

Evaluation of the Mwangaza Mashinani pilot project in Kilifi and Garissa counties, Kenya

Volume II: Midline technical annexes

Evaluation period: 2019 - 2020

Evaluation location: Kenya



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ACRONYMS

ARI	Acute Respiratory Infection
ATT	Average Treatment Effect on the Treated
BCC	Behaviour Change Communication
BWC	Beneficiary Welfare Committee
CATI	Computer-assisted Telephone Interview
CC	Community Champion
CT-OVC	Cash Transfer for Orphans and Vulnerable Children
DEQ	Detailed Evaluation Question
DID	Difference-in-differences
E4I	Energy4Impact
FCDO	Foreign, Commonwealth and Development Office
ITT	Average treatment effect on the intended to be treated
KEQ	Key Evaluation Question
KOSAP	Kenya Off-Grid Solar Access Project
KSh	Kenyan shilling
NSNP	National Safety Net Programme
OP-CT	Older Persons Cash Transfer
OPM	Oxford Policy Management
PAYG	Pay As You Go
PSM	Propensity Score Matching
QA	Quality Assurance
RA	Research Assistant
RCT	Randomised Control Trial

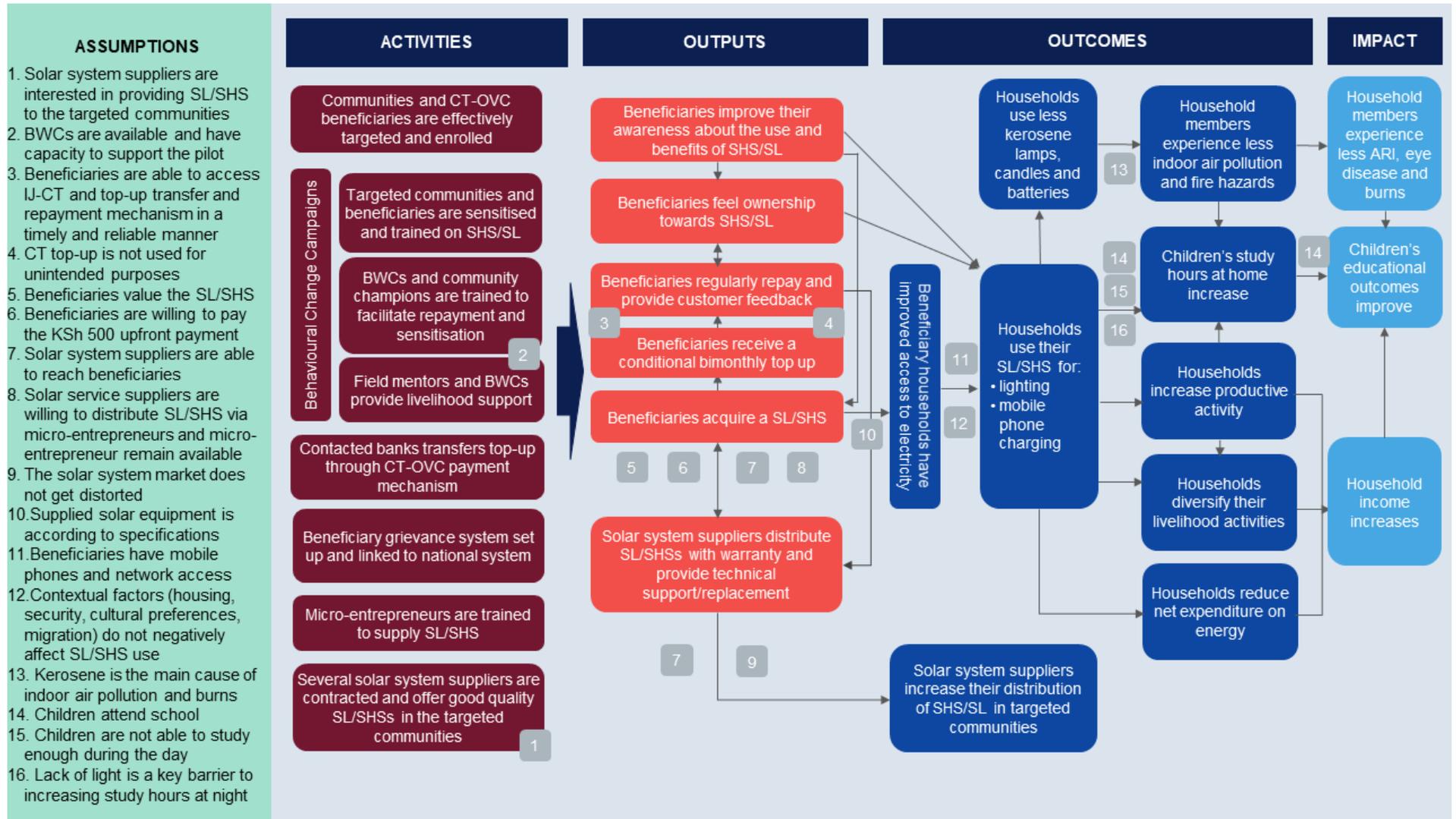
RGA	Research Guide Africa
SAU	Social Assistance Unit
SHS	Solar Home System
SIDA	Swedish International Development Agency
SL	Solar Lantern
SPS	Social Protection Secretariat
ToC	Theory of Change
TWG	Technical Working Group
UNICEF	United Nations Children's Fund
VfM	Value for Money

INTRODUCTION

Oxford Policy Management (OPM) has been contracted by UNICEF to conduct an independent evaluation of the Mwangaza Mashinani pilot project. This midline report presents the findings from the quantitative midline remote survey, the qualitative study, the implementation review and the value-for-money analysis conducted as part of a mixed methods evaluation. This report is presented in two volumes. Volume I presents the midline findings and discussion and Volume II contains the technical annexes to the midline report.

Volume II is structured as follows: Annex A presents the pilot project's Theory of Change. Annex B presents the evaluation matrix which guides our assessment of the project. Annex C provides technical details on the design and implementation of the remote quantitative midline survey. Annex D presents a comparison between the compliant and non-compliant households in the treatment sub-counties. Annex E provides technical details of our approach to quantitatively estimating impact on the sub-set of indicators assessed at midline. Annex F provides details on the qualitative approach. Annex G provides technical details related to the implementation review. Annex H provides details on the approach to the value-for-money analysis. Annex I contains statistical tables across all indicators for the treatment group at midline.

ANNEX A THEORY OF CHANGE



ANNEX B EVALUATION MATRIX

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
Relevance				
KEQ1. How well is the pilot project suited to the needs of the target population, their community and private sector solar device suppliers?				
DEQ 1.1. Is the pilot project's objective of improving access to off-grid solar device relevant to the target population's energy and welfare (education, health and livelihood) needs?	<ul style="list-style-type: none"> The market penetration of solar device in targeted communities was limited at the start of the pilot 	<ul style="list-style-type: none"> Prevalence of solar devices in sample population's homes in control or target groups at baseline Distribution of solar devices and PAYG mechanisms in local markets as perceived by suppliers 	Quantitative survey Routine monitoring data Key informant interviews (suppliers, last mile distributors)	Baseline Midline Endline
	<ul style="list-style-type: none"> Affordability and cash constraints are the main barriers to the target population's acquisition of off-grid solar device 	<ul style="list-style-type: none"> Reasons for not having a solar device Take up of solar device options amongst target population, compared to comparison population, once cash transfer plus option introduced 	Quantitative survey Routine monitoring data	Baseline Endline
	<ul style="list-style-type: none"> Solar devices are suited to address the target population's energy needs, particularly related to education, health and productive activity 	<ul style="list-style-type: none"> Children's school attendance Children's study hours Prevalence of respiratory diseases and burns Number of hours spent on productive activities including during darkness hours Beneficiaries' perception of relevance of solar device 	Quantitative survey Household and community qualitative research	Baseline Midline Endline
DEQ1.2. Is the intervention approach acceptable to the target population, their community and private solar device suppliers?	<ul style="list-style-type: none"> The target population perceive the acquisition of solar devices through the contracted suppliers, the down-payment and repayment following cash top-ups as acceptable 	<ul style="list-style-type: none"> Affordability of down-payment as perceived by the target population Frequency and reliability of cash top-ups in relation to the PAYG repayment schedule Availability of last mile distributors Target population's trust in last mile distributors 	Routine monitoring data Household and community qualitative research	Midline Endline

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
		- Acceptability of mechanism for both receiving cash top-up and making PAYG repayments		
	<ul style="list-style-type: none"> Community leaders and other representatives perceive the intervention as well targeted and beneficial to the community 	<p>In the view of community leaders:</p> <ul style="list-style-type: none"> Perception of who is being targeting Knowledge and perceptions of targeting criteria Reason why some households did not take up the project Perception of solar device systems provided to households 	<p>Routine monitoring data</p> <p>Household and community qualitative research</p>	Midline
	<ul style="list-style-type: none"> Solar suppliers are interested in providing solar devices to the entire target population according to the planned intervention specifications 	<ul style="list-style-type: none"> Suppliers interest in continuing / engaging in supply Suppliers plans to continue to supply the target population 	Key informant interviews (contracted suppliers, suppliers not contracted)	Midline Endline
KEQ2. Is the pilot project ToC internally and externally coherent?				
DEQ2.1. Is the pilot project's ToC valid, comprehensive and commonly understood by the main stakeholders?	<ul style="list-style-type: none"> Key ToC assumptions are likely to hold true and pathways are plausible 	<ul style="list-style-type: none"> Evidence that key assumptions are holding true at outset of project, namely: <ul style="list-style-type: none"> competition results in supplier being contracted (assumption 1) beneficiaries demonstrate demand by making KSh 500 deposit (assumption 6) beneficiaries can access cash top-up in a timely manner to make repayments (assumption 3) solar device suppliers are able to reach beneficiaries (assumption 7) beneficiaries have mobile phones (assumption 11) Children attend school and would study more if light were available after dark (assumptions 14,15 and 16) 	<p>Routine monitoring data</p> <p>Quantitative survey</p> <p>Household and community qualitative research</p> <p>Literature review</p>	<p>Inception</p> <p>Baseline</p> <p>Midline</p> <p>Endline</p>

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
		<ul style="list-style-type: none"> ○ cooking occurs outdoors or in separate building (making kerosene lighting more likely to be the most significant source of indoor air pollution) (assumption 13) - Evidence that key assumptions hold at baseline: <ul style="list-style-type: none"> ○ solar equipment supplied matches required specifications (assumption 10) - Literature review findings on pathways to impacts on health education and productive use for solar devices. 		
	<ul style="list-style-type: none"> • The objectives of enhancing access to energy to the most vulnerable segment of the population and increasing market penetration in vulnerable communities can plausibly be achieved through the intervention approach 	<ul style="list-style-type: none"> - Reasons for not joining the project - Specifications of solar equipment supplied - Number of household members - Number of rooms in household 	Routine monitoring data Quantitative survey Household and community qualitative research Key informant interviews (implementing partner, community leaders) Documentation review	Baseline Endline
	<ul style="list-style-type: none"> • Key programme stakeholders commonly understand the objectives and intervention approach 	<ul style="list-style-type: none"> - Stakeholder understanding of the pilot project's target population - Stakeholder understanding of level of impact expected on target population - Stakeholder understanding of methodological approach to extending PAYG market delivery mechanism 	Key informant interviews	Midline Endline
DEQ2.2. Are the pilot project's objectives and approach aligned with government policies?	<ul style="list-style-type: none"> • The pilot project is aligned with government's energy policies 	<ul style="list-style-type: none"> - Degree of alignment with the Kenya Rural Electrification Authority's own off grid solar access project (KOSAP) in terms of approach or counties selected - Specifications of solar devices supplied in relation to Kenya standards 	Key informant interviews Documentation review	Midline Endline

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
	<ul style="list-style-type: none"> The pilot project is aligned with government's social protection policies 	- Alignment with the NSNP's targeting procedures	Key informant interviews (SPS, SAU) Documentation review	Endline
	<ul style="list-style-type: none"> The pilot project is aligned with the development plans of the targeted counties 	- Alignment with plans for rural electrification as perceived by local county planners	Key informant interviews (county authorities)	Endline
Effectiveness				
KEQ3. To what extent have beneficiary households improved their awareness about and feel a sense of ownership towards their solar device?				
DEQ3.1. To what extent have beneficiary households improved their awareness about the use and benefits of solar devices?	<ul style="list-style-type: none"> Increased awareness of existence and application of solar devices 	<ul style="list-style-type: none"> Proportion of households without a solar device that are aware of solar devices Households awareness of devices and their benefits Households use of solar device 	Quantitative survey Household and community qualitative research	Baseline Midline Endline
	<ul style="list-style-type: none"> Increased knowledge of potential benefits of solar devices for household members' quality of life and welfare 	<ul style="list-style-type: none"> Proportion of households aware of at least one benefit of solar devices Proportion of households aware of more than one benefit of solar devices 	Quantitative survey Household and community qualitative research	Baseline Midline Endline
	<ul style="list-style-type: none"> Increased awareness and knowledge of solar devices within the community 	<ul style="list-style-type: none"> Proportion of households that have been approached by BWC members or community champions to discuss use and benefits of solar devices Proportion of households that have discussed use and benefits of solar devices with other households in the community Community leaders understanding of the application of solar devices and their use Community leaders understanding of the benefits of solar devices at the community level 	Quantitative survey Household and community qualitative research	Baseline Midline Endline
DEQ3.2. To what extent do beneficiary	<ul style="list-style-type: none"> Willingness to own a solar device 	- Number of households willing to pay deposit for a solar device	Quantitative survey	Midline Endline

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
households feel a sense of ownership towards their solar device?		<ul style="list-style-type: none"> - Average monetary value attached by households to the solar device - Proportion of households without a solar device that would like a solar device 	Household and community qualitative research Routine monitoring data	
	<ul style="list-style-type: none"> • Regular use and payment for solar devices 	<ul style="list-style-type: none"> - Proportion of households that have repaid the solar systems, including repayment schedule and overall repayment - Households' perception of the value in paying/identifying ways to pay for solar systems beyond the end of the pilot project, including gendered differences 	Routine monitoring data Quantitative survey Household and community qualitative research	Endline
	<ul style="list-style-type: none"> • Regular maintenance of solar systems 	<ul style="list-style-type: none"> - Proportion of households whose solar devices are not working - Proportion of households who have taken their solar device to be repaired - Proportion of households who have paid to repair their solar device - Households' perception of the value and benefits of the solar device - Households' willingness to keep devices functioning 	Quantitative survey Household and community qualitative research	Endline
KEQ4. How effectively have the operational modalities been taken up by the targeted beneficiaries and private sector suppliers? What are lessons for scale-up and replication in the NSNP?				
DEQ4.1. How well was the pilot project able to generate take up of the solar device among the target population?	<ul style="list-style-type: none"> • The pilot project is able to enrol the target population as planned 	<ul style="list-style-type: none"> - Number of target population enrolled, by gender and location - Proportion of targeted population that accept enrolment and take up of solar device - Proportion of enrolled beneficiaries that satisfy the beneficiary targeting criteria - Proportion of selected/enrolled beneficiaries that pay the initial down-payment as planned - Lessons learnt about enrolment process 	Routine monitoring data Quantitative survey Household and community qualitative research Key informant interviews (implementing partner)	Baseline Midline

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
	<ul style="list-style-type: none"> The enrolled beneficiaries are able to choose between types of solar device, and take up the selected solar device 	<ul style="list-style-type: none"> Proportion of enrolled beneficiary HHs that choose a solar device Proportion of enrolled beneficiary HHs that received a solar device (compared to planned) Proportion of enrolled beneficiary that made use of warranty or after sales service Proportion of enrolled beneficiary HHs that have a functioning installed solar device at the end of the pilot Information received by the enrolled beneficiary to make an informed choice Lessons learnt about supply and demand of solar device and after sales services 	<ul style="list-style-type: none"> Routine monitoring data Quantitative survey Household and community qualitative research Key informant interviews (implementing partner, suppliers) 	<ul style="list-style-type: none"> Midline Endline
	<ul style="list-style-type: none"> The enrolled beneficiaries are satisfied with the solar device delivered 	<ul style="list-style-type: none"> Households' satisfaction with delivery system of the solar device Households' satisfaction with the solar device products 	<ul style="list-style-type: none"> Household and community qualitative research 	<ul style="list-style-type: none"> Endline
DEQ4.2. To what extent did beneficiary household take up the bi-monthly top-up and payment modality?	<ul style="list-style-type: none"> The cash top-ups were paid and received according to plan and conditionality 	<ul style="list-style-type: none"> Proportion of beneficiaries that are paid the top-up amount on a bi-monthly basis Proportion of beneficiaries that do not comply with conditionality whose payment is stopped Proportion of beneficiaries that accessed the last bi-monthly payment Beneficiaries' understanding and experience with top-up payments Lessons learnt about top-up payment modality 	<ul style="list-style-type: none"> Routine monitoring data Quantitative survey Household and community qualitative research Key informant interviews (implementing partner, SAU, UNICEF) 	<ul style="list-style-type: none"> Midline Endline
	<ul style="list-style-type: none"> The enrolled beneficiaries repay the price of the solar device 	<ul style="list-style-type: none"> Proportion of beneficiaries that complete repayment Proportion of repayments to suppliers that have been delayed by x days Average length of payment delays 	<ul style="list-style-type: none"> Routine monitoring data Quantitative survey Household and community qualitative research 	<ul style="list-style-type: none"> Midline Endline

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
		<ul style="list-style-type: none"> - Beneficiaries' understanding and acceptance of the repayment modality - Households' perception of feasibility of repayment mechanisms - Barriers to or reasons for delayed or non-repayment - BWCs and community champions follow ups with households - Lessons learnt about repayment modalities 	Key informant interviews (implementing partner, suppliers, UNICEF)	
DEQ4.3. How well were the solar device suppliers able to distribute the solar devices among the enrolled beneficiaries and other community members?	<ul style="list-style-type: none"> • The suppliers set up a supply chain to deliver the solar device and after sales services in the targeted communities 	<ul style="list-style-type: none"> - Location of point of sales and after sales services by supplier - Number of trained micro-entrepreneurs/last mile distributors - Extent of after sales services provided by suppliers in targeted communities - Lessons learnt in the creation of a supply chain 	Key informant interviews (implementing partner, suppliers, UNICEF, energy experts)	Endline
	<ul style="list-style-type: none"> • The suppliers supply solar device to the beneficiaries according to MoU specifications 	<ul style="list-style-type: none"> - Specifications of solar device received by beneficiary households - Date of delivery of solar device to beneficiary households - Barriers to supplying the specified solar device to the enrolled beneficiaries - Lessons learnt about the feasibility of supplying the solar device according to MoU specifications 	Routine monitoring data Household and community qualitative research Key informant interviews (implementing partners, suppliers, UNICEF, energy experts)	Endline
	<ul style="list-style-type: none"> • The suppliers expand their supply solar device in the targeted communities beyond the beneficiaries 	<ul style="list-style-type: none"> - Sales of specified solar device in the targeted communities - Sales of other energy products in the targeted communities - Barriers to expanded distributions of solar device in the targeted communities - Lessons learn about expanded distribution of solar device in the targeted communities 	Household and community qualitative research Key informant interviews (implementing partners, suppliers, UNICEF, energy experts)	Endline

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
Impact				
KEQ5. To what extent did the pilot project have an attributable significant impact on beneficiary households' access to energy and use of the solar device for energy services?				
DEQ5.1. To what extent did the pilot project have an attributable significant impact on beneficiary households' access to energy?	<ul style="list-style-type: none"> Increase in household level energy access between Tier 0 and Tier 1 	<ul style="list-style-type: none"> Proportion of households falling into tier 0 and tier one using the multi-tier measurement of energy access (capacity and availability of supply) Number of people who are served with a tier 1 level of energy access (equivalent to a lighting system that provides 1000 lumen hours of light for a household of 5 persons) 	Quantitative Survey	Baseline Endline
	<ul style="list-style-type: none"> Increase in number of energy sources used by the household 	<ul style="list-style-type: none"> Proportion of households with access to mini grid and/or national grid Proportion of households owning a solar device 	Quantitative Survey	Baseline Midline Endline
DEQ5.2. To what extent did the pilot project have an attributable significant impact on beneficiary households' use of solar device for energy services?	<ul style="list-style-type: none"> Beneficiary households use own solar device for lighting 	<ul style="list-style-type: none"> Sources of energy used for lighting Proportion of households using solar device for lighting Average hours solar system is used for lighting each day 	Quantitative Survey	Baseline Midline Endline
	<ul style="list-style-type: none"> Beneficiary households use own solar device for mobile phone charging 	<ul style="list-style-type: none"> Proportion of households using solar device for charging their household's mobile phone Proportion of households using solar device for charging other household's mobile phone Proportion of households using solar device for charging other household's mobile phone for a fee 	Quantitative Survey	Baseline Midline Endline
	<ul style="list-style-type: none"> Beneficiary households use own solar device for productive activities and/or study time 	<ul style="list-style-type: none"> Proportion of households using solar device for charging other household's mobile phone for a fee Proportion of households using solar device for productive purposes 	Quantitative Survey	Baseline Midline Endline

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
		<ul style="list-style-type: none"> - Proportion of women using solar device for productive or social purposes - Proportion of children using solar device for studying 		
	<ul style="list-style-type: none"> • Beneficiary households use less kerosene lamps, candles and batteries 	<ul style="list-style-type: none"> - Number of kerosene lamps in use in household - Number of candles used in the household each month - Number of batteries used in the household month 	Quantitative Survey	Baseline Endline
KEQ6. To what extent and how did the pilot project have an attributable significant impact on the quality of life of beneficiary households, especially children?				
DEQ6.1. To what extent and how did the pilot project have an attributable significant impact on the education of children, girls and boys, in beneficiary households?	<ul style="list-style-type: none"> • Girls' and boys' study hours at home increase 	<ul style="list-style-type: none"> - Children's time spent (in hours on a typical day): studying at home (in daylight) - Children's time spent (in hours on a typical day): studying at home (during darkness using lighting) - Proportion of children doing homework outside of school 	Quantitative Survey	Baseline Endline
	<ul style="list-style-type: none"> • Girls' and boys' school attendance increases 	<ul style="list-style-type: none"> - Proportion of children attending school - Proportion of children regularly attending school 	Quantitative Survey	Baseline Endline
	<ul style="list-style-type: none"> • Girls and boys are promoted to the following grade 	<ul style="list-style-type: none"> - Proportion of children graduating to their next grade 	Quantitative Survey	Endline
DEQ6.2. To what extent did the pilot project have an attributable significant impact on the household members' health in	<ul style="list-style-type: none"> • Household members report fewer symptoms of respiratory illness due to indoor air pollution 	<ul style="list-style-type: none"> - Proportion of household members reporting symptoms of acute respiratory infections (ARI) - Proportion of households burning kerosene inside the home - Proportion of households cooking indoors - Type of cooking fuel used by household 	Quantitative Survey	Baseline Midline Endline

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
beneficiary households?	<ul style="list-style-type: none"> Household members report fewer symptoms of ocular disease due to indoor air pollution 	<ul style="list-style-type: none"> Proportion of school going children reporting symptoms of eye irritation 	Quantitative Survey	Baseline Endline
	<ul style="list-style-type: none"> Household members report fewer incidences of burns due to lighting fuel fire hazards 	<ul style="list-style-type: none"> Proportion of household members reporting burns related to lighting fuel in past six months 	Quantitative Survey	Baseline Endline
DEQ6.3. To what extent and how did the pilot project have an attributable significant impact on beneficiary household income by increasing men and women's livelihood opportunities and reducing household energy expenditure?	<ul style="list-style-type: none"> Increase in number and type of income-generating activities for household 	<ul style="list-style-type: none"> Proportion of household members engaged in income-generating activities, by gender Number of new income-generating activities started in the past 12 months (including enterprises promoted by project's engagement strategy) 	Quantitative Survey	Baseline Midline Endline
	<ul style="list-style-type: none"> Increase in engaging in income-generating activities during darkness hours 	<ul style="list-style-type: none"> Proportion of household members engaged in income generating activities undertaken during darkness hours, by gender Hours spent on income generating activities undertaken during darkness hours 	Quantitative Survey	Baseline Midline Endline
	<ul style="list-style-type: none"> Increase in hours spent on income generating activities 	<ul style="list-style-type: none"> Number of hours worked in the last one week (for working household members) Women's time spent (in hours on a typical day): paid labour Women's time spent (in hours on a typical day): unpaid labour 	Quantitative Survey	Baseline Endline
	<ul style="list-style-type: none"> Increase in total household income 	<ul style="list-style-type: none"> Total monthly household income 	Quantitative Survey	Baseline Midline Endline
	<ul style="list-style-type: none"> Decrease in household energy expenditure 	<ul style="list-style-type: none"> Monthly energy expenditure on fuel by type of fuel (kerosene, battery, solar device, SL, candles) Monthly expenditure on mobile phone charging Monthly expenditure on cooking fuel 	Quantitative Survey	Baseline Endline

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
KEQ7. What have been unintended and/or unexpected outcomes of the pilot project?				
No DEQ – one KEQ	<ul style="list-style-type: none"> Unintended and/or unexpected uses of the solar device among beneficiary households 		Quantitative Survey Household and community qualitative research	Midline Endline
	<ul style="list-style-type: none"> Unintended and/or unexpected effects of solar device use on beneficiary households' quality of life 	<ul style="list-style-type: none"> Primary cooking fuel used by household Female household member's time poverty Uses of solar device Gendered differences in terms of quality of life: additional hours of light contribute to/hinder girls' ability to study Gendered differences in terms of labour market outcomes based on increased working days for women (reallocation of existing work burdens) Gendered differences in terms of health based on reduction of indoor air pollution, preventing women from exposure to kerosene-related health risks Child labour outcomes Improved ability to take loans based on re-paying of solar device loan that builds up beneficiaries' credit rating 	Quantitative Survey Household and community qualitative research	Endline
	<ul style="list-style-type: none"> Unintended and/or unexpected outcomes of the pilot project at community level 	<ul style="list-style-type: none"> Household and community perceptions of personal safety Changes in communication within community 	Quantitative Survey Household and community qualitative research	Midline Endline
Efficiency				
KEQ8. What have been the strengths and weaknesses of the coordination process	<ul style="list-style-type: none"> Strengths and weaknesses of the functioning of the coordination mechanisms at county and national level 	<ul style="list-style-type: none"> Type of coordination mechanism established Roles of coordination mechanisms 	Documentation review (MoUs and minutes of coordination meetings) Key informant interviews (implementing partners, UNICEF,	Midline Endline

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
<p>among key stakeholders involved in the implementation of the pilot project? What are lessons for scale-up and replication?</p>		<ul style="list-style-type: none"> - Ongoing functioning of the coordination mechanism (county TWGs, national advisory committee) - Integration/alignment of coordination mechanism with existing coordination mechanisms and coordination practices 	<p>Sida, national and county government stakeholders, experts and development partners in the energy and social protection sectors, suppliers)</p>	
	<ul style="list-style-type: none"> • Strengths and weaknesses of stakeholder participation in the coordination process 	<ul style="list-style-type: none"> - Core national Ministries (Energy and Labour & Social Protection) and county government departments involved in the design of the pilot project - Degree and frequency of participation of relevant stakeholders to supervise and provide guidance during implementation - Government leadership in coordination process - Coordination with private sector stakeholders during the design and implementation of the pilot project 	<p>Documentation review (MoUs and minutes of coordination meetings)</p> <p>Key informant interviews (implementing partners, UNICEF, Sida, national and county government stakeholders, experts and development partners in the energy and social protection sectors, suppliers)</p>	<p>Midline</p>
	<ul style="list-style-type: none"> • Strengths and weaknesses of the content of the coordination process 	<ul style="list-style-type: none"> - Coordination about the design and targeting of the pilot project - Coordination about community engagement and communication - Communication about programme progress, challenges and results - Coordination about expansion and scale-up of the pilot project 	<p>Documentation review (MoUs and minutes of coordination meetings)</p> <p>Key informant interviews (implementing partners, UNICEF, Sida, national and county government stakeholders, experts and development partners in the energy and social protection sectors, suppliers)</p>	<p>Endline</p>
<p>KEQ9. What have been the strengths and weaknesses of the engagement of community structures and leaders in the</p>	<ul style="list-style-type: none"> • Strengths and weaknesses of beneficiary engagement processes 	<ul style="list-style-type: none"> - Communication about the cash top-up and value of solar device to beneficiaries - Training on the use of the solar device and payment modalities - Training on livelihood activities - Access and use of beneficiary feedback/grievance mechanisms 	<p>Routine monitoring data</p> <p>Quantitative survey</p> <p>Household and community qualitative research</p>	<p>Midline</p> <p>Endline</p>

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
implementation of the pilot project? What are lessons for scale-up and replication in the NSNP?		- Involvement of suppliers in beneficiary sensitisation	Key informant interviews (implementing partners, suppliers, county government staff)	
	<ul style="list-style-type: none"> Strengths and weaknesses of the engagement of Beneficiary Welfare Committees (BWC) or community champions (CC) 	<ul style="list-style-type: none"> Availability and capacity of BWCs or CCs to perform planned roles Training and support that BWCs or CCs receive to perform planned roles Support provided by BWCs and community champions in solar device repayment Support provided by BWCs and community champions in sensitisation and BCC Monitoring, grievance resolution and reporting practices of BWCs and community champions Communication between BWC/community champions and suppliers 	Routine monitoring data Quantitative survey Household and community qualitative research Key informant interviews (implementing partners, suppliers, county government staff, SAU)	Midline Endline
	<ul style="list-style-type: none"> Strengths and weaknesses of the engagement with micro-entrepreneurs and last mile distributors 	<ul style="list-style-type: none"> Selection and mobilisation of micro-entrepreneurs and last mile distributors Training and support that micro-entrepreneurs/last mile distributors receive to perform planned roles Linkages between micro-entrepreneurs/last mile distributors and suppliers 	Key informant interviews (implementing partners, suppliers, county government staff)	Endline
Sustainability				
KEQ10. How well are factors that are likely to affect the sustainability and scalability of the pilot project addressed?				
DEQ10.1. How strong is stakeholder commitment to sustain and scale-up the pilot project?	<ul style="list-style-type: none"> Suppliers are interested in maintaining and expanding their supply chain in the targeted communities based on existing or changed delivery models and prices 	<ul style="list-style-type: none"> Interest in continuing / engaging in supply expressed by suppliers contracted by programme and others (as per 1.2 above). Delivery model that suppliers intend to use for expansion uses approaches that mean it is likely that most vulnerable households will be able to continue to participate 	Key informant interviews (suppliers, suppliers not contracted)	Endline

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
	<ul style="list-style-type: none"> Beneficiary households feel a sense of ownership towards the solar device 	<ul style="list-style-type: none"> Frequency of use of solar device in beneficiary households Condition of solar device Beneficiaries understanding solar device ownership after 12 months 	<p>Quantitative survey</p> <p>Household and community qualitative research</p>	Endline
	<ul style="list-style-type: none"> Key government stakeholders and/or development partners show interest/commitment to continuing, expanding and scaling up the pilot project using the existing or a changed approach 	<ul style="list-style-type: none"> Government department (REA or Ministry of Labour and Social Protection) that takes ownership of the pilot project. Degree of effort by appropriate government department(s) to either allocate budget or engage with other donor programmes (e.g. World Bank) to allocate funding to larger programmes based on learning from this pilot. Development partners' interest in the pilot project 	<p>Key informant interviews (Ministry of Energy, REA, SPS, SPS, county authorities and key donors)</p>	Endline
DEQ10.2. How financially sustainable is the intervention approach?	<ul style="list-style-type: none"> The beneficiary households are likely to be able to cover the replacement costs of solar device or its components 	<ul style="list-style-type: none"> The costs of PAYG payments compared to typical household expenditure on kerosene, batteries and phone charging Households' understanding of lifetime of product Households' understanding of maintenance requirements and costs Ways to pay for solar systems beyond the end of the pilot project identified by households 	<p>Quantitative survey</p> <p>Household and community qualitative research</p>	Midline Endline
	<ul style="list-style-type: none"> The payment modalities facilitate sustained repayment of the solar device by the beneficiary households 	<ul style="list-style-type: none"> Suppliers' plans to offer PAYG approaches for replacement parts / systems after the pilot project ends The costs of PAYG payments compared to typical household expenditure on kerosene, batteries and phone charging. Lessons learned from household experience with payment modalities 	<p>Quantitative survey</p> <p>Household and community qualitative research</p> <p>Key informant interviews (implementing partners, suppliers, UNICEF, energy expert, micro-entrepreneurs/last mile distributors)</p>	Endline

Evaluation Questions	Criteria to answer the questions	Indicators and observable manifestations	Source of evidence	Timing of data collection
	<ul style="list-style-type: none"> Government stakeholders perceive the cash top-up priority use of public money 	<ul style="list-style-type: none"> Public fund priorities in the government departments responsible for energy and social protection Perceived reason why the cash top-up subsidy is considered priority or not for use of public money by government stakeholders 	Key informant interviews (Ministry of energy, SPS, SAU, county authorities)	Midline Endline
DEQ10.3. How well have operational modalities of the pilot project been integrated or aligned with the NSNP?	<ul style="list-style-type: none"> The beneficiary targeting and enrolment is well integrated or aligned with NSNP mechanisms 	<ul style="list-style-type: none"> Alignment of targeting mechanism with NSNP targeting guidelines 	Documentation review Key informant interviews (SPS, SAU)	Midline
	<ul style="list-style-type: none"> The cash top-up is well integrated or aligned with the NSNP mechanisms 	<ul style="list-style-type: none"> Timing of cash top-up payments Timing of regular CT payments 	Key informant interviews (SPS, SAU)	Midline
	<ul style="list-style-type: none"> The beneficiary grievance system is well integrated or aligned with the NSNP mechanisms 	<ul style="list-style-type: none"> Number of grievances received Channels used to report grievances Types of grievances received 	Routine monitoring data	Endline
	<ul style="list-style-type: none"> Coordination of the pilot project is well integrated or aligned with the NSNP mechanisms 	<ul style="list-style-type: none"> Role of SPS, SAU in coordinating the pilot 	Key informant interviews (SPS, SAU)	Endline

ANNEX C SURVEY DESIGN AND IMPLEMENTATION

This Annex presents detail on the design of the quantitative midline survey and the implementation of the midline data collection.

