Given the differences in the relationship between household



characteristics and consumption across different areas, separate PMT formulas are estimated for Nairobi, rural areas, and other urban areas (Republic of Kenya, 2018).

The socio-economic factors considered in Kenya's PMT do not capture any factors related to the nutrition status of the household. Another potential shortcoming of PMT is that the variables used are mainly related to the household head. These variables may not adequately describe the characteristics of other household members. PMT uses household assets that do not change rapidly, therefore, discriminating against households headed by older persons who are likely to have accumulated some assets over time. In addition, PMT considers only the monetary phenomenon of poverty and does not appreciate the multidimensional nature of poverty. Academia, social protection practitioners and policy makers are acknowledging the multidimensional nature of poverty, because income deprivation does not necessarily reflect the deprivations in other important dimensions such as health, nutrition, and education. The assumption that having a higher income enables a household to deal with other deprivations assumes the presence of a competitive market for goods and services in health care, education, and nutrition.

## 3.2 Multidimensional Poverty Index

Multidimensional targeting draws household identification from poverty measures developed by Alkire and Foster (2011). This multidimensional targeting is suitable compared to other targeting methodologies because of the following reasons. First, the identification status of a poor household does not change if the poor household improves in a non-deprived dimension. Therefore, eligibility is not affected by performance in other dimensions not relevant to the programme. On the other hand, if a household becomes deprived in one additional dimension which is of interest to the programme, then the household becomes eligible. An increase in the number of deprivations directly increases the chances of becoming eligible. Second, multidimensional index has a score vector that can be used in prioritizing households from the most deprived to the least deprived. This is particularly important if the programme does not cover all eligible households or is being implemented sequentially, or the transfer levels vary according to the level of deprivation; for example, benefits can be increased for those with lower scores and decreased for those with higher scores.

The multidimensional poverty scores can also be broken down to show the contribution of each dimension, showing which dimension is the household most deprived in. This enables the tailoring of the programme to give relative importance to each specific deprivation. The MPI targeting allows full consideration of programme objectives right from the start as one can identify dimensions in line with the objective of the programme. For example, in 2020, during the COVID-19 pandemic, the government of Honduras designed an MPI-like Multidimensional Vulnerability Index (MVI) for Bono Unico, a programme designed to support individuals affected by the socio-economic implications of COVID-19.

The MVI was developed by the government of Honduras in collaboration with UNDP and OPHI in 2020 to identify potential beneficiaries of Bono Unico, a cash transfer programme. The index was computed from the national register, which has data on the poorest 40 per cent of the population, but also provided a webpage for self-registration as a potential beneficiary. The MVI has four dimensions and 15 indicators. Each dimension carries an equal weight, while the indicators carry relative equal weight within each dimension. The cut-off for the MVI was set at 35 per cent to identify programme beneficiaries. A household with 35 per cent or more of weighted sum indicators was selected as beneficiaries of Bono Unico Programme. The MVI enabled the government of Honduras to focus its targeting beyond monetary deprivations, allowing it to tailor the programme to the health emergency. It also allowed the inclusion of deprivation indicators relevant to health emergency, including employment, housing, health, and food security (World Health Organization, 2021).

### 3.3 Evaluating Targeting Performance of PMT

The performance of PMT can be evaluated by analysing the extent of inclusion and exclusion errors. From the reviews of various PMT models of Social Assistance Programmes across the world, it is evident that their coefficient of determination is between 30 per cent and 60 per cent (Sabates-Wheeler, Hurell and Devereux, 2015). Kidd and Wylde (2011) assessed the accuracy of PMT regressions of Bangladesh, Indonesia, Rwanda, and Sri Lanka. The study noted that the smaller the targeted population, the higher the error rates. For instance, when 20 per cent of the population was targeted, the inclusion and exclusion errors varied between 44 and 55 per cent, and when 10 per cent of the population was covered, the exclusion and inclusion error rates averaged between 57-71 per cent.

Budlender (2014) explored the strengths and weaknesses of PMT and noted some of the key challenges associated with PMT. The study first acknowledged the use of expenditure in PMT because of its smoothing characteristic, unlike income which fluctuates highly depending on the period. However, he noted that just as income, expenditure data may be incorrect or some individuals may omit expenditures that are deemed to be less socially acceptable, such as alcohol and tobacco expenditure. He noted that the less socially acceptable expenditures are mostly incurred by men, who are in most cases the head of households, and non-disclosure of this expenditure increases men's poverty and had the potential of misrepresenting the poverty status of the household. This brings to the fore the assumption that household expenditure/income is evenly spread across household members according to need. This assumption creates a challenge when a social assistance programme specifically targets individual household members such as women, children, or disabled who are then evaluated as per household-level characteristics.

The determination of cut-off in PMT relies on statistical analysis and will choose a point that minimizes exclusion and inclusion errors. However, the choice of a cut-off for targeting is a policy decision and not a technical (statistical) decision. For example, if there are no budgetary constraints and the policy of the government is that everyone needs to receive social assistance, then the policy cut-off is made to coincide with the point that minimizes errors. On the other hand, if there are budget restrictions, the policy cut-off will be lower and the exclusion errors will be high (Budlender, 2014). Therefore, in the evaluation of PMT, the choice of the cut-off should be considered.

PMT performs well when using monetary indicators, but monetary poverty is only one dimension of vulnerability and may not be noticeable as compared to other dimensions, such as nutrition or health. MPI considers several dimensions of vulnerability separately: nutrition, health, education, housing, and child protection. Merttens et al. (2017) analyzed the Kenya National Safety Net Programme's (NSNP) ability to reach multidimensionally poor households. NSNP beneficiaries were found to be worse off in terms of the number of deprivations than non-beneficiaries. However, targeting performance was relatively weak when assessed in terms of MPI inclusion and exclusion errors. The magnitude of the error was similar to those achieved by monetary poverty. It is on this basis that Merttens et al. (2017) recommended that multiple categorical eligibility is not the most relevant characteristic if the aim is to target the poor and most vulnerable.

Ha, Alviar and Chai (2010) simulated targeting performance of the multiple deprivation index and PMT approaches of the Orphan and Vulnerable Children (CT-OVC) using the Kenya Integrated Household Budget Survey 2005/6. The results affirmed that there is no targeting approach that is perfect. The multiple deprivation approach use a cut-off of eight deprivations or more out of the 17<sup>1</sup> considered by the study for one to be considered as poor. The results

1 The 17 characteristics were no adult in the household has standard eight level of education, caregiver is not employed or s/he is working as a farmer or labourer, the caregiver has less than two acres of land, walls is made of mud/cow dung, grass, sticks, or makuti; the floor is mud/cow-dung, roof is

of the study showed that PMT outperformed MDI in terms of inclusion errors, but on the other hand PMT had high exclusion errors in most of the circumstances, both in rural and urban setups. However, they note that PMT had been customised to fit urban settings while MDI is not adjusted. If MDI is adjusted accordingly, the study foresees a pattern with no relative advantage or disadvantage over the other one.

### 3.4 Identification and Measurement of Exclusion and Inclusion Gaps in Targeting Beneficiaries

Errors of inclusion and exclusion can arise either at the design or implementation stage of the programme. At the design stage, design errors occur when proxy measures used to identify households in the proxy model have no link to poverty measures of consumption, income, or assets (WFP, 2021). The choice of proxy indicators can never include all factors that have an influence on household consumption levels.

There is no perfect targeting mechanism, as it usually leads to two types of errors: inclusion errors and exclusion errors (FAO, 2001). Inclusion error occurs when an individual or household who is not eligible benefits from a social transfer intervention. On the other hand, exclusion error is the failure of a social transfer intervention to reach an eligible household or individual. A good targeting process should minimize under-coverage (error of exclusion) and leakage (error of inclusion) and ensure the national social protection transfers are always transferred to poor and vulnerable individuals who deserve it (Sabates-Wheeler, Hurell and Devereux, 2015).

There are different approaches used to measure targeting errors, however, the most pertinent to policy makers is defined as follows: exclusion error is the number of eligible people not included in the social protection programme as a proportion of the total number of eligible individuals. It may also be referred to as coverage inefficiency. Inclusion error, on the other hand, is the number of ineligible beneficiaries as a proportion of total programme beneficiaries. (Mohammad and Jillur, 2019).

Grosh, Leite, Wai-Poi and Tesliuc (2022) when measuring errors of exclusion and inclusion note the importance of maintaining the same threshold used for eligibility. Cut-offs used during programme design should be the same cut-offs used during the analysis of targeting performance. The study also recommends consideration of programme size while measuring errors of inclusion and exclusion. A programme meant for 20 per cent of the population when 40 per cent of the population are eligible will automatically have at least 50 per cent exclusion errors. Therefore, exclusion/inclusion errors cannot be measured in absence of the programme size.

### 3.5 Eligibility Criteria for Inclusion in a Programme

According to WFP (2021), the criteria for inclusion into a programme should be based on characteristics of the vulnerable population that are observable and can be assessed easily without bias. They identify characteristics of a good eligibility criteria to include: evidence based-informed by vulnerability analysis; sensitive-correctly include the people most in need and exclude those less in need; specific - formulated clearly and unambiguously; feasible given the time, resources and capabilities available; acceptable to the beneficiaries and their

made of mud/cow-dung; toilet type pan/bucket or no toilet; Source of drinking is water is river, lake, pond or similar; Source of lighting fuel is firewood; Source of cooking fuel is firewood or residue/ animal waste/grass; Owns no real state property here or elsewhere; Owns two or less traditional zebu cattle; Owns no hybrid cattle; Owns five or less goats; Owns five or less sheep; Owns no pigs; Owns no camels

communities and verifiable, such that targeting decisions can be checked and challenged by monitoring staff or community members. The criteria should ensure that the most vulnerable and food-insecure groups are not left out.