C.1 Survey Instrument

The quantitative household impact evaluation relies on a panel survey, collecting data from the same households at baseline, midline and endline. Due to the COVID-19 pandemic, the midline survey was designed to take place remotely with the in-person endline survey delayed until early 2021. For the mobile phone survey, a concise instrument was conceptualised to collect data on key outcome areas related to the Mwangaza Mashinani pilot as well as data relevant to the COVID-19 response.

The midline household survey includes the following modules:

- Household member identification and basic information;
- Access to energy and awareness of alternative sources of energy;
- Exposure to the intervention;
- Household livelihoods and remittances;
- Education activities during school closure;
- Household member health;
- COVID-19 knowledge and behaviour.

The survey instrument was designed by OPM and as much as possible, questions were aligned with those asked during the baseline survey. For the new modules, we drew on many widely used questionnaires including those from the World Bank as well as sector experts in OPM's poverty and social protection team, and our own findings from the qualitative research and implementation review. The instrument was programmed using a computer-assisted telephone interview (CATI) software platform and was comprehensively desk-tested ahead of the training, pilot and main survey implementation. Comments from UNICEF were incorporated into the final survey instrument.

We conducted a small pre-test during which interviewers used the CATI software to call a small number of households that were interviewed as part of the baseline pre-test. This ensured that interviewers were familiar with the software and mobile phone interview prior to the data collection. The pre-test was also used to refine the survey instrument, including the phrasing of questions, answer options and translations.

C.2 Fieldwork

Data collection for the quantitative household survey was conducted simultaneously in Kilifi and Garissa. Interviews were conducted from 25 July to 20 August 2020 with all data collection taking place remotely.

C.2.1 Fieldwork protocols

The interviews were conducted by 10 enumerators. Two supervisors monitored and supervised data collection and the fieldwork teams were overseen by RGA's project manager.

Data collection was conducted using electronic tablets and laptops using the VOXCO CATI application. The choice of the CATI software was based on best practice for telephone interviews. The CATI software includes a call management platform which manages interview assignments, schedules, tracks call attempts and records the outcome of each attempted interview.



Interviewers were issued a headset with an in-built microphone so that they were able to fill in the survey questionnaire on their tablet or laptop. Questionnaires were prefilled with data collected at baseline which was used to contact the respondent and verify that they are in contact with the correct household (e.g. name of household head, names of household members).

All supervisors and interviewers were fluent in Swahili. However, we recruited enumerators that also had specific language skills as Somali is widely spoken in Garissa and many respondents in Kilifi were found to be Giriama-speaking during the baseline survey. We therefore created two further groups of interviewers namely the “Somali speaking group” and the “Giriama speaking” group so that the VOXCO system could assign respondents to calls based on language.

C.2.2 Fieldwork challenges and mitigation

We anticipated a number of challenges during the fieldwork. In this section, we describe the challenges experienced and the mitigation measures.

- **Reaching respondents:** a key challenge was to find respondents using the phone numbers collected at the time of baseline survey. The fieldwork teams worked closely with the implementing consortium and community structures, such as the community champion or chief/assistant chief, to track respondents if they could not be reached using the phone number. To help local leaders to find respondents, GPS coordinates collected at baseline were shared to identify in which village respondents were residing. This helped to improve the response rate to some extent.
- **Language:** we ensured that our team of interviewers had the requisite language skills (including Swahili, Somali and Giriama) based on our experience of implementing the baseline survey.
- **Literacy:** we ensured that the types of questions asked were amendable to phone interview. For example, questions asked on a likert scale are often difficult to understand via phone interview and therefore, these types of questions were not included in the survey instrument. In addition, the pre-test and pilot was used to ensure questions and answers were clearly understood.
- **High attrition due to poor network, limited access to technology:** we expected a much higher attrition rate than we would expect during in-person interviews. In order to mitigate attrition, we ensured that community leaders were aware of the research before we began and engaged community structures to inform households about the survey before starting data collection. We also attempted to contact households repeatedly and,

in the case of partially completed interviews or respondent fatigue, completed the interview over multiple calls. With these measures in place, we were able to achieve a response rate of 80% and our analysis suggested that attrition bias (e.g. where the poorest, elderly and disabled people are most difficult to reach) was not a problem in this case. As such, it was not necessary to use statistical techniques to adjust for attrition bias at the analytical stage. This also meant that the descriptive analysis, trend analysis and impact analysis were possible.

- **Community access and legitimacy:** ensuring legitimacy of the survey was crucial to the success of contacting and interviewing households. As with in person surveys, it was important to obtain the requisite permissions from all levels of government and local leadership to ensure that leaders and households were aware of the scope and modalities of the survey. We obtained permission from the county commissioner as well as deputy sub-commissioners, assistant county commissioners, chiefs and assistant chiefs. As mentioned above, we also worked closely with local project structures, including the BWCs and community champions, to ensure that households were aware of the survey and to determine when best to attempt to contact households.

C.2.3 Fieldwork ethical standards

Conducting quantitative and qualitative data collection generally, and particularly for vulnerable populations in Kenya, requires high ethical standards. This is important to ensure that expectations are not unduly raised, confidentiality is maintained, respondents are never forced to participate or encouraged to speak about subjects that may be traumatising and that all activities are appropriate (including with regards to age, disability, gender, diversity, among other dimensions). These considerations are even more important during a public health emergency when households may be facing stressful circumstances.

Prior to commencing fieldwork, the design for the remote survey study and the remote survey tools were submitted to OPM's ethical review committee and received approval to proceed. Regarding the implementation of the household survey, the following principles were followed:

- **Seeking the informed consent of all participants in data collection.** In practice, this entailed providing potential survey respondents with information about the content of the study and how their information would be used, as well as seeking to make them feel comfortable and empowered to refuse to participate or not answer any questions if they did not want to. The importance of seeking informed consent was emphasised during enumerator training.
- **Maintaining confidentiality and anonymity:** This is particularly challenging during mobile phone surveys as the interviewer is not able to ensure that the respondent is alone during the interview. We ensured that part of the consent procedure ascertains whether the respondent is comfortable to proceed with the interview at that time and, if not, another time was arranged to ensure that the respondent is afforded privacy.
- **Ensuring the safety of research participants** and respecting cultural sensitivities throughout all interactions with participants. Enumerator training included a module on safeguarding of research participants.
- **Provision of information on COVID-19.** At the end of each interview, we provided respondents with information related to COVID-19 and details on toll-free numbers in Kenya that have been set up for this purpose.
- **Protecting the safety of the local researchers who conducted data collection and respondents.** To protect local researchers and respondents during this assignment, all data collection took place remotely to ensure that the research did not result in the spread of COVID-19.

C.2.4 Quality assurance (QA)

To provide ongoing support to field teams during their assignment and protect the quality of the data, a rigorous QA process for the Mwangaza Mashinani midline survey was established.

Our quality control process included training of enumerators, a rigorous pre-test, during which the questions were tested and refined, and a pilot. The pre-test of the survey instrument and survey set-up helped ensure that the questions were well-understood by respondents and answer options were appropriate as well as helped refine the survey protocols and familiarise interviewers with the CATI software. A remote cascaded training was conducted in which OPM consultants trained the RGA team (fieldwork manager, project manager and supervisors) on the survey instrument. The RGA team then trained the interviewers on the survey instrument. Once the interviewers had been trained on the instrument, we conducted a small pilot during which interviewers used the CATI software to call a small number of households that were interviewed as part of the baseline pilot. This ensured that interviewers were familiar with the software and mobile phone interview prior to the data collection.

Another element of the QA approach was to develop a fieldwork model that emphasised close and regular communication between fieldwork teams, and between RGA field staff and OPM. The OPM team provided remote support to RGA fieldwork staff for the initial roll-out of the survey, to support resolution of early challenges faced in implementation of the survey. This communication allowed teams to raise any issues they were facing and seek support early.

In terms of the integrity of the data itself, there were two safeguards in place. The first was a series of basic consistency and range checks that were built into the CATI software. These checks meant that interviewers would immediately be notified (during the interview) if data that they had entered fell outside an acceptable range or were inconsistent with a previous answer. Second, the OPM and RGA teams were able to monitor data on an ongoing basis throughout the fieldwork to identify and respond quickly to any issues as they arose. The ability to closely track quantitative data quality during its collection is an opportunity provided by electronic data collection that is not generally possible with paper-based surveys, where there is a lag in receiving data due to the need to enter them first. A systematic set of cleaning checks that each batch of new data was subject to was set up to check for consistency errors and high rates of anomalous responses. This was then fed back immediately to teams if any concerns became apparent.

C.3 Sample achievement

Given the longitudinal nature of the evaluation, the same baseline respondents were tracked and re-interviewed at midline so as to create a panel of survey respondents. At midline, the quantitative survey respondents are therefore those who were successfully interviewed for the baseline survey and then again successfully traced and interviewed for the midline survey. The final quantitative survey sample achievement at midline is shown in

Table 1 below, including the distribution by evaluation group, county and sub-county.

Table 1: Final midline sample (target and actual)

County	Sub-county	Number of households in sample	Number of completed interviews	Percentage completed
Treatment		600	501	83.5%
Kilifi	Ganze	173	145	83.8%
Kilifi	Magarini	214	176	82.2%
Garissa	Dadaab	128	105	82.0%
Garissa	Ijara	59	52	88.1%
Garissa	Fafi	26	23	88.5%
Comparison		586	442	75.4%
Kilifi	Kaloleni	373	268	71.8%
Garissa	Balambala	213	174	81.7%
Total		1,186	943	79.5%

When taking into account sample attrition between the two survey rounds as well as incomplete and/or unusable interviews, we successfully interviewed about 80% of the baseline sample. This includes a higher proportion of households from the treatment group (83.5%) than in the comparison group (75.4%). Importantly, a comparative analysis between households that dropped out of the sample between baseline and midline and those that were re-interviewed at midline shows that there are no systematic differences between the two groups. Attrition can therefore be considered as random and no additional adjustment or attrition weights need to be used for correcting a potential attrition bias.

Having kept the attrition rate around the 20% mark can be considered as a success, especially given the remote survey mode. As mentioned in section 0, this was made possible through a number of measures including a systematic call back routine and calling respondents at different times of the day depending on their availability.

The sampling strategy adopted to select the sample at baseline as well as the full technical details concerning the sampling frame, sampling weights and baseline sample distribution are presented in detail in the evaluation Baseline Report.¹

¹ See Section 4.3 of the Evaluation Baseline Report in Volume I and Annex C in Volume II.

ANNEX D COMPARISON BETWEEN COMPLIANT AND NON-COMPLIANT HOUSEHOLDS IN TREATMENT SUB-COUNTIES

As reported in Section 4.3 of Volume I of this report, not all households in the evaluation sample at baseline that were intended to be treated ended up enrolling in the Mwangaza Mashinani pilot project and receiving a solar device. In this annex, we show the size and distribution of the sub-sample of households that were actually enrolled into the pilot project and investigate how this group of households differs from the group of non-compliant households that did not end up enrolling in the project.

Table 2 shows that 67% of the households that originally registered for the pilot (and were therefore part of our baseline evaluation treatment group) ended up being enrolled. This discrepancy between registration and enrolment is particularly marked in Garissa, when just over half of the originally registered households were actually enrolled in the pilot (treated). As explained in Section 2.2.1 of Volume I, this sample forms the basis for the ATT estimation of impact and is also used as part of the descriptive results, when focusing on the enrolled households only.

Table 2: Actually enrolled (treated) sample achievement

County	Number of treatment households interviewed at midline (<i>intended treatment sample</i>)	Number of treatment households that enrolled in the Mwangaza Mashinani pilot project (<i>actually treated sample</i>)	Proportion of the intended treatment sample that was actually treated
Kilifi	321	237	74%
Garissa	180	98	54%
Total	501	335	67%

To gain an understanding of the potential bias in the ATT estimation of impact, we explore how the actually treated sample of households differs from the non-compliant households. To do so, we conduct a comparison of means between the two samples across a range of key characteristics and outcomes at baseline that may affect outcomes at midline. Table 3 presents the results of this comparison. The indicators in the table were selected as those that were deemed essential characteristics that could affect household outcomes such as location, gender, cash transfer type (as a proxy for age of beneficiary), education, and wealth index, as well as other factors that were selected as covariates in the baseline matching models, and key outcome indicators at baseline. All indicators represent baseline data for the two groups of households.

We find that while the two groups are similar across many indicators, there are some significant differences. Most notably, the actually treated households were much more likely to reside in Kilifi as opposed to the non-compliant households (by 20 percentage points). The actually treated sample also has more female-headed households, more CT-OVC beneficiaries and less OP-CT beneficiaries. Households in the actually treated sample have a higher wealth index and a higher proportion of school-age children attending school. They

also have more lamps, lanterns and bulbs, and are more likely to burn kerosene inside the home, and relatedly, are more likely to have high risk on their members' health.

Table 3: Comparison between compliant and non-compliant treatment households

Indicator	Non-compliant households		Actually treated households		Difference
	N	Estimate	N	Estimate	
Household resides in Kilifi (%)	166	50.6	335	70.75	20.1***
Household head is male (%)	166	55.42	335	43.88	-11.5**
Household enrolled in CT-OVC (%)	166	43.98	335	56.72	12.7***
Household enrolled in OP-CT (%)	166	55.42	335	44.48	-10.9**
Size of household (mean)	166	7.52	335	7.38	-0.12
Number of female household members (mean)	166	3.95	335	4.03	0.05
Household wealth index (standardised mean)	166	-0.3	335	0	.3***
Household head never attended school (%)	166	84.94	335	80.6	-4.34
Number of children enrolled in primary school (mean)	166	2.89	335	2.9	0.01
Household used solar energy for lighting in last 30 days (%)	166	8.43	335	10.15	1.67
Number of lamps/bulbs/lanterns (mean)	166	0.5	335	0.76	.3***
Household burns kerosene inside the home (%)	166	31.33	335	44.18	12.9***
Household have discussed solar systems with others (%)	166	20.48	335	22.99	2.52
Household aware of solar energy (%)	166	69.28	335	72.24	2.92
Number of household members >14 years old engaged in work (mean)	166	2.17	335	2.52	.3*
Household head belongs to savings group (%)	161	13.66	330	17.27	3.64
Household monthly total income (mean Ksh)	164	4812.91	325	3783.58	-1029.31
High risk to average household member's health (%)	166	12.05	335	18.51	6.4**
Proportion of household members with ARI symptoms (%)	166	5.84	335	6.34	0.46
Proportion of household members with eye irritation (%)	166	12.03	335	13.84	1.77
Use of last cash transfer for food (%)	163	81.6	335	80.6	-1
Use of last cash transfer for school fees and materials (%)	163	65.03	335	72.84	7.8*

Indicator	Non-compliant households		Actually treated households		Difference
	N	Estimate	N	Estimate	
Proportion of 3-18 year olds currently attending school (%)	166	81.03	335	86.38	5.4**
Number of hours spent on productive activities (mean, for one selected woman per household)	150	9.46	319	9.84	0.34

Source: OPM Mwangaza Mashinani Baseline Survey (2019). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

It is important to note, that household head gender is correlated with cash transfer type and both are correlated with county. The baseline report also found that the location of households was highly correlated with most indicators at baseline suggesting that the profile of households in Kilifi differ significantly from those in Garissa. As a result, we attempt to isolate the correlations between these different characteristics discussed above, and the enrolment status of households by conducting a simple probit regression analysis. The dependent variable in this case is a dummy variable that takes the value 1 if the household in the treatment sample actually enrolled in the project and received the treatment. The independent variables are all those indicators listed in Table 3. We find that the county is significantly and independently correlated with the probability of households enrolling in the project – that is, households in Kilifi are more likely to enrol in the project than those in Garissa. Additionally, the gender of the household head and the type of cash transfer (which can be a proxy for age of beneficiary) are also independently correlated with enrolment in the project. Female-headed households were more likely to enrol, while CT-OVC beneficiaries (i.e. younger beneficiaries) were more likely to enrol. All other indicators identified as significant in Table 3 (i.e. showed differences across the two samples of households) are not significant in the regression once other factors are controlled for. While this is a simple regression analysis with limitations, it does provide an indication that county, gender and age seem to be the primary factors affecting the probability of enrolment into the project among households that were offered the treatment.

Results of the regression are available upon request.

ANNEX E IMPACT ESTIMATION

The quasi-experimental design for the impact evaluation of the Mwangaza Mashinani project relies on Propensity Score Matching (PSM) techniques to estimate impact on a small set of indicators at midline. The first stage of this approach requires the household samples used to generate the impact indicators to be balanced across treatment and control groups, which was done at the baseline stage and reported on in the Baseline Report Volumes I and II. At midline, two additional steps were undertaken. First, further balancing checks were undertaken in light of the high proportion of households in the treatment sample at baseline that did not end up being treated at midline, and therefore the need to additionally balance the sample of households that were actually treated with the non-treated group (given that at baseline, only the intended to be treated group and the comparison group were balanced). Second, once the matching and balancing were achieved, the impact estimations on the midline outcome indicators were carried out.

Table 4 lists the outcome indicators related to the two impact areas covered by the midline survey and for which impact was estimated.

Table 4: Impact indicators for midline PSM estimation

Impact area	Impact indicators	Sample for the impact evaluation
Health	Proportion of household members per household with ARI (mean %)	All households
	Proportion of household members per household with a cough (mean %)	
	Proportion of household members per household with cough and fever (mean %)	
	Proportion of household members per household with cough and difficulty breathing (mean %)	
Livelihoods	Number of household members per household who are working	All households
	Number of productive activities per household	
	Total monthly income per household	

The rest of this section explains in detail the measurement approach taken to impact estimation, and presents the detailed results.

E.1 Impact identification strategy

A rigorous identification of programme impact in quantitative studies generally builds on the idea that such impact can be defined as the difference in the outcomes measured among individuals that participate in a programme compared to the outcomes measured among the same individuals in a theoretical state of the world where the programme is not implemented but where everything else, except the programme, stays the same. This is normally referred to as the counterfactual and, because it is purely hypothetical, the key challenge that impact evaluations face is to find alternative observed counterfactual measures that can credibly be used to infer programme impact.

A Randomised Controlled Trial (RCT), where observations are randomly assigned to a treatment and control group, is commonly considered as one of the most robust designs to deal with the problem of the counterfactual. Because treatment assignment is implemented randomly in these trials, individuals from control and treatment groups are, on average, the same. This means that after the implementation of the programme, averages of outcomes measured among participants and non-participants can be compared directly and differences can be attributed to the programme, rather than any other confounding factors. Sometimes, however, implementing an RCT is not feasible or not appropriate. Alternative identification strategies use econometric modelling techniques to try to come as close as possible to replicating the situation of such an experimental design.

This was the case in the present evaluation, where an RCT was not feasible given that the Mwangaza Mashinani pilot project beneficiaries were purposefully selected on the basis of a series of specific criteria. As discussed in Volume I of this Midline Report, the impact estimation is therefore based on a quasi-experimental design, which approximates the results of an experimental design by constructing a valid counterfactual. In particular, we have implemented a matching approach to build the control group² using PSM whereby control households were selected to match pilot beneficiary households (i.e. the treatment group) on the basis of the criteria that was used by the programme to enrol beneficiaries.

At baseline we had also mentioned the possibility of augmenting the PSM impact estimation with a Difference-in-Differences (DID) analysis. DID would exploit the longitudinal nature of this study to control for any remaining imbalances at baseline across the treatment and comparison groups, however there is no need to augment the PSM impact estimation with a DID, given the balance achieved at baseline across health and livelihoods indicators. The need for using DID will be considered again at endline on a larger range of impact indicators.

The following sections elucidate how the PSM was implemented and present the results of the balancing tests and the impact estimates for each impact indicator.

E.2 Propensity Score Matching

The key problem that PSM attempts to solve is selection bias. In the present case, this problem appears because households that enrolled into the Mwangaza Mashinani programme and received the solar device could be systematically different from households that did not receive such support and form part of the comparison group – because the assignment to treatment status was not implemented randomly. Such systematic differences could plausibly be related to outcome measures that this evaluation is interested in. This in turn implies that observed dissimilarities in outcome measures across households from treatment and control groups could be due to underlying systematic differences and not the programme itself. Simple comparisons of indicators across such groups would be invalid and biased to infer programme impact, because these groups cannot be assumed to be alike. This is the problem of selection bias.

PSM tackles this problem by using data from the control group to construct appropriate comparisons to households in the treatment group, thus building a valid counterfactual. This happens by matching and comparing outcomes for units in the treatment group with control units that are as similar as possible to each other according to a set of relevant observable characteristics, i.e. comparing like with like only. Relevant characteristics are the ones that are thought to be driving selection bias. These are the characteristics that are systematically different across treatment groups and are related to outcome measures of interest. When

² Note that the term 'control group' is used throughout this document to refer to the comparison group.

appropriately controlling for all of those characteristics, selection bias is also controlled for. A good example is represented by the education level of the household head. In the present analysis, this is found to be correlated with livelihood outcome measures. It is therefore a 'relevant' characteristic to control for in the PSM model. While the variable mean value is unbalanced between treatment and control groups before matching, the model achieves balance on this after the PSM matching procedure. The matching therefore successfully controls for this sample characteristic, increasing the comparability between treatment and control groups and making the estimation of impact more robust.

Specifically, PSM is a two-stage analytical approach that employs a propensity score as a 'comparator metric' that summarises the information of the set of relevant characteristics, i.e. the ones that drive selection bias. This propensity score can also be interpreted as an estimation of the hypothetical probability of any unit to be in the treatment group, given its characteristics. The first stage of any PSM analysis is to compute a valid propensity score for each unit of observation. The second stage is to then compare outcome indicators of interest across units (i.e. households in this case) with similar propensity scores. Note that because outcome indicators from treatment units are compared to outcome indicators from specific control units based on the propensity score, the estimated average treatment effect will be valid for the group of treatment observations only. This means that PSM allows to estimate an Average Treatment Effect on the Treated (ATT) or Average Treatment Effect on the Intended to be Treated (ITT) (see Section 0 for further discussion on treatment effects measured by PSM).

It is important to note that, for PSM to work appropriately, the comparator metric constructed in the first stage needs to be valid. For that to be the case, it needs to be calculated using variables that are 'relevant' for the construction of the counterfactual. As described above, 'relevant' here means that these are variables which are driving selection bias. To meet this, researchers typically argue from a theoretical perspective about which variables could be relevant to control for selection bias. This study improves this selection of relevant variables by using a data-driven algorithmic approach that aims to reduce researcher discretion in the choice of variables.

The validity of any PSM approach also depends on how well it reduces any imbalance, and thereby selection bias, between treatment and control groups. Achieving balance means that if matched appropriately treatment and control groups' characteristics will not be significantly different from each other. In other words, this means that, across the list of relevant characteristics that are assumed to drive selection bias, the treatment and control groups will be statistically similar to each other.

PSM first stage model selection

To estimate the propensity score in the first stage, this study followed the procedure suggested by Imbens and Rubin (2015, p. 281 ff.). The underlying model specification for this procedure is either a logit or probit regression for the first stage. This means that the propensity scores are estimated by first specifying treatment and control assignment as a binary variable that has the values 0 (for control) and 1 (for treatment). The estimated scores are then modelled as the fitted values that are derived from a logit or probit estimation, with the binary treatment variable as dependent variable and the covariates across which balance is supposed to be achieved as the regressors. These fitted values lie between 0 and 1.

To be more concrete, in the case of a logistic regression specification, the binary response variable is modelled as follows:

$$\Pr(T = 1 | X_i) = \frac{e^{f(X_i)}}{1 + e^{f(X_i)}}, \quad (1)$$

where $\Pr(T = 1 | X_i)$ is the probability of the treatment indicator (T) being equal to one, conditional on the covariates (X_i) for unit i . The function $f(X)$ is normally modelled linearly, i.e. is of the form $f(X) = X\beta$. The coefficients of this function (β) are estimated using maximum likelihood techniques. The fitted values, i.e. the predicted probabilities that follow from this procedure, are the propensity scores for each unit of observation.

The key question for the first stage is which covariates to include in $f(X)$ so that this procedure produces a valid estimate of the propensity score. Building on the procedure described in Imbens and Rubin (2015) for selecting covariates, this study implemented a three-step approach to make this decision:

1. Select a set of basic covariates based on substantive grounds

The starting point for the PSM analysis was to select variables that were likely to be relevant to be used for this analysis from a theoretical perspective. ‘Relevant’ in this case meant that variables had to be selected that were theoretically expected to be correlated with treatment status and treatment effects, thereby introducing selection bias in a simple comparison of treatment outcomes between control and treatment groups. This requires a theoretically substantiated understanding of the relationships that were being analysed.

2. Increase the set of valid covariates based on algorithmic approaches

In addition, this study employed variable selection algorithms to identify valid variables, i.e. variables that were not affected by the programme, and that are significantly correlated both with the treatment status and the outcome variable. There are a variety of methods available to do this. This study’s approach was to implement stepwise regressions. Such regressions are commonly used and easily implemented algorithms to select independent variables based on significant correlations with certain dependent variables.

There are two stepwise regression approaches that can be employed for this: backward and forward stepwise regression. The underlying idea behind both approaches is to check each covariate, step-by-step, for significant correlation with the outcome and treatment assignment variable separately. Such a correlation is relevant because variables that possibly bias impact estimates will have some relation to both the treatment status and the outcome looked at.

Backward selection starts with the full set of covariates, i.e. a regression including all variables, and then discards the term that is least significantly correlated with the dependent variable. It continues to do so until all variables that are uncorrelated with the dependent variable are discarded. Forward selection, instead, starts with an empty set of covariates, i.e. a regression on a constant, and then checks the significance of each covariate if it is included in the regression. It then adds the most significantly correlated variable to the model. This step is repeated until all significant covariates are included in the model.

Both for backward and forward estimation a threshold p-value for what is considered to be significant needs to be specified. For backward selection, this means setting the level for identifying whether all variables that are uncorrelated with the outcome variable have been discarded: if the p-value of the least significant variable remaining is under the threshold, i.e. all the variables still included in the model are even more significant, the procedure stops. For forward selection, this means setting the level for identifying whether all significant covariates have been included in the model: if the p-value of the most significant variable to be added is equal to the threshold, i.e. the significance level of all variables that have not yet

been included in the model is equal or below the threshold, the procedure stops. Setting this threshold therefore influences the variables that are selected in stepwise regressions.

This study implemented both backward and forward selection, using baseline data and using thresholds of $p = 0.05$. The analysis is employing this covariate selection procedure on both relevant outcome variables and treatment status, given the importance of determining the significance of covariate correlation on both, as explained when discussing our approach above. A common set of variables for the models were then selected based on whether they were selected in either of the forward or backward stepwise regressions.

3. Increasing the set of covariates with polynomial and interaction terms using algorithmic selection

In a third step, the same method of stepwise regressions (backwards and forwards) was employed to augment the set of covariates by quadratic terms or interactions of variables that had already been selected in steps one and two. The rationale behind this is the fact that balance might only be achieved if the propensity score is estimated using non-linear transformations of the variables selected in the first two steps (Imbens and Rubin 2015, p. 287). Again, the stepwise regression approach helped to decide which of these non-linear terms were significant predictors of differences across control and treatment groups, and should therefore be controlled for.

The result of this process was the identification of an optimal selection model comprising a set of covariates that were included in the first stage estimation of the propensity score. This three-step approach was conducted for every estimation strategy for each of the outcome variables. It is important to note, however, that good balancing properties using PSM also depend on the matching algorithm used in the second stage of the PSM analysis described in the next section.

Second stage algorithm selection

There are a variety of algorithms available to implement the second stage of PSM, i.e. to match control and treatment units to each other based on the propensity score estimated in the first stage.

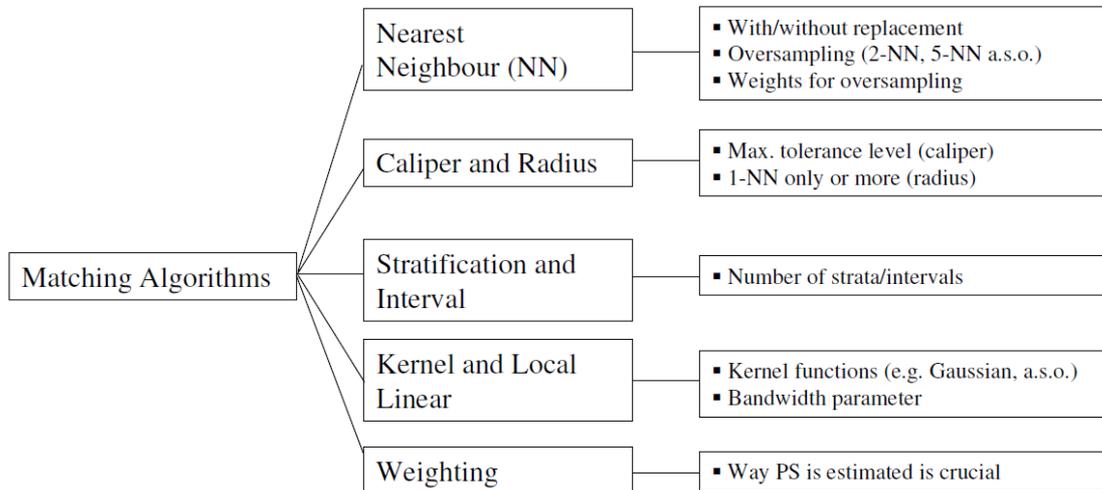
Figure 1 shows algorithm options and sub-options for each of these possibilities. It is beyond the scope of this report to explain in detail the technicalities of each of these approaches.³ For all approaches the goal is to find appropriate, i.e. sufficiently similar, control group members for treatment group members. Differences between these approaches can be defined along three main dimensions: first, which estimated propensity scores are considered to be valid for inclusion in the analysis? Second, what is the appropriate range of propensity scores that define control comparators for treatment units? Finally, how are these comparators used when estimating the treatment effects?

The first dimension relates to the fact that within both control and treatment groups there could be estimated propensity scores that lie either at the upper or lower bound of the distribution, i.e. close to 0 or 1. For such values, there might not be an appropriately similar propensity score in the respective comparison group. However, for matching to work appropriately, there must be comparable propensity scores in both control and treatment groups – the so-called common support condition. Hence, matching algorithms employ cut-

³ See Caliendo and Kopeinig (2005) for a summary overview.

offs or trimming procedures by which some proportion of observations with propensity scores that are not comparable are dropped from the analysis.

Figure 1: Matching algorithms selection



NN: Nearest Neighbour, PS: Propensity Score

Note: Figure taken from Caliendo and Kopeinig (2005, p. 9).