Further, according to WFP (2021), the extent of the usefulness and appropriateness of eligibility criteria may be reviewed by asking the following questions: Do the criteria relate to things that can be collected or observed? Can they verify that the correct beneficiary has been selected? For life-saving operations, how many vulnerable households may be incorrectly excluded because of the criteria? How many non-vulnerable households may be incorrectly included because of the criteria? Can the criteria be clearly communicated to all stakeholders? Are they fair and will they be acceptable to the community members? Will the criteria be valid for a long time? Can the application of the criteria be monitored?

For instance, FAO (2001) asserts that for a nutrition programme, households should be screened on the basis of their sizes, their socio-economic status, the education level of the mother, child spacing within the family, and/or history of poor nutrition for any family member. A household's socio-economic status is a useful way of identifying malnourished individuals or those at high risk of malnourishment. Other socio-economic indicators include individuals living in households in which an infant has died, a mother is very young or relatively old, or a household with many young children.

Targeting at-risk individuals in a nutrition programme is informed through indicators such as: nutrition status assessed through anthropometric measures and clinical or laboratory examinations; physiological status (e.g. pregnant and or lactating mothers); health status (incidence of diarrhoeal disease); age; sex; individual's socio-economic status (FAO, 2001). Any of the indicators can be applied singly or in combination when selecting potential recipients.



## Methodology

The study computes criteria for a nutrition improvement programme using two targeting approaches, i.e. MPI and PMT. Both approaches include nutrition as one of the indicators. The methodology for computing MPI borrows from Alkire and Foster (2011), whereas the PMT approach borrows from Grosh and Baker (1995).

### 4.1 MPI

The MPI process starts with the choice of dimensions to be covered, and the identification of indicators for each of the dimension. The analysis in this study borrows from the global MPI, which has three dimensions namely health, education and living standards. Indicators include nutrition and child mortality for health; years of schooling and school attendance for education; and cooking fuel, sanitation, drinking water, electricity, housing and assets for living standards. Each of the indicators is associated with a minimum level of satisfaction called deprivation. A complete description of the dimensions, indicators and their respective deprivation cut-offs are outlined in Annex Table 1.

Each dimension is weighted equally and subsequently the indicator is weighted based on the dimension weight and the proportional weight of the indicator within the dimension. The weighted score is therefore arrived at by summing each of the indicator weights within the household.

According to Alkire and Foster (2011), the poverty cut-off is defined as a third of the dimensions. These cut-offs define whether a household is poor or not. A household is categorized as multidimensionally poor if the weighted score is greater than or equal to the poverty cut-off (see Alkire and Foster (2011) for detailed presentation).

### 4.2 Proxy Means Testing

The methodology of PMT utilizes a set of key socio-economic indicators. The selection of verifiable household variables is necessary to ensure they are a good proxy of household welfare. The per capita household consumption expenditure is used as the welfare measure. The variables selected are well correlated with the welfare measure, easy to measure and observe, and are difficult for the household to manipulate.

In this study, a broad range of variables is drawn from the KIHBS survey dataset that includes consumption, employment, education, health, housing, household assets and population characteristics. The data is applied on the OLS model for national, rural and urban. OLS is sufficient in the targeting process since the interest here is to identify the poor and not to explain why they are poor.

This model is specified as:

$$Y = f(X) \dots\dots\dots 1$$

Where Y=Welfare measure, X is a set of explanatory variables.

The estimable form of the equation is:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n + \varepsilon \dots\dots\dots 2$$

Where

Y is the per capita household consumption expenditure

X are the correlates of Y

### 4.3 Measuring Targeting Performance

The extent to which the model correctly identifies the poor is established by categorizing households into four groups according to whether their “true” and predicted welfare levels fall above or below the defined cut-off score. Those whose “true” welfare falls below the cut-off score constitute the target group, while those with predicted welfare below the cut-off score constitute the eligible group. Individuals whose “true” and predicted welfare measures put them on the same side of the cut-off are considered targeting successes (T1). Those who should not and do not receive benefits under the targeting scheme are likewise a targeting success (T2).

**Table 4.1: Targeting performance**

	Actual Poor (actual welfare $\leq$ cut-off line)	Actual Non-Poor (actual welfare $>$ cut-off line)	Total
Predicted as poor	Correctly targeted as poor (T1)	Inclusion Error (E2) Type 2 error	P1
Predicted as non-poor	Exclusion Error (E1) Type 1 error	Correctly targeted as non-poor (T2)	P2
Total	N1	N2	N

When “true” and predicted welfare levels fall on different sides of the eligibility cut-off point, a targeting error has occurred. Where the “true” welfare level is below the cut-off, but the predicted welfare is above, a household will be incorrectly identified as ineligible for programme benefits. This error is called a type I error or exclusion error (E1).

Under-coverage is calculated by dividing the type II error by the total number who should get benefits. It refers to the percentage of those whom the programme is meant to cover but are not covered.

The alternative targeting error occurs when a household’s “true” welfare level is above the cut-off, but the predicted welfare is below it. Such households are incorrectly identified as eligible for the programme benefits. This is a type II error or inclusion error and leads to the leakage<sup>2</sup> of programme benefits. Leakage increases programme costs by giving benefits to those who are not the intended recipients, thereby rendering the programme inefficient.

2 Leakage refers to the percentage of programme benefits that are received by beneficiaries who are not eligible to receive them. It is calculated by dividing the number in the type II error category by the number of households served by the programme.



## 4.4 Proposed Approach for Identifying the Eligibility Criteria

Using the two approaches for targeting, i.e. PMT testing and MPI, we identify the characteristics of poor households that meet the requirements specified in Section 3.4 (eligibility criteria for selection) and also matter for nutrition improvement. The households are categorically grouped as per the perceived vulnerabilities.

Eligibility criteria is based on the objective of the study. In this case, the objective is to identify a targeting criterion for nutrition improvement. Height-for-age (stunting) is therefore adopted as the outcome measure for nutrition. Using the approach as specified in Section 3.4, characteristics of poor households that meet the requirements specified are selected. The households are categorically grouped as per their vulnerabilities. The variables in the PMT model are then correlated with the stunting measure to select the variables to be used in the eligibility criteria.

Based on the variables in the PMT model, those that are significant and highly correlated with stunting are identified as indicators for eligibility criteria. Another level of check is the criteria must be feasible and appropriate for implementation and have cut-off points for inclusion and exclusion that result in the lowest possible targeting design errors. For each criterion, the inclusion error is calculated by taking the number of ineligible beneficiaries as a proportion of the total beneficiaries in the programme. Similarly, the exclusion error is calculated by computing the number of eligible beneficiaries in the programme as a proportion of the total number of eligible but excluded households.

The selected criteria is applied on the dataset that contains the cash transfer beneficiaries as reported in the KIHBS 2015/16 data set to draw lessons for a nutrition improvement programme.<sup>3</sup>

## 4.5 Data

The main data source in this study is the most recent household level budget survey in Kenya, the KIHBS 2015/16. The household budget survey data was collected over a period of 12 months between April 2015 and May 2016 and this facilitated the control for seasonality. The sampling frame was based on the fourth National Sample Survey and Evaluation Frame (NASSEP IV). The survey was conducted in 2,400 clusters stratified by rural and urban. The interviews were conducted across all the 47 counties in Kenya, covering about 24,000 households. The final dataset used in this analysis consisted of 21,773 households.

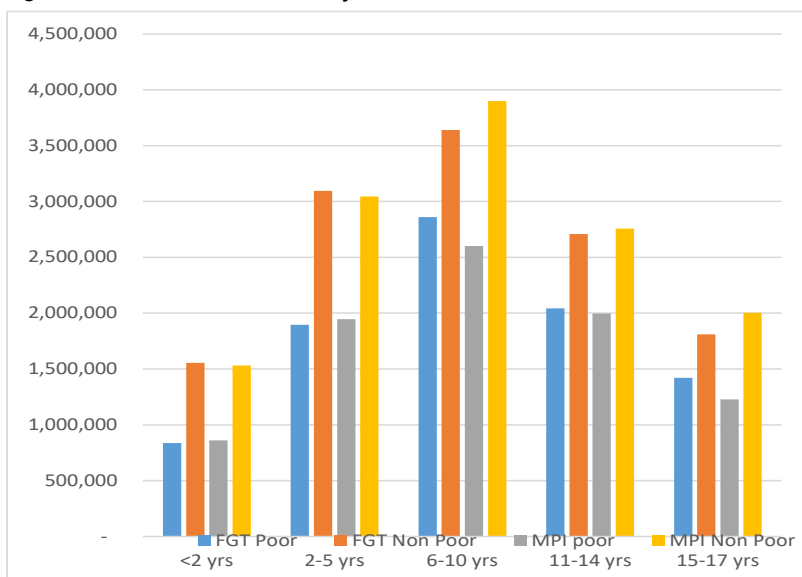
The multipurpose survey contains information covering individual and household dimensions useful for this study, such as: consumption, employment, education, health, housing, household assets and population characteristics. The data also contains both population and household weights.

### 4.5.1 Descriptive statistics of key variables used in analysis

Figure 4.1 shows that distribution of both poor and non-poor children by their age categories is normal. There are more households with children aged six to ten years compared to all the age-groups provided. There are fewer households with children aged less than two years compared to those aged between two and five years. This is an indicator to the fact that targeting only households with children who are less than two years is an under-estimate of those in need given that malnutrition affects children in the age category of two to five years as well.

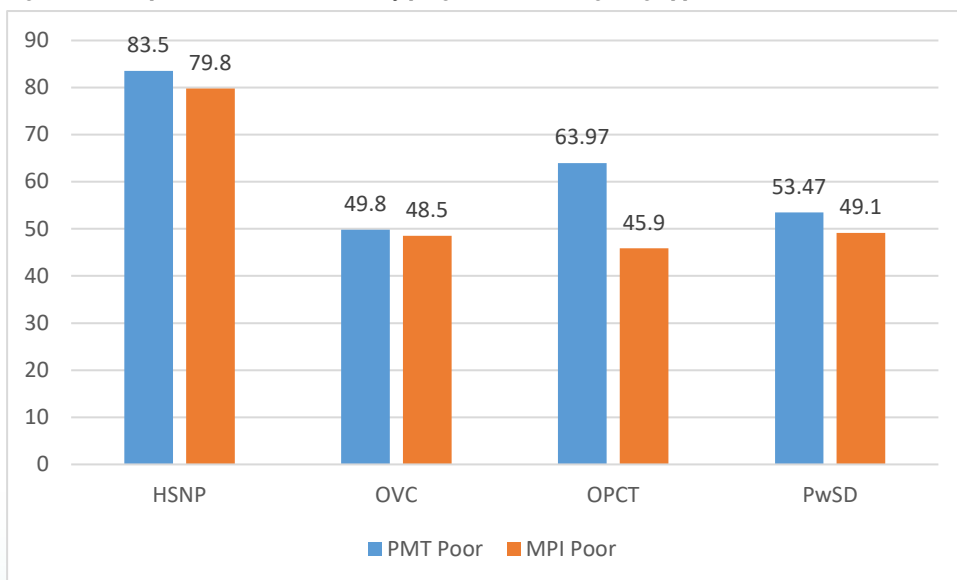
3 NICHE data would have been a better dataset to apply the criteria. However, KIHBS data is used for purposes of informing policy.



**Figure 41 Distribution of children by household welfare status**

Source: KIHBS 2015/16

Looking at the distribution of beneficiaries in the data set, Figure 4.2 shows that there are 4 cash transfer programs. The HSNP targets the highest number of beneficiaries. Both the PMT and MPI have closely identified beneficiaries who are poor and also benefiting from the cash transfer programs.

**Figure 4.2: Proportion of beneficiaries by programme and targeting approach**

Source: KIHBS 2015/16



# Results and Discussions

## 5.1 Identify Poor Households using PMT and MPI

### 5.1.1 OLS estimation of predicted mean of consumption expenditure using PMT

The original listing of variables is shown in Annex Table 3. Predicted mean of consumption expenditure is shown in Annex Table 4. Using OLS stepwise regression function, variables that are not statistically significant in the model were eliminated. Variables with a probability value above 0.01 were automatically excluded from the regression model. They are poor predictors of per capita consumption expenditure. The resulting variables are then used to estimate the final OLS regression model (see Annex Table 5).

The predicted value of household consumption expenditure is obtained by regressing the log of per capita household consumption expenditure on the predictors of welfare measure (see Annex Table 2). The mean predicted value of consumption expenditure was Ksh 7,178 per month per adult equivalent. The actual consumption expenditure for urban areas was just about twice the rural mark. Conversely, the predicted consumption for urban areas is more than twice that for rural (see Table 5.1)

**Table 5.1: Distribution of monthly mean actual and predicted consumption expenditure per adult equivalent by region**

Region	Actual consumption expenditure	Predicted consumption expenditure	Number of households
National	6,222	7,178	11,414,543
Rural	4,547	4,921	6,442,232
Urban	9,225	10,103	4,972,311

Source: KIHBS 2015/16

Annex Table 4 presents mean predicted consumption expenditure by county. The disparity among the counties is noticeable with urban cities accounting for higher mean consumption than rural regions. Using the predicted household consumption expenditure and the prevailing poverty line for KIHBS 2015/16, households are categorized as either poor or non-poor for purposes of targeting.

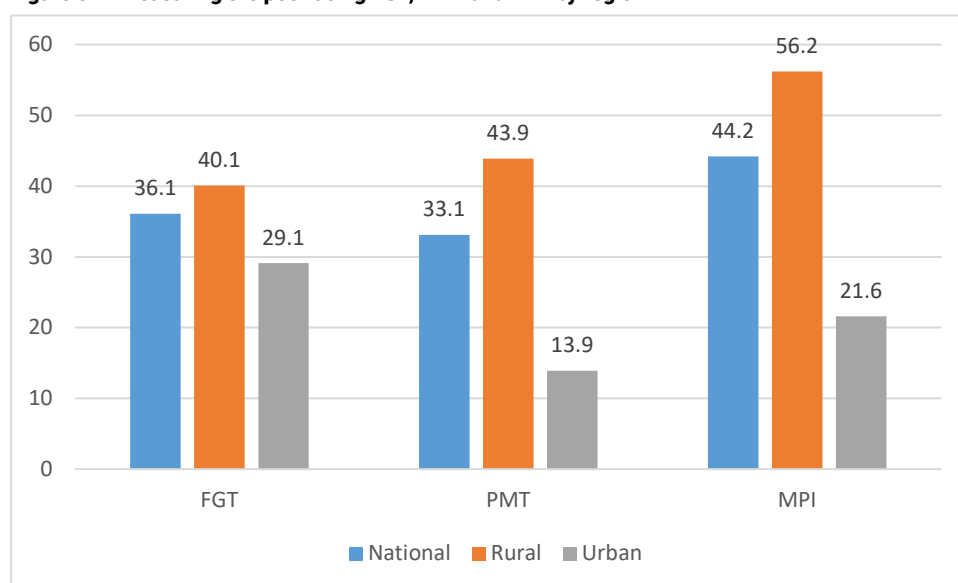
### 5.1.2 Identification of poor households

The first step to identify the targeting criteria is to understand the targeting approach that best identifies the poor based on the objective of the programme. Poverty results for both PMT and MPI are presented for purposes of comparing the two approaches. PMT uses the

true welfare measure from the Foster, Greer and Thorbecke (FGT) method to predict per capita consumption measure whereas MPI uses qualitative measures of poverty by Alkire and Foster method.

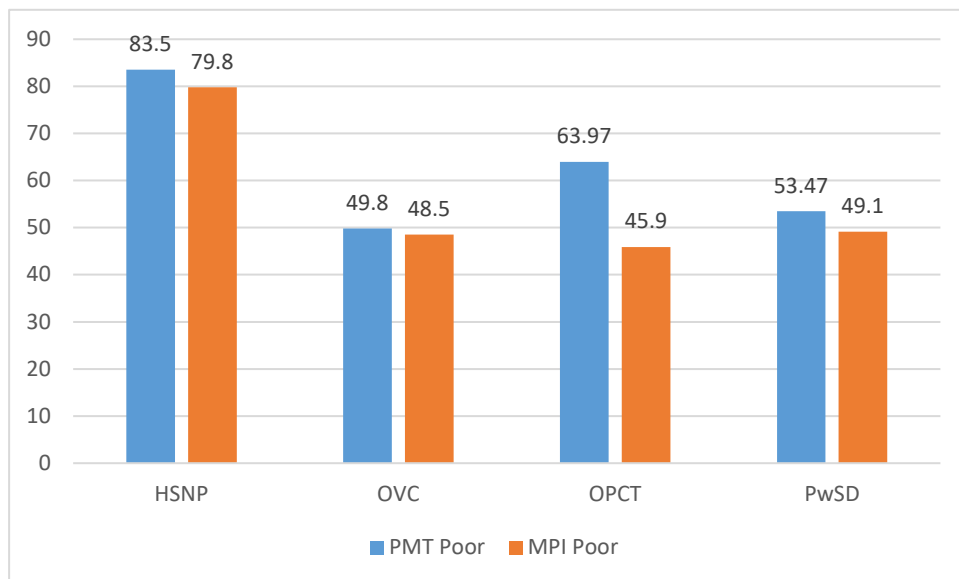
The results are presented in Figure 5.1. Given the PMT characteristics, about 33.1 per cent of the population were found to be poor compared to poverty measure by FGT (36.1%). When poverty is measured using the dimensions of MPI, more households were identified as poor (44.2%). This means that other than poverty of income, the poor also face a number of deprivations in different aspects such as health, education and living standards. The number of poor households in rural areas were more than double the poor in urban areas when both income poverty and deprivations are considered. 43.9 per cent and 13.9 per cent are income poor whereas 56.2 per cent and 21.6 per cent were deprived in rural and urban areas, respectively.

**Figure 5.1: Measuring the poor using FGT, PMT and MPI by region**



Source: KIHBS 2015/16

Disparities in level of poverty are glaring when poverty is measured at the county level. Figure 5.2 presents county level poverty as measured using both FGT, PMT and MPI measures. Arid counties, namely Wajir, West Pokot, Mandera, Samburu, Turkana and Marsabit experience the highest poverty levels whereas Kiambu, Nairobi, Mombasa and Nyeri had the lowest poverty. As observed, the MPI over-estimates the number of poor households compared to PMT. There is very little difference between FGT and PMT.

**Figure 5.2: Measuring the poor using FGT, PMT and MPI by county**

Source: KIHBS 2015/16

Further, the targeting performance of the PMT scoring system is evaluated by comparing how well the predicted values in the PMT score compare with actual consumption at the national level. It is feasible to compare the poverty estimates computed using FGT and PMT. However, the same comparison is not feasible with MPI. Therefore, the above-stated analysis concentrates on PMT only.

Table 5.1 measures the targeting efficiency of the PMT score. It measures the extent to which the PMT score accurately predicts poverty if a household's consumption is below the poverty line given the selected PMT characteristics. Column A presents the actual poor using FGT and Column B presents the actual non-poor using FGT. The results show that using PMT, 71.8 per cent of the poor are correctly predicted to be poor whereas, 81.2 per cent of the non-poor are correctly predicted to be non-poor.