The second dimension relates to how units in the control group with propensity scores close to a treatment group observation are treated. For instance, kernel matching, which was selected to be used in this midline impact estimation for the Mwanganza Mashinani programme, is a non-parametric matching estimator that uses the weighted averages of all units in the control groups to create the counterfactual outcome. The weights are determined by the distance between each unit from the control group and the participant observation for which the counterfactual is estimated. Therefore, higher weights are given to units closer in terms of the propensity score of a treated unit (Caliendo and Kopeinig (2005), p.10–11). Alternatively, Nearest Neighbour (NN) matching with just one unit looks for the one control observation that has the closest propensity score to a treatment unit and compares the outcome measure for those observations. NN matching with more than one neighbour looks for several control units with similar propensity scores and compares the treatment outcome to an average of these neighbours. Caliper matching is similar to NN matching but does not include a fixed number of neighbours. Instead, the comparators are selected based on a maximum difference in propensity scores allowed.

Finally, the third dimension refers to how, once comparator units are found, the outcome measures are compared across treatment and control. For example, with NN matching and more than one neighbour simple averages are calculated. Similarly, with kernel functions a form of weighted averages are calculated to estimate treatment effects.

Selecting the appropriate matching algorithm for a PSM exercise is not straightforward and requires careful analysis of how well-balanced samples are after employing algorithms with certain sub-specifications. In general, however, the selection of models in this study was

based on the fact that discriminating between models poses a bias/variance trade-off in the estimated treatment effect. For instance, in the extreme case of NN matching with just one neighbour, it could be that the NN is actually quite far away in terms of propensity scores and hence a bad match. If this happens often, this could introduce bias into the estimation procedure. A solution to this could be to implement matching using several comparators in a caliper matching setting. However, this could decrease the number of available matches, which could increase the variance of the treatment estimate.

Kernel matching with appropriate trimming and enforcement of common support is a good compromise between these different approaches and was therefore selected as the main matching algorithm for baseline estimates.⁴ In order to find the optimal estimation model, this study used different kernel matching algorithms with different bandwidths and trimming levels. These different results were then compared with respect to the best balancing properties, with the best performing approach being selected as the optimal.

Following the first and second stages of the PSM analysis, within each of the two impact areas for the midline analysis, one optimal model was selected based on the estimation strategy for the key outcome indicator for that area (for health this was the proportion of household members with ARI, while for livelihoods this was the household monthly income). The selected model per impact area was then used for the estimation strategies of all other outcome indicators in that impact area. The balancing properties were then checked for each estimation strategy to ensure that the selected model per impact area performs well – in terms of balancing – for all outcome indicators. The results presented in Section 0 show that the selected model for each impact area performed well for all outcome indicators, and therefore, we do not use different models within an impact area.

Key PSM assumptions: common support and conditional independence

There are two key assumptions that need to hold for PSM to be a valid approach to estimating treatment effects: the common support assumption and the conditional independence assumption.

The **common support assumption** states that the estimated propensity score for all units in the treatment and control groups must lie within 0 and 1. Expressed differently, units in both groups must have a positive non-zero probability of belonging to either the treatment or control group and the distribution of those probabilities across the two groups must be such that comparable units across the groups can be found. This can easily be enforced by only comparing observations with appropriate propensity scores.

The second key assumption is the **conditional independence assumption**, which posits that, once observable characteristics have been accounted for, the outcome measure is not related to the treatment status anymore, other than via the effect of the programme. In essence, this assumption states that once observable characteristics are appropriately controlled for, treatment status can be treated as if it was assigned randomly. As described above, PSM deals with this problem by comparing outcome measures across treatment and control groups only for units that are similar, i.e. by controlling for the important characteristics that are related to both treatment status and the outcome measure. The conditional independence assumption simply states that all important characteristics have been taken care of. This means that any bias that arises due to participation in the programme has been dealt with. Note that this includes biases that arise due to

⁴ See Caliendo and Kopeinig (2005, p. 10 f.) for a short summary of the pros and cons of different matching techniques.

unobservable factors – PSM cannot control for these and the assumption is that once observable characteristics have been dealt with no unobservable bias remains.

The validity of any PSM approach therefore crucially depends on how well the approach reduces any imbalance between treatment and control groups. Under conditional independence – i.e. independence of the treatment assignment from outcome measures when controlling for covariates – the propensity score is a valid balancing score. Conditioning on this score appropriately means that bias will be removed between control and treatment groups. Hence, treatment and control groups will be balanced, i.e. they will have similar covariate distributions. This means that, across a variety of different characteristics, the treatment and control groups will be similar to each other.

Assessing balance of covariates after matching is therefore a key step for any PSM analysis. The more balanced samples are after matching, the more plausible is it that the conditional independence assumption holds. As described above, however, balance also depends on the models and algorithms used to implement matching. The following paragraphs explain in detail how balance assessments were implemented and used in the current study.

Assessing balance

To select between different matching algorithms and to assess covariate balance after matching, this study compared matching models along a variety of dimensions. First, individual covariate balance was assessed across samples by looking at the standardised difference in means across treatment and control groups both before and after matching. This standardised difference is the difference in group averages over the square root of the average of the sample variances. If samples are balanced, this difference should be small and matching should reduce this standardised difference as compared to the unmatched samples.

In addition, this study performed t-tests to assess whether differences across treatment and control groups were statistically significant. If balance is achieved with PSM, differences between treatment and control groups should be negligible and therefore should not be significantly different from zero.

In this context, the variance ratios of covariates of treated over control measures was also assessed. If there is perfect balance across samples, then covariates should be distributed equally and hence this ratio should be equal to one.

All of these measures give an indication of whether specific individual covariates are balanced across treatment and control groups. To assess overall variance, this study used two statistics that summarise covariate balance in the sample at hand: Rubin's B and Rubin's R. Rubin's B reflects the absolute standardised difference of the means of the propensity score in the treated and control groups (unmatched and matched). Rubin's R is the ratio of the treated to control variances of the propensity scores. Rubin (2001) suggests that the value of B should lie below 25 and that R should lie between .5 and 2 for overall balance to be sufficient. Together, Rubin's B and Rubin's R provide an informative indication of the trade-off between bias and variance across the treatment and control groups, as it changes before and after the matching procedure. However, individual-level balance should always be assessed as the overall balance is only an approximation of goodness of fit.

Matching procedures were implemented using the psmatch2 package in Stata (16) and balancing tests were carried out using the pstest package, which provides the results for all of the statistics mentioned above.⁵

Finally, the distribution of propensity scores was also analysed graphically. Ideally, propensity scores should be distributed equally across treatment and control groups. Very skewed/diverging distributions could be an indication that balance has not been achieved successfully. The visual distribution of propensity scores was therefore taken into account in selecting the preferred estimation model for the impact analysis.

Results of balancing assessments are presented in Section 0 of this report.

E.3 Treatment effects measured by the impact strategy

The midline impact estimation for this study provides two estimates for each outcome indicator, as detailed below.

Intention to Treat: As discussed at baseline, the main impact estimation methodology provides a measure of an Intention-To-Treat (ITT) estimate. The ITT covers every household that is surveyed at midline in areas defined as treatment (according to the implementation plan) and ignores non-compliance or anything else that may prevent households from being treated. The ITT approach thus allows us to include in the estimation of impact all households that were originally included in the treatment group at baseline. Our midline data on exposure to treatment shows that 33% of eligible households surveyed at baseline did not end up being enrolled in the pilot and did not therefore receive the treatment (solar device). Therefore, in the ITT analysis the impact estimates provide a measure of the effect of being offered, rather than actually receiving the treatment and is generally more conservative compared to the analysis of impact on observations that are all equally treated.

Average Treatment Effect on the Treated: In addition to the ITT estimation, we also provide a measure of impact specifically focusing on households who were actually enrolled into the pilot project and therefore received the solar devices. This measure of impact represents the average effect of the pilot project on the group of households that received the treatment and is called the Average Treatment Effect on the Treated (ATT). The ATT is indicative of the expected causal effect of the pilot when its constituent parts (solar device and cash top-up, in this case) reach its intended beneficiaries. The ATT impact estimates are thus biased towards a sub-set of the target population that may have been better placed to receive the intervention (e.g. more eligible and registered households in Kilifi were enrolled into the pilot than in Garissa, which points towards local factors influencing the probability of enrolment as also suggested by our sensitivity analysis discussed in Annex D) and cannot be seen as representative of the overall impact of the pilot. They still represent interesting impact estimates from a research perspective, especially when compared to the ITT estimates as they show the difference between the effect of the pilot on its intended target population when also considering implementation issues and the potential effect that the pilot could have if households are actually exposed to the intervention as per the original design.

Furthermore, it is important to emphasise that the PSM approach used in this study works by looking for control units that can be compared to treatment units, and not the other way round. This means that it is assumed that treatment units are a given and control units need to be identified. Through finding matches for the treatment units (households in the treatment sub-counties in our case) in the pool of control units (households in the comparison sub-

⁵ See <http://fmwww.bc.edu/repec/bocode/p/pstest.html> for details.

counties), the resulting estimates of the treatment effect are therefore the Average Treatment Effect on the Intended to be Treated (when looking at all households intended to be treated) and the Average Treatment Effect on the Treated (when looking at households that actually were treated). Extrapolating these estimates beyond the population for which the treatment sample is representative is not immediately possible.

The PSM approach described above was applied twice for each outcome indicator: first, on the sample of all households in the treatment sub-counties (ignoring non-compliance) to estimate the ITT; and second, on the subsample of households in the treatment sub-counties that were actually treated to estimate the ATT. As mentioned above, for each impact area, an optimal matching model was selected based on the key outcome indicator, which was then applied on all other outcome indicators in that impact area. The same selected model was applied to estimate both, the ITT and ATT, for each outcome indicator. The balancing properties were then checked for each estimation strategy to ensure that the selected model performs well. The results presented in Section 0 show that the selected model for each impact area performed well for all outcome indicators and for both ITT and ATT samples.

The main goal is to conduct inference on these treatment effects (the ITT and ATT estimates), i.e. to see whether they are significantly different from zero or not from a statistical point of view. Note that all standard errors for the impact estimates used are based on bootstrapping procedures for PSM estimates. See next section on why standard errors for PSM are bootstrapped.

E.4 Caveats - Addressing weaknesses in the analysis

Two key caveats related to the present estimation strategy need to be mentioned here. First, PSM only controls for observable characteristics that cause selection bias. This is a problem for any impact identification strategy that relies on controlling only for factors (variables) that can be observed in the data – not only PSM. PSM helps addressing this by allowing for extensive balancing checks after matching, which can provide substantial evidence for the fact that balance is achieved across a large variety of characteristics and – by implication – is likely to also extend to unobservables. In this study, such extensive balancing checks were implemented. Results are presented in Section 0 below.

Second, calculating standard errors of estimated treatment effects using PSM methods is not straightforward. As Caliendo and Kopeinig (2005, p. 18) put it, 'The problem is that the estimated variance of the treatment effect should also include the variance due to the estimation of the propensity score, the imputation of the common support, and possibly also the order in which treated individuals are matched'. These estimations increase the variation of the treatment effect estimates over and above normal sampling variation. In the literature, there is no consensus on how to take this into account.

A popular approach to solve this problem is to bootstrap standard errors for the estimated treatment effect (see Lechner 2002). Each bootstrap draw re-estimates both the first and second stages of the estimation. This produces N bootstrap samples for which the ITT/ATT is estimated. The distribution of these means approximates the true sampling distribution, and therefore the standard errors of the population mean (Caliendo and Kopeinig 2005, p.18). This study followed this approach and implemented bootstrapping, using 200 repetitions, to estimate the standard errors of the estimated treatment effects. Note that, for the sake of completeness, this report shows both the bootstrapped and the non-bootstrapped standard errors below.

It is also important to note that there is no clear direction in which estimated standard errors should change due to bootstrapping. On the one hand, the additional variation taken into account should increase standard errors. On the other, bootstrapping generally makes estimates more precise, which tends to decrease standard errors. Overall, the direction of the change is not uniform. In fact, the results show that, with bootstrapping, standard errors in some instances are smaller and in some larger than without bootstrapping.

E.5 Results

This section presents the results obtained from applying PSM to the Mwangaza Mashinani baseline and midline data. For each outcome indicator, the balancing results and the impact estimates are presented for both, the ITT and ATT samples.

Presentation of results

In Volume I, the ITT and ATT estimates are presented in a visual form, where each graph shows point estimates for treatment effects (either ITT or ATT) on outcome indicators and 95% confidence intervals for these effects. The confidence intervals indicate that the probability for the true treatment estimate to fall within the lower and upper bounds of the interval is 95%. When confidence intervals of such estimates do not overlap with zero, then this is an indication that this treatment effect is truly different from zero. This zero value is indicated using a red line in the graphs.

In Volume II, for each outcome variable, two sets of results are presented for each of the ITT and ATT samples: (a) the balancing results, and (b) the PSM estimates. The following paragraphs use the example of Figure 2 to explain the interpretation of results in detail.

The second stage results are presented, as illustrated in Figure 2 for the indicator on mean proportion of household members with ARI for the ITT sample. The figure is divided into two panels; the top panel and the bottom panel, showing baseline and midline results respectively. The format for each panel is as follows:

- The graph on the left-hand side indicates how individual baseline variables balance before and after matching. The x-axis displays the standardised bias, which is the percentage difference of the sample means in the intended to be treated and not intended to be treated (or treated and non-treated) – unmatched or matched – subsamples as a percentage of the square root of the average of the sample variances in the intended to be treated and not intended to be treated groups (or treated and non-treated groups) (Rosenbaum and Rubin 1985). In Figure 2 below, for example, the unmatched samples display large imbalances with standardised bias being present across many of the covariates of interest. However, once matching takes place, the standardised imbalances are diminished.
- The second graph, on the right-hand side, shows the distribution of propensity scores across treatment and control groups. This graph visually confirms that, after dropping observations that are off common support, both treatment and control groups contain observations with propensity scores across the full range of the distribution, which is an indication for overall balance. Although the distributions of propensity scores across treatment and control groups would ideally be symmetric, the presence of some level of skewness does not put at risk the estimation procedure, as indicated by the balance achieved for each covariate and the overall values of Rubin's R and B after matching.
- The remaining rows on the right hand side display information related to the PSM model. The bandwidth and level of trimming for the optimal PSM model can be found in the first

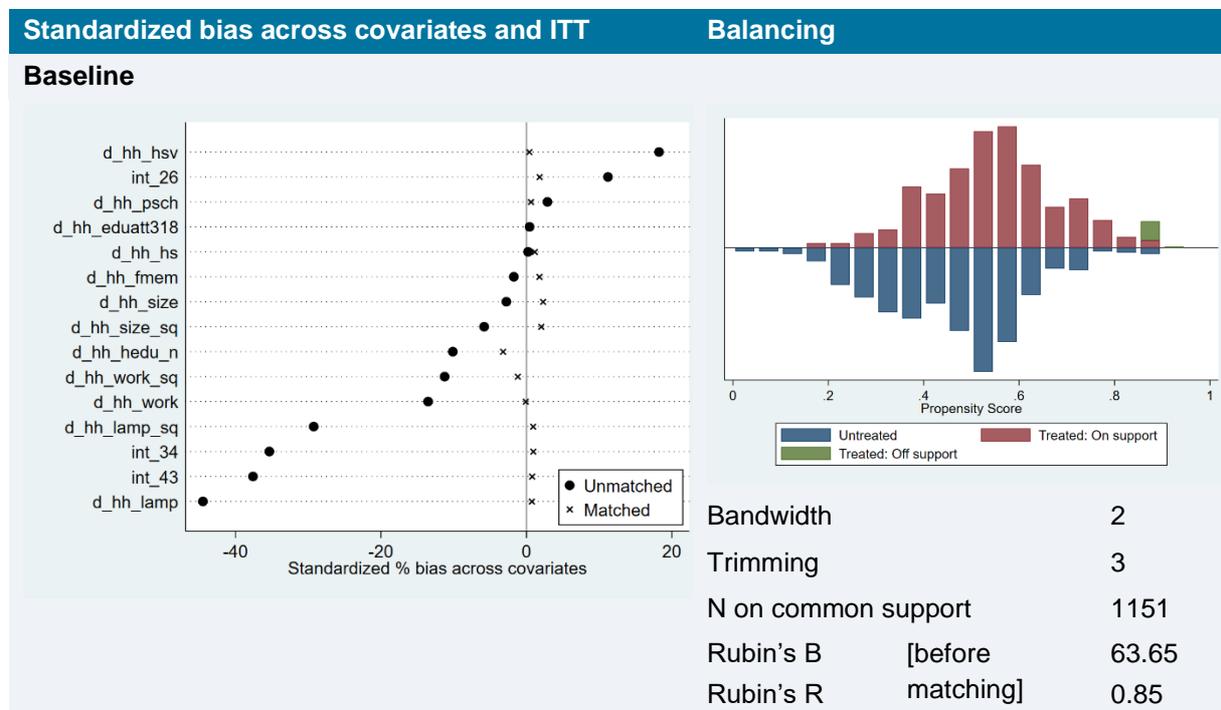
two rows. For example, the optimal model has a bandwidth of 2 and a trimming value of 3 for the baseline sample in Figure 2. This is then followed by the number of observations on common support in the next row, and then the Rubin's R and Rubin's B values both before and after matching. Generally, a Rubin's B score under 25 after matching is desirable, whilst a Rubin's R score between 0.85 and 1.25 is the preferred range after matching (Rubin 2001). The unmatched samples are particularly unbalanced; for instance, the Rubin's B is 63.65. However, the Rubin's B score after matching, which is below 25, show how matching removes the previous imbalances.

- Finally, the remaining rows on the left hand side under the midline panel indicate the impact estimate (ITT or ATT) for midline and the associated standard errors. Given that it is not definitively clear how to produce standard errors for PSM, both bootstrapped and non-bootstrapped standard errors are presented for robustness purposes. (See Section 0 for more detail on this.)

Note that the balancing was done on the full sample of households that were interviewed at baseline (1,186), while the impact estimation of the ITT and ATT effects was done on the sample of households that were interviewed at midline (943). Conducting the balancing on the full baseline sample rather than on the non-attrited sample that was reached at midline is acceptable in this case given that, as discussed in section 0, the attrition analysis conducted did not find any systematic differences between the group of households that attrited and the group that didn't. This then allows us to make use of the full range of observations at baseline for each evaluation group when assessing balance.

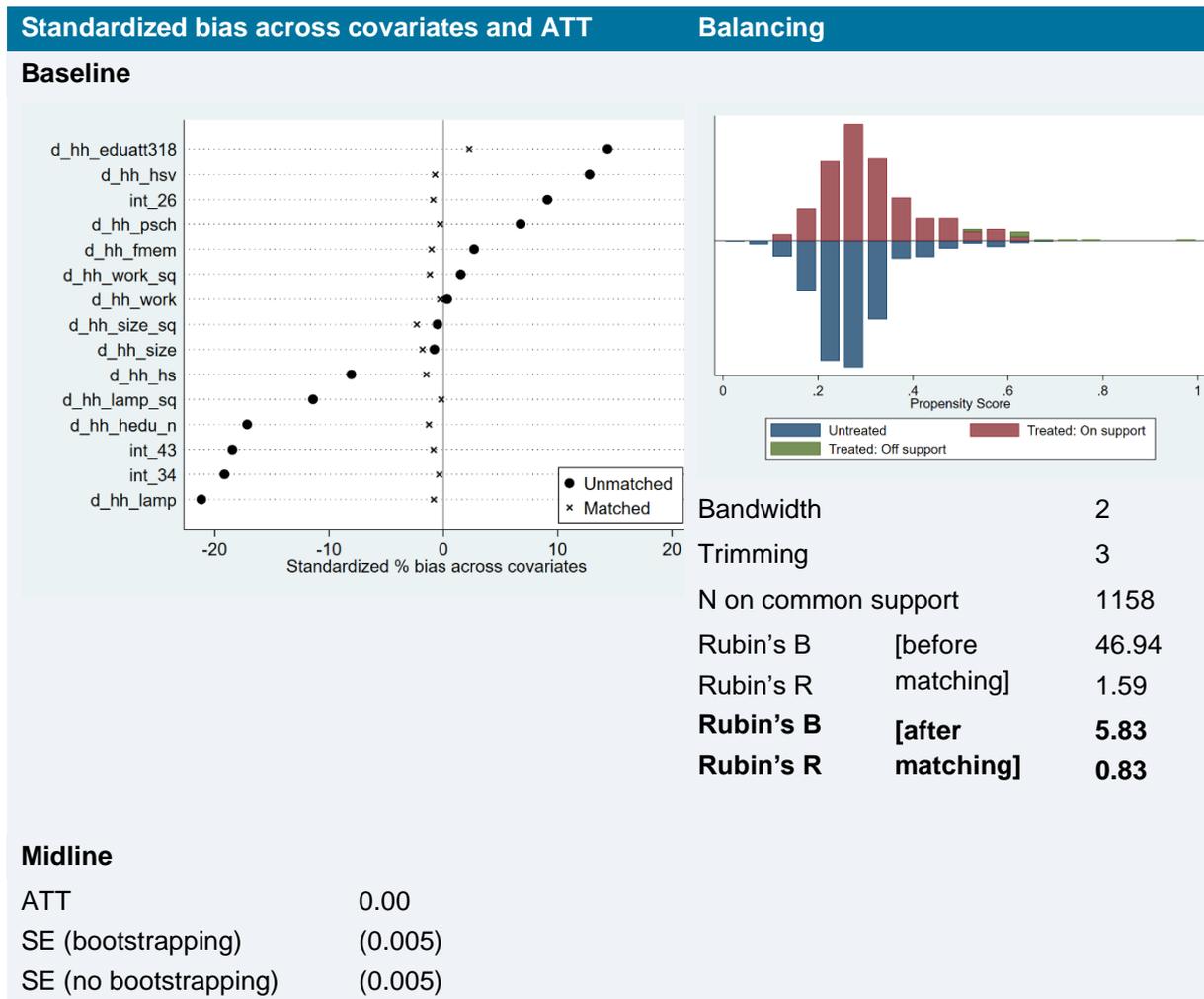
Mean proportion of household members who experienced ARI symptoms in last two weeks

Figure 2: ARI symptoms: Second stage results (ITT)



		Rubin's B	[after	9.18
		Rubin's R	matching]	1.13
Midline				
ITT		0.00		
SE (bootstrapping)		(0.004)		
SE (no bootstrapping)		(0.005)		

Figure 3: ARI symptoms: Second stage results (ATT)



Mean proportion of household members who experienced cough in last two weeks

Figure 4: Cough symptoms: Second stage results (ITT)

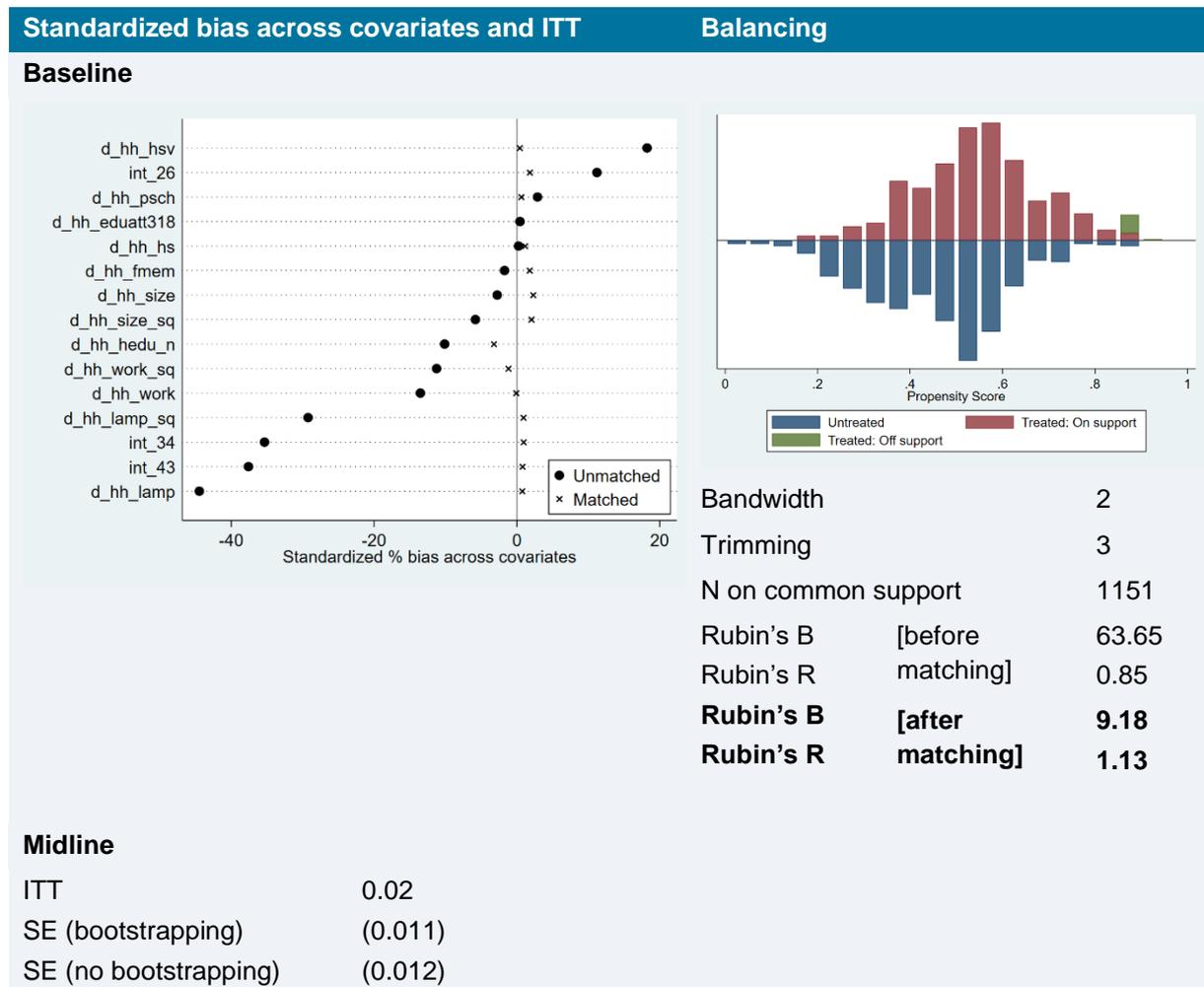
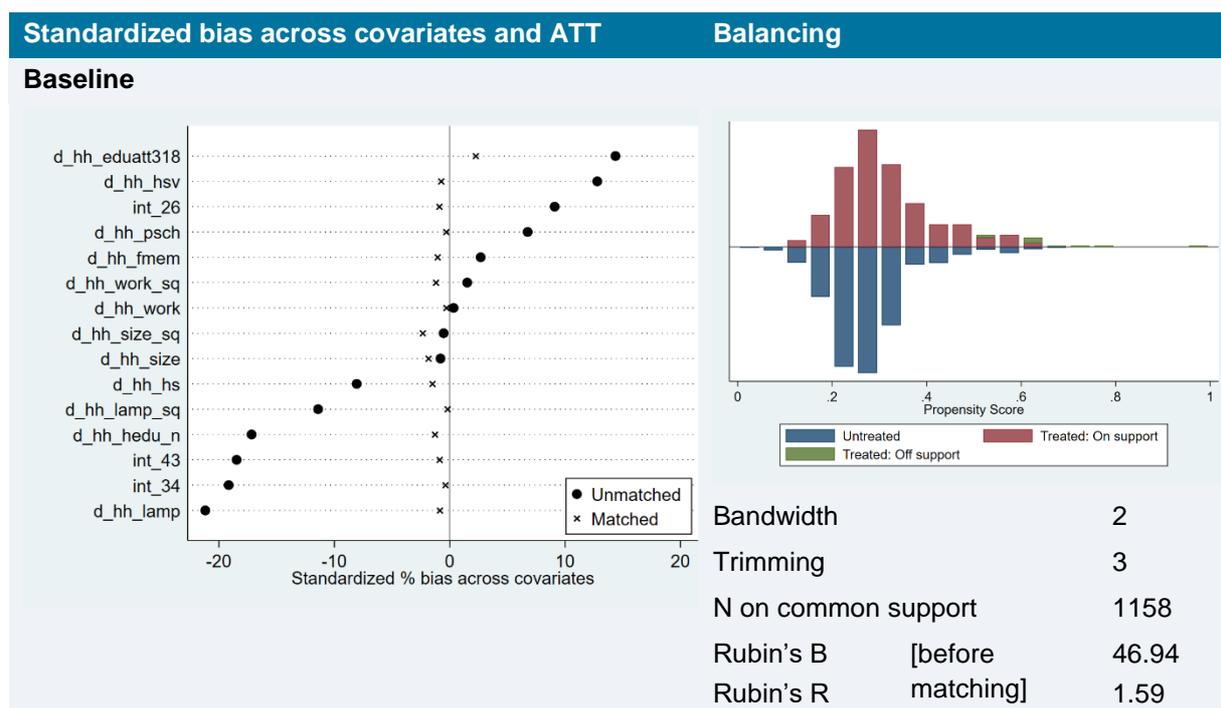


Figure 5: Cough symptoms: Second stage results (ATT)



Rubin's B	[after	5.83
Rubin's R	matching]	0.83

Midline

ATT	0.01
SE (bootstrapping)	(0.013)
SE (no bootstrapping)	(0.011)

Mean proportion of household members who experienced cough with fever in last two weeks

Figure 6: Cough with fever symptoms: Second stage results (ITT)