The concepts of PMT and MPI are not comparable. MPI is a qualitative measure based on household deprivations while PMT is quantitative based on predicted welfare consumption. Due to the nature of MPI it is not possible to measure its effectiveness against the FGT measure. As such the foregoing analysis is presented for PMT only.

**Table 5.2: Measuring PMT performance**

	Column A: Actual Poor (actual welfare $\leq$ cut-off line)	Column B: Actual Non-Poor (actual welfare $>$ cut-off line)	Total
PMT Predicted_Poor	71.8	28.2	100
PMT Predicted_non-Poor	18.8	81.2	100
Total	36.1	63.9	100

Source: Author's calculations using KIHBS 2015/16 data

Similarly, PMT predicts that 18.8 per cent of the poor (FGT predicts them as poor) are not poor. This means they are incorrectly included as poor households when the true welfare

(FGT) is measured whereas PMT predicted measure identifies them as non-poor households, and hence are excluded.

In this case, the exclusion error as measured is 18.8 per cent. On the other hand, the true welfare measure identifies 28.2 per cent of households as non-poor whereas, predicted PMT finds the households to be poor. These households are included in the target group. In this case, the inclusion error is 28.2 per cent.

## 5.2 Criteria for Targeting Beneficiaries for a Nutrition-Sensitive Cash Transfer Programme

Based on vulnerability analysis and classification, we adopt a categorical targeting approach. These are the characteristics of the population assumed to be in need of nutritional intervention (see Annex Table 7 and 8). The characteristics are obtained from the KIHBS 2015/16 data as guided by PMT eligibility characteristics. Using stunting as the measure of malnutrition, characteristics of the vulnerable population that are observable and were assessed without bias are identified. Twenty-three (23) eligibility criteria items were selected and each analysed against the measure of malnutrition (stunting) (see Annex 6). Table 5.3 shows the correlation matrix for those variables that were significant.

**Table 5.3: Correlation matrix for pairwise correlation coefficient between stunting and observable characteristics of vulnerable population**

Variable	Coefficient
Households with children under 2 years	0.2826*
Households with children under 5 years	0.4485*
Households with 4 members	0.0258*
Households with 5 members	0.0287*
Households with 6 members	0.0534*
Households with 7 members	0.1760*
Dependency ratio	0.2622*
Number of children 2-4	0.3959*
Number of children 5-9	0.1689*
Number of children 10-14	0.0534*
HH with Breastfeeding mothers	0.2841*
Child under 5 BMI	0.4880*
HH with at least one person with no education	0.1486*
Unimproved sanitation	0.0602*
Improved water source	0.1017*

\* Significant at 0.01%

Source: Author's calculations

According to literature on targeting, the eligibility criteria are the most important element in establishing a targeting scheme and they ought to be directly related to the programme's objectives (Grosh, Leite, Wai-Poi and Tesliuc, 2022). There is no one criterion that is better than the other. In the context of malnutrition, the programme objective is twofold: First, to prevent malnutrition, of which the relevant group includes all those who are at risk of future malnutrition and second, to improve the nutritional status of children who are malnourished children. Based on this study objectives the selected eligibility criteria are presented in a pairwise correlation matrix in Annex Table 5.

Annex Table 6 shows all pairwise correlation coefficients. Only variables with positive correlation that portray statistically significant relationships between potential eligibility criteria and stunting are selected in Annex Table 7. As such, all the negative correlations are excluded from the final matrix. For instance, households with fewer members (household size less than four) and households with educated members (at least primary education and above) were among the 23 variables presented in Annex Table 6 but were eliminated and are not presented in Annex Table 7. Such households are less likely to be poor and therefore less likely to be vulnerable to malnutrition compared with households with larger household sizes and those with no education.

The feasibility and timeliness of collecting the information is the other factor that informed the selecting of the criteria listed in Annex Table 8. This was done by eliminating eligibility criteria that are not easy to measure/collect and/or validate. In this case, the dependency ratio and BMI measures were eliminated despite the fact that the correlation coefficient is high.

As such for purposes of this analysis, the selected eligibility criteria were proposed to include the following: households with children under five, households with two to four children, households with breastfeeding mothers and lastly households with children under two in that order. These variables are highly correlated with stunting and can easily be validated. They can be applied in isolation or combined depending on the project objective and budget. A criterion that minimizes exclusion and inclusion errors should be the guiding factor. The criteria of under-five and households with two to four children is additional criteria to what has been used before in the existing nutritional programmes being piloted currently with beneficiaries in the social assistance programmes.

### 5.3 Practical Application of Selected Criteria

Table 5.4 presents simulation results using the NICHE eligibility criteria with only two criteria (KIHBS 2015/16 does not capture information on pregnant women). The consumption expenditure percentiles are presented up to the 40th percentile. Column 1 depicts the percentile cut-off; Column 2 presents the eligibility criteria.

There are three criteria used: poverty criteria, children under two years and breastfeeding mothers. Each criterion is analysed independent of each other. The results show that where resources available can support about 571,125 households targeted to benefit from a nutrition programme, then using poverty as the targeting criteria, the appropriate cut-off would be the 5th percentile. By adopting PMT at the 5th percentile cut-off, 13.3 per cent of households would be included into the programme (FGT poverty measure excludes this). Similarly, where the budget can accommodate 183,129 households, using eligibility criteria of targeting children under two would be the most appropriate. In a situation where the programme adopts the 5th percentile, 12.4 per cent of households would be included as beneficiaries.

Further analysis show that increasing the cut-off up to 15 per cent progressively increases the inclusion errors. However, the criteria for children under two years and breastfeeding mothers account for lower inclusion errors compared to poverty criteria. Up to 15 per cent, there are no exclusion errors whereas the inclusion errors are at the lower scale and measure below the recommended 30 per cent according to the literature (FAO, 2001).

**Table 5.4: Simulation of targeted households using the NICHE criteria-all poor**

Percentile cut-off	Criteria	Number of Targeted HHS	Exclusion Error	Inclusion Error	Number of Excluded HHS	Number of Included HHS
5	<b>Poverty</b>	<b>571,125</b>	-	<b>13.3</b>	-	<b>80,517</b>
	Children under 2	183,129	-	12.4	-	22,829
	Breastfeeding	181,762	-	13.5	-	24,403
10	<b>Poverty</b>	<b>1,142,207</b>	-	<b>21.2</b>	-	<b>252,594</b>
	Children under 2	332,613	-	19.8	-	65,482
	Breastfeeding	331,257	-	19.2	-	63,605
15	<b>Poverty</b>	<b>1,712,650</b>	-	<b>26.4</b>	-	<b>474,928</b>
	Children under 2	485,257	-	23.3	-	115,983
	Breastfeeding	465,384	-	23.3	-	111,607
20	<b>Poverty</b>	<b>1,889,415</b>	<b>51.8</b>	<b>27.9</b>	<b>205,410</b>	<b>552,535</b>
	Children under 2	532,977	54.4	25.0	55,678	137,532
	Breastfeeding	508,720	56.7	25.1	52,462	131,481
25	<b>Poverty</b>	<b>1,936,987</b>	<b>45.9</b>	<b>27.6</b>	<b>420,954</b>	<b>559,657</b>
	Children under 2	542,946	47.0	24.9	103,394	138,816
	Breastfeeding	518,436	46.0	24.9	95,885	132,765
30	<b>Poverty</b>	<b>1,989,327</b>	<b>41.0</b>	<b>27.4</b>	<b>587,990</b>	<b>570,417</b>
	Children under 2	554,255	41.1	24.9	137,601	141,412
	Breastfeeding	528,379	40.1	24.8	126,234	134,554
35	<b>Poverty</b>	<b>2,052,805</b>	<b>36.8</b>	<b>27.2</b>	<b>714,127</b>	<b>583,905</b>
	Children under 2	567,288	36.3	25.1	169,660	145,893
	Breastfeeding	540,091	36.0	24.7	156,329	137,397
40	<b>Poverty</b>	<b>2,145,124</b>	<b>33.7</b>	<b>27.1</b>	<b>808,395</b>	<b>605,338</b>
	Children under 2	593,675	34.0	24.9	190,558	151,070
	Breastfeeding	565,277	33.7	24.7	175,777	142,574

As the number of households increases, the exclusion errors increase initially but begin to decline while the inclusion errors oscillate between 24-25 per cent (which is still below the recommended 30%) (Sabates-Wheeler, Hurell and Devereux, 2015). Depending on the resources available and the objective of the programme a cut-off can be determined.

Table 5.5 presents targeting results using population receiving cash transfer in the KIHBS 2015/16 data set. Results show a significant decline in number of beneficiary households in general. For instance, where the cut-off is the bottom five per cent, only 15,084 households would qualify. Similarly, the errors of inclusion are high for all the three eligibility criteria, having increased from 13 per cent to 14.4 per cent; 12.4 per cent to 14.1 per cent and 13.5 per cent to 20.7 per cent for poverty, children under two years and breastfeeding mothers at the 5<sup>th</sup> percentile. A similar trend applies to the bottom 10<sup>th</sup>, 15<sup>th</sup> and 20<sup>th</sup> percentiles.

By focusing only on the cash transfer beneficiaries, the NICHE programme excludes would-be beneficiary households, and this is likely to undermine the objective of effectively addressing the problem of malnutrition in the country.



**Table 5.5: NICHE Targeted households receiving cash transfer programme**

Percentile cut-off	Criteria	Number of Targeted HHS	Exclusion Error	Inclusion Error	Number of Excluded HHS	Number of Included HHs
5	<b>Poverty</b>	<b>67,927</b>	-	<b>14.4</b>	-	<b>10,835</b>
	Children under 2	15,084	-	14.1	-	2,041
	Breastfeeding	17,179	-	20.7	-	3,334
10	<b>Poverty</b>	<b>98,996</b>	-	<b>17.3</b>	-	<b>19,872</b>
	Children under 2	22,669	-	18.5	-	4,632
	Breastfeeding	24,020	-	22.6	-	5,547
15	<b>Poverty</b>	<b>125,910</b>	-	<b>22.7</b>	-	<b>31,508</b>
	Children under 2	30,342	-	23.9	-	7,268
	Breastfeeding	31,533	-	27.3	-	8,474
20	<b>Poverty</b>	<b>135,206</b>	<b>46.0</b>	<b>22.9</b>	<b>3,739</b>	<b>34,614</b>
	Children under 2	33,279	56.9	23.2	2,085	7,864
	Breastfeeding	33,306	53.2	27.8	1,714	9,070
25	<b>Poverty</b>	<b>137,178</b>	<b>52.5</b>	<b>23.2</b>	<b>14,235</b>	<b>35,555</b>
	Children under 2	34,551	53.7	24.3	3,184	8,703
	Breastfeeding	34,578	53.0	28.7	2,813	9,909
30	<b>Poverty</b>	<b>138,228</b>	<b>47.0</b>	<b>23.1</b>	<b>18,940</b>	<b>35,658</b>
	Children under 2	34,551	39.5	24.3	3,184	8,703
	Breastfeeding	34,578	42.4	28.7	3,049	9,909
35	<b>Poverty</b>	<b>138,980</b>	<b>41.6</b>	<b>23.0</b>	<b>22,792</b>	<b>35,761</b>
	Children under 2	34,855	25.8	24.3	3,231	8,805
	Breastfeeding	34,882	37.1	28.6	3,171	10,012
40	<b>Poverty</b>	<b>140,052</b>	<b>40.5</b>	<b>23.0</b>	<b>24,317</b>	<b>36,079</b>
	Children under 2	34,905	36.8	24.2	4,066	8,805
	Breastfeeding	34,932	47.6	28.6	4,006	10,012

Source: Authors' calculations using KIHBS 2015/16

Table 5.6 presents results of expanded selection criteria that considers only poor households with children under five years. This means the selection criteria has considered children under two years of age and households with breastfeeding. In addition, children aged between two and five years are also included. With this eligibility criteria, the objective of addressing malnutrition among children is likely to be attained. In this case, the relevant group includes all those who are at risk of future malnutrition (under two years, two to five years and breastfeeding children) and those children who are malnourished (under five years and poor). Due to data limitations, another key category that is missing in this analysis is pregnant women. As such, this analysis is not included in the report. The results in Table 5.5 show that where the resources are available to cater for 335,765 households, targeting the bottom five per cent would be appropriate.

**Table 5.6: Targeted households based on the under 5 criteria**

Percentile cut-off	Criteria	Number of Targeted HHS	Exclusion Error (%)	Inclusion Error (%)	Number of Excluded HHS	Number of Included HHS
5	Under 5	335,765	-	13.0	-	45,716
10	Under 5	637,815	-	20.2	-	130,906
15	Under 5	935,669	-	24.5	-	237,246
20	Under 5	1,027,868	53.8	26.1	101,357	279,650
25	Under 5	1,051,644	46.2	25.9	200,082	283,610
30	Under 5	1,083,318	40.6	25.8	263,275	290,712
35	Under 5	1,111,962	35.9	25.7	321,661	296,462
40	Under 5	1,154,341	33.0	25.5	356,983	304,015

The inclusion error is lowest when the poorest five per cent are targeted. There is no exclusion error if the bottom 15 per cent of the poor are targeted.

As such, this criterion effectively targets the children under five. Specifically, the bottom five per cent of the population seem to be the best category to target if the bear minimum objective of addressing malnutrition is to be achieved in a nutrition improvement programme. This is explained by the fact that children under five are prone to suffer from malnutrition, and that the age is within the range that is critical for a child's growth and development.



## Conclusions and Recommendations

The process of selecting appropriate eligibility criteria and identifying eligible persons for selection into a social protection programme is challenging to policy makers. Evidence from country reviews suggests that trade-offs between targeting accuracy and targeting costs are inevitable. In addition, the implementing agency has to choose between investing more resources into improving targeting accuracy and whether to minimize inclusion error or exclusion errors (Sabates-Wheeler, Hurrell and Devereux, 2015). Further, the final decision on the criteria to apply is subject to the objective of the programme and the budget.

Using the KIHBS 2015/16, this study analyses the targeting performance and proposes the eligibility criteria for selecting beneficiaries of a nutrition-sensitive programme. The study further evaluates the effectiveness of the NICHE criteria using the data. The results are presented up to the 40<sup>th</sup> percentile.

The results show that it is not just enough to target the poor, but the criteria should include a variable that is related to the objective of the programme. Further, targeting the poorest 15 per cent is more effective as opposed to targeting all the poor. The exclusion error is zero (0) while the inclusion error is below 30 per cent. The poorest 5 per cent account for the lowest inclusion error.

In addition, targeting poor households with children who are below two years and households with breastfeeding mothers is effective. However, targeting poor households with children under five years is more inclusive and tends to not only meet the objective of preventing malnutrition but also managing cases of already existing malnutrition.

This study therefore, concludes that using the criteria of targeting under five years for a nutrition-sensitive programme is a better policy instrument for the policy maker than using both under-two and breastfeeding mothers either combined or in isolation.

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## ANNEX

**Annex Table 1: Description of the indicators and deprivation cut-offs<sup>4</sup>**

Dimension	Indicator	Deprivation cut-off	Weight
Health	Nutrition	Any person under 70 years for whom there is nutritional information is undernourished	1/6
	Child mortality	A child under 18 has died in the household in the five-year period preceding the survey	1/6
Education	Years of schooling	No eligible household member has completed six years of schooling	1/6
	School attendance	Any school-aged child is not attending school up to the age at which he/she would complete Class 8.	1/6
Living Standards (1/3)	Cooking fuel	A household cooks using solid fuel, such as dung, agricultural crop, shrubs, wood, charcoal, or coal.	1/18
	Sanitation	The household has unimproved or no sanitation facility or it is improved but shared with other households	1/18
	Drinking water	The household's source of drinking water is not safe or safe drinking water is a 30-minute or longer walk from home, roundtrip	1/18
	Electricity	The household has no electricity	1/18
	Housing	The household has inadequate housing materials in any of the three components: floor, roof, or walls	1/18
	Assets	The household does not own more than one of these assets: radio, TV, telephone, computer, animal cart, bicycle, motorbike, or refrigerator, and does not own a car or truck	1/18

**Annex Table 2: Variables used to compute PMT scores**

Variables	Description
Sex	Sex of the Household Head
Marriage	Type of marriage
Education level	Education level of the household head
Household Size	Number of members in the household
Marital status of household head	Marital status of household head
Type of occupation	Occupation of the household head
Wall	Construction material of the wall
Roof	Construction material of the roof
Floor	Construction material of the floor
Drinking water	Source of the drinking water
Toilet	Type of the toilet (flush, pit latrine)

4 Definition could be in line with a country's national context and social strategy.

Fuel	Cooking fuel used
Ownership of durable assets	Ownership of a radio, TV, motorcycle, car, fridge, computer, cooker, electric fan, mobile phone, water dispenser, washing machine
Location (urban/rural)	Whether the household resides in urban or rural area
Location (County)	County in which the household resides

**Annex Table 3: List of PMT variables that enter into OLS model**

Variable	Variable	Variable
Log of consumption	<b>HH size</b>	<b>HH floor Material</b>
Residence	HH with 1 member	Earth/sand
County dummies	HH with 2 members	Dung
Female headed HH	HH with 3 members	Wood planks/shingles
Children 0-7 years	HH with 4 members	Palm/bamboo
Children 8-14 years	HH with 5 members	Parquet or polished wood
Children 15-18 years	HH with 6 members	Vinyl or asphalt strips
Age	<b>HH wall Material</b>	Ceramic tiles
Log of age	No walls	Cement
Dependency ratio	Cane/palm/trunks	Carpet
<b>Marital status</b>	Grass/reeds	<b>Source of water</b>
Married monogamous	Mud	Piped water - piped into dwelling
Married polygamous	Bamboo with mud	Piped water - piped into plot/yard
Separated	Stone with mud	Piped water - public tap/stand pipe
Divorced	Uncovered abode	Tube well/borehole with pump
Widowed	Plywood	Dug well - protected well
Never married	Cardboard	Dug well - unprotected well
<b>Nutrition</b>	Reused wood	Water from spring - protected spring
Stunting (u5)	Corrugated iron sheets	Water from spring - unprotected spring
Wasting (u5)	Cement	Rain water collection
Underweight (u5)	Stone with lime/cement	Vendors - tankers-truck
Body Mass Index (Children under 5)	Bricks	Vendors - cart with small tank/drum/buckets
<b>Employment</b>	Cement Blocks	Vendors - bicycles with buckets
Wage earners	Covered abode	Surface water - river, stream, pond, dam, lake, canal, irrigation