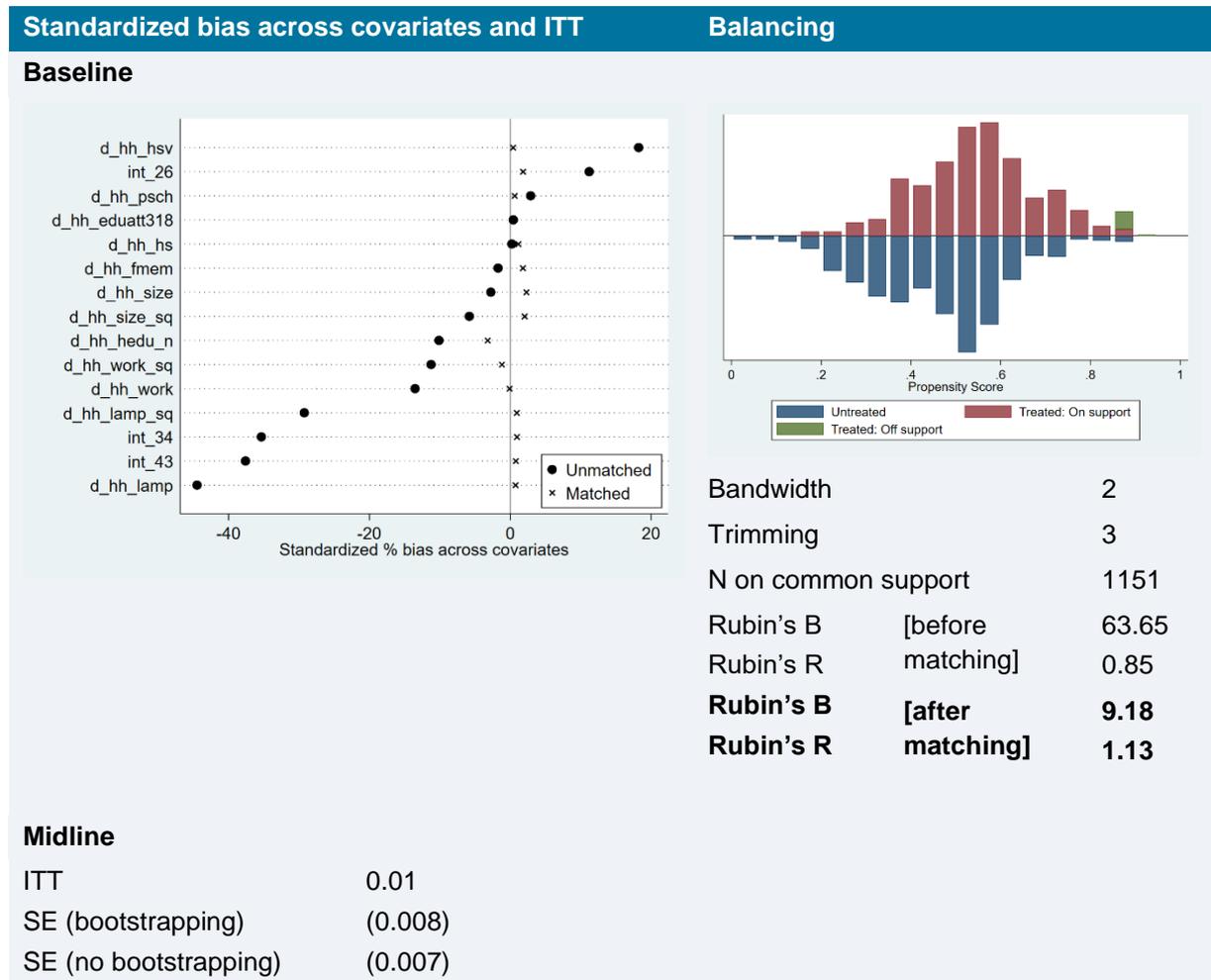
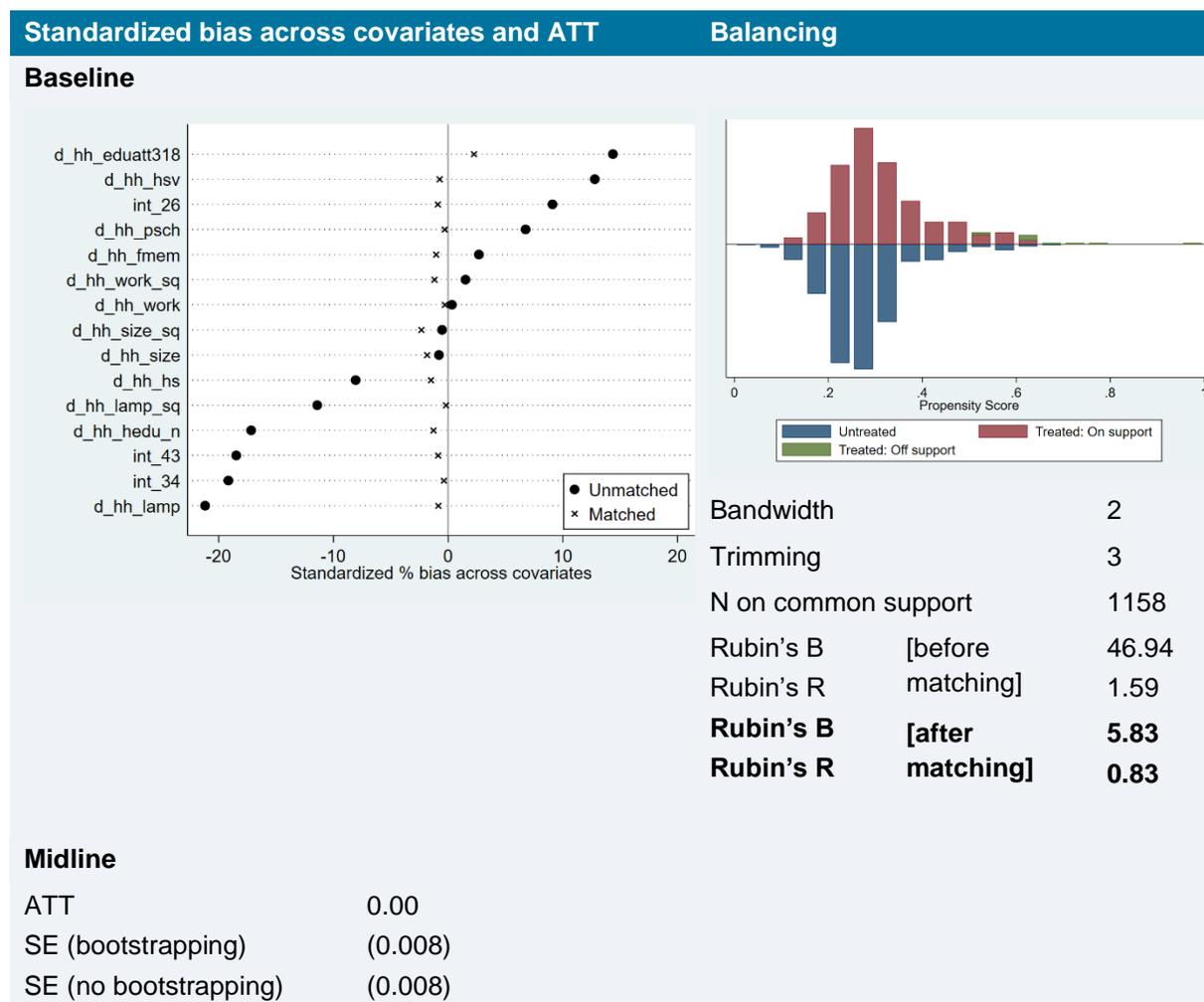
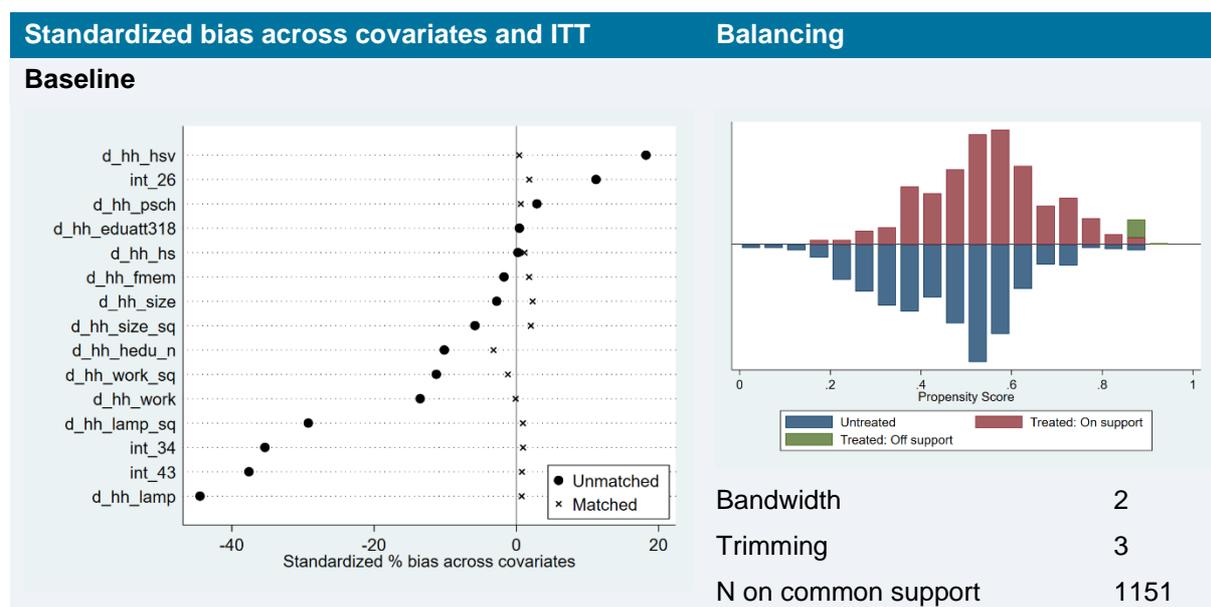


Figure 7: Cough with fever symptoms: Second stage results (ATT)



Mean proportion of household members who experienced cough with difficulty breathing in last two weeks

Figure 8: Cough with difficulty breathing symptoms: Second stage results (ITT)

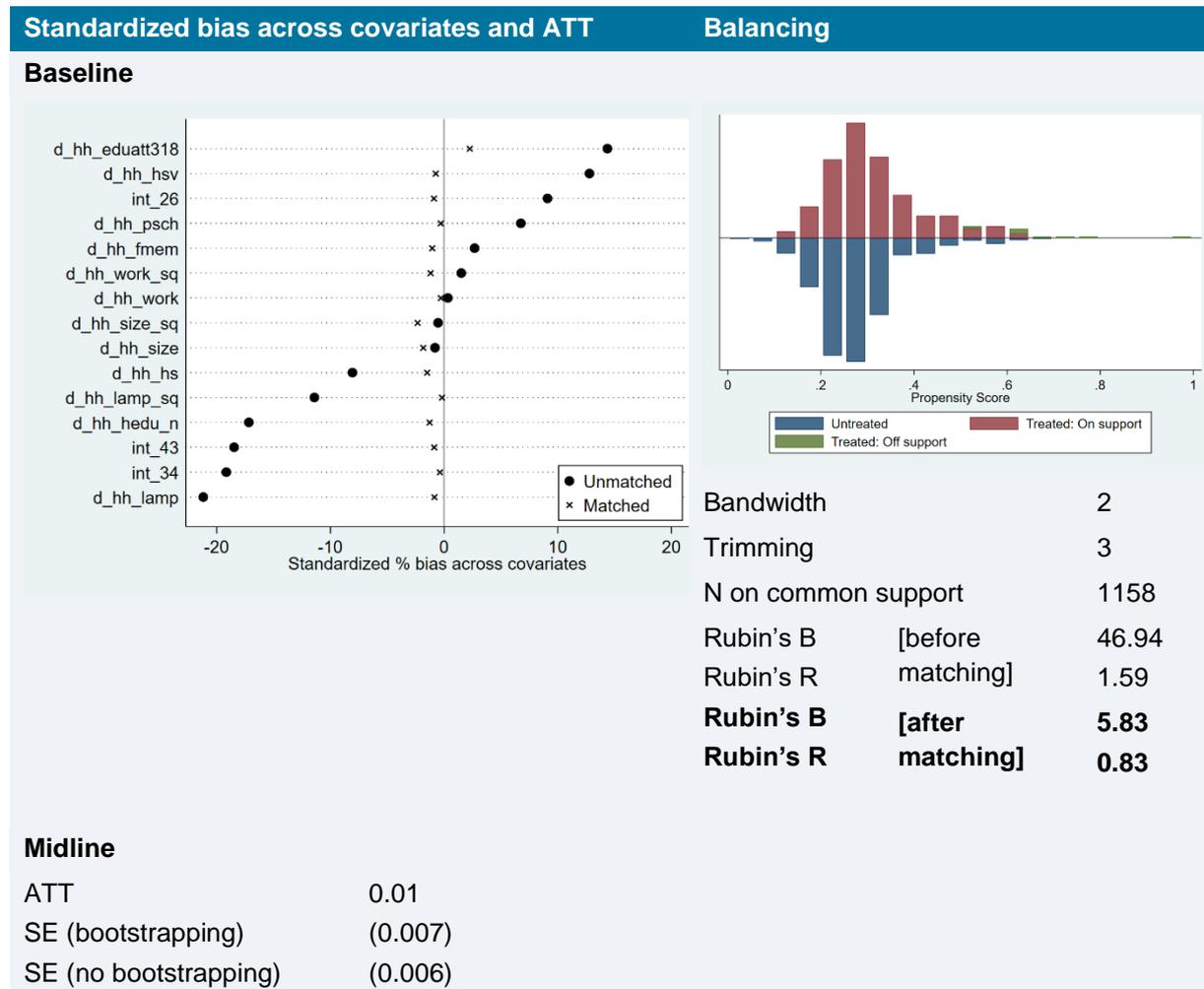


Rubin's B	[before	63.65
Rubin's R	matching]	0.85
Rubin's B	[after	9.18
Rubin's R	matching]	1.13

Midline

ITT	0.01
SE (bootstrapping)	(0.005)
SE (no bootstrapping)	(0.006)

Figure 9: Cough with difficulty breathing symptoms: Second stage results (ATT)



Total household monthly income (in Ksh)

Figure 10: Household income: Second stage results (ITT)

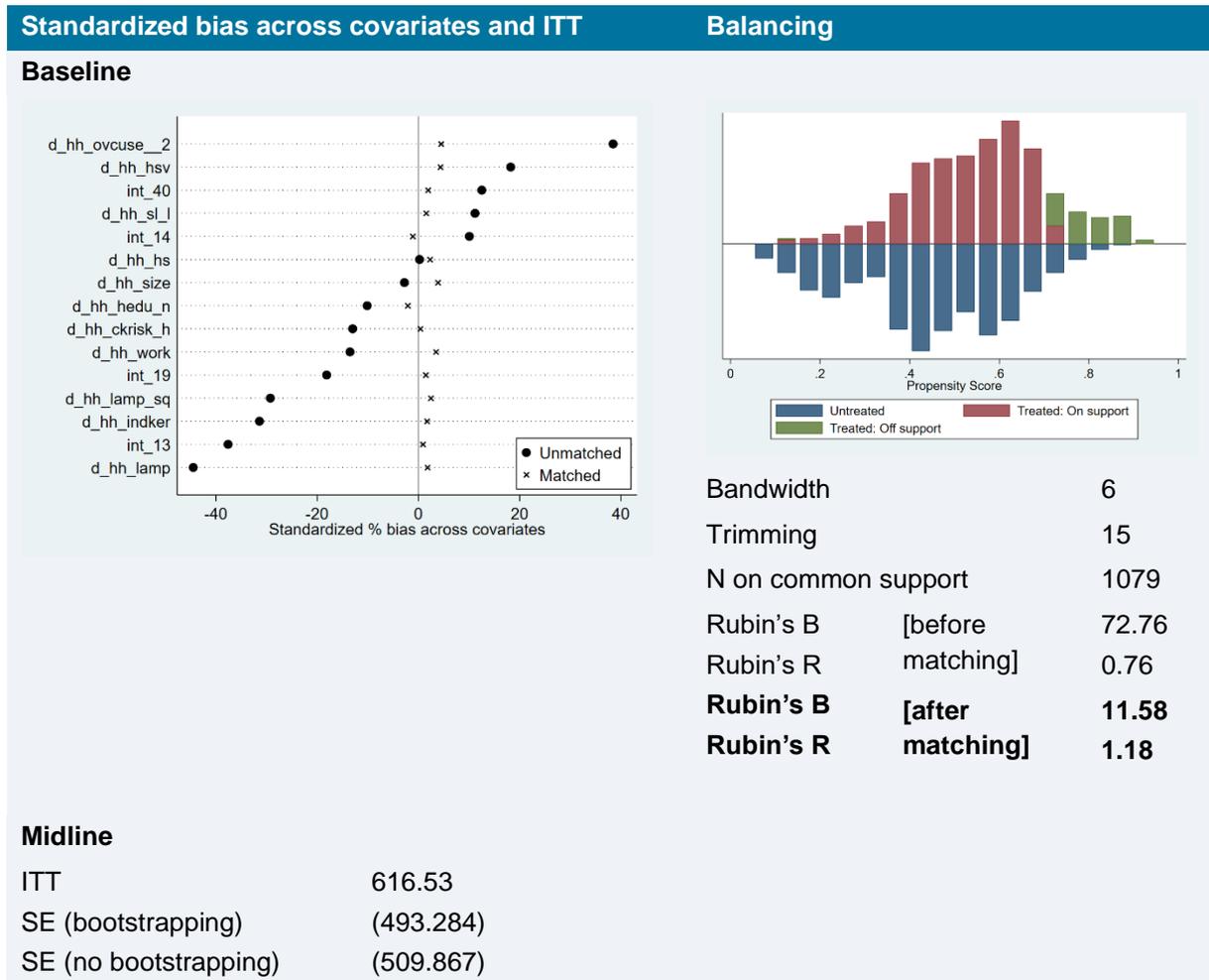
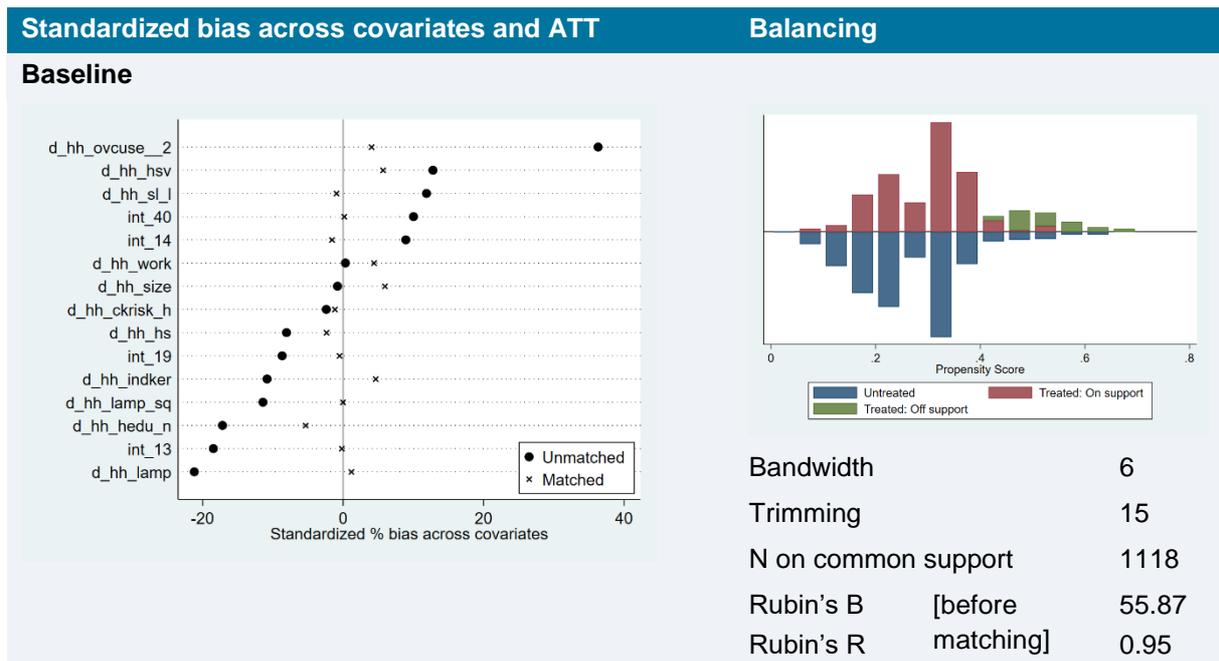


Figure 11: Household income: Second stage results (ATT)



Rubin's B	[after	15.45
Rubin's R	matching]	1.15

Midline

ATT	-418.35
SE (bootstrapping)	(444.279)
SE (no bootstrapping)	(457.527)

Number of working household members per household

Figure 12: Working household members: Second stage results (ITT)

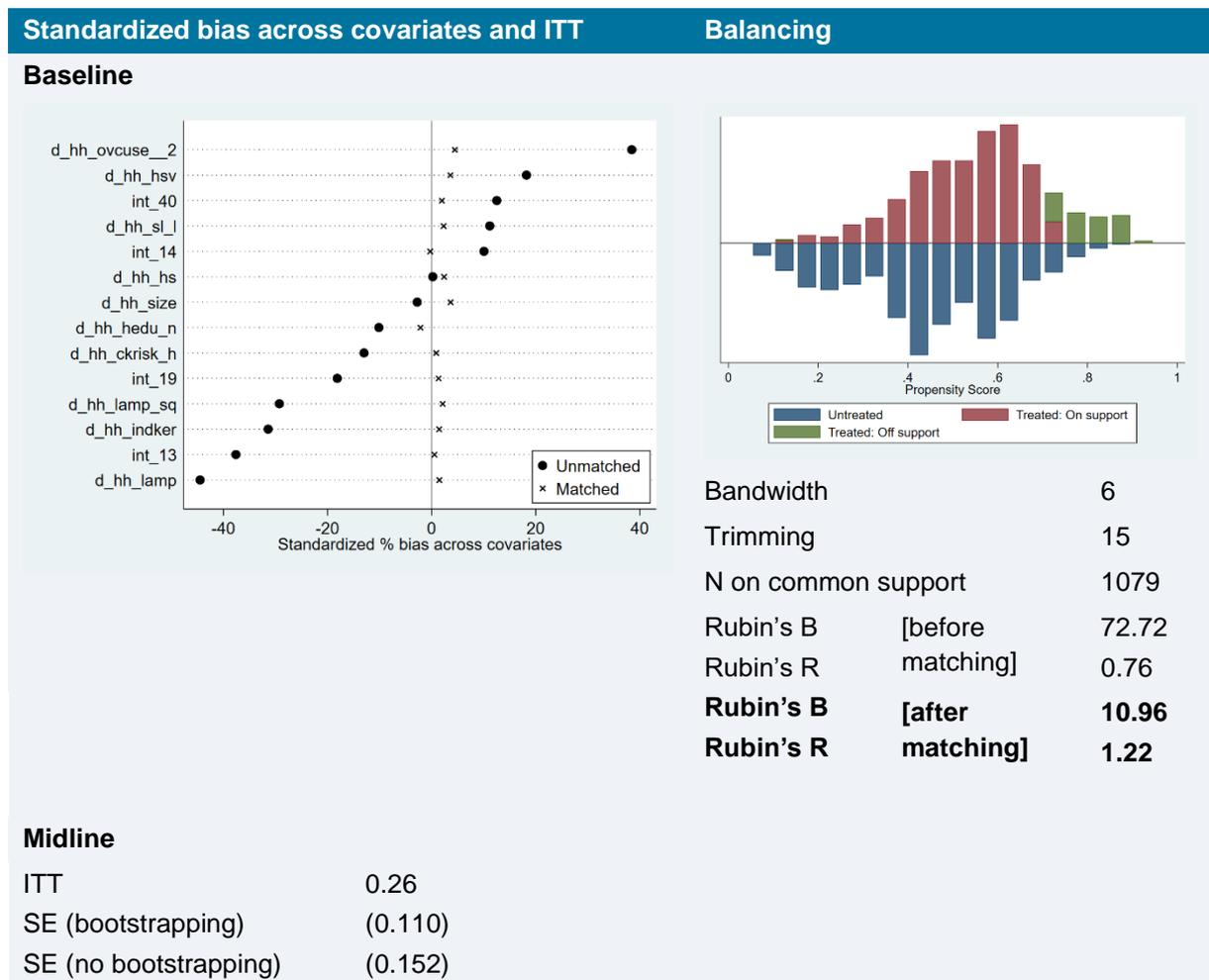
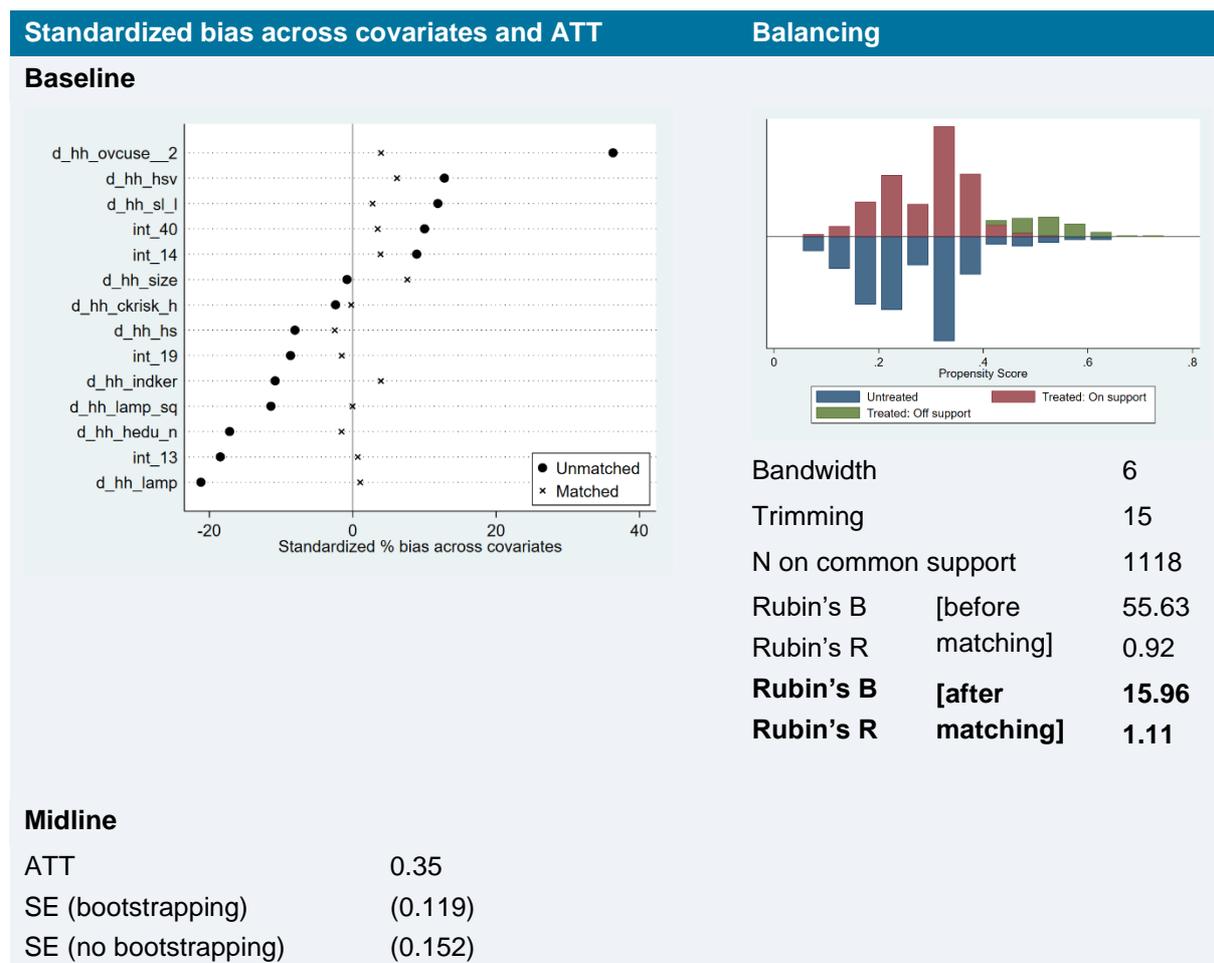
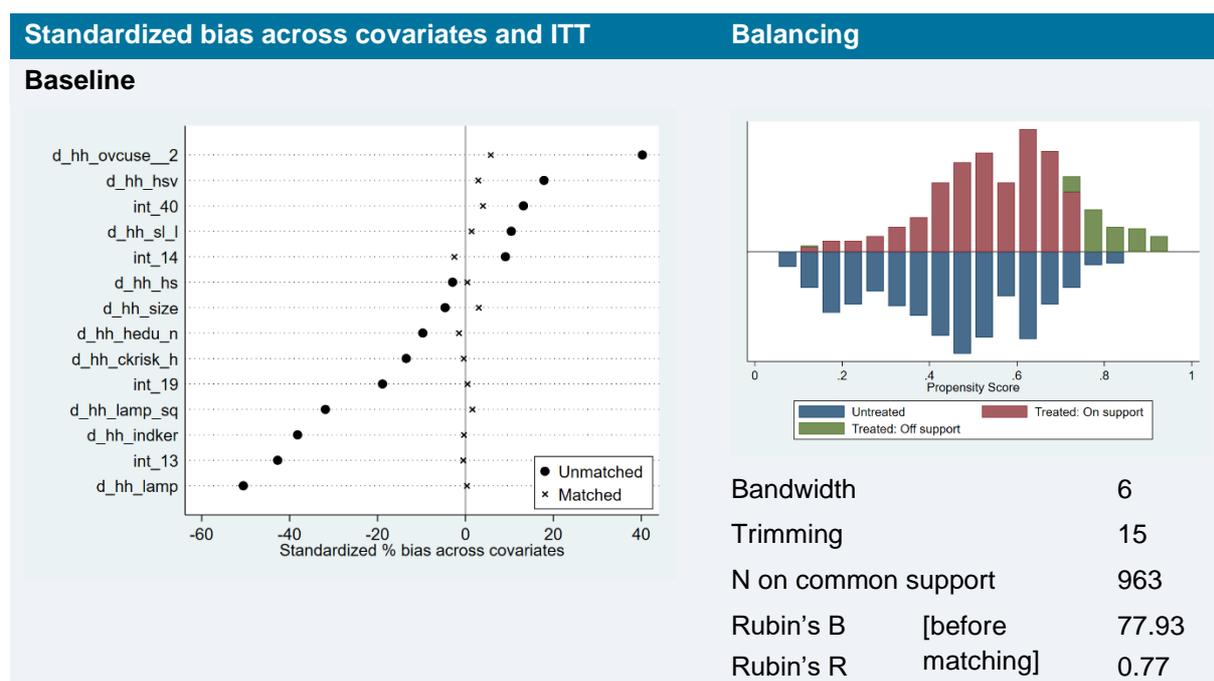


Figure 13: Working household members: Second stage results (ATT)



Number of work activities per household

Figure 14: Number of activities: Second stage results (ITT)

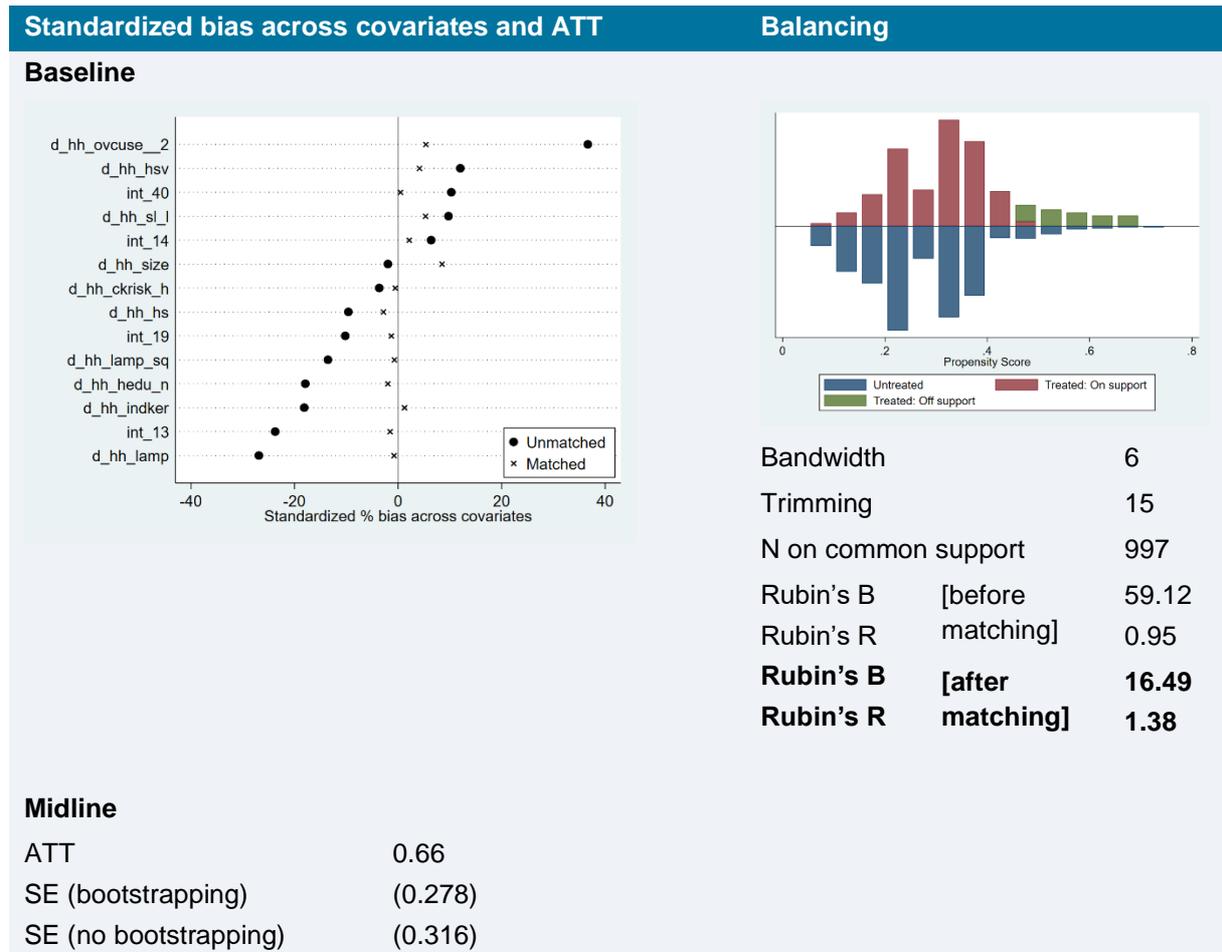


Rubin's B	[after	13.68
Rubin's R	matching]	1.43

Midline

ITT	0.20
SE (bootstrapping)	(0.269)
SE (no bootstrapping)	(0.317)

Figure 15: Number of activities: Second stage results (ATT)



ANNEX F QUALITATIVE APPROACH

The qualitative component was originally designed as part of a mixed methods study. The research questions and framework were developed to respond to the endline evaluation report that would provide a summative assessment of the Mwangaza Mashinani pilot. Owing to changes in the design as a result of COVID-19, OPM had to make changes to the design and presentation of the evaluation. As qualitative data collection was completed, these findings serve as a midline assessment for the programme.

F.1 Introduction and evaluation criteria

The key focus of the qualitative component is on the relevance, effectiveness and sustainability of the Mwangaza Mashinani pilot.⁶ We summarise below the main focus of the qualitative study with respect to each of these OECD-DAC⁷ criteria, as well as provide the specific Key Evaluation Questions (KEQ) which we aim to answer within each of the criteria.