Own Account worker	Wood planks/ shingles	Bottled water
Own Account worker farm	<b>HH roof Material</b>	<b>Toilet facilities</b>
<b>Education</b>	Grass/thatch/makuti	Flush to piped sewer system
None	Dung/mud	Flush to septic tank
Primary	Corrugated iron sheets	Flush to pit (latrine)
Secondary	Tin cans	Flush to somewhere else
	Concrete	Flush to unknown place/not sure/dk where
Ventilated improved pit latrine (vip)	Tiles	<b>Asset-Durables</b>
Pit latrine with slab	<b>Asset-Durables</b>	Electric drill
Pit latrine without slab/ open pit	Refrigerator/freezers	Hedge cutters
Bucket toilet	Kerosene stove	Wheelbarrow
Hanging toilet/hanging latrine	Iron box - charcoal	Chaff cutter
No facility/bush/field	Washing Machine	Water tank
<b>Source of Lighting</b>	Electric/gas cooker/ Meko	Solar panels
Firewood	Jiko - charcoal	High pressure cleaner
Electricity	Microwave oven	Torches
Liquified petroleum gas	Vacuum cleaner	Batteries (dry cells)
Biogas	Sewing machine	Solar lamps
Kerosene	Water dispenser	Paraffin lamps, tin lamp
Charcoal	Other appliances	Garden hose/watering cans
Straw/shrubs/grass	Electric iron	Electric bulb /Fluorescent tubes
Animal dung	Rice cooker	Padlocks
Agricultural crop residue	Air conditioner/fans	House alarm
<b>Asset-Durables</b>	Electric heater	Barbed wire/chain link
Dressing Tables	Electric toaster	Electric fence
Writing/Study Tables	Electric kettle	Mattock/saw/panga/axe/slasher
Coffee table	Coffee mills/makers	Forks/jembe/rake/spade/mattock/file
Dining Table	Food mixers, blenders, juicers	Hammer/mallet
Entertainment Unit/TV stand	Deep fryers	Mobile handset-basic/smartphone
Sofa sets	Cups/glasses	Telephone installation
Chairs	Plates/bowls	Home theatre

Beds	Knives/spoons/forks/ cooking stick	Woofers/speakers/tweeters
Stools	Cooking sufurias/ pots	Television
Book shelves/chest of drawers	Frying pans	Antennae (aerial) /Satellite/Decoder
Wardrobes	Pressure cooker	Radio
Iron boards	Buckets/basins	MP3/MP4/Ipod
Side boards/wall units	Feeding bottle	Calculators
Curtains and accessories	Thermos flask	Computer (Laptop)
Pillows	Plastic containers	Computer (Tablet)
Mattresses	Tray	Computer(Desktop)
Bed Sheets/bed covers/ pillow cases	Towels	Uninterruptable Power Supply (UPS)
Table cloth/mats	Carpets and mats	Car for personal use
Mosquito net	Flash disks/memory card	Pick-up for personal use
Printers/copiers	Hard disk	Motorcycle for personal use
Radio/cassette/CD player	Boat/canoe	Bicycle/tricycles for personal use
Pre-recorded/blank cassettes	Outboard engine	Animal-drawn vehicles
Blank/recorded CD/DVD		

**Annex Table 4: Monthly mean predicted household consumption**

County	Mean	No. of households
Mombasa	10,161	396,731
Kwale	5,974	174,257
Kilifi	7,010	326,201
Tana River	4,522	56,089
Lamu	6,844	29,757
Taita Taveta	6,499	101,704
Garissa	4,298	78,425
Wajir	3,410	69,078
Mandera	3,120	111,033
Marsabit	3,779	62,232
Isiolo	5,872	33,670
Meru	6,703	393,443
Tharaka Nithi	6,726	106,915
Embu	6,197	164,267
Kitui	5,071	236,358

Machakos	7,465	327,584
Makueni	5,557	233,279
Nyandarua	5,883	191,429
Nyeri	8,251	271,129
Kirinyaga	7,106	198,294
Murang'a	6,207	323,057
Kiambu	8,996	599,910
Turkana	3,005	245,683
West Pokot	3,659	119,211
Samburu	3,736	61,474
Trans Nzoia	6,073	209,900
Uasin Gishu	6,970	269,555
Elgeyo Marakwet	4,704	99,188
Nandi	5,152	201,585
Baringo	6,107	152,251
Laikipia	5,847	135,286
Nakuru	8,007	578,193
Narok	8,098	222,770
Kajiado	7,449	249,976
Kericho	5,365	210,554
Bomet	4,442	179,036
Kakamega	5,142	392,111
Vihiga	4,488	144,185
Bungoma	5,186	321,496
Busia	3,522	176,969
Siaya	5,581	245,838
Kisumu	6,252	284,382
Homa Bay	5,083	224,494
Migori	4,659	232,932
Kisii	4,823	290,552
Nyamira	5,578	178,789
Nairobi City	13,227	1,503,295

**Annex Table 5: Estimation results for regressing predicted welfare on household characteristics**

Variable Name	Variable label	Coefficient
Dependent Variable	Mean consumption expenditure	
Nutrition	Body Mass Index (children under 5)	0.003866
Population Characteristic	Children 0-7 years	-0.015411
	Children 15-18 years	-0.032811

Labour	Own Account worker	0.067512
Labour	Own Account worker farm	0.055992
Education level	None	-0.227999
	Primary	-0.203356
	Secondary	-0.141187
Population Characteristic	1-member household	0.618155
	2-member household	0.407711
	3-member household	0.260750
	4-member household	0.173168
	5-member household	0.096769
	6-member household	0.073088
Household	No walls	-0.187563
	Cane/palm/trunks	-0.244489
	Grass/reeds	-0.139658
	Mud	-0.067478
	Corrugated iron sheets	-0.052403
	Dung/mud	0.101543
	Corrugated iron sheets	0.066520
	Asbestos sheet	0.168384
	Concrete	0.143825
	Tiles	0.247000
	Ceramic tiles	0.079062
	Piped water - piped into plot/yard	-0.110024
	Piped water - public tap/stand pipe	-0.144986
	Tube well/borehole with pump	-0.167216
	Dug well - protected well	-0.158552
	Dug well - unprotected well	-0.153342
	Water from spring - protected spring	-0.158555
	Water from spring - unprotected spring	-0.117838
	Rain water collection	-0.128384
	Cart with tank	-0.101800
	Bicycles with buckets	-0.182529
	surface water	-0.120397
	Fuel wood	-0.059247
	Gas lamp	-0.050938
	Electricity connection	-0.183799
	Generator	-0.165951
	Kerosene	-0.124233
	Charcoal	-0.102226
	Crop residue	-0.260891

	Male-headed HH	0.057072
	Log of sum of members' ages	-0.196369
	Residence	0.098921
	Sum of members' ages	0.000192
	Dressing tables	0.110910
	Sofa sets	0.050245
	Curtains and accessories	0.031767
	Pillows	0.072970
	Mattresses	0.115265
	Towels	0.062923
	Iron box-charcoal	0.062114
	Electric/Gas Cooker/Meko	0.065772
	Jiko - charcoal	0.043566
	Microwave oven	0.082196
	Electric iron	0.065321
	Electric kettle	0.108231
	Cooking sufurias/pots	-0.203167
	Frying pans	0.066905
	Thermos flask	0.077305
	Wheelbarrow	0.065383
	Torches	0.053798
	Batteries (dry cells)	0.044425
	Solar lamps	0.040710
	Electric bulb /fluorescent tubes	0.046614
	Barbed wire/chain link	0.073035
	mattock/saw/panga/axe/slasher	0.042555
	Mobile handset-basic/smartphone	0.050439
	Telephone installation	0.356367
	Television	0.074614
	Calculators	0.090355
	Computer (laptop)	0.112137
	Flash disks/memory card	0.074727
	Hard disk	0.143638
	Boat/canoe	0.831876
	Car for personal use	0.210104
	Pick-up for personal use	0.209323
	Motorcycle for personal use	0.046744

Annex Table 6: All pairwise correlation coefficients for all criteria

	HH with standard child	HH with child under 2	HH with child under 5	HH with 1 member	HH with 2 members	HH with 3 members	HH with 4 members	HH with 5 members	HH with 6 members	HH with 7 members	Dependent ratio	Number of 4	Number of 9	Number of 10-14	Number of 15-17	HH with Breastfeeding mothers	Child under 5 BMI	HH with at least one person with primary education	HH with at least one person with secondary education	HH with at least one person with university education	Unimproved sanitation
HH with standard child	1																				
HH with child under 2	0.2826*	1																			
HH with child under 5	0.4485*	0.6933*	1																		
HH with 1 member	-0.1567*	-0.2288*	-0.3323*	1																	
HH with 2 members	-0.1073*	-0.1466*	-0.2175*	-0.1572*	1																
HH with 3 members	-0.0331*	-0.003	-0.0694*	-0.1830*	-0.1410*	1															
HH with 4 members	0.0258*	0.0370*	0.0545*	-0.1954*	-0.1506*	-0.1753*	1														
HH with 5 members	0.0287*	0.0482*	0.0803*	-0.1791*	-0.1380*	-0.1606*	-0.1716*	1													
HH with 6 members	0.0534*	0.0633*	0.1184*	-0.1554*	-0.1197*	-0.1393*	-0.1488*	-0.1364*	1												
HH with 7 members	0.1760*	0.2148*	0.3343*	-0.2132*	-0.1643*	-0.1912*	-0.2042*	-0.1872*	-0.1623*	1											
Dependency ratio	0.8222*	0.3143*	0.5043*	0.5043*	0.8345*	0.2886*	0.3197*	-0.2156*	-0.1735*	-0.0415*	0.0931*	0.751*	0.4575*	0.2770*	0.2770*	0.4478*	0.2919*	0.4478*	0.2919*	0.4478*	0.2919*
Number of children 2-4	0.3959*	0.1815*	0.8345*	-0.2765*	-0.1847*	-0.0787*	0.0461*	0.0727*	0.1131*	0.2919*	0.4478*	0.2770*	0.4575*	0.2770*	0.4478*	0.2919*	0.4478*	0.2919*	0.4478*	0.2919*	0.4478*
Number of children 5-9	0.6889*	0.1545*	0.2886*	-0.3197*	-0.2156*	-0.1735*	-0.0415*	0.0931*	0.751*	0.4575*	0.2770*	0.4478*	0.2919*	0.4478*	0.2919*	0.4478*	0.2919*	0.4478*	0.2919*	0.4478*	0.2919*
Number of children 10-14	0.6534*	0.0253*	0.0784*	-0.2737*	-0.1783*	-0.1341*	-0.0720*	0.0451*	0.431*	0.4443*	0.3820*	0.0876*	0.4443*	0.3820*	0.0876*	0.4443*	0.3820*	0.0876*	0.4443*	0.3820*	0.0876*
Number of children 15-17	-0.0077	-0.0233*	-0.0109	-0.2173*	-0.1280*	-0.0918*	-0.0665*	0.0250*	0.0861*	0.3608*	-0.0443*	0.0029	0.1452*	0.2786*	0.2786*	0.0029	0.1452*	0.2786*	0.2786*	0.0029	0.1452*
HH with Breastfeeding mothers	0.2841*	0.8177*	0.6471*	-0.2239*	-0.1416*	-0.001	0.0298*	0.0588*	0.0698*	0.1964*	0.3194*	0.2578*	0.1639*	0.282*	0.282*	0.1964*	0.3194*	0.2578*	0.1639*	0.282*	0.282*
Child under 5 BMI	0.4880*	0.4944*	0.7733*	-0.3251*	-0.2051*	-0.0041	0.0746*	0.0859*	0.1168*	0.2449*	0.4154*	0.6772*	0.2506*	0.0781*	0.0781*	0.2449*	0.4154*	0.6772*	0.2506*	0.0781*	0.0781*
HH with at least one person with no education	0.1486*	0.0901*	0.2286*	-0.1580*	-0.0464*	-0.0685*	-0.0306*	0.0113	0.0502*	0.2295*	0.2535*	0.2402*	0.1836*	0.1098*	0.0832*	0.1078*	0.0832*	0.1078*	0.0832*	0.1078*	0.0832*
HH with at least one person with primary education	-0.0430*	-0.0186*	-0.0806*	-0.0405*	-0.0259*	0.0266*	0.0397*	0.0454*	0.0287*	-0.0628*	-0.0658*	-0.0957*	-0.0226*	0.0214*	0.0204*	-0.0250*	-0.0241*	-0.0250*	-0.0241*	-0.0250*	-0.0241*
HH with at least one person with secondary education	-0.1000*	-0.0596*	-0.1279*	0.1596*	0.0696*	0.0554*	0.0033	-0.0516*	-0.0715*	-0.1613*	-0.1700*	-0.1291*	-0.1489*	-0.1255*	-0.0995*	-0.0721*	-0.0953*	-0.0721*	-0.0953*	-0.0721*	-0.0953*
HH with at least one person with university education	-0.0335*	-0.0337*	-0.0563*	0.1038*	0.0227*	-0.0126*	-0.0164	-0.0220*	-0.0305*	-0.0462*	-0.0696*	-0.0510*	-0.0564*	-0.0456*	-0.0349*	-0.0317*	-0.0559*	-0.0812*	-0.1024*	-0.0595*	-0.0595*
Unimproved sanitation	0.8602*	0.0485*	0.0678*	0.0892*	0.0659	0.0177*	-0.0235*	-0.0422*	-0.0285*	-0.0250*	0.0593*	0.0553*	0.0291*	-0.0432*	-0.0563*	0.0602*	0.0413*	0.1311*	-0.0338*	-0.0861*	-0.0869*
Improved water source	0.1017*	0.0776*	0.1208*	-0.1659*	-0.0485*	-0.0237*	-0.0095*	0.0153	0.0572*	0.1130*	0.1467*	0.1056*	0.1258*	0.0760*	0.0609*	0.0881*	0.0922*	0.2185*	-0.0166	-0.1948*	-0.0708*

\* significant at 0.01 level

	Male-headed HH	0.057072
	Log of sum of members' ages	-0.196369
	Residence	0.098921
	Sum of members' ages	0.000192
	Dressing tables	0.110910
	Sofa sets	0.050245
	Curtains and accessories	0.031767
	Pillows	0.072970
	Mattresses	0.115265
	Towels	0.062923
	Iron box-charcoal	0.062114
	Electric/Gas Cooker/Meko	0.065772
	Jiko - charcoal	0.043566
	Microwave oven	0.082196
	Electric iron	0.065321
	Electric kettle	0.108231
	Cooking sufurias/pots	-0.203167
	Frying pans	0.066905
	Thermos flask	0.077305
	Wheelbarrow	0.065383
	Torches	0.053798
	Batteries (dry cells)	0.044425
	Solar lamps	0.040710
	Electric bulb /fluorescent tubes	0.046614
	Barbed wire/chain link	0.073035
	mattock/saw/panga/axe/slasher	0.042555
	Mobile handset-basic/smartphone	0.050439
	Telephone installation	0.356367
	Television	0.074614
	Calculators	0.090355
	Computer (laptop)	0.112137
	Flash disks/memory card	0.074727
	Hard disk	0.143638
	Boat/canoe	0.831876
	Car for personal use	0.210104
	Pick-up for personal use	0.209323
	Motorcycle for personal use	0.046744



**Annex Table 6: All pairwise correlation coefficients for all criteria**

	HH with standard child	HH with child under 2	HH with child under 5	HH with 1 member	HH with 2 members	HH with 3 members	HH with 4 members	HH with 5 members	HH with 6 members	HH with 7 members	Dependancy ratio	Number of children 2-4	Number of children 5-9	Number of children 10-14	Number of children 15-17	HH with Breastfeeding mothers	Child under 5 BMI	HH with atleast one person with no primary education	HH with atleast one person with secondary education	HH with atleast one person with university education	Unimproved sanitation
HH with standard child	1																				
HH with child under 2	0.2826*	1																			
HH with child under 5	0.4485*	0.6933*	1																		
HH with 1 member	-0.1567*	-0.2288*	-0.3323*	1																	
HH with 2 members	-0.1073*	-0.1466*	-0.2175*	-0.1572*	1																
HH with 3 members	-0.0331*	-0.0031	-0.0594*	-0.1830*	-0.1410*	1															
HH with 4 members	0.0258*	0.0370*	0.0545*	-0.1954*	-0.1506*	-0.1753*	1														
HH with 5 members	0.0287*	0.0482*	0.0803*	-0.1791*	-0.1380*	-0.1605*	-0.1716*	1													
HH with 6 members	0.0534*	0.0633*	0.1184*	-0.1554*	-0.1197*	-0.1393*	-0.1488*	-0.1364*	1												
HH with 7 members	0.1760*	0.2148*	0.3343*	-0.2132*	-0.1643*	-0.1912*	-0.2042*	-0.1872*	-0.1623*	1											
Dependancy ratio	0.2822*	0.3143*	0.5043*	-0.4131*	-0.1906*	-0.0567*	0.0649*	0.1461*	0.781*	0.2730*	1										
Number of children 2-4	0.3959*	0.1815*	0.8345*	-0.2785*	-0.1847*	-0.0787*	0.0461*	0.0727*	0.1131*	0.2919*	0.4478*	1									
Number of children 5-9	0.6889*	0.1545*	0.2896*	-0.3197*	-0.2156*	-0.1735*	-0.0415*	0.0931*	0.751*	0.4575*	0.5651*	0.2770*	1								
Number of children 10-14	0.6534*	0.0253*	0.0784*	-0.2737*	-0.1783*	-0.1341*	-0.0720*	0.0451*	0.4431*	0.4443*	0.3820*	0.0876*	0.2984*	1							
Number of children 15-17	-0.0077	-0.0233*	-0.0109	-0.2173*	-0.1280*	-0.0918*	-0.0665*	0.0250*	0.0961*	0.3608*	-0.0443*	0.0029	0.1452*	0.2766*	-0.0245*	1					
HH with Breastfeeding mothers	0.2841*	0.8177*	0.6471*	-0.2239*	-0.1416*	-0.0010	0.0298*	0.0588*	0.0698*	0.1964*	0.3194*	0.2578*	0.1639*	0.0282*	-0.0245*	1					
Child under 5 BMI	0.4880*	0.4944*	0.7733*	-0.3251*	-0.2051*	-0.0041	0.0746*	0.0859*	0.1168*	0.2449*	0.4154*	0.6772*	0.2506*	0.0781*	-0.0053	0.4673*	1				
HH with atleast one person with no education	0.1486*	0.0901*	0.2266*	-0.1580*	-0.0494*	-0.0685*	-0.0306*	0.0113	0.0502*	0.2295*	0.2535*	0.2402*	0.1836*	0.1098*	0.0832*	0.1078*	0.1385*	1			
HH with atleast one person with primary education	-0.0430*	-0.0186*	-0.0806*	-0.0405*	-0.0259*	0.0266*	0.0397*	0.0454*	0.0267*	-0.0628*	-0.0658*	-0.0957*	-0.0226*	0.0214*	0.0204*	-0.0250*	-0.0241*	-0.6154*	1		
HH with atleast one person with secondary education	-0.1000*	-0.0595*	-0.1279*	0.1596*	0.0696*	0.0554*	0.0033	-0.0516*	-0.0715*	-0.1613*	-0.1700*	-0.1291*	-0.1489*	-0.1255*	-0.0995*	-0.0721*	-0.0953*	-0.3590*	-0.4521*	1	
HH with atleast one person with university education	-0.0335*	-0.0337*	-0.0563*	0.1038*	0.0227*	-0.0126*	-0.0164	-0.0220*	-0.0305*	-0.0462*	-0.0696*	-0.0510*	-0.0564*	-0.0456*	-0.0349*	-0.0317*	-0.0559*	-0.0812*	-0.1024*	-0.0595*	1
Unimproved sanitation	0.9602*	0.0485*	0.0678*	0.0892*	0.0959	0.0177*	-0.0235*	-0.0422*	-0.0285*	-0.0250*	0.0593*	0.0553*	0.0291*	-0.0432*	-0.0563*	0.0602*	0.0413*	0.1311*	-0.0338*	-0.0861*	-0.0869*
Improved water source	0.1017*	0.0776*	0.1208*	-0.1059*	-0.0485*	-0.0237*	-0.0095*	0.0153	0.0572*	0.1130*	0.1467*	0.1056*	0.1258*	0.0760*	0.0609*	0.0881*	0.0922*	0.2185*	-0.0166	-0.1948*	-0.0708*
significant at 0.01 level																					