Relevance

As part of the assessment of **relevance**, we assess the extent to which the objectives of the Mwangaza Mashinani pilot respond to the needs of the target population and the communities it is serving. Crucially, we focus on the population of interest which is ‘the most vulnerable segment’. Although it is beyond the remit of this evaluation to unpack the characteristics of the vulnerability and poverty and their manifestations with regard to the current programme, the objective for the qualitative component is to assume throughout the work that the needs of this particular population are greater than those of the ‘poor’ and that members of households and communities not only have varying needs but also power in accessing and using energy.⁸

In this context, we investigate whether the assumptions of the pilot project’s ToC hold, particularly with respect to the pilot project’s objectives of:

1. Enhancing access to energy to the most vulnerable (i.e. whether SHS will be perceived relevant to the context our sampled households live in comparison to other sources of energy); and
2. Increasing market penetration in vulnerable communities (i.e. whether the targeting approach and awareness raising activities are focused on and involve the right people in the household and community who make decisions on assess and use of energy; whether payment and repayment modalities make sense to the contexts of the sampled households and whether assumptions made about ownership are right).

The KEQs which the qualitative component answers include:

⁶ The main focus of the qualitative research was relevance and effectiveness. The qualitative design included preliminary indications on sustainability. However, data on this was limited as communities had only received the first cash top-up and still had to make several more repayments before fully owning their devices. While it was too early to determine if the programme would be sustained, data collected in relation to sustainability has provided an early indication about the challenges related to sustaining the use of the device and have been included in this report.

⁷ These are definitions and principles for use as evaluation criteria. See <https://www.oecd.org/dac/evaluation/daccriteriaforevaluatingdevelopmentassistance.htm>

⁸ The qualitative study also considers aspects of the project and its assumptions that are not relevant to the target population, if any.

KEQ1. How well is the pilot project suited to the needs of the target population, their community and private sector SHS suppliers?

- DEQ1.1 Is the pilot project's objective of improving access to off-grid SHS relevant to the target population's energy and welfare (education, health and livelihood) needs?
- DEQ1.2. Is the intervention approach acceptable to the target population, their community and private SHS suppliers?

Effectiveness

The **effectiveness** assessment focuses on the way in which the project operations are functioning in order to identify ways in which implementation can be improved. In addition, this assessment considers whether or not the project is improving access to and use of energy amongst the most vulnerable population, and how women in different households as well as their communities are benefiting (or not) from the programme. In this regard, we explore how SHS is being used (or not), by whom, and in what ways. We also try to understand how and to what extent (if at all) the target population has improved their understanding of – and their ownership over – SHS.

The KEQs which we aim to answer through the qualitative study are:

KEQ3. To what extent have beneficiary households improved their awareness about and feel a sense of ownership towards their SHS?

- DEQ3.1. To what extent have beneficiary households improved their awareness about the use and benefits of SHS?
- DEQ3.2. To what extent do beneficiary households feel a sense of ownership towards their SHS?

Sustainability

The **sustainability** assessment focuses on identifying factors that enable and hinder the likelihood that the targeted population will maintain their solar systems beyond the project cycle. Given that the target population is the most vulnerable, the qualitative research study collects information early on in the life of the project on affordability of the SHS and its maintenance and the extent to which the sampled households make an informed choice about whether to use SHS and maintain it in the longer run, taking into account other available sources of energy.

KEQ10. How well are factors that are likely to affect the sustainability and scalability of the pilot project addressed?

- DEQ10.1. How strong is stakeholder commitment to sustain and scale-up the pilot project?
- DEQ10.3. How well have operational modalities of the pilot project been integrated or aligned with the NSNP?

F.2 Qualitative instrument design

The evaluation utilises a set of quantitative and qualitative tools to capture data on the key evaluation criteria. The main qualitative tools used to answer the KEQs are: 1) semi-structured key informant interviews and community mapping with village leaders, community champions and members of the Beneficiary Welfare Committee (BWC); and 2) in-depth interviews with households who are members of the Mwangaza Mashinani project.

Key Informant Interviews

Key informants are people who have an informed perspective or have an experience relating to particular aspects of the intervention. Thus, key informant interviews were conducted with the village leader and a member of the BWC and/or community champions in each village. In this way, they complement and triangulate information collected from household studies.

Community Mapping

A community map is a participatory tool that draws on the support of community members (in this study, the village leader and community champion/BWC member) to identify the physical, social or economic landscape of the community. Maps are drawn by first identifying the geographical indicators of the village and sub-village and then map the inhabitants onto the geographic landscape. It is a useful way to understand vulnerability, access, sources of conflict or underlying challenges in the community. A community map was used to understand vulnerabilities in the community and locate especially vulnerable households that were part of the Mwangaza Mashinani.

In each sub-location, we drew one community map of the sub-location with the village leader to identify areas where vulnerable people in the sub-location/villages live. The village leader was first asked to map the boundary of the sub-location, and any major landmarks – the main road, schools, well, trees, water resources, chief's house etc. – before then mapping the villages in the community.

The village leader was then asked for their definition of vulnerability and, keeping this definition in mind, to locate the most vulnerable communities in the sub-location. Using the map and the list of project participants provided by the BWC/community champions, we then worked together with community champions/BWC members to locate Mwangaza Mashinani beneficiaries in these areas who had received a solar device.

In-depth Interviews

In-depth interviews (IDI) are intensive one-to-one discussions on a range of structured, semi-structured or unstructured questions. IDIs allow for probing and gaining insight from an individual's point of view. As in-depth interviews allow for additional privacy and anonymity, interviews can cover greater ground and explore more sensitive topics. IDIs were conducted with one male and one female member in each household. Differences in opinion based on gender and age were explored this way. We sampled three households per site and conducted one IDI with a man and one with a woman from the same household.

F.3 Qualitative Sampling Strategy

The qualitative sample draws from the quantitative household survey. Only households that have received the solar device under the Mwangaza Mashinani pilot were sampled. Specifically, these are households residing in off-grid communities in Kilifi and Garissa and that have at least one child enrolled in and attending school, which are CT-OVC or OP-CT beneficiaries and have received the solar device. The sampling followed a purposive, two-step process. First, a list of sub-locations were drawn up for Kilifi and Garissa. These sub-locations were sorted from lowest average household income in a sub-location to the highest average household income. Any sub-location that had fewer than 10 sampled households in the quantitative baseline were removed from the list, to ensure that there would be a sufficient number of respondents available to select for qualitative research. In addition, any

sub-locations that were deemed too insecure to travel to were removed from the list. Finally, the sub-locations with the lowest average household income were selected in Kilifi and Garissa. The purpose of selecting the poorest sub-locations was to visit those sub-counties with the most vulnerable solar device owners.

Definition of the eligible universe is constricted by the circumstances on the ground. In particular, areas of extreme security risk were excluded from the viable population where it would be unsafe for evaluation teams to work.

Each eligible registered beneficiary represents a single household and therefore, by drawing a list of registered beneficiaries, we selected households for our research sample.

Sampling households

A list of households for the sub-locations was drawn from the quantitative sample. With the help of the village leader (Chief/Assistant Chief) and the beneficiary lists provided by community champions/BWC members, the research teams shortlisted the households based on which households are considered most vulnerable in the community and are Mwangaza Mashinani beneficiaries.

Sampling community level representatives

OPM selected either a BWC or a community champion in each sub-county with the help of implementation teams. As the qualitative research relies on the community representative as a key informant of how the implementation has progressed in each community, the implementation teams interviewed both informants where both were present.

Selection of evaluation respondents

Village leaders include community elders, religious leaders, and any other authority figures in the community, who are sufficiently in tune with community needs and are able to speak about the context, challenges and opportunities where they live. Village leaders were mobilised in the field and are particularly powerful in affecting the moods, choices and dynamics within villages. They have certain control over village resources and therefore represent an important group of respondents interviewed separately and individually.

Community level implementers/representatives. We interviewed members of the BWC and/or community champions, who were able to speak specifically to targeted households experience with the intervention modalities and their use of solar device. These individuals are key to understanding the needs, challenges and opportunities of the supply chain at the level of the community. We used project data to identify and select these respondents.

Head of the household/female. We interviewed women/household heads who are women, on their access, use, ownership over and experience of the pilot. We interviewed women to gauge their understanding and acceptance of the SHS and related communications, payment mechanisms, and SHS use, and issues related to affordability, maintenance, and sustainability. We explore differences in gender especially around ownership and access.

Head of the household/male. We interviewed men/household heads who are men on their access, use, ownership over and experience of the pilot. We interviewed men to gauge their understanding and acceptance of the SHS and related communications, payment mechanisms, and SHS use, and issues related to affordability, maintenance, and sustainability. We used interviews with men and women from the same household to explore differences in gender especially around ownership and access

F.4 Fieldwork implementation

F.4.1 Piloting and training

Training in the use of the qualitative tools took place in Kilifi over four days followed by one day of piloting. The training was led and conducted by OPM staff responsible for the qualitative component of the study, with the support of senior staff from the local partner organisation, Research Guide Africa (RGA). Training was classroom-based and comprised presentations and interactive exercises. The training covered an introduction to the pilot project and evaluation, as well as how the pilot was implemented. Emphasis was placed on generating collective understanding of the project, research tools, sampling details and fieldwork protocols (personal conduct, general behaviour and other considerations). In particular, training was provided on formulating questions, how to interpret the research guide, recording using audio devices, note-taking, transcribing, labelling data, and the overall fieldwork plan. Finally, the OPM team explained key policies around safeguarding and ensuring confidentiality and consent. Researchers shared their qualitative research experience and participated in practical sessions involving role-play using the research guides, as well as mock community-mapping exercises, to help researchers gain familiarity with the tools.

Following the training, the entire field team piloted the qualitative instruments, as well as the sampling strategy and fieldwork protocols in one sub-location (Mwahera) in Kilifi. Researchers with knowledge of the local language facilitated and took notes while other researchers observed. Piloting of the tools was used to check the content and meaning of each tool, the length, and logistics in relation to implementing the tools in the communities. Together with RGA, we also assessed the research teams' work patterns as well as the personal strengths and weaknesses of the researchers.

F.4.2 Qualitative fieldwork

The qualitative research was conducted by RGA in January 2020. RGA also conducted the quantitative baseline survey and therefore had a strong understanding of the project context and our approach. Research Assistants (RAs) were recruited on a competitive basis and were chosen based on their experience of conducting qualitative studies, working with qualitative datasets, and knowledge of the local context and languages. The researchers were divided into two smaller research teams – one for each of Kilifi and Garissa counties – and each team was led by a lead researcher from either OPM or RGA (and by both in one Kilifi location). Each team was further divided into sub-teams, each consisting of one facilitator and one note-taker. Research activities were supervised by both OPM and RGA survey staff in Kilifi, and by RGA senior survey staff in Garissa to provide technical support.

Each interview and discussion had a lead facilitator and a note-taker. The researchers asked for each participant's consent to willingly participate in the interview as well as consent to be recorded using an audio device. Interviews and discussions were conducted mostly in local languages and translated into English. In both Kilifi and Garissa, there are some interviews, especially with some Chiefs and community champions, that were conducted in English or a mixture of English and Swahili. Most household interviews were conducted in the local language (Somali, Giriama or Swahili). The division of tasks among researchers, i.e. note-taking and facilitating/conducting interviews, was based on capacity to speak the local language as well as each researcher's skills and competencies. In Kilifi, interviews were

conducted in either Swahili or Giriama. In Garissa, interviews were conducted in Somali. Field researchers were deployed in sub-locations where they could speak the languages.

Notes collated during the interviews and discussions were used to facilitate daily debrief sessions at the end of each day. These were led by RGA senior staff (and with OPM staff for Kilifi county) in order to discuss fieldwork and provide an initial synthesis of the findings. These sessions were a key stage of the analysis and were used to reveal research gaps; as well as to think about the team’s performance, the effectiveness of the tools, and how each data collection tool helped to answer the key evaluation questions. The debrief sessions marked the start of building a narrative around findings, discussing emerging themes, and identifying additional areas to explore throughout the fieldwork. The completion of the qualitative data collection was followed by the transcription of data recorded during the interviews.

Table 5 summarises some of the challenges encountered during the qualitative fieldwork and the ways in which these were overcome.

Table 5: Qualitative Fieldwork Challenges

Fieldwork challenges	Resolution
<p>High-level security situation throughout fieldwork duration</p>	<p>Al-Shabab terrorist attacks occurring across Kenya preceding the fieldwork posed risks to the research team when carrying out fieldwork in both counties.</p> <p>OPM contracts Spearfish Security who provided daily security briefings and guidance on which areas were safe to travel to. In addition, the team benefited from intel on the ground through RGA. The team only travelled to the sub-locations when it was deemed safe to do so. This meant that there was a break between data collection in Kilifi and in Garissa.</p> <p>Furthermore, RGA carefully determined who from their Kenyan research team was safe to travel to Garissa given this county is high-risk even in normal times.</p>
<p>Sampling: BWC’s household lists not being updated</p>	<p>The community mapping exercise highlighted that the project’s beneficiary list was not always the most recently updated list, which posed challenges for sampling households.</p> <p>The research team worked with the list provided by the baseline quantitative data collection and compared this with the BWC member’s list. The RGA team phoned sampled participants ahead of every fieldwork day to ensure that these households were enrolled in the project and had received a SHS through the project.</p>
<p>Revisiting households when heads were not there on the first visit</p>	<p>There were occasions where only one member of the sampled household was present for the interview. On these occasions, the research team interviewed the</p>

Fieldwork challenges	Resolution
	available household member and revisited the household to interview the second household member.
Reluctance of some interviewees (mainly female) to be interviewed without their husbands or another male household member being present	In cases where there was an initial reluctance for beneficiaries to be interviewed, the RGA team exercised patience and caution. RAs took time to reiterate the purpose of the visit and to emphasise the anonymity and confidentiality of the interview. When permitted to interview the participant, this would in some cases have been in the presence of other household members but not to the extent that it would have compromised findings.
Observation bias	<p>The presence of the research team (especially that of OPM staff who are non-Kenyan) will inevitably have affected participant responses.</p> <p>Research team members who were not directly involved in the interview physically distanced themselves from where the interview was taking place, especially where it was felt our presence was impacting the interview.</p> <p>Triangulating within-household and with community-level responses partially addressed the observation bias to some degree.</p>

F.5 Analysis process

We followed the stages of theme development in qualitative content and thematic analysis, as detailed by Vaismoradi et al (2016). The broad qualitative themes were based on the key evaluation criteria which were the focus of the qualitative.

We developed sub-themes within each of these based on themes emerging from the baseline analysis; from our own observations and field notes having conducted the qualitative research in the field; and from daily debriefs with the RGA team following data collection in Kilifi and Garissa (initialisation). Using NVivo, we coded up the transcripts from all interviews using these themes and sub-themes, in particular making use of conceptual codes (e.g. payment systems), participant perspective codes (role of the BWC, role of community champions, etc.), and the setting code (e.g. context). In the construction phase, we classified, compared and labelled the translated transcripts. Any additional themes therefore arose from the OPM researchers reading through all translated transcripts and adding codes where needed using the NVivo software; and related themes to our established knowledge of project implementation to date (rectification).

The storyline was already emerging from previous baseline data collection and our own first-hand observation during qualitative fieldwork, but we focused on developing the storyline more specifically following initialisation, construction and rectification (the finalisation stage). The qualitative analytical process is cyclical in nature and, as stated in Vaismoradi et al

(2016), entailed the OPM team repeatedly returning to the data and refining sub-themes and the coding of transcripts.

ANNEX G IMPLEMENTATION REVIEW

TECHNICAL DETAILS

As part of the implementation review, we conducted qualitative interviews with stakeholders at the national level.⁹ The purpose of this data collection was to generate evidence to address evaluation questions related to the relevance, effectiveness, efficiency and sustainability of the pilot project.¹⁰ The interviews took place after 6 months of implementation and were timed such that the findings could be taken into account in time for the design of the second phase of the Mwangaza Mashinani pilot.

Data collection took the form of semi-structured, qualitative individual or group interviews with project stakeholders with most of the 15 interviews conducted face-to-face in Nairobi between 18 and 22 November 2019.¹¹ The same topics were discussed with different stakeholders to allow for triangulation and different perspectives to inform the evidence base. However, not all topics were part of the interview with each stakeholder and interview topics varied depending on the stakeholder's potential knowledge of the topic. Because of the large number of evaluation questions and topics to cover, the interviews could not explore each topic in-depth.

Stakeholder selection was done in consultation with UNICEF and the implementing consortium. Table 6 indicates the stakeholders that were interviewed as part of the national-level implementation review.

Table 6: National-level stakeholders

Stakeholder Group	Stakeholders Interviewed
Funding agencies	SIDA, UNICEF
Development partners	The World Bank
Implementing consortium	Energy4Impact, The Busara Center for Behavioural Economics
Energy sector	Ministry of Energy, Kenya Off-Grid Solar Access Project (KOSAP), Power Africa, Kenya Private Sector Alliance (KEPSA), d.light, Bright Sky Solar Solution
Social Protection sector	Social Assistance Unit (SAU), Social Protection Secretariat (SPS)

⁹ County-level data collection with stakeholders in Kilifi and Garissa, which will complement the national level findings, is planned to take place at the same time as the endline survey (May 2020).

¹⁰ The evaluation matrix in **Error! Reference source not found.** of the inception report (OPM, January 2019) indicates which evaluation questions will draw on different stakeholder interviews.

¹¹ Where stakeholders were not available or based outside of Nairobi, interviews were held via Skype between 25 November and 2 December 2019.

The findings from the implementation review were shared in a Policy Note in January 2020. The results were shared with stakeholders through a workshop in Nairobi and at the technical working group in Kilifi in February 2020.

ANNEX H VALUE FOR MONEY ANALYSIS

H.1 Objectives and research questions

The objectives of the Value for Money analysis (VfM) are to review how much the Mwangaza Mashinani pilot project, as managed by UNICEF and implemented by a consortium led by Energy for Impact, has spent and assess whether the project provided VfM, being '*the optimal use of resources to achieve intended outcomes*' (DFID, 2011). Based on discussions with UNICEF, for the purpose of this midline analysis, we focused on two areas of VfM, namely economy and efficiency. By looking at these areas, we have attempted to answer the following research questions:

- **Economy:** Is the project buying inputs of the appropriate quality at the right price? Inputs include staff, contractual services from external providers, and other goods and services that are used to produce outputs.
- **Efficiency:** How well does the project convert inputs into outputs? Outputs are results delivered by the project, as measured by the project log frame. In this case, the cost efficiency analysis looks at the cost of delivering cash top-ups to beneficiaries and the cost incurred by the project per beneficiary household.

Using the FCDO guidelines on VfM (DFID, 2011) and OPM's VfM approach (King and OPM, 2018), an assessment framework has been applied that sets out a transparent basis for making VfM evidence-based judgements. This clarity is achieved through the use of explicit criteria (aspects of performance) and standards (levels of performance) for each of the VfM dimensions. The criteria and standards are specific to the Mwangaza Mashinani pilot and aligned with the pilot's design and ToC. The VfM assessment is based on the comparison between identified standards and project level indicators for each criterion.

The core evidence base for this VfM assessment includes data that are routinely collected as part of the pilot monitoring and evaluation system, UNICEF annual reports to SIDA, E4I quarterly reports to UNICEF, the project implementation plan, contracts and MoUs with key input providers, and budget and expenditure data as recorded by UNICEF and E4I. The analysis also draws on a validation interview with UNICEF and E4I. This includes a mix of quantitative indicator-based measurement and qualitative contextual evidence.¹²

There exists some limitations to the VfM assessment analysis.

- Some inconsistencies in the data limit the ability to assess comprehensively all areas of VfM. There are some discrepancies on the spending and results as reported by different data sources, which have not been fully clarified. This potentially limits the comprehensiveness of the analysis. Budget data and actual spending are not reported based on a standardised coding approach. The budget is disaggregated by activity, while spending is coded according to the cost centre money was spent on (for example, personnel, travel, contractual services, etc.). This makes comparability of budget and spending data difficult and required the team to make a set of assumptions to analyse the efficiency of the project. This introduces some challenges to the robustness of the results.
- Lack of disaggregated data. The evaluation team was not able to access some data disaggregated at the appropriate level for the spending incurred by the consortium led by

¹² In the following report, costs have been reported in USD and KES. For reference, at present, the exchange rate applied is 1 KES= USD 0.0092

Energy for Impact, therefore limiting the extent to which certain aspects of the VfM assessment could be explored and expanded upon.

H.2 Approach

H.2.1 Economy assessment

The assessment of the project performance against the economy criterion assesses whether the project uses resources economically, buying inputs of the appropriate quality at the right price, and following good project management practices. When evaluating the pilot's performance against the economy criterion, the following sub-criteria are used:

1. Whether the project is meeting agreed benchmarks for technical assistance and management costs, and costs of key inputs: cost of contractual services for implementation and evaluation of project activities, prices of M-Pesa and bank charges, prices of the solar products;
2. Whether the project shows sound procurement practices and effective negotiation in respect of solar suppliers' services.

Performance standards for the economy area have been adapted to the design of the project and data received from UNICEF and E4I. The performance standards are as follows:

Performance	Criteria
A: Very Good	Evaluation deems that costs have been minimised, without compromising the integrity of expected results, and may even exceed expected results.
B: Good	TA and management costs, cost of key inputs meet benchmarks. Project comprehensively follows sound procurement practices for solar products and meets expectations for quality and price.
C: Average	Any of the Economy measurements do not consistently reach benchmarks, or any significant departures from benchmarks can be justified in terms of context and evolving circumstances. Project generally follows sound procurement practices for solar devices and meets expectations for quality and price .
D: Low	Any one of the Economy measurements consistently under-perform benchmarks. Project does not follow sound procurement practices

Note: Benchmarks are based on design documents and/or comparable figures for other similar projects.

H.2.2 Efficiency assessment

Drawing on the FCDO's VfM framework, efficiency is concerned with the relationship between inputs and outputs, which are the goods and services the project delivers. The efficiency analysis will focus on the way in which the resources were managed for the project's delivery of outputs. We focus on three metrics within the efficiency area: allocative efficiency, technical efficiency and dynamic efficiency. Performance standards for the efficiency area have been adapted to the design of the project and data received from UNICEF and E4I. The performance standards are as follows:

Performance	Criteria
A: Very Good	Evaluation deems that the organisations have a capacity (HR and IT/financial) and system in place for determining cost efficiency (including outsourcing choices, appraisal, due diligence of partners etc.), regularly evaluate allocative efficiency and practice sound financial management techniques, and

Performance	Criteria
	demonstrate the ability for the programme resources to adapt to changes in delivery costs or unforeseen events.
B: Good	Evaluation deems that the organisations have an adequate capacity (HR and IT/financial) and system in place for determining cost efficiency (including outsourcing choices, appraisal, due diligence of partners etc.), have good evaluate allocative efficiency practices, and have a system in place for the programme resources to adapt to changes in delivery costs or unforeseen events. Management of key drivers for efficiency is adequate.
C: Average	Any of the Efficiency measurements do not consistently reach benchmarks, or any significant departures from benchmarks can be justified in terms of context and evolving circumstances. System in place for determining cost efficiency are only partially effective.
D: Low	Any one of the efficiency measurements consistently under-perform benchmarks. System in place for determining cost efficiency are not effective.

Note: Benchmarks are based on design documents and /or comparable figures for other similar projects.

H.3 VfM assessment framework

Table 7: VfM assessment framework

Indicator	Indicator	Type of data	How is the indicator measured	Benchmark	Source
1 Economy criterion: the pilot uses resources economically, buying inputs of the appropriate quality at the right price, and following good programme management practices					
Sub-criterion: the project is meeting agreed benchmarks for TA and management costs, and costs of key inputs: cost of contractual services for implementation and evaluation of project activities, prices of M-Pesa and bank charges, prices of the solar products					
1.1	Difference between average monthly UNICEF staff cost and benchmark as a percentage of the benchmark	Quantitative (monetary)	Total UNICEF staff costs divided on months till Sept 2020. Staff costs are derived from data on annual salary, number of months working on the project and percentage of FTE worked on the project	Budget estimation for TA and QA activities over planned project duration;	Actual: UNICEF staff costs as provided by Social Protection Specialist. Benchmark: UNICEF budget as presented UNICEF KCO Energy and Cash Plus (draft concept note) 31 August 2017
1.2	Difference between average monthly UNICEF operational cost and benchmark as a percentage of the benchmark	Quantitative (monetary)	Total non-staff costs excluding transfers to beneficiaries divided on months till Sept 2020	UNICEF budget for inception activities and fieldwork monitoring over planned project duration	Actual: UNICEF spending accounts. Benchmark: UNICEF budget as presented in UNICEF KCO Energy and Cash Plus (draft concept note) 31 August 2017
1.3	Difference between actual cost for E4I contractual services and benchmark as a	Quantitative (monetary)	Final contract(s) value vs original contract value	UNICEF -E4I original contract (July 2018- February 2020)	Actual: Contracts and contract extensions between UNICEF and E4I. Benchmark: UNICEF-E4I institutional contract. Contract number 43253093 July 2018-February 2020

Indicator	Indicator	Type of data	How is the indicator measured	Benchmark	Source
	percentage of the benchmark				
1.4	Difference between actual cost for OPM contractual services and benchmark as a percentage of the benchmark	Quantitative (monetary)	Final contract(s) value vs original contract value	UNICEF -OPM original contract	Actual: Contracts and contract extensions between UNICEF and OPM. Benchmark: UNICEF-OPM original contract value
1.5	Difference between actual transaction costs as percentage of total transfer value and benchmark as a percentage of the benchmark	Quantitative (monetary)	Total value of M-Pesa charge, EFT charges and zoning charges as a percentage of total cash transfer to beneficiaries	UNICEF budget for transaction costs	Actual: E4I payroll data and interviews with implementers. Benchmark: UNICEF budget as presented in UNICEF KCO Energy and Cash Plus (draft concept note) 31 August 2017
1.6	Difference between actual unit cost of solar product and benchmark as a percentage of the benchmark	Quantitative (monetary)	Actual costs paid vs budgeted amount	Expected amount as presented in UNICEF KCO SIDA Project Proposal Clean 5th September 2017 (003)	Actual: MoU with solar suppliers. Benchmark: UNICEF KCO Energy and Cash Plus (draft concept note) 31 August 2017
Sub-criterion: the project shows sound procurement practices and effective negotiation in respect of solar suppliers' services.					

Indicator	Indicator	Type of data	How is the indicator measured	Benchmark	Source
1.7	Existence of operational evidence of procurement policies and procedures being documented and followed	Qualitative – document review	Evidence of competitive tendering and multiple quotes for solar device suppliers	UNICEF procurement policy	Actual: UNICEF KCO SIDA Project Proposal, UNICEF SIDA Annual Report June 2020, Project MoU with Solar suppliers, Project Operational Manual. Benchmark: UNICEF procurement policy
<p>2 Efficiency criterion: the project has the capacity (HR and IT/financial) and systems in place for determining cost efficiency (including outsourcing choices, appraisal, due diligence of partners etc.), regularly evaluate allocative efficiency and practice sound financial management techniques, and demonstrate the ability for the project resources to adapt to changes in delivery costs or unforeseen events.</p>					
<p>Sub criterion: Allocative efficiency. Allocation of resources across intervention pathways in appropriate proportion; that is, reflecting the relative priority given and associated costs.</p>					
2.1	Difference between actual expenditure on cost centre and budgeted amount as a percentage of the budgeted amount	Quantitative (monetary)	For each cost centre: (total budget- total spent) for this cost centre as a % of total budgeted for this cost centre by the time of the evaluation and by the end of the project	Difference within 20% above/below budget is considered to be adequate	Actual: UNICEF spending accounts and additional staff costs provided by Social Protection Specialist. Benchmark: UNICEF budget as presented in UNICEF KCO Energy and Cash Plus (draft concept note) 31 August 2017; UNICEF Concept Note To Swedish International Development Cooperation Agency (SIDA) Additional Financing – Mwangaza Mashinani Maisha Bora Project (Energy Plus Cash Pilot). Kenya 2018 and UNICEF KCO and ESARO funds allocated to the project

Indicator	Indicator	Type of data	How is the indicator measured	Benchmark	Source
2.2	Time series of expenses by cost item	Quantitative (monetary)	Disaggregation of expenses by cost item across payment cycles	Trend - assumption that expenses on cash transfers to beneficiaries reflect planned payment schedule; UNICEF TA and QA costs are high initially and decreasing over time. Expenses on contractual services meet agreed payment schedule and delivery of services. Operational costs increasing in line with fieldwork activities	Actual: UNICEF spending accounts, Benchmark: Implementation plan, Contracts with service providers (E4I and OPM); payment cycle schedule
2.3	Cost to transfer ratio	Quantitative (monetary)	Ratio of the project costs (excluding cash transfers to beneficiaries) to the total value transferred to a recipient	CTRs from other cash transfer projects in Kenya	Actual: UNICEF spending accounts. Benchmark: Bahri, O'Brien (2018), O'Brien, Hove (2015)
Sub criterion: Technical efficiency. Delivery according to the project implementation plan					
2.4	Adherence to implementation timeline	Qualitative – document review	Whether there has been any changes to the implementation timeline, whether those were agreed in advance, whether those were justified	Implementation timeline as agreed with project stakeholders during the set up phase	Actual: E4I Quarterly reports to UNICEF, UNICEF KCO Energy for the poor – Mwangaza Mashinani Progress Report prepared for SIDA Sweden November 2018-June 2020. June, 2020, E4I contract addendum. Benchmark: Implementation timeline at project set up
2.5	Key logframe achievements are on track to meet targets	Quantitative	Achievement against logframe targets of key outputs	Project Logframe June 2020	Actual: Logframe indicators in UNICEF KCO Energy for the poor – Mwangaza Mashinani Progress Report prepared for SIDA Sweden November 2018-June 2020. June, 2020 Benchmark: Logframe targets in UNICEF KCO Energy for the poor – Mwangaza Mashinani Progress Report prepared for SIDA

Indicator	Indicator	Type of data	How is the indicator measured	Benchmark	Source
					Sweden November 2018-June 2020. June, 2020
2.6	Actual spend per household per device	Quantitative (monetary)	Ratio of the project costs (excluding cash transfers to beneficiaries) to total number of households purchasing the solar device	Actual cost of solar devices	Actual: UNICEF spending accounts and logframe indicators. Benchmark: MoU with Solar suppliers
Sub criterion: Dynamic efficiency. Appropriate use of M&E findings to support adaptive management and appropriate reallocation of resources to reflect evolving circumstances and opportunities in the context of the project's implementation.					
2.7	Narrative evidence of use of M&E to support adaptive management and learning and changes to implementation activities reflecting evolving circumstances	Qualitative – document review and KIIs	Whether project is showing proof of adaptive management	Systems are in place to allow for adaptive management. Some project-generated evidence is being used	Actual: Vulnerability assessment, outputs of the external independent evaluation, implementer's quarterly reports, UNICEF annual progress reports to SIDA, beneficiary survey data, qualitative feedback from fieldwork activities, the project grievance process, project dashboard, TWGs' minutes

Table 8: VfM assessment for each indicator

Indicator	Indicator	Actual	Benchmark	Difference between benchmark and actual value	% Difference between benchmark and actual value	VfM assessment
1 Economy criterion: the pilot uses resources economically, buying inputs of the appropriate quality at the right price, and following good programme management practices						
Sub-criterion: the project is meeting agreed benchmarks for TA and management costs, and costs of key inputs: cost of contractual services for implementation and evaluation of project activities, prices of M-Pesa and bank charges, prices of the solar products (within 25% above/below benchmark is considered to be acceptable)						
1.1	Monthly average staff cost (\$)	2,986	6,667	3681	55%	Good (potentially lower capacity to provide necessary QA and TA)
1.2	Monthly average operational cost (\$)	1,532	3,750	2,218	59%	Very good
1.3	Contractual services - E4I (\$)	530,126	449,933	- 80,193	-18%	Average
1.3.1	E4I Staff costs (\$)	261,689	183,719	-77,970	-42%	Low
1.3.2	E4I Non staff costs (4)	396,608	346,407	-50,201	-14%	Good
1.4	Contractual services – OPM (\$)	605,989	544,939	- 61,050	-11%	Good
1.5	% of transaction charges over total amount to beneficiaries	5%	10%	50%		Very good
1.6.1	Cost of Biolite Home 620 (\$)	125	100	- 25	-25%	Average
1.6.2	Cost of D-31 cost (\$)	127	100	- 27	-27%	Low
Sub-criterion: the project shows sound procurement practices and effective negotiation in respect of solar suppliers' services.						
1.7	Existence of operational evidence of procurement policies and procedures being documented and followed			--		Very good - There is evidence of competitive tendering and multiple quotes for solar device suppliers

Indicator	Indicator	Actual	Benchmark	Difference between benchmark and actual value	% Difference between benchmark and actual value	VfM assessment
2 Efficiency criterion: the project has the capacity (HR and IT/financial) and systems in place for determining cost efficiency (including outsourcing choices, appraisal, due diligence of partners etc.), regularly evaluate allocative efficiency and practice sound financial management techniques, and demonstrate the ability for the project resources to adapt to changes in delivery costs or unforeseen events.						
Sub criterion: Allocative efficiency. Allocation of resources across intervention pathways in appropriate proportion; that is, reflecting the relative priority given and associated costs. (within 15% above/below benchmark is considered to be acceptable)						
2.1.1	Cash transfer to beneficiaries (\$)	254,995	318,840	63,845	20%	Not acceptable (low). We would expect full amount to be disbursed to beneficiaries
2.1.2	Inception phase: Sensitisation, enrollment, targeting and identification/recruitment of potential beneficiaries including service providers (\$)	77,735	70,000	- 7,735	-11%	Acceptable (average), although some risks could have been foreseen
2.1.3	Community level activities and cost of implementing partner: BWC training and incentives, community education before and after payments, development of communication materials, community livelihood development support (\$)	404,219	337,500	- 66,719	-20%	Not acceptable (low)
2.1.4	UNICEF technical assistance and QA (\$)	107,491	160,000	52,509	33%	Acceptable (good).
2.1.5	Field monitoring (\$)	19,108	23,492	4,384	19%	Acceptable (average)
2.1.6	Procurement of a certified research institution including	333,520	761,050	427,531	56%	Acceptable (average). This is in line with project timeline

Indicator	Indicator	Actual	Benchmark	Difference between benchmark and actual value	% Difference between benchmark and actual value	VfM assessment
	baseline, midline and end line surveys (\$)					
2.2	Time series of expenses by cost item	Trend - assumption that expenses on cash transfers to beneficiaries reflect planned payment schedule; set up and inception follow original timeline; UNICEF TA and QA costs are high initially and decreasing over time. Expenses on contractual services meet agreed payment schedule and delivery of services. Operational costs increasing in line with fieldwork activities				Low at set up/ inception. Good during implementation, reflecting changes in timeline due to Government's delays
2.3	Cost to transfer ratio	3.69	0.502	-3.19	-636%	Low, although primarily driven by pilot related costs and deliver of additional activities on top of cash
Sub criterion: Technical efficiency. Delivery according to the project implementation plan (within 15% above/below benchmark is considered to be acceptable)						
2.4	Adherence to implementation timeline	Implementation timeline as agreed with project stakeholders during the set up phase				Low – we observed severe delays during the procurement process and at the inception phase.
2.5.1	Number of households purchasing an SHS or SL	1500	1692	-192	-13%	Acceptable (Good)
2.5.2	Number of beneficiaries using a SL or SHS regularly	1500	1669	-169	-11%	Acceptable (Good)
2.5.3	% of households regularly repaying	100%	70%	30%	30%	Not acceptable (Low)
2.5.4	Percent of beneficiaries that complete repayment	100%	70%	30%	30%	Not acceptable (Low)
2.5.5	% of payments delayed	--	33%			--

Indicator	Indicator	Actual	Benchmark	Difference between benchmark and actual value	% Difference between benchmark and actual value	VfM assessment
2.5.6	The average length of payment delays (days)	10	66	-56	560%	Not acceptable (Low)
2.5.7	Beneficiaries understanding of utilisation of SHS and SL	1500	1692	-192	13%	Acceptable (Good)
2.5.8	Number of the beneficiaries engaged in livelihood activities (capacity building activities)	1500	1692	-192	13%	Acceptable (Good)
2.5.9	BWC or local entrepreneurs trained to support beneficiaries	All	65		--	--
2.5.10	Number of beneficiaries with working SL or SHS	100%	99%	1%	1%	Acceptable (Very Good)
2.6	Actual spend per household per device (\$)	1) 557 2) 296 (excluding evaluation and TA and QA costs)	1) 151 2) 151	1) -406 2) -145	1) -269% 2) -96%	Low, although mostly driven by pilot related costs.
Sub criterion: Dynamic efficiency. Appropriate use of M&E findings to support adaptive management and appropriate reallocation of resources to reflect evolving circumstances and opportunities in the context of the project's implementation.						
2.7	Narrative evidence of use of M&E to support adaptive management and learning and changes to implementation activities reflecting evolving circumstances	Systems are in place to allow for adaptive management. Some project-generated evidence is being used				Average. Some project-generated evidence is being used, although the project lacks a solid MIS.

Table 9: Pilot team composition

Staff Role	Salary (annual \$)	Recruited	Number of months worked on the pilot (till Sept 2020)	Revised % work time for the pilot*	Original % work time for the pilot shared by UNICEF	Note
Chief of Social Policy	283,642	At project start	26	3%	10%	Position was vacant for 10 months from November 2019 to September 2020
Social Protection Specialist	187,460	At project start	33	10%	30%	Position was vacant for 3 months (July-October 2019)
Evaluation Specialist	187,460	At project start	36	1%	5%	Only involved in the impact evaluation and not in other programme aspects
Social Protection Specialist	106,162	At project start	36	5%	15%	
Social Policy Consultant	60,060	January 2020	8	10%	30%	
Social policy programme associate	45,888	At project start	36	3%	10%	
Social Policy UNV based in Nairobi	14,986	May 2019	16	10%	30%	
Social protection UNV based in Kilifi	17,743	March 2020	6	30%	75%	
Social Protection UNV based in Garissa	21,073	March 2020	6	30%	75%	

Note: * revised estimates of percent of time work on the pilot have been shared after submission of the first draft of this note. Indicators presented in the current version of the note are constructed using these revised estimates.

Table 10: Project budget and actual spending

	Budget (by source of funds)				Spending (by September 2020)		
	SIDA 1 (Aug 2017- Nov 2019)	SIDA 2 (Nov 2019 onward)	Other grants	TOTAL	Spending till Sept 2020	Known commitment	TOTAL
Cash transfer to beneficiaries	\$ 155,040	\$ 163,800		\$ 318,840	\$ 254,995		\$ 254,995
Inception phase: Sensitization, enrollment, targeting and identification/recruitment of potential beneficiaries including service providers	\$ 70,000			\$ 70,000	\$ 77,735		\$ 77,735
Community level activities and Cost of implementing partner: BWC training and incentives, Community education before and after payments, Development of Communication materials, Community livelihood development support	\$ 337,500			\$ 337,500	\$ 404,219	\$ 125,907	\$ 530,126
UNICEF TA and QA	\$ 160,000			\$ 160,000	\$ 107,491		\$ 107,491
Field monitoring	\$ 20,000		\$ 3,492	\$ 23,492	\$ 19,108		\$ 19,108
Procurement of a certified research institution including baseline, midlines and end line surveys	\$ 340,000		\$ 421,050	\$ 761,050	\$ 333,520	\$ 272,470	\$ 605,989
TOTAL	\$ 1,082,540	\$ 163,800	\$ 424,542	\$ 1,670,882	\$ 1,197,067	\$ 398,377	\$1,595,443

Note: Budget excludes UNICEF indirect costs (8%). Spending and budget lines. The comparison maps expenditures incurred by the project until September 2020 against the original budget lines. We use the budget proposal presented in UNICEF KCO Energy and Cash Plus (draft concept note) 31 August 2017 and UNICEF Concept Note To Swedish International Development Cooperation Agency (SIDA) Additional Financing – Mwangaza Mashinani Maisha Bora Project (Energy Plus Cash Pilot). Kenya 2018 to estimate the project budget and DFAM Expenditure Listing Summary Report till September 2020 and additional information on staff costs

	Budget (by source of funds)	Spending (by September 2020)
<p>shared by UNICEF's team to estimate the project expenditures by activity. Estimates of spending by activity relies on assumptions because the DFAM Expenditure Listing Summary Report reports costs by cost item rather than activity. Assumptions are as follows:</p> <ul style="list-style-type: none"> - Spend on Cash transfer to beneficiaries: total value of transfers to beneficiaries, including Bank charges and Mpesa charges. - Inception phase: total costs incurred before June 2019, excluding evaluation activities; transfers to beneficiaries (pilot cycle in April 2019), E4I's contractual services and UNICEF staff costs; - Community level activities and Cost of implementing partner: total value of contractual services provided by the consortium partner. - Field monitoring: costs incurred after May 2019, excluding UNICEF staff costs, transfers to beneficiaries and contractual services provided by E4I and OPM; - Procurement of a Certified research institution including baseline, midlines and end line surveys: total value of contractual services provided by OPM; - UNICEF technical assistance and QA: total UNICEF staff and other personnel costs derived from information on staff costs shared by UNICEF Social Protection Specialist. 		

Table 11: Changes in estimates and VfM assessment after revision of UNICEF staff costs

	Original	Revised	Benchmark
Monthly average staff cost (\$)	9,452	2,986	6,667
UNICEF costs for technical assistance and QA (\$)	340,269	107,491	160,000
CTR	4.61	3.69	0.50
Actual spend per household per device (\$)	694	557	151
VfM assessment of the project economy	Average	Good	
VfM assessment of the project allocative efficiency	Low	Average	

Figure 16: Trend analysis staff cost (total staff cost per month)



Staff costs are generally below the expected benchmark, derived by UNICEF budget allocation for TA, QA and support to project implementation. Staff costs are lower in August-October 2019 because one social protection specialist left and his role was vacant for three months. The position of chief of social policy was also vacant for 10 months from November 2019 to September 2020. The increase in costs in February 2020 is attributable to the expansion of the project team. In fact, the project team hired a new staff member in January 2020. Staff costs increase again in April 2020 because the project hired new personnel to coordinate the last two payment cycles and facilitate transition to the second phase of the pilot in both counties.

ANNEX I STATISTICAL TABLES

Results presented in this Annex are for the group of treatment households that were intended to be treated and successfully interviewed at midline, with the exception of the indicators on exposure to project operations that are reported on the sub-sample of households that were actually treated.

I.1 Population Characteristics

Table 12: Household characteristics at midline (Household level indicators)

Indicator	Overall				Kilifi				Garissa				Diff
	N	Estimate	Lower CI	Upper CI	N	Estimate	Lower CI	Upper CI	N	Estimate	Lower CI	Upper CI	
Resides in Kilifi (%)	501	64.1	63.7	64.5	.	.	.	.	.	.	.	.	.
Resides in Garissa (%)	501	35.9	35.5	36.3	.	.	.	.	.	.	.	.	.
Receives CT-OVC (%)	501	44.9	41.9	47.9	321	47	43.5	50.6	180	41.1	35.8	46.5	5.9*
Receives OP-CT (%)	501	50.1	47	53.2	321	46.4	42.7	50.1	180	56.7	51.1	62.2	-10.2***
Receives PWSD-CT (%)	501	4.6	2.8	6.4	321	6.2	3.7	8.8	180	1.7	-0.1	3.5	4.6***
Does not receive regular cash transfer (%)	501	1.4	0.4	2.4	321	1.6	0.2	2.9	180	1.1	-0.4	2.6	0.4
Household head is male (%)	501	47.7	44.3	51.1	321	44.9	40.9	48.8	180	52.8	46.4	59.2	-7.9**
Number of household members (mean)	501	7.6	7.3	7.9	321	8	7.6	8.5	180	6.9	6.5	7.3	1.2***
Dependency Ratio (mean)	487	1.7	1.6	1.8	314	1.5	1.4	1.6	173	2.1	1.9	2.4	-0.6***
Number of female household members (mean)	501	4	3.8	4.2	321	4.4	4.1	4.6	180	3.5	3.2	3.7	0.9***

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 13: Household characteristics at midline (Household level indicators) – continued

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
	N	Estimate	Lower CI	Upper CI	N	Estimate	Lower CI	Upper CI		N	Estimate	Lower CI	Upper CI	N	Estimate	Lower CI	Upper CI	
Resides in Kilifi (%)	239	60.3	56.7	63.9	262	67.6	64.2	71	-7.3**	225	67.1	63.9	70.3	248	59.3	56.5	62.1	7.8***
Resides in Garissa (%)	239	39.7	36.1	43.3	262	32.4	29	35.8	7.3**	225	32.9	29.7	36.1	248	40.7	37.9	43.5	-7.8***
Receives CT-OVC (%)	239	25.1	20.4	29.8	262	63	58.1	67.9	-37.9***	.	.	.	.	.	.	.	.	.
Receives OP-CT (%)	239	69	64	74.1	262	32.8	27.9	37.7	36.2***	.	.	.	.	.	.	.	.	.
Receives PWSD-CT (%)	239	5	2.3	7.7	262	4.2	1.8	6.6	0.8	.	.	.	.	.	.	.	.	.
Does not receive regular cash transfer (%)	239	1.7	0.1	3.3	262	1.1	-0.1	2.4	0.5	.	.	.	.	.	.	.	.	.
Household head is male (%)	.	.	.	.	.	.	.	.	.	225	26.7	21.5	31.8	248	66.1	61	71.2	-39.5***
Number of household members (mean)	239	8.2	7.7	8.7	262	7.1	6.7	7.5	1.0***	225	6.9	6.5	7.2	248	8.1	7.6	8.6	-1.2***
Dependency Ratio (mean)	233	1.8	1.6	1.9	254	1.7	1.5	1.8	0.1	223	1.5	1.3	1.7	238	1.9	1.7	2.1	-0.4***
Number of female household members (mean)	239	4	3.7	4.3	262	4	3.8	4.3	0	225	3.8	3.5	4	248	4.2	3.9	4.5	-0.4**

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

I.2 Exposure to project operations

Table 14: Exposure to project operations at midline (Household level indicators)

Indicator	Overall				Kilifi				Garissa				Diff
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	
Type of solar device-d.light	335	54.9	49.6	60.3	237	58.2	51.9	64.5	98	46.9	36.8	57	11.3*
Type of solar device-BioLite	335	43	37.7	48.3	237	38.8	32.6	45	98	53.1	43	63.2	-14.2**
Type of solar device-Sun King	335	2.1	0.6	3.6	237	3	0.8	5.1	98	0			3.0***
Received information about solar device before selecting device	335	74.9	70.4	79.5	237	81	76	86	98	60.2	50.3	70.1	20.8***
Source of information (of households that received information):													
Solar provider	251	61.4	55.7	67	192	53.6	46.7	60.6	59	86.4	77.7	95.2	-32.8***

Mwangaza Mashinani programme staff	251	7.6	4.4	10.8	192	9.9	5.7	14.1	59	0			9.9***
BWC	251	10	6.3	13.6	192	12	7.4	16.6	59	3.4	-1.3	8.1	8.6**
Chief	251	6.8	3.7	9.9	192	8.3	4.4	12.3	59	1.7	-1.6	5	6.6**
Inua Jamii programme staff	251	12	8	15.9	192	13.5	8.8	18.3	59	6.8	0.2	13.3	6.8
Community Champion	251	5.6	2.7	8.4	192	7.3	3.6	11	59	0			7.3***
Family friends or neighbours	251	10	6.3	13.6	192	11.5	7	15.9	59	5.1	-0.7	10.9	6.4*
Other	251	1.6	0	3.1	192	1.6	-0.2	3.3	59	1.7	-1.6	5	-0.1
Source of commitment fee-Own money or savings	335	40.3	35.1	45.5	237	33.8	27.7	39.8	98	56.1	46	66.2	-22.4***
Source of commitment fee-Family or friends gave it to me	335	14.6	11	18.3	237	7.6	4.3	10.9	98	31.6	22.2	41.1	-24.0***
Source of commitment fee-Loan from family or friends	335	1.2	0	2.4	237	0.8	-0.3	2	98	2	-0.8	4.9	-1.2
Source of commitment fee-Loan from another source	335	0.3	-0.3	0.9	237	0.4	-0.4	1.2	98	0			0.4
Source of commitment fee-Programme gave it to me	335	45.1	40.2	50	237	58.2	51.9	64.5	98	13.3	6.4	20.1	45.0***
Source of commitment fee-Other	335	0.6	-0.2	1.4	237	0.8	-0.3	2	98	0			0.8
Household still has a solar device	335	97.9	96.4	99.4	237	98.7	97.3	100.2	98	95.9	92.1	99.8	2.8
Device is fully working (of those with a device)	328	71	66.3	75.8	234	77.8	72.4	83.1	94	54.3	44.5	64.1	23.5***
Device is partially working (of those with a device)	328	14.3	10.5	18.1	234	15	10.4	19.5	94	12.8	6	19.5	2.2
Device is not working at all (of those with a device)	328	14.6	11.2	18.1	234	7.3	4	10.5	94	33	24.1	41.9	-25.7***
Main POC to report cash problems-Solar provider	335	29.3	25	33.5	237	15.2	10.6	19.7	98	63.3	53.8	72.8	-48.1***
Main POC to report cash problems-MM programme staff	335	6.3	3.7	8.8	237	8	4.6	11.4	98	2	-0.8	4.9	6.0***
Main POC to report cash problems-BWC	335	12.8	9.3	16.3	237	15.6	11.1	20.1	98	6.1	1.4	10.9	9.5***
Main POC to report cash problems-Chief	335	4.2	2.1	6.3	237	5.5	2.6	8.4	98	1	-1	3	4.5**
Main POC to report cash problems-Inua Jamii programme staff	335	7.2	4.4	9.9	237	9.3	5.6	13	98	2	-0.8	4.9	7.2***
Main POC to report cash problems-Community champion	335	14.6	11	18.3	237	20.3	15.2	25.3	98	1	-1	3	19.2***
Main POC to report cash problems-Family or friends	335	2.1	0.6	3.6	237	1.3	-0.1	2.7	98	4.1	0.2	8	-2.8
Main POC to report cash problems-No one	335	11.6	8.2	15	237	8.9	5.2	12.5	98	18.4	10.8	26	-9.5**
Main POC to report cash problems-Other	335	2.1	0.6	3.6	237	2.5	0.6	4.5	98	1	-1	3	1.5

Main POC to report cash problems-Don't Know	335	9.9	6.7	13	237	13.5	9.1	17.9	98	1	-1	3	12.5***
Reported problem with receiving MM cash to the POC (of those that know POC)	263	56.3	50.3	62.3	184	60.9	53.8	68	79	45.6	34.3	56.9	15.3**
Ability of POC to help with cash payment-Yes always	148	66.2	58.5	73.9	112	66.1	57.1	75.1	36	66.7	51.7	81.6	-0.6
Ability of POC to help with cash payment-Yes sometimes	148	16.2	10.1	22.3	112	17.9	10.6	25.1	36	11.1	0.4	21.8	6.7
Ability of POC to help with cash payment-No never	148	8.1	3.6	12.7	112	8	2.9	13.2	36	8.3	-1.2	17.9	-0.3
Ability of POC to help with cash payment-Issues pending	148	9.5	4.6	14.3	112	8	2.9	13.1	36	13.9	1.8	25.9	-5.9
Main POC to report maintenance problem-Solar provider	335	40	35.2	44.8	237	28.3	22.6	33.9	98	68.4	59.2	77.5	-40.1***
Main POC to report maintenance problem-MM programme staff	335	6	3.5	8.5	237	8	4.6	11.5	98	1	-1	3	7.0***
Main POC to report maintenance problem-BWC	335	12.5	9.1	16	237	15.2	10.8	19.6	98	6.1	1.3	10.9	9.1***
Main POC to report maintenance problem-Chief	335	1.5	0.2	2.8	237	1.7	0.1	3.3	98	1	-1	3	0.7
Main POC to report maintenance problem-Inua Jamii programme staff	335	5.4	3	7.8	237	6.3	3.3	9.4	98	3.1	-0.4	6.5	3.3
Main POC to report maintenance problem-Community champion	335	14	10.4	17.6	237	18.6	13.6	23.5	98	3.1	0	6.1	15.5***
Main POC to report maintenance problem-Family or friends	335	0.9	-0.1	1.9	237	1.3	-0.2	2.7	98	0			1.3*
Main POC to report maintenance problem-No one	335	6.9	4.2	9.6	237	4.6	1.9	7.3	98	12.2	5.8	18.7	-7.6**
Main POC to report maintenance problem-Other	335	1.8	0.4	3.2	237	2.5	0.6	4.5	98	0			2.5**
Main POC to report maintenance problem-Don't Know	335	11	7.7	14.4	237	13.5	9.2	17.8	98	5.1	0.7	9.5	8.4***
Contacted help from POC for maintenance problem (of those that know POC)	274	39.1	33.4	44.7	193	38.3	31.5	45.2	81	40.7	30.9	50.5	-2.4
Ability of POC to help with maintenance problem-Yes always	107	56.1	46.6	65.5	74	59.5	47.8	71.1	33	48.5	32.5	64.5	11
Ability of POC to help with maintenance problem-Yes sometimes	107	8.4	3.1	13.7	74	8.1	1.8	14.4	33	9.1	-0.8	19	-1
Ability of POC to help with maintenance problem-No never	107	14	7.2	20.8	74	12.2	4.6	19.7	33	18.2	4	32.4	-6

Ability of POC to help with maintenance problem-Issues pending	107	21.5	13.5	29.5	74	20.3	11.1	29.4	33	24.2	8.6	39.8	-4
Device has been switched off or been without lights since receiving it	335	81.8	77.7	85.9	237	80.6	75.6	85.6	98	84.7	77.6	91.8	-4.1
Main reason for device being switched off-I didn't make a repayment	274	39.8	34	45.5	191	41.9	34.9	48.8	83	34.9	24.6	45.3	6.9
Main reason for device being switched off-I didn't receive money from MM	274	47.8	41.8	53.8	191	48.7	41.6	55.8	83	45.8	34.6	56.9	2.9
Main reason for device being switched off-The device does not work	274	9.1	5.8	12.4	191	5.8	2.5	9	83	16.9	9.1	24.6	-11.1***
Main reason for device being switched off-I am connected to another light source	274	0.7	-0.3	1.7	191	0.5	-0.5	1.6	83	1.2	-1.2	3.6	-0.7
Main reason for device being switched off-Other	274	2.6	0.7	4.4	191	3.1	0.7	5.6	83	1.2	-1.2	3.6	1.9
Community Champion in the area-Yes	335	44.2	39.2	49.1	237	55.3	49	61.6	98	17.3	9.9	24.8	37.9***
Community Champion in the area-No	335	31.6	27	36.3	237	21.1	15.9	26.3	98	57.1	47.2	67.1	-36.0***
Community Champion in the area-Don't know	335	24.2	19.6	28.8	237	23.6	18.2	29.1	98	25.5	16.9	34.2	-1.9
Frequency of contacting CC-Never interacted or contacted them	148	4.1	1.2	6.9	131	1.5	-0.6	3.6	17	23.5	4.6	42.5	-22.0**
Frequency of contacting CC-Once per week or more often	148	23	16.4	29.5	131	26	18.6	33.4	17	0			26.0***
Frequency of contacting CC-Every two weeks	148	23	16.3	29.6	131	26	18.5	33.4	17	0			26.0***
Frequency of contacting CC-Once per month	148	27.7	20.4	35	131	26	18.3	33.6	17	41.2	17.4	65	-15.2
Frequency of contacting CC-Once every two months	148	13.5	7.9	19.1	131	13	7.2	18.7	17	17.6	-2.8	38.1	-4.7
Frequency of contacting CC-Once every four months	148	2	-0.3	4.3	131	1.5	-0.6	3.7	17	5.9	-5.8	17.6	-4.4
Frequency of contacting CC-Less often than every four months	148	6.8	2.6	10.9	131	6.1	1.9	10.3	17	11.8	-3.9	27.4	-5.7
Role of CC-Support on technical issues related to solar device	148	46.6	39	54.3	131	42.7	34.5	51	17	76.5	55.6	97.3	-33.7***
Role of CC-Fix the solar devices when they break	148	15.5	9.6	21.4	131	16	9.7	22.4	17	11.8	-3.9	27.4	4.3
Role of CC-Provide information to MM beneficiaries	148	54.7	46.8	62.7	131	58.8	50.2	67.4	17	23.5	3.3	43.8	35.2***
Role of CC-Represent MM beneficiaries collectively	148	33.1	25.6	40.6	131	36.6	28.4	44.9	17	5.9	-5.8	17.6	30.8***
Role of CC-Other	148	2	-0.3	4.3	131	2.3	-0.3	4.9	17	0			2.3*
Role of CC-Don't know	148	6.1	2.2	10	131	6.1	1.9	10.3	17	5.9	-5.1	16.9	0.2

Household raised an issue with CC	148	86.5	80.9	92.1	131	87	81.2	92.9	17	82.4	63.6	101.1	4.7
Extent to which CC was helpful-Very helpful	128	74.2	66.4	82	114	74.6	66.3	82.8	14	71.4	46.9	95.9	3.1
Extent to which CC was helpful-Moderately helpful	128	16.4	9.9	22.9	114	16.7	9.7	23.6	14	14.3	-4.6	33.1	2.4
Extent to which CC was helpful-Not helpful	128	9.4	4.3	14.5	114	8.8	3.4	14.1	14	14.3	-2.4	31	-5.5
Main org leading MM-The government of Kenya	335	20.6	16.5	24.7	237	11	7	14.9	98	43.9	33.7	54.1	-32.9***
Main org leading MM-The government of Kilifi or Garissa	335	0.6	-0.2	1.4	237	0.8	-0.3	2	98	0			0.8
Main org leading MM-UNICEF	335	8.1	5.2	10.9	237	4.2	1.7	6.8	98	17.3	9.8	24.9	-13.1***
Main org leading MM-Energy4Impact or SomaliAid or Busara	335	0			237	0			98	0			0
Main org leading MM-BioLite or d.light	335	12.2	8.8	15.7	237	16.9	12.1	21.6	98	1	-1	3	15.9***
Main org leading MM-Inua Jamii	335	7.5	4.7	10.2	237	10.5	6.7	14.4	98	0			10.5***
Main org leading MM-Department of children's services	335	0			237	0			98	0			0
Main org leading MM-Other	335	3	1.2	4.8	237	3.8	1.4	6.2	98	1	-1	3	2.8*
Main org leading MM-Don't know	335	48.1	42.7	53.4	237	52.7	46.4	59.1	98	36.7	26.7	46.7	16.0***
Household used last MM top up to repay for solar device	335	91.9	89	94.8	237	92	88.6	95.4	98	91.8	86.3	97.4	0.1

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 15: Exposure to project operations at midline (Household level indicators) – continued

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI		N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	
Type of solar device-d.light	148	54.7	46.7	62.8	187	55.1	48	62.2	-0.4	162	54.9	47.3	62.6	152	55.3	47.2	63.4	-0.3
Type of solar device-BioLite	148	43.9	35.9	51.9	187	42.2	35.3	49.2	1.7	162	43.8	36.3	51.4	152	43.4	35.4	51.5	0.4
Type of solar device-Sun King	148	1.4	-0.5	3.2	187	2.7	0.4	5	-1.3	162	1.2	-0.5	2.9	152	1.3	-0.5	3.1	-0.1
Received information about solar device before selecting device	148	76.4	69.5	83.2	187	73.8	67.7	79.9	2.6	162	79	72.9	85.1	152	71.7	64.5	78.9	7.3
Source of information (of households that received information):																		
Solar provider	113	65.5	56.9	74.1	138	58	50.1	65.8	7.5	128	57.8	49.7	66	109	65.1	56.6	73.6	-7.3
Mwangaza Mashinani programme staff	113	11.5	5.7	17.3	138	4.3	0.9	7.7	7.2**	128	4.7	1.1	8.3	109	10.1	4.5	15.7	-5.4
BWC	113	9.7	4.3	15.2	138	10.1	5.1	15.2	-0.4	128	11.7	6.1	17.3	109	8.3	3.1	13.4	3.5
Chief	113	4.4	0.7	8.2	138	8.7	4	13.4	-4.3	128	7.8	3.2	12.5	109	5.5	1.3	9.7	2.3
Inua Jamii programme staff	113	9.7	4.4	15	138	13.8	8.1	19.5	-4	128	14.1	8.2	20	109	9.2	3.8	14.5	4.9
Community Champion	113	4.4	0.6	8.2	138	6.5	2.4	10.6	-2.1	128	6.3	2.1	10.4	109	3.7	0.2	7.2	2.6
Family friends or neighbours	113	8.8	3.6	14.1	138	10.9	5.7	16	-2	128	12.5	6.8	18.2	109	8.3	3	13.5	4.2
Other	113	0.9	-0.8	2.6	138	2.2	-0.2	4.6	-1.3	128	2.3	-0.3	5	109	0.9	-0.9	2.7	1.4
Source of commitment fee-Own money or savings	148	41.2	33.4	49.1	187	39.6	32.6	46.5	1.6	162	39.5	32.2	46.8	152	39.5	31.7	47.2	0
Source of commitment fee-Family or friends gave it to me	148	13.5	8.1	18.9	187	15.5	10.5	20.6	-2	162	13	8	17.9	152	17.1	11.3	22.9	-4.1
Source of commitment fee-Loan from family or friends	148	1.4	-0.5	3.2	187	1.1	-0.4	2.5	0.3	162	1.9	-0.2	3.9	152	0.7	-0.6	1.9	1.2
Source of commitment fee-Loan from another source	148	0			187	0.5	-0.5	1.6	-0.5	162	0			152	0.7	-0.6	1.9	-0.7

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
Source of commitment fee-Programme gave it to me	148	45.9	38.5	53.4	187	44.4	37.7	51.1	1.6	162	48.8	41.5	56	152	41.4	34.1	48.8	7.3
Source of commitment fee-Other	148	0.7	-0.6	2	187	0.5	-0.5	1.6	0.1	162	0			152	1.3	-0.5	3.1	-1.3
Household still has a solar device	148	97.3	94.7	99.9	187	98.4	96.6	100.1	-1.1	162	97.5	95.1	99.9	152	98	95.8	100.2	-0.5
Device is fully working (of those with a device)	144	69.4	61.9	77	184	72.3	66.2	78.4	-2.8	158	71.5	65	78	149	69.1	61.7	76.6	2.4
Device is partially working (of those with a device)	144	13.9	8.3	19.5	184	14.7	9.6	19.7	-0.8	158	15.8	10.3	21.4	149	13.4	7.9	18.9	2.4
Device is not working at all (of those with a device)	144	16.7	10.7	22.7	184	13	8.5	17.5	3.6	158	12.7	8	17.3	149	17.4	11.6	23.3	-4.8
Main POC to report cash problems-Solar provider	148	30.4	23.4	37.4	187	28.3	22.6	34.1	2.1	162	22.8	17	28.7	152	34.2	27.6	40.8	-11.4**
Main POC to report cash problems-MM programme staff	148	7.4	3.2	11.6	187	5.3	2.2	8.5	2.1	162	8	3.9	12.2	152	4.6	1.3	7.9	3.4
Main POC to report cash problems-BWC	148	12.8	7.6	18.1	187	12.8	8.2	17.5	0	162	13	7.9	18	152	14.5	9	19.9	-1.5
Main POC to report cash problems-Chief	148	5.4	1.8	9	187	3.2	0.7	5.7	2.2	162	3.7	0.9	6.5	152	4.6	1.3	7.9	-0.9
Main POC to report cash problems-Inua Jamii programme staff	148	6.8	2.7	10.8	187	7.5	3.7	11.2	-0.7	162	9.3	4.8	13.7	152	4.6	1.3	7.9	4.7*
Main POC to report cash problems-Community champion	148	12.2	7	17.4	187	16.6	11.4	21.7	-4.4	162	17.9	12.2	23.6	152	12.5	7.3	17.7	5.4
Main POC to report cash problems-Family or friends	148	2.7	0.1	5.3	187	1.6	-0.1	3.4	1.1	162	0.6	-0.6	1.8	152	3.9	0.9	7	-3.3**
Main POC to report cash problems-No one	148	10.8	5.8	15.8	187	12.3	7.7	16.9	-1.5	162	13.6	8.4	18.8	152	9.9	5.2	14.6	3.7
Main POC to report cash problems-Other	148	1.4	-0.5	3.2	187	2.7	0.4	5	-1.3	162	2.5	0.1	4.8	152	1.3	-0.5	3.1	1.2
Main POC to report cash problems-Don't Know	148	10.1	5.3	15	187	9.6	5.4	13.8	0.5	162	8.6	4.3	12.9	152	9.9	5.2	14.6	-1.2