\* significant at 0.01 level

**Annex Table 7: Pairwise Positive Correlations for proposed eligibility criteria**

	HH with stunted child	HH with child under 2	HH with child under 5	HH with 4 members	HH with 5 members	HH with 6 members	HH with 7 members	Dependancy ratio	Number of children 2-4	Number of children 5-9	Number of children 10-14	HH with Breastfeeding mothers	Child under 5 BMI	HH with atleast one person with no education	Unimproved sanitation	Improved water source
HH with stunted child	1															
HH with child under 2	0.2826*	1														
HH with child under 5	0.4485*	0.6933*	1													
	0.0258*	0.0370*	0.0545*	1												
HH with 5 members	0.0287*	0.0482*	0.0803*	-0.1716*	1											
HH with 6 members	0.0534*	0.0633*	0.1184*	-0.1488*	-0.1364*	1										
HH with 7 members	0.1760*	0.2148*	0.3343*	-0.2042*	-0.1872*	-0.1623*	1									
Dependancy ratio	0.2622*	0.3143*	0.5043*	0.0649*	0.1461*	0.1781*	0.2730*	1								
Number of children 2-4	0.3959*	0.1815*	0.8345*	0.0461*	0.0727*	0.1131*	0.2919*	0.4478*	1							
Number of children 5-9	0.1689*	0.1545*	0.2896*	-0.0415*	0.0931*	0.1751*	0.4575*	0.5651*	0.2770*	1						
Number of children 10-14	0.0534*	0.0253*	0.0784*	-0.0720*	0.0451*	0.1431*	0.4443*	0.3820*	0.0876*	0.2984*	1					
HH with Breastfeeding mothers	0.2841*	0.8177*	0.6471*	0.0298*	0.0588*	0.0698*	0.1964*	0.3194*	0.2578*	0.1639*	0.0282*	1				
Child under 5 BMI	0.4880*	0.4944*	0.7733*	0.0746*	0.0859*	0.1168*	0.2449*	0.4154*	0.6772*	0.2506*	0.0781*	0.4673*	1			
HH with atleast one person with no education	0.1486*	0.0901*	0.2266*	-0.0306*	0.0113	0.0502*	0.2295*	0.2535*	0.2402*	0.1836*	0.1098*	0.1078*	0.1385*	1		
Unimproved sanitation	0.0602*	0.0485*	0.0678*	-0.0235*	-0.0422*	-0.0285*	-0.0250*	0.0593*	0.0553*	0.0291*	-0.0432*	0.0602*	0.0413*	0.1311*	1	
Improved water source	0.1017*	0.0776*	0.1208*	-0.0095	0.0153	0.0572*	0.1130*	0.1467*	0.1056*	0.1256*	0.0760*	0.0881*	0.0922*	0.2185*	0.1146*	1

\* significant at 0.01 level

**Annex Table 8: Targeting households using the new criteria**

Percentile cut-off	Criteria	Number of Targeted HHS	Exclusion Error	Inclusion Error	Number of Excluded HHS	Number of Included HHs
5	Children 0-17	558,119	-	13.3	-	78,808
	Under-5	335,765	-	13.0	-	45,716
	2-4 children	187,052	-	15.6	-	28,530
	5+ children	245,908	-	11.3	-	27,036
	No education	326,811	-	12.4	-	64,551
	Unimproved sanitation	495,432	-	13.2	-	73,214
	Improved water source	328,005	-	14.8	-	57,097
	4 members	67,464	-	17.2	-	9,032
	5 members	105,764	-	10.1	-	7,620
	6 members	107,188	-	10.7	-	8,209
	7 members	231,757	-	13.3	-	41,468
	Female Headed	223,154	-	11.4	-	32,443
10	Children 0-17	1,096,459	-	21.0	-	236,854
	Under-5	637,815	-	20.2	-	130,906
	2-4 children	401,411	-	23.2	-	93,925
	5+ children	455,329	-	19.3	-	85,849
	No education	475,131	-	18.1	-	160,740
	Unimproved sanitation	521,678	-	20.8	-	219,344
	Improved water source	382,785	-	20.7	-	155,256
	4 members	52,427	-	22.0	-	24,168
	5 members	75,266	-	22.7	-	36,305
	6 members	76,812	-	22.0	-	38,814
	7 members	309,190	-	20.2	-	116,236
	Female Headed	249,921	-	20.2	-	106,177

15	Children 0-17	1,635,513	-	26.2	-	446,428
	Under-5	935,669	-	24.5	-	237,246
	2-4 children	621,349	-	30.1	-	190,874
	5+ Children	624,655	-	22.7	-	139,979
	No education	810,978	-	22.8	-	268,196
	Unimproved sanitation	1,002,526	-	25.7	-	396,694
	Improved water source	722,905	-	25.2	-	275,622
	4 members	109,622	-	28.0	-	49,027
	5 members	159,915	-	28.2	-	75,777
	6 members	176,706	-	30.6	-	87,108
	7 members	581,062	-	24.0	-	194,427
	Female Headed	475,521	-	24.5	-	182,692
20	Children 0-17	1,794,672	51.4	27.7	185,411	517,543
	Under5	1,027,868	53.8	26.1	101,357	279,650
	2-4 children	699,567	52.8	32.5	91,095	229,353
	5+ children	660,393	51.6	23.2	40,579	150,960
	No education	1,081,452	50.2	23.9	79,369	302,819
	Unimproved sanitation	1,456,294	52.7	26.9	163,453	455,965
	Improved water source	1,028,294	54.3	26.8	112,075	318,392
	4 members	174,832	49.2	29.6	31,129	59,055
	5 members	268,477	51.8	30.8	45,668	96,726
	6 members	284,897	59.3	32.1	44,332	100,133
	7 members	804,026	49.1	25.2	53,561	216,699
	Female Headed	674,090	54.8	26.0	76,029	209,102
25	Children 0-17	1,840,560	45.5	27.4	372,615	524,246
	Under-5	1,051,644	46.2	25.9	200,082	283,610
	2-4 children	719,981	46.9	32.1	174,540	233,088
	5+ Children	674,449	44.8	22.8	74,336	152,216
	No education	1,169,694	45.4	23.8	161,212	308,708
	Unimproved sanitation	1,599,599	46.8	26.6	326,928	461,472
	Improved water source	1,118,206	48.5	26.6	230,619	319,488
	4 members	199,345	41.1	28.6	68,987	59,055
	5 members	314,210	46.7	30.3	87,946	97,053
	6 members	311,917	52.5	31.5	83,611	101,820
	7 members	855,769	44.1	25.0	104,070	219,778
	Female Headed	740,759	45.4	25.4	146,339	211,280

30	Children 0-17	1,890,937	40.6	27.2	512,686	534,369
	Under-5	1,083,318	40.6	25.8	263,275	290,712
	2-4 children	744,711	41.7	31.7	233,925	237,369
	5+ children	685,554	41.0	22.7	93,778	153,848
	No education	1,194,936	41.3	24.0	216,079	315,195
	Unimproved sanitation	1,635,283	42.2	26.3	446,840	466,664
	Improved water source	1,131,432	42.8	26.6	309,604	322,364
	4 members	206,256	36.2	28.9	100,224	61,098
	5 members	320,488	42.1	29.6	125,432	100,430
	6 members	323,082	44.9	31.1	108,249	102,623
	7 members	873,342	40.3	25.0	131,089	223,575
	Female Headed	760,401	40.3	25.0	211,344	212,159
35	Children 0-17	1,949,705	36.3	27.1	609,322	546,636
	Under-5	1,111,962	35.9	25.7	321,661	296,462
	2-4 children	764,573	35.9	31.4	263,361	240,732
	5+ children	693,505	38.2	22.6	107,721	155,191
	No education	1,216,527	38.4	24.0	263,646	321,449
	Unimproved sanitation	1,670,647	38.0	26.1	541,376	476,690
	Improved water source	1,142,680	38.7	26.4	373,255	325,370
	4 members	211,756	33.2	27.8	126,687	65,049
	5 members	338,871	35.2	29.6	139,730	103,092
	6 members	330,245	39.9	30.6	123,731	103,232
	7 members	888,576	37.2	25.0	150,355	226,960
	Female Headed	778,589	36.4	25.0	258,183	217,191
40	Children 0-17	2,029,660	33.4	27.0	676,795	564,267
	Under-5	1,154,341	33.0	25.5	356,983	304,015
	2-4 children	791,773	33.3	31.0	293,761	245,383
	5+ children	705,847	36.6	22.9	117,084	159,490
	No education	1,239,123	35.4	24.0	293,720	326,811
	Unimproved sanitation	1,724,758	35.1	26.1	602,744	495,432
	Improved water source	1,158,006	36.1	26.3	416,955	328,005
	4 members	234,151	30.3	26.0	148,688	67,464
	5 members	348,755	32.5	29.1	155,737	105,764
	6 members	337,642	36.6	30.4	136,689	107,188
	7 members	901,513	35.0	25.2	159,683	231,757
	Female Headed	800,143	34.2	24.7	302,502	223,154









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