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
Reported problem with receiving MM cash to the POC (of those that know POC)	117	58.1	49.1	67.1	146	54.8	46.7	62.9	3.3	126	57.1	48.6	65.7	122	57.4	48.5	66.3	-0.2
Ability of POC to help with cash payment-Yes always	68	64.7	52.9	76.5	80	67.5	57	78	-2.8	72	68.1	57.1	79	70	64.3	53.2	75.4	3.8
Ability of POC to help with cash payment-Yes sometimes	68	19.1	9.2	29	80	13.8	6.2	21.3	5.4	72	18.1	8.9	27.2	70	15.7	7.1	24.3	2.3
Ability of POC to help with cash payment-No never	68	7.4	1	13.7	80	8.8	2.5	15	-1.4	72	5.6	0.2	10.9	70	8.6	1.7	15.5	-3
Ability of POC to help with cash payment-Issues pending	68	8.8	2	15.7	80	10	3.4	16.6	-1.2	72	8.3	1.9	14.7	70	11.4	3.8	19	-3.1
Main POC to report maintenance problem-Solar provider	148	45.3	37.6	53	187	35.8	29.4	42.2	9.4*	162	32.7	25.9	39.5	152	48	40.6	55.5	-15.3***
Main POC to report maintenance problem-MM programme staff	148	6.8	2.8	10.7	187	5.3	2.2	8.5	1.4	162	7.4	3.4	11.4	152	3.9	0.9	7	3.5
Main POC to report maintenance problem-BWC	148	9.5	4.8	14.1	187	15	10	20	-5.5	162	14.8	9.5	20.1	152	10.5	5.7	15.3	4.3
Main POC to report maintenance problem-Chief	148	0.7	-0.6	2	187	2.1	0.1	4.2	-1.5	162	1.9	-0.2	3.9	152	1.3	-0.5	3.1	0.5
Main POC to report maintenance problem-Inua Jamii programme staff	148	3.4	0.5	6.2	187	7	3.3	10.6	-3.6	162	8	3.8	12.2	152	2.6	0.1	5.1	5.4**
Main POC to report maintenance problem-Community champion	148	14.2	8.6	19.7	187	13.9	9.1	18.7	0.3	162	16.7	11	22.3	152	11.8	6.8	16.9	4.8
Main POC to report maintenance problem-Family or friends	148	1.4	-0.5	3.2	187	0.5	-0.5	1.6	0.8	162	1.2	-0.5	2.9	152	0.7	-0.6	1.9	0.6
Main POC to report maintenance problem-No one	148	4.7	1.3	8.2	187	8.6	4.6	12.5	-3.8	162	7.4	3.5	11.4	152	6.6	2.6	10.6	0.8

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
Main POC to report maintenance problem-Other	148	0.7	-0.6	2	187	2.7	0.4	4.9	-2	162	1.9	-0.2	3.9	152	1.3	-0.5	3.1	0.5
Main POC to report maintenance problem-Don't Know	148	13.5	8	19	187	9.1	5	13.2	4.4	162	8	3.8	12.2	152	13.2	7.9	18.5	-5.1
Contacted help from POC for maintenance problem (of those that know POC)	121	43	34.3	51.6	153	35.9	28.4	43.5	7	137	35	27.2	42.8	121	43	34.3	51.7	-7.9
Ability of POC to help with maintenance problem-Yes always	52	61.5	48	75.1	55	50.9	37.2	64.6	10.6	48	52.1	38.2	65.9	52	61.5	47.6	75.5	-9.5
Ability of POC to help with maintenance problem-Yes sometimes	52	9.6	1.7	17.5	55	7.3	0.3	14.2	2.3	48	8.3	0.3	16.4	52	3.8	-1.4	9.1	4.5
Ability of POC to help with maintenance problem-No never	52	17.3	6.8	27.8	55	10.9	2.6	19.2	6.4	48	8.3	0.1	16.5	52	19.2	8	30.5	-10.9
Ability of POC to help with maintenance problem-Issues pending	52	11.5	2.6	20.5	55	30.9	18.1	43.7	-19.4**	48	31.3	17.5	45	52	15.4	5.6	25.1	15.9*
Device has been switched off or been without lights since receiving it	148	80.4	74	86.8	187	82.9	77.5	88.3	-2.5	162	84	78.4	89.5	152	81.6	75.4	87.7	2.4
Main reason for device being switched off-I didn't make a repayment	119	42	32.9	51.1	155	38.1	30.6	45.5	4	136	36	27.9	44.1	124	42.7	33.8	51.7	-6.7
Main reason for device being switched off-I didn't receive money from MM	119	47.1	37.8	56.3	155	48.4	40.6	56.1	-1.3	136	52.9	44.5	61.3	124	44.4	35.3	53.4	8.6
Main reason for device being switched off-The device does not work	119	7.6	2.8	12.3	155	10.3	5.7	15	-2.8	136	7.4	3.1	11.6	124	11.3	5.8	16.8	-3.9
Main reason for device being switched off-I am	119	0			155	1.3	-0.5	3.1	-1.3	136	0.7	-0.7	2.2	124	0			0.7

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
connected to another light source																		
Main reason for device being switched off- Other	119	3.4	0.2	6.6	155	1.9	-0.2	4.1	1.4	136	2.9	0.1	5.8	124	1.6	-0.6	3.8	1.3
Community Champion in the area-Yes	148	44.6	36.8	52.4	187	43.9	37.1	50.6	0.7	162	45.1	37.8	52.3	152	44.7	37.2	52.3	0.3
Community Champion in the area-No	148	33.1	25.7	40.5	187	30.5	24.2	36.7	2.6	162	30.9	24.2	37.6	152	31.6	24.6	38.6	-0.7
Community Champion in the area-Don't know	148	22.3	15.5	29.1	187	25.7	19.4	31.9	-3.4	162	24.1	17.5	30.7	152	23.7	16.9	30.5	0.4
Frequency of contacting CC-Never interacted or contacted them	66	3	-1.2	7.3	82	4.9	1.1	8.7	-1.8	73	4.1	-0.1	8.3	68	4.4	-0.6	9.4	-0.3
Frequency of contacting CC-Once per week or more often	66	24.2	14.9	33.6	82	22	12.9	31	2.3	73	19.2	10.2	28.2	68	25	15.2	34.8	-5.8
Frequency of contacting CC-Every two weeks	66	19.7	10.4	29	82	25.6	16.2	35	-5.9	73	23.3	13.8	32.8	68	19.1	9.7	28.5	4.2
Frequency of contacting CC-Once per month	66	30.3	19.2	41.5	82	25.6	16.1	35.1	4.7	73	26	15.8	36.3	68	32.4	21.3	43.4	-6.3
Frequency of contacting CC-Once every two months	66	9.1	1.8	16.3	82	17.1	8.9	25.2	-8	73	15.1	6.9	23.3	68	13.2	5.1	21.4	1.8
Frequency of contacting CC-Once every four months	66	3	-1.2	7.3	82	1.2	-1.2	3.6	1.8	73	2.7	-1	6.5	68	1.5	-1.4	4.4	1.3
Frequency of contacting CC-Less often than every four months	66	10.6	3	18.2	82	3.7	-0.5	7.8	6.9	73	9.6	2.7	16.5	68	4.4	-0.5	9.4	5.2
Role of CC-Support on technical issues related to solar device	66	39.4	28.7	50.1	82	52.4	41.8	63.1	-13.0*	73	41.1	29.9	52.3	68	54.4	42.8	66.1	-13.3
Role of CC-Fix the solar devices when they break	66	15.2	6.3	24	82	15.9	7.9	23.8	-0.7	73	13.7	5.8	21.6	68	17.6	8.3	27	-3.9

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
Role of CC-Provide information to MM beneficiaries	66	50	38.1	61.9	82	58.5	47.8	69.2	-8.5	73	54.8	43.2	66.4	68	55.9	44.4	67.4	-1.1
Role of CC-Represent MM beneficiaries collectively	66	36.4	25.1	47.7	82	30.5	20.6	40.4	5.9	73	39.7	28.4	51.1	68	23.5	13.4	33.7	16.2**
Role of CC-Other	66	1.5	-1.5	4.5	82	2.4	-0.9	5.8	-0.9	73	2.7	-1.1	6.5	68	1.5	-1.4	4.4	1.3
Role of CC-Don't know	66	9.1	2.2	16	82	3.7	-0.4	7.7	5.4	73	5.5	0.2	10.8	68	7.4	1.1	13.6	-1.9
Household raised an issue with CC	66	90.9	83.7	98.1	82	82.9	74.6	91.2	8	73	86.3	78.3	94.3	68	88.2	80.3	96.2	-1.9
Extent to which CC was helpful-Very helpful	60	71.7	59.9	83.4	68	76.5	66.3	86.6	-4.8	63	76.2	65.4	87	60	73.3	61.9	84.7	2.9
Extent to which CC was helpful-Moderately helpful	60	16.7	7.1	26.2	68	16.2	7.3	25	0.5	63	17.5	8.1	26.8	60	13.3	4.6	22.1	4.1
Extent to which CC was helpful-Not helpful	60	11.7	3.2	20.1	68	7.4	1.1	13.6	4.3	63	6.3	0.1	12.6	60	13.3	4.4	22.2	-7
Main org leading MM-The government of Kenya	148	18.2	12.2	24.3	187	22.5	16.8	28.2	-4.2	162	21	14.9	27.1	152	22.4	16.1	28.6	-1.4
Main org leading MM-The government of Kilifi or Garissa	148	0.7	-0.6	2	187	0.5	-0.5	1.6	0.1	162	0.6	-0.6	1.8	152	0.7	-0.6	1.9	0
Main org leading MM-UNICEF	148	8.1	3.7	12.5	187	8	4.2	11.8	0.1	162	8.6	4.4	12.9	152	7.9	3.8	12	0.7
Main org leading MM-Energy4Impact or SomaliAid or Busara	148	0			187	0			0	162	0			152	0			0
Main org leading MM-BioLite or d.light	148	12.8	7.6	18.1	187	11.8	7.2	16.3	1.1	162	11.7	6.9	16.6	152	12.5	7.3	17.7	-0.8
Main org leading MM-Inua Jamii	148	4.1	0.9	7.2	187	10.2	5.9	14.4	-6.1**	162	11.1	6.3	15.9	152	4.6	1.4	7.9	6.5**
Main org leading MM-Department of children's services	148	0			187	0			0	162	0			152	0			0
Main org leading MM-Other	148	4.1	0.9	7.3	187	2.1	0.1	4.2	1.9	162	1.9	-0.2	3.9	152	2.6	0.1	5.2	-0.8
Main org leading MM-Don't know	148	52	44	60	187	44.9	37.8	52	7.1	162	45.1	37.4	52.7	152	49.3	41.5	57.2	-4.3

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT			Diff	
Household used last MM top up to repay for solar device	148	90.5	85.9	95.2	187	93	89.4	96.7	-2.5	162	94.4	90.9	98	152	88.8	83.8	93.8	5.6*

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

I.3 Awareness and use of solar energy

Table 16: Awareness of solar lighting at midline among households that use solar lighting (Household level indicators)

Indicator	Overall				Kilifi				Garissa				Diff
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	
Know at least 1 benefit of solar lighting	333	99.4	98.6	100.2	253	99.2	98.1	100.3	80	100			-0.8
Know more than 1 benefit of solar lighting	333	95.8	93.7	97.9	253	95.3	92.7	97.9	80	97.5	94	101	-2.2
Number of benefits of solar lighting cited	333	3.8	3.6	4	253	3.6	3.4	3.8	80	4.4	4	4.7	-0.7***
Benefits-allow my children to study when its dark	333	68.2	63.1	73.2	253	67.6	61.8	73.3	80	70	59.7	80.3	-2.4
Benefits-charge mobile phones, radios or other devices	333	67.6	62.7	72.4	253	63.6	57.9	69.4	80	80	71.2	88.8	-16.4***
Benefits-brighter or better quality lighting or reliable	333	66.4	61.3	71.4	253	68.8	63.1	74.5	80	58.8	47.7	69.8	10
Benefits-reduce spend on kerosene, candles or batteries	333	36.3	31.2	41.5	253	34	28.2	39.8	80	43.8	32.5	55	-9.8
Benefits-allow household members to do chores after dark	333	30.3	25.5	35.1	253	26.1	20.7	31.5	80	43.8	33	54.5	-17.7***
Benefits-help me do productive work after dark	333	18	13.9	22.1	253	13.4	9.2	17.6	80	32.5	21.9	43.1	-19.1***
Benefits-create less smoke in the house	333	14.1	10.4	17.8	253	16.2	11.7	20.7	80	7.5	1.6	13.4	8.7**
Benefits-make me feel safer	333	13.5	9.9	17.2	253	13.4	9.3	17.6	80	13.8	6	21.5	-0.3
Benefits-deter pests such as rats	333	13.5	9.9	17.2	253	15	10.6	19.4	80	8.8	2.4	15.1	6.3
Benefits-reduce time spent looking for other energy sources	333	9.9	6.7	13.1	253	8.3	4.9	11.7	80	15	7	23	-6.7
Benefits-allow for increased leisure time	333	9.3	6.2	12.4	253	7.9	4.6	11.2	80	13.8	6.1	21.4	-5.8
Benefits-improve the quality of sleep at night	333	8.4	5.4	11.4	253	8.7	5.3	12.1	80	7.5	1.6	13.4	1.2
Benefits-lower risk of fire in the house	333	6.3	3.7	8.9	253	3.6	1.3	5.8	80	15	7	23	-11.4***
Benefits-better for respiratory health	333	6	3.4	8.6	253	5.9	3	8.9	80	6.3	1	11.5	-0.3
Benefits-experience fewer burns due to lighting fuel	333	5.4	3	7.8	253	3.6	1.3	5.8	80	11.3	4.4	18.1	-7.7**

Benefits-lower environmental impact	333	4.5	2.3	6.7	253	3.2	1	5.3	80	8.8	2.5	15	-5.6*
Benefits-better for eye health or less eye irritation	333	3	1.2	4.8	253	3.6	1.3	5.8	80	1.3	-1.2	3.7	2.3

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 17: Awareness of solar lighting at midline among households that use solar lighting (Household level indicators)

– continued

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI		N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	
Know at least 1 benefit of solar lighting	156	99.4	98.1	100.6	177	99.4	98.3	100.5	-0.1	156	99.4	98.1	100.6	156	99.4	98.1	100.6	0
Know more than 1 benefit of solar lighting	156	96.2	93.1	99.2	177	95.5	92.4	98.5	0.7	156	94.9	91.4	98.3	156	96.2	93.1	99.2	-1.3
Number of benefits of solar lighting cited	156	3.9	3.6	4.1	177	3.8	3.6	4	0.1	156	3.9	3.6	4.1	156	3.8	3.5	4.1	0.1
Benefits-allow my children to study when its dark	156	69.9	62.6	77.1	177	66.7	59.8	73.5	3.2	156	71.2	64	78.3	156	64.7	57.3	72.2	6.4
Benefits-charge mobile phones, radios or other devices	156	62.8	55.4	70.2	177	71.8	65.3	78.2	-8.9*	156	71.8	65	78.6	156	65.4	58	72.8	6.4
Benefits-brighter or better quality lighting or reliable	156	67.9	60.6	75.3	177	65	57.9	72	3	156	67.9	60.6	75.3	156	64.7	57.1	72.4	3.2
Benefits-reduce spend on kerosene, candles or batteries	156	39.7	32	47.5	177	33.3	26.5	40.1	6.4	156	34	26.7	41.3	156	40.4	32.6	48.2	-6.4
Benefits-allow household members to do chores after dark	156	28.8	22	35.7	177	31.6	24.8	38.4	-2.8	156	30.8	23.6	38	156	30.8	23.7	37.8	0
Benefits-help me do productive work after dark	156	17.3	11.4	23.2	177	18.6	13	24.3	-1.3	156	21.8	15.4	28.2	156	13.5	8.1	18.8	8.3**
Benefits-create less smoke in the house	156	15.4	9.8	21	177	13	8.1	17.9	2.4	156	11.5	6.6	16.5	156	16.7	11	22.3	-5.1
Benefits-make me feel safer	156	14.1	8.7	19.5	177	13	8	18	1.1	156	12.8	7.6	18	156	13.5	8.1	18.9	-0.6
Benefits-deter pests such as rats	156	15.4	9.8	21	177	11.9	7.1	16.6	3.5	156	10.3	5.5	15	156	15.4	9.7	21	-5.1

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
Benefits-reduce time spent looking for other energy sources	156	9	4.4	13.5	177	10.7	6.2	15.2	-1.8	156	10.9	6	15.8	156	9.6	4.9	14.3	1.3
Benefits-allow for increased leisure time	156	9.6	5	14.2	177	9	4.9	13.2	0.6	156	10.3	5.5	15	156	9.6	5	14.2	0.6
Benefits-improve the quality of sleep at night	156	5.8	2.2	9.4	177	10.7	6.1	15.3	-5.0*	156	9	4.5	13.4	156	8.3	4	12.7	0.6
Benefits-lower risk of fire in the house	156	6.4	2.5	10.3	177	6.2	2.7	9.7	0.2	156	5.8	2.1	9.4	156	7.1	3.1	11	-1.3
Benefits-better for respiratory health	156	8.3	4	12.6	177	4	1.1	6.9	4.4*	156	7.7	3.5	11.9	156	5.1	1.7	8.6	2.6
Benefits-experience fewer burns due to lighting fuel	156	3.2	0.4	6	177	7.3	3.6	11.1	-4.1*	156	5.1	1.6	8.6	156	5.8	2.1	9.4	-0.6
Benefits-lower environmental impact	156	6.4	2.6	10.3	177	2.8	0.5	5.2	3.6	156	3.2	0.5	6	156	5.8	2.1	9.4	-2.6
Benefits-better for eye health or less eye irritation	156	3.8	0.8	6.9	177	2.3	0.1	4.5	1.6	156	3.8	0.8	6.9	156	1.9	-0.2	4.1	1.9

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 18: Awareness of solar lighting at midline among households that do not use solar lighting (Household level indicators)

Indicator	Overall			
	N	%	Lower CI	Upper CI
Household aware of solar systems for lighting	119	68.9	60.6	77.2
Know at least 1 benefit of solar lighting (of those aware)	82	98.8	96.3	101.2
Know more than 1 benefit of solar lighting (of those aware)	82	91.5	85	97.9
Number of benefits of solar lighting cited (of those aware)	82	3.9	3.5	4.2
Benefits-brighter or better quality lighting or reliable (of those aware)	82	80.5	71.7	89.3
Benefits-allow my children to study when its dark (of those aware)	82	65.9	55.4	76.3
Benefits-charge mobile phones, radios or other devices (of those aware)	82	61	50.1	71.9
Benefits-reduce spend on kerosene, candles or batteries (of those aware)	82	45.1	33.5	56.7
Benefits-help me do productive work after dark (of those aware)	82	25.6	16.2	35.1
Benefits-deter pests such as rats (of those aware)	82	23.2	15.2	31.1
Benefits-allow household members to do chores after dark (of those aware)	82	17.1	8.5	25.7
Benefits-make me feel safer (of those aware)	82	14.6	6.5	22.8
Benefits-reduce time spent looking for other energy sources (of those aware)	82	13.4	5.8	21

Benefits-create less smoke in the house (of those aware)	82	9.8	3.6	15.9
Benefits-better for eye health or less eye irritation (of those aware)	82	7.3	1.7	13
Benefits-improve the quality of sleep at night (of those aware)	82	7.3	1.5	13.2
Benefits-better for respiratory health (of those aware)	82	6.1	0.8	11.4
Benefits-lower risk of fire in the house (of those aware)	82	4.9	0.2	9.6
Benefits-experience fewer burns due to lighting fuel (of those aware)	82	3.7	-0.5	7.8
Benefits-allow for increased leisure time (of those aware)	82	2.4	-1	5.8

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** We do not disaggregate the data by groups given the small sample size.

Table 19: Use of energy and SHS at midline (Household level indicators)

Indicator	Overall				Kilifi				Garissa				Diff
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	
Light sources used-Solar home system	501	56.7	52.6	60.7	321	67.6	62.6	72.6	180	37.2	30.3	44.1	30.4***
Light sources used-Mobile phone torch	501	53.5	49.6	57.4	321	68.8	63.9	73.8	180	26.1	19.8	32.4	42.7***
Light sources used-Dry-cell battery torch	501	51.5	47.3	55.7	321	44.5	39.2	49.9	180	63.9	57	70.8	-19.3***
Light sources used-Firewood	501	31.5	27.8	35.2	321	44.5	39.2	49.9	180	8.3	4.3	12.4	36.2***
Light sources used-Kerosene-Paraffin-Tin lamp-lantern	501	30.5	26.9	34.1	321	45.8	40.4	51.2	180	3.3	0.7	6	42.5***
Light sources used-Solar lantern	501	13.2	10.3	16.1	321	17.4	13.4	21.5	180	5.6	2.2	8.9	11.9***
Light sources used-Candle	501	8.2	5.8	10.5	321	11.8	8.3	15.4	180	1.7	-0.2	3.5	10.2***
Light sources used-Solar torch	501	6.6	4.4	8.7	321	9	5.9	12.1	180	2.2	0	4.4	6.8***
Light sources used-Rechargeable battery	501	3.2	1.7	4.7	321	5	2.6	7.3	180	0			5.0***
Light sources used-National grid (KPLC)	501	0.6	-0.1	1.3	321	0			180	1.7	-0.2	3.5	-1.7*
Light sources used-Diesel or gasoline lamp	501	0.4	-0.1	0.9	321	0.6	-0.2	1.5	180	0			0.6
Light sources used-Generator	501	0.2	-0.2	0.6	321	0.3	-0.3	0.9	180	0			0.3
Light sources used-LPG (gas) lamp	501	0			321	0			180	0			0
Light sources used-Mini-grid	501	0			321	0			180	0			0
HH used SHS or solar lantern or solar torch for lighting in last 30 days	501	66.5	62.7	70.3	321	78.8	74.4	83.2	180	44.4	37.4	51.4	34.4***
Solar used for charging household members mobile phones	333	85.6	81.9	89.3	253	88.1	84.2	92.1	80	77.5	68.2	86.8	10.6**
Solar used for lighting the house so that children can study	333	82.6	78.9	86.3	253	92.5	89.3	95.7	80	51.3	39.8	62.7	41.2***
Solar used for lighting the house to work on unpaid activities	333	72.7	68.8	76.5	253	87.4	83.4	91.3	80	26.3	16.6	35.9	61.1***
Solar used for lighting the surrounding of the households	333	72.1	67.5	76.7	253	79.1	74.1	84	80	50	38.9	61.1	29.1***
Solar used for lighting the house so that the children can play	333	61.3	56.3	66.3	253	68.8	63.1	74.4	80	37.5	26.8	48.2	31.3***

Solar used for lighting the way when household members leave the household	333	54.4	49.4	59.3	253	64	58.2	69.8	80	23.8	14.3	33.2	40.3***
Solar used for lighting the house to work on usual business	333	42.3	37.1	47.6	253	45.5	39.4	51.5	80	32.5	21.7	43.3	13.0**
Solar used for charging phone of people outside the household	333	42.3	37.1	47.6	253	41.5	35.5	47.6	80	45	34.4	55.6	-3.5
Solar used for charging or powering the radio	333	42	36.8	47.3	253	47.4	41.3	53.5	80	25	15.1	34.9	22.4***
Solar used for watching TV	333	3.3	1.4	5.2	253	4.3	1.8	6.9	80	0			4.3***
Solar used for powering the fan	333	2.4	0.8	4	253	2.4	0.5	4.2	80	2.5	-1	6	-0.1
Household earned extra income using SHS from the project	335	28.1	23.4	32.7	237	35.4	29.4	41.4	98	10.2	4	16.4	25.2***
Used additional income on-Food	94	76.6	67.7	85.5	84	76.2	66.8	85.6	10	80	52.7	107.3	-3.8
Used additional income on-School fees or materials	94	18.1	10.5	25.6	84	20.2	11.9	28.6	10	0			20.2***
Used additional income on-Health costs	94	3.2	-0.4	6.8	84	3.6	-0.4	7.6	10	0			3.6*
Used additional income on-Clothes or other non-food household items	94	13.8	6.9	20.7	84	15.5	7.8	23.2	10	0			15.5***
Used additional income on-my business	94	3.2	-0.4	6.8	84	3.6	-0.4	7.6	10	0			3.6*
Used additional income on-House materials	94	14.9	7.8	22	84	14.3	7	21.5	10	20	-7.3	47.3	-5.7
Used additional income on-Farming or livestock	94	2.1	-0.8	5.1	84	1.2	-1.2	3.6	10	10	-8.6	28.6	-8.8
Used additional income on-Pay off debts	94	2.1	-0.9	5.1	84	2.4	-1	5.7	10	0			2.4
Used additional income on-Purchase kerosene, candles or batteries	94	0			84	0			10	0			0
Used additional income on-Payment for the solar device	94	14.9	7.7	22.1	84	16.7	8.7	24.7	10	0			16.7***
Used additional income on-Transport costs	94	2.1	-0.9	5.1	84	2.4	-1	5.7	10	0			2.4
Used additional income on-Savings	94	3.2	-0.2	6.5	84	3.6	-0.2	7.3	10	0			3.6*

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 20: Use of energy and SHS at midline (Household level indicators) – continued

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI		N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	
Light sources used-Solar home system	239	52.3	46.2	58.4	262	60.7	55	66.3	-8.4*	225	64	58.1	69.9	248	50.4	44.4	56.5	13.6***
Light sources used-Mobile phone torch	239	52.7	46.6	58.8	262	54.2	48.8	59.6	-1.5	225	58.2	52.3	64.1	248	46.4	40.6	52.1	11.9***
Light sources used-Dry-cell battery torch	239	54.8	48.6	61	262	48.5	42.6	54.4	6.3	225	49.3	43.1	55.6	248	53.2	47.1	59.4	-3.9
Light sources used-Firewood	239	30.5	24.9	36.1	262	32.4	27.2	37.7	-1.9	225	33.3	27.4	39.2	248	28.2	23	33.4	5.1
Light sources used-Kerosene-Paraffin-Tin lamp-lantern	239	28.5	23.1	33.8	262	32.4	27.1	37.7	-4	225	30.7	25	36.3	248	27.4	22.4	32.4	3.2
Light sources used-Solar lantern	239	14.6	10.3	19	262	11.8	8	15.6	2.8	225	9.3	5.6	13.1	248	14.9	10.6	19.2	-5.6*
Light sources used-Candle	239	6.3	3.3	9.3	262	9.9	6.4	13.5	-3.6	225	9.3	5.6	13.1	248	6	3.1	9	3.3
Light sources used-Solar torch	239	8.4	4.9	11.8	262	5	2.4	7.6	3.4	225	6.2	3.1	9.3	248	6.5	3.4	9.5	-0.2
Light sources used-Rechargeable battery	239	2.9	0.8	5	262	3.4	1.3	5.6	-0.5	225	2.7	0.6	4.7	248	2.8	0.8	4.8	-0.2
Light sources used-National grid (KPLC)	239	0.8	-0.3	2	262	0.4	-0.4	1.1	0.5	225	0.4	-0.4	1.3	248	0.8	-0.3	1.9	-0.4
Light sources used-Diesel or gasoline lamp	239	0			262	0.8	-0.3	1.8	-0.8	225	0.9	-0.3	2.1	248	0			0.9
Light sources used-Generator	239	0			262	0.4	-0.4	1.1	-0.4	225	0.4	-0.4	1.3	248	0			0.4
Light sources used-LPG (gas) lamp	239	0			262	0			0	225	0			248	0			0
Light sources used-Mini-grid	239	0			262	0			0	225	0			248	0			0
HH used SHS or solar lantern or solar torch for lighting in last 30 days	239	65.3	59.6	70.9	262	67.6	62.1	73	-2.3	225	69.3	63.7	75	248	62.9	57.3	68.6	6.4
Solar used for charging household members mobile phones	156	84	78.2	89.7	177	87	82.1	91.9	-3	156	87.8	82.8	92.9	156	83.3	77.4	89.3	4.5
Solar used for lighting the house so that children can study	156	82.1	76.4	87.7	177	83.1	77.9	88.2	-1	156	85.9	81	90.8	156	77.6	71.4	83.8	8.3**

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
Solar used for lighting the house to work on unpaid activities	156	68.6	62.2	75	177	76.3	70.9	81.6	-7.7*	156	73.1	67.3	78.8	15 6	70.5	64.5	76.5	2.6
Solar used for lighting the surrounding of the households	156	72.4	65.8	79	177	71.8	65.2	78.3	0.7	156	75	68.5	81.5	15 6	67.9	61	74.9	7.1
Solar used for lighting the house so that the children can play	156	62.2	54.8	69.5	177	60.5	53.4	67.5	1.7	156	64.1	56.9	71.3	15 6	57.1	49.4	64.7	7.1
Solar used for lighting the way when household members leave the household	156	57.1	49.7	64.4	177	52	44.9	59	5.1	156	55.1	47.7	62.6	15 6	51.9	44.5	59.3	3.2
Solar used for lighting the house to work on usual business	156	39.1	31.5	46.7	177	45.2	37.9	52.5	-6.1	156	47.4	39.7	55.2	15 6	35.9	28.5	43.3	11.5**
Solar used for charging phone of people outside the household	156	39.1	31.4	46.8	177	45.2	38	52.4	-6.1	156	48.7	40.8	56.6	15 6	37.2	29.8	44.6	11.5**
Solar used for charging or powering the radio	156	43.6	36.1	51.1	177	40.7	33.4	47.9	2.9	156	43.6	36	51.2	15 6	40.4	32.6	48.1	3.2
Solar used for watching TV	156	2.6	0.1	5	177	4	1.1	6.8	-1.4	156	3.2	0.5	6	15 6	3.2	0.4	6	0
Solar used for powering the fan	156	2.6	0	5.1	177	2.3	0.1	4.4	0.3	156	2.6	0.1	5	15 6	1.9	-0.2	4.1	0.6
Household earned extra income using SHS from the project	148	27	19.9	34.1	187	28.9	22.7	35.1	-1.8	162	31.5	24.7	38.3	15 2	24.3	17.5	31.1	7.1
Used additional income on-Food	40	75	61.4	88.6	54	77.8	66	89.5	-2.8	51	74.5	62.2	86.8	37	78.4	64.4	92.4	-3.9
Used additional income on-School fees or materials	40	12.5	2.7	22.3	54	22.2	10.9	33.5	-9.7	51	27.5	15.5	39.4	37	8.1	-0.6	16.9	19.3**
Used additional income on-Health costs	40	2.5	-2.5	7.5	54	3.7	-1.3	8.7	-1.2	51	3.9	-1.4	9.3	37	2.7	-2.7	8.1	1.2
Used additional income on-Clothes or other non-food household items	40	10	0.4	19.6	54	16.7	6.9	26.4	-6.7	51	19.6	8.8	30.4	37	8.1	-0.9	17.1	11.5
Used additional income on-my business	40	0			54	5.6	-0.6	11.7	-5.6*	51	3.9	-1.4	9.3	37	2.7	-2.7	8.1	1.2
Used additional income on-House materials	40	10	0.4	19.6	54	18.5	8.6	28.4	-8.5	51	13.7	4.1	23.3	37	16.2	4	28.5	-2.5
Used additional income on-Farming or livestock	40	5	-1.9	11.9	54	0			5	51	0			37	5.4	-2.1	12.9	-5.4

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
Used additional income on-Pay off debts	40	5	-2.1	12.1	54	0			5	51	0			37	2.7	-2.7	8.1	-2.7
Used additional income on-Purchase kerosene, candles or batteries	40	0			54	0			0	51	0			37	0			0
Used additional income on-Payment for the solar device	40	17.5	5.8	29.2	54	13	3.6	22.3	4.5	51	17.6	7.2	28.1	37	13.5	1.8	25.2	4.1
Used additional income on-Transport costs	40	2.5	-2.5	7.5	54	1.9	-1.8	5.5	0.6	51	2	-1.9	5.8	37	0			2
Used additional income on-Savings	40	2.5	-2.4	7.4	54	3.7	-1.4	8.8	-1.2	51	3.9	-1.5	9.4	37	0			3.9

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

I.4 Health

Table 21: Household member health at midline (Member level indicators)

Indicator	Overall				Kilifi				Garissa				Diff
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	
Symptoms of ARI in the last two weeks	3798	1.4	1.1	1.7	2563	2	1.6	2.5	1235	0.2	0	0.3	1.9***
Experienced cough in last two weeks	3803	6.8	6.2	7.5	2566	9.3	8.4	10.2	1237	1.7	1.1	2.3	7.6***
Experienced cough with fever in last two weeks	3802	3.4	2.9	3.8	2565	4.8	4.1	5.4	1237	0.5	0.2	0.8	4.3***
Experienced cough with difficulty breathing in last two weeks	3799	2	1.7	2.4	2564	2.8	2.3	3.4	1235	0.2	0	0.5	2.6***
Reason for difficulty breathing-Chest only (of those with difficulty breathing)	75	50.7	41.3	60.1	72	51.4	41.8	61	3	33.3	-9.7	76.4	18.1
Reason for difficulty breathing-Nose only (of those with difficulty breathing)	75	28	19.7	36.3	72	27.8	19.4	36.2	3	33.3	-9.7	76.4	-5.6
Reason for difficulty breathing-Both (of those with difficulty breathing)	75	21.3	13.9	28.7	72	20.8	13.4	28.3	3	33.3	-9.7	76.4	-12.5

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 22: Household member health at midline (Member level indicators) – continued

Indicator	Male				Female				Diff	<6 years old				6-15 years old				>15 years old			
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI		N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI
Symptoms of ARI in the last two weeks	1783	1.5	1	1.9	2013	1.4	1	1.8	0.1	442	2.7	1.5	3.9	1515	0.7	0.4	1.1	1788	1.6	1.2	2.1
Experienced cough in last two weeks	1788	6.5	5.6	7.4	2013	7.2	6.3	8	-0.7	443	6.8	4.9	8.6	1515	4.2	3.4	5	1792	9	8	10.1
Experienced cough with fever in last two weeks	1787	3.1	2.4	3.7	2013	3.6	3	4.3	-0.5	443	3.6	2.2	5	1515	2.4	1.8	3	1791	4.1	3.4	4.8
Experienced cough with difficulty breathing in last two weeks	1784	2.2	1.7	2.8	2013	1.8	1.3	2.2	0.5	442	4.1	2.6	5.5	1515	1.1	0.7	1.5	1789	2.2	1.6	2.7
Reason for difficulty breathing-Chest only (of those with difficulty breathing)	39	46.2	33	59.4	36	55.6	42.4	68.7	-9.4	18	27.8	11.9	43.7	17	47.1	27.3	66.8	38	63.2	50.4	75.9
Reason for difficulty breathing-Nose only (of those with difficulty breathing)	39	33.3	21.3	45.3	36	22.2	11.4	33.1	11.1	18	33.3	16.2	50.4	17	35.3	16.5	54.1	38	23.7	12.7	34.7
Reason for difficulty breathing-Both (of those with difficulty breathing)	39	20.5	10.6	30.4	36	22.2	10.9	33.6	-1.7	18	38.9	21	56.8	17	17.6	3.1	32.2	38	13.2	4.3	22

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

I.5 Livelihoods

Table 23: Household livelihoods at midline (Member level indicators)

Indicator	Overall				Kilifi				Garissa				Diff
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	
Household member is working (of those >14 years old)	1946	82.8	81.6	84.1	1356	90.2	88.9	91.4	590	65.9	62.9	68.9	24.3***
Number of work activities per working member (of those working)	1612	1.7	1.6	1.7	1223	1.8	1.8	1.9	389	1.1	1.1	1.2	0.7***
Number of hours worked per week (of those working)	1603	38.3	37.3	39.3	1216	37.5	36.4	38.7	387	40.7	39.1	42.3	-3.2***
Reason not working-too old (of those not working)	334	44.9	40.8	49	133	44.4	37.8	50.9	201	45.3	40	50.5	-0.9
Reason not working-unable (of those not working)	334	24.6	20.9	28.2	133	29.3	23.1	35.6	201	21.4	16.8	25.9	7.9**
Reason not working-unemployed (of those not working)	334	8.7	6.3	11.1	133	6.8	3.4	10.1	201	10	6.7	13.2	-3.2
Reason not working-in education (of those not working)	334	18	14.7	21.2	133	14.3	9.7	18.9	201	20.4	16	24.8	-6.1*
Reason not working-in vocational training (of those not working)	334	1.2	0.3	2.1	133	1.5	-0.2	3.2	201	1	-0.1	2.1	0.5
Reason not working-volunteering (of those not working)	334	0.3	-0.2	0.8	133	0			201	0.5	-0.3	1.3	-0.5
Reason not working-COVID-19 (of those not working)	334	1.2	0.3	2.1	133	0.8	-0.4	1.9	201	1.5	0.2	2.8	-0.7
Reason not working-other (of those not working)	334	1.2	0.3	2.1	133	3	0.7	5.3	201	0			3.0**
Type of work activity (of those working):													
Farming for own consumption	1612	47.2	45.6	48.8	1223	61.8	59.7	64	389	1.3	0.4	2.2	60.5***
Unpaid domestic work	1612	43.1	41.2	45	1223	39.3	37.2	41.5	389	55	51.1	59	-15.7***
Collecting water	1612	22.8	21.2	24.4	1223	26.5	24.5	28.4	389	11.3	8.8	13.8	15.2***
Collecting firewood or other fuel materials	1612	16.2	14.8	17.6	1223	20.1	18.3	21.9	389	3.9	2.3	5.4	16.3***
Herding/Livestock producer(unpaid)	1612	13	11.7	14.3	1223	11.4	10	12.9	389	17.7	14.7	20.7	-6.3***
Small scale business (self-employed)	1612	9.1	7.9	10.2	1223	8.4	7.2	9.7	389	11.1	8.6	13.5	-2.6*
Labourers in Mining, Construction, Manufacturing, Agriculture, Transport	1612	4.9	4.1	5.7	1223	5.6	4.6	6.7	389	2.6	1.3	3.8	3.1***
Other	1612	1.9	1.4	2.5	1223	2.5	1.8	3.1	389	0.3	-0.1	0.7	2.2***
Farming/Agricultural producer	1612	1.3	0.9	1.7	1223	1.6	1	2.1	389	0.5	0	1.1	1.0***

Messengers, Porters, Watchmen and Related Workers	1612	1.1	0.7	1.5	1223	0.7	0.3	1	389	2.6	1.3	3.8	-1.9***
Herding/Livestock producer(paid)	1612	1	0.6	1.4	1223	1.2	0.7	1.7	389	0.3	-0.1	0.7	1.0***
Cleaners, Launderers, Domestic Workers (paid)	1612	0.9	0.6	1.3	1223	0.6	0.2	0.9	389	2.1	0.9	3.2	-1.5**
Handicraft workers	1612	0.7	0.4	1	1223	0.9	0.5	1.3	389	0			0.9***
Unpaid work in family business	1612	0.7	0.4	1.1	1223	0.2	0	0.5	389	2.3	1.1	3.5	-2.1***
Fishmonger, fisherman (paid)	1612	0.4	0.2	0.7	1223	0.6	0.2	0.9	389	0			0.6***
Collecting forest products for consumption/medicine	1612	0.4	0.1	0.6	1223	0.5	0.2	0.8	389	0			0.5***
Livestock trader	1612	0.2	0.1	0.4	1223	0.3	0.1	0.6	389	0			0.3**
Teacher at school	1612	0.2	0.1	0.4	1223	0.2	0	0.3	389	0.5	-0.1	1.1	-0.4
Religious tutor (self-employed)	1612	0.2	0	0.4	1223	0.1	0	0.2	389	0.5	-0.1	1.1	-0.4
Woodworking Trades Workers	1612	0.2	0.1	0.4	1223	0.3	0.1	0.6	389	0			0.3**
Shoe-Making, repairs and Related Trades Workers	1612	0.2	0	0.4	1223	0.2	0	0.5	389	0			0.2**
Building Caretakers	1612	0.2	0.1	0.4	1223	0.2	0	0.5	389	0.3	-0.1	0.7	0
Public official (incl. armed forces, police)	1612	0.2	0	0.4	1223	0.2	0	0.3	389	0.3	-0.1	0.7	-0.1
Fishing for own consumption	1612	0.1	0	0.3	1223	0.2	0	0.3	389	0			0.2*
Religious teacher/leader (at madrasa)	1612	0.1	0	0.3	1223	0			389	0.5	-0.1	1.1	-0.5*
Butchers, Fishmongers and Related Food Preparers	1612	0.1	0	0.2	1223	0.1	0	0.2	389	0			0.1
Bakers, Pastry-Cooks and Confectionery Makers	1612	0.1	0	0.2	1223	0.1	0	0.2	389	0			0.1
Textile, Garment and Related Trades Workers	1612	0.1	0	0.2	1223	0.1	0	0.2	389	0			0.1
Street and market vendors	1612	0.1	0	0.3	1223	0.2	0	0.3	389	0			0.2*
Collecting bush products	1612	0.1	0	0.2	1223	0.1	0	0.2	389	0			0.1
Work activities changed since schools closed in March 2020 (of those working)	1612	38.4	36.5	40.3	1223	39.3	37.2	41.5	389	35.5	31.7	39.3	3.9*
Reason for change-Activity not possible with COVID-19	619	86.9	84.8	89	481	84.6	82.1	87.1	138	94.9	92	97.8	-10.3***
Reason for change-New activity makes more income	619	1.5	0.7	2.2	481	1.9	0.9	2.8	138	0			1.9***
Reason for change-Unable to work in old activity	619	2.3	1.3	3.2	481	2.1	1.1	3.1	138	2.9	0.7	5.1	-0.8
Reason for change-Other	619	9.4	7.6	11.2	481	11.4	9.2	13.7	138	2.2	0.3	4.1	9.3***
Household member does work at home using artificial light (of those working)	1612	36.5	34.7	38.4	1223	31.6	29.6	33.7	389	51.9	48	55.9	-20.3***
Number of activities done at home using light (of those working)	1612	0.4	0.4	0.4	1223	0.3	0.3	0.3	389	0.5	0.5	0.6	-0.2***

Number of hours worked per week using light (of those working using light)	569	10.4	9.9	10.8	371	7.4	7	7.9	198	15.9	15	16.8	-8.5***
Light used for work-Candle (of those working using light)	589	0.5	0.1	1	387	0.8	0.1	1.5	202	0			0.8**
Light used for work-Kerosene/Paraffin/Tin lamp/lantern (of those working using light)	589	14.3	12.1	16.4	387	21.4	18.2	24.7	202	0.5	-0.3	1.3	21.0***
Light used for work-Dry-cell battery torch (of those working using light)	589	27.3	25	29.6	387	8.8	6.6	11	202	62.9	57.7	68	-54.1***
Light used for work-Rechargeable battery (of those working using light)	589	0.7	0.2	1.2	387	0.8	0.1	1.5	202	0.5	-0.3	1.3	0.3
Light used for work-Solar lantern (of those working using light)	589	7.1	5.5	8.7	387	9	6.9	11.2	202	3.5	1.5	5.4	5.6***
Light used for work-Solar home system (of those working using light)	589	42.1	39	45.2	387	48.3	44.4	52.3	202	30.2	25.3	35.1	18.1***
Light used for work-National grid (of those working using light)	589	0			387	0			202	0			0
Light used for work-Mobile phone torch (of those working using light)	589	4.2	3	5.5	387	6.2	4.4	8	202	0.5	-0.3	1.3	5.7***
Light used for work-Firewood (of those working using light)	589	3.6	2.4	4.7	387	4.4	2.8	6	202	2	0.5	3.5	2.4**
Light used for work-Solar torch (of those working using light)	589	0.5	0.1	1	387	0.8	0.1	1.5	202	0			0.8**
Household member belongs to merry-go-round or savings scheme (of those >14 years old)	1946	13.2	12	14.4	1356	17.1	15.5	18.7	590	4.2	3	5.5	12.9***

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 24: Household livelihoods at midline (Member level indicators) – continued

Indicator	Male				Female				Diff
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	
Household member is working (of those >14 years old)	860	79.8	77.7	81.8	1086	85.3	83.6	86.9	-5.5***
Number of work activities per working member (of those working)	686	1.3	1.3	1.4	926	1.9	1.9	2	-0.6***
Number of hours worked per week (of those working)	684	37.1	35.7	38.6	919	39.2	37.9	40.4	-2.0**
Reason not working-too old (of those not working)	174	40.8	35.2	46.4	160	49.4	43.3	55.4	-8.6**
Reason not working-unable (of those not working)	174	20.1	15.3	25	160	29.4	23.8	35	-9.3**
Reason not working-unemployed (of those not working)	174	14.4	10.2	18.5	160	2.5	0.6	4.4	11.9***
Reason not working-in education (of those not working)	174	21.3	16.5	26	160	14.4	10.1	18.6	6.9**
Reason not working-in vocational training (of those not working)	174	1.1	-0.1	2.4	160	1.3	-0.1	2.6	-0.1
Reason not working-volunteering (of those not working)	174	0			160	0.6	-0.3	1.6	-0.6

Indicator	Male				Female				Diff
Reason not working-COVID-19 (of those not working)	174	1.7	0.2	3.3	160	0.6	-0.3	1.6	1.1
Reason not working-other (of those not working)	174	0.6	-0.3	1.5	160	1.9	0.2	3.6	-1.3
Type of work activity (of those working):									
Farming for own consumption	686	46.2	43.4	49	926	47.9	45.6	50.3	-1.7
Unpaid domestic work	686	12	10	13.9	926	66.2	63.8	68.6	-54.2***
Collecting water	686	9.3	7.6	11	926	32.8	30.5	35.2	-23.5***
Collecting firewood or other fuel materials	686	5.4	4.1	6.7	926	24.2	22.1	26.3	-18.8***
Herding/Livestock producer(unpaid)	686	24.2	21.7	26.7	926	4.6	3.6	5.7	19.6***
Small scale business (self-employed)	686	8.5	6.8	10.1	926	9.5	8	11	-1
Labourers in Mining, Construction, Manufacturing, Agriculture, Transport	686	10.1	8.3	11.8	926	1.1	0.6	1.6	9.0***
Other	686	2.9	1.9	3.9	926	1.2	0.6	1.7	1.7***
Farming/Agricultural producer	686	1.6	0.9	2.3	926	1.1	0.6	1.6	0.5
Messengers, Porters, Watchmen and Related Workers	686	2	1.2	2.9	926	0.4	0.1	0.8	1.6***
Herding/Livestock producer(paid)	686	2	1.2	2.9	926	0.2	0	0.5	1.8***
Cleaners, Launderers, Domestic Workers (paid)	686	0.4	0	0.8	926	1.3	0.7	1.9	-0.9**
Handicraft workers	686	1.2	0.5	1.8	926	0.3	0	0.6	0.8**
Unpaid work in family business	686	1.2	0.5	1.8	926	0.4	0.1	0.8	0.7**
Fishmonger, fisherman (paid)	686	0.6	0.1	1	926	0.3	0	0.6	0.3
Collecting forest products for consumption/medicine	686	0.3	0	0.6	926	0.4	0.1	0.8	-0.1
Livestock trader	686	0.6	0.1	1	926	0			0.6**
Teacher at school	686	0.4	0	0.8	926	0.1	-0.1	0.3	0.3
Religious tutor (self-employed)	686	0.4	0	0.8	926	0			0.4**
Woodworking Trades Workers	686	0.4	0	0.8	926	0.1	-0.1	0.3	0.3
Shoe-Making, repairs and Related Trades Workers	686	0.1	-0.1	0.4	926	0.2	0	0.5	-0.1
Building Caretakers	686	0.6	0.1	1	926	0			0.6**
Public official (incl. armed forces, police)	686	0.3	0	0.6	926	0.1	-0.1	0.3	0.2
Fishing for own consumption	686	0.3	0	0.6	926	0			0.3*
Religious teacher/leader (at madrasa)	686	0.3	0	0.6	926	0			0.3*
Butchers, Fishmongers and Related Food Preparers	686	0.1	-0.1	0.4	926	0			0.1
Bakers, Pastry-Cooks and Confectionery Makers	686	0			926	0.1	-0.1	0.3	-0.1
Textile, Garment and Related Trades Workers	686	0.1	-0.1	0.4	926	0			0.1
Street and market vendors	686	0.1	-0.1	0.4	926	0.1	-0.1	0.3	0
Collecting bush products	686	0.1	-0.1	0.4	926	0			0.1
Work activities changed since schools closed in March 2020 (of those working)	686	44.6	41.7	47.5	926	33.8	31.4	36.2	10.8***
Reason for change-Activity not possible with COVID-19	306	88.9	86.1	91.7	313	85	81.9	88.1	3.9*
Reason for change-New activity makes more income	306	0.3	-0.2	0.8	313	2.6	1.2	3.9	-2.2***
Reason for change-Unable to work in old activity	306	2.3	1	3.6	313	2.2	0.9	3.5	0.1
Reason for change-Other	306	8.5	6	11	313	10.2	7.6	12.8	-1.7
Household member does work at home using artificial light (of those working)	686	8	6.4	9.6	926	57.7	55.2	60.1	-49.6***
Number of activities done at home using light (of those working)	686	0.1	0.1	0.1	926	0.6	0.6	0.6	-0.5***
Number of hours worked per week using light (of those working using light)	50	9.7	8.2	11.2	519	10.4	10	10.9	-0.7

Indicator	Male				Female				Diff
Light used for work-Candle (of those working using light)	55	1.8	-1	4.6	534	0.4	0	0.8	1.4
Light used for work-Kerosene/Paraffin/Tin lamp/lantern (of those working using light)	55	14.5	7.3	21.8	534	14.2	12	16.5	0.3
Light used for work-Dry-cell battery torch (of those working using light)	55	36.4	26.5	46.2	534	26.4	24	28.8	10.0*
Light used for work-Rechargeable battery (of those working using light)	55	0			534	0.7	0.2	1.3	-0.7**
Light used for work-Solar lantern (of those working using light)	55	5.5	0.7	10.2	534	7.3	5.6	9	-1.8
Light used for work-Solar home system (of those working using light)	55	38.2	28.1	48.3	534	42.5	39.2	45.8	-4.3
Light used for work-National grid (of those working using light)	55	0			534	0			0
Light used for work-Mobile phone torch (of those working using light)	55	1.8	-1	4.6	534	4.5	3.2	5.8	-2.7*
Light used for work-Firewood (of those working using light)	55	1.8	-1	4.6	534	3.7	2.5	5	-1.9
Light used for work-Solar torch (of those working using light)	55	0			534	0.6	0.1	1.1	-0.6**
Household member belongs to merry-go-round or savings scheme (of those >14 years old)	860	9.1	7.6	10.6	1086	16.5	14.8	18.2	-7.4***

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 25: Household livelihoods at midline (Household level indicators)

Indicator	Overall				Kilifi				Garissa				Diff
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	
Number of household members >14 years old engaged in work	501	3.2	3.1	3.4	321	3.8	3.6	4	180	2.2	2	2.3	1.6***
Total number of work activities per household (of those with at least 1 working member)	490	5.5	5.2	5.8	321	7	6.6	7.5	169	2.6	2.4	2.8	4.4***
Number of activities started in last year (of those with at least 1 working member)	490	2.7	2.4	2.9	321	3.5	3.1	3.9	169	1.1	0.9	1.3	2.4***
Mean proportion of activities done at home (of those with at least 1 working member)	490	48.4	45.8	51.1	321	44.3	41.1	47.5	169	56.3	51.5	61.1	-12.0***
Household monthly income excluding remittances - Ksh	501	3161.9	2533.9	3789.9	321	3061.8	2394	3729.5	180	3340.6	2061.3	4619.8	-278.8
Household monthly income from remittances and gifts - Ksh	493	364.2	248.5	479.9	315	157	81.8	232.3	178	730.8	439.3	1022.4	-573.8***
Household monthly total income - Ksh	501	3520.3	2880.1	4160.5	321	3215.9	2546.8	3884.9	180	4063.3	2740.1	5386.5	-847.4
Remittances changed-receive less frequently (of those that received remittances last year)	83	30.1	20.1	40.2	33	18.2	3.9	32.4	50	38	24.2	51.8	-19.8*
Remittances changed-receive smaller amounts (of those that received remittances last year)	83	36.1	25.8	46.5	33	33.3	16.4	50.2	50	38	24.9	51.1	-4.7

Remittances changed-less frequency & amount (of those that received remittances last year)	83	20.5	12.5	28.5	33	18.2	5.6	30.8	50	22	11.6	32.4	-3.8
Remittances changed-No (of those that received remittances last year)	83	13.3	6.2	20.3	33	30.3	14.3	46.3	50	2	-2	6	28.3***

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 26: Household livelihoods at midline (Household level indicators) – continued

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI		N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	
Number of household members >14 years old engaged in work	239	3.5	3.2	3.7	262	3	2.8	3.2	0.5***	225	2.9	2.7	3.1	248	3.3	3.1	3.6	-0.4**
Total number of work activities per household (of those with at least 1 working member)	235	5.8	5.3	6.3	255	5.2	4.8	5.6	0.5	224	5.3	4.9	5.7	239	5.4	4.9	5.8	-0.1
Number of activities started in last year (of those with at least 1 working member)	235	2.5	2.1	2.9	255	2.8	2.5	3.2	-0.3	224	2.7	2.3	3	239	2.5	2.2	2.9	0.2
Mean proportion of activities done at home (of those with at least 1 working member)	235	46.8	43	50.7	255	49.9	46.1	53.7	-3.1	224	46.3	42.5	50.1	239	51.2	47.2	55.2	-5.0*
Household monthly income excluding remittances - Ksh	239	3460.3	2540.4	4380.1	262	2889.8	2037.5	3742.1	570.5	225	2939.9	2239.7	3640	248	3472.4	2394.1	4550.7	-532.5
Household monthly income from remittances and gifts - Ksh	234	379.3	234.7	523.8	259	350.6	171.7	529.6	28.6	225	201.5	73.6	329.3	247	481.3	294.9	667.7	-279.8**
Household monthly total income - Ksh	239	3831.6	2906.4	4756.7	262	3236.4	2356	4116.7	595.2	225	3141.3	2425.8	3856.9	248	3951.7	2852.1	5051.3	-810.4
Remittances changed- receive less frequently (of those that received remittances last year)	44	34.1	20.5	47.7	39	25.6	11.2	40	8.4	22	13.6	-0.7	27.9	56	39.3	25.9	52.7	-25.6**
Remittances changed- receive smaller amounts (of those that received remittances last year)	44	27.3	13.6	40.9	39	46.2	29.8	62.5	-18.9*	22	59.1	39.3	78.9	56	28.6	16.1	41	30.5**
Remittances changed- less frequency & amount (of those that	44	29.5	16.2	42.9	39	10.3	0.4	20.1	19.3**	22	22.7	8.8	36.7	56	19.6	9.3	30	3.1

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
received remittances last year)																		
Remittances changed-No (of those that received remittances last year)	44	9.1	0.5	17.7	39	17.9	6.7	29.2	-8.9	22	4.5	-4.2	13.3	56	12.5	4	21	-8

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

I.6 Education

Table 27: Engagement in learning activities at home at midline (Household level indicators)

Indicator	Overall				Kilifi				Garissa				Diff
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	
Children engaged in learning at home-Yes, all of them	501	55.9	52	59.8	321	72.3	67.4	77.1	180	26.7	20.1	33.3	45.6***
Children engaged in learning at home-Yes, most of them	501	24.2	20.7	27.6	321	11.8	8.3	15.3	180	46.1	38.9	53.3	-34.3***
Children engaged in learning at home-Yes, some of them	501	11.8	9	14.5	321	7.5	4.6	10.3	180	19.4	13.8	25.1	-12.0***
Children engaged in learning at home-None of them	501	7.6	5.3	9.9	321	7.8	4.9	10.7	180	7.2	3.5	11	0.6
Children engaged in learning at home-No school-going children	501	0.6	-0.1	1.3	321	0.6	-0.2	1.5	180	0.6	-0.5	1.6	0.1
At least some children engaged in learning at home (of those with school-going children)	498	92.4	90.1	94.7	319	92.2	89.2	95.1	179	92.7	89	96.5	-0.6
Type of learning at home-Educational TV programmes	460	0.4	-0.2	1	294	0.7	-0.3	1.6	166	0			0.7
Type of learning at home-Radio education programmes	460	2.2	0.9	3.5	294	1.7	0.2	3.2	166	3	0.4	5.6	-1.3
Type of learning at home-Books provided by school	460	41.1	36.8	45.4	294	50.3	44.7	56	166	24.7	18.2	31.2	25.6***
Type of learning at home-Their own school books	460	89.3	86.6	92.1	294	92.2	89.1	95.2	166	84.3	78.9	89.8	7.8**
Type of learning at home-Books we have in the household	460	18.3	14.7	21.8	294	17.7	13.4	22	166	19.3	13.2	25.4	-1.6
Type of learning at home-Teaching by household members	460	13.5	10.4	16.6	294	15.3	11.2	19.4	166	10.2	5.6	14.9	5.1

Type of learning at home-Community members/neighbours are teaching them	460	4.1	2.3	5.9	294	2.7	0.9	4.6	166	6.6	2.9	10.4	-3.9*
Type of learning at home-Educational content available on mobile phone	460	3.3	1.6	4.9	294	3.4	1.3	5.5	166	3	0.4	5.6	0.4
Type of learning at home-Other	460	0.2	-0.2	0.6	294	0.3	-0.3	1	166	0			0.3
Reason for not learning-Lack of access to television	38	0			25	0			13	0			0
Reason for not learning-Lack of access to radio	38	10.5	-0.4	21.4	25	12	-2.3	26.3	13	7.7	-8.3	23.7	4.3
Reason for not learning-Lack of access to internet	38	10.5	-0.4	21.4	25	12	-2.3	26.3	13	7.7	-8.3	23.7	4.3
Reason for not learning-Lack of access to educational programmes	38	23.7	12.1	35.3	25	4	-4.2	12.2	13	61.5	34.1	89	-57.5***
Reason for not learning-Lack of access to textbooks or learning materials	38	18.4	5.5	31.3	25	16	0.3	31.7	13	23.1	0.5	45.6	-7.1
Reason for not learning-Lack of motivation	38	5.3	-2.4	12.9	25	8	-3.7	19.7	13	0			8
Reason for not learning-Lack of support from teachers and schools	38	7.9	-1.5	17.3	25	8	-3.7	19.7	13	7.7	-8.3	23.7	0.3
Reason for not learning-Children are taking care of their siblings	38	5.3	-1.6	12.1	25	8	-2.4	18.4	13	0			8
Reason for not learning-Children are doing housework	38	5.3	-2.4	12.9	25	8	-3.7	19.7	13	0			8
Reason for not learning-Lack of supervision from adults in the household	38	5.3	-2.4	12.9	25	8	-3.7	19.7	13	0			8
Reason for not learning-There is not a good/quiet place to study	38	5.3	-2.4	12.9	25	8	-3.7	19.7	13	0			8
Reason for not learning-Children need to spend their time doing other things	38	28.9	14.2	43.7	25	36	15.7	56.3	13	15.4	-1	31.8	20.6
Reason for not learning-Other	38	10.5	0.2	20.9	25	16	0.3	31.7	13	0			16.0**

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

Table 28: Engagement in learning activities at home at midline (Household level indicators) – continued

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
	N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI		N	%	Lower CI	Upper CI	N	%	Lower CI	Upper CI	
Children engaged in learning at home-Yes, all of them	239	53.1	47.1	59.2	262	58.4	52.9	63.9	-5.3	225	59.6	53.7	65.5	248	51.6	45.8	57.4	7.9*
Children engaged in learning at home-Yes, most of them	239	23.8	18.6	29.1	262	24.4	19.6	29.2	-0.6	225	22.2	17.1	27.4	248	26.6	21.5	31.7	-4.4
Children engaged in learning at home-Yes, some of them	239	15.1	10.6	19.5	262	8.8	5.4	12.2	6.3**	225	9.3	5.6	13	248	13.7	9.5	17.9	-4.4
Children engaged in learning at home-None of them	239	7.1	3.9	10.3	262	8	4.7	11.3	-0.9	225	8.9	5.2	12.6	248	6.9	3.7	10	2
Children engaged in learning at home-No school-going children	239	0.8	-0.3	2	262	0.4	-0.4	1.1	0.5	225	0			248	1.2	-0.1	2.6	-1.2*
At least some children engaged in learning at home (of those with school-going children)	237	92.8	89.6	96.1	261	92	88.7	95.2	0.9	225	91.1	87.4	94.8	245	93.1	89.9	96.2	-2
Type of learning at home-Educational TV programmes	220	0.9	-0.3	2.2	240	0			0.9	205	0			228	0.4	-0.4	1.3	-0.4
Type of learning at home-Radio education programmes	220	1.8	0.1	3.6	240	2.5	0.6	4.4	-0.7	205	2.4	0.4	4.5	228	1.8	0	3.5	0.7
Type of learning at home-Books provided by school	220	42.3	35.9	48.6	240	40	34	46	2.3	205	46.3	39.7	53	228	35.5	29.6	41.5	10.8**
Type of learning at home-Their own school books	220	90	86.1	93.9	240	88.8	84.8	92.7	1.3	205	90.7	86.8	94.7	228	88.2	84	92.4	2.6
Type of learning at home-Books we have in the household	220	19.1	13.9	24.2	240	17.5	12.7	22.3	1.6	205	19	13.7	24.4	228	16.7	11.8	21.5	2.4
Type of learning at home-Teaching by household members	220	13.2	8.8	17.6	240	13.8	9.4	18.1	-0.6	205	12.7	8.1	17.2	228	14.5	9.9	19	-1.8
Type of learning at home-Community	220	4.5	1.9	7.2	240	3.8	1.4	6.1	0.8	205	4.9	1.9	7.8	228	3.1	0.9	5.3	1.8

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
members/neighbours are teaching them																		
Type of learning at home-Educational content available on mobile phone	220	4.5	1.8	7.3	240	2.1	0.3	3.9	2.5	205	2	0.1	3.8	228	3.5	1.1	5.9	-1.6
Type of learning at home-Other	220	0.5	-0.4	1.3	240	0			0.5	205	0.5	-0.5	1.4	228	0			0.5
Reason for not learning-Lack of access to television	17	0			21	0			0	20	0			17	0			0
Reason for not learning-Lack of access to radio	17	17.6	-2.2	37.5	21	4.8	-5.1	14.6	12.9	20	10	-4.8	24.8	17	11.8	-5.2	28.7	-1.8
Reason for not learning-Lack of access to internet	17	17.6	-3.5	38.8	21	4.8	-5.1	14.6	12.9	20	0			17	17.6	-3.9	39.2	17.6
Reason for not learning-Lack of access to educational programmes	17	23.5	6.5	40.5	21	23.8	6.9	40.7	-0.3	20	20	6.7	33.3	17	23.5	4.8	42.3	-3.5
Reason for not learning-Lack of access to textbooks or learning materials	17	17.6	-0.1	35.4	21	19	0.5	37.6	-1.4	20	30	8.4	51.6	17	5.9	-5.6	17.4	24.1 **
Reason for not learning-Lack of motivation	17	0			21	9.5	-4.2	23.3	-9.5	20	10	-4.4	24.4	17	0			10
Reason for not learning-Lack of support from teachers and schools	17	11.8	-5.3	28.8	21	4.8	-5.1	14.6	7	20	0			17	11.8	-5.7	29.2	- 11.8
Reason for not learning-Children are taking care of their siblings	17	0			21	9.5	-2.8	21.9	-9.5	20	10	-3.2	23.2	17	0			10
Reason for not learning-Children are doing housework	17	5.9	-6.4	18.1	21	4.8	-5	14.5	1.1	20	5	-5.4	15.4	17	5.9	-6.3	18.1	-0.9
Reason for not learning-Lack of supervision from adults in the household	17	11.8	-4.7	28.3	21	0			11.8	20	5	-5.4	15.4	17	5.9	-6.3	18.1	-0.9
Reason for not learning-There is not a good/quiet place to study	17	0			21	9.5	-4.2	23.3	-9.5	20	5	-5.1	15.1	17	5.9	-6.4	18.1	-0.9
Reason for not learning-Children need to spend their time doing other things	17	35.3	11.6	59	21	23.8	4.6	43	11.5	20	15	-2.3	32.3	17	47.1	20.4	73.7	- 32.1 **

Indicator	Male Headed Household				Female Headed Household				Diff	CT-OVC				OP-CT				Diff
Reason for not learning-Other	17	5.9	-6.4	18.1	21	14.3	-1.2	29.7	-8.4	20	15	-1.5	31.5	17	5.9	-6.3	18.1	9.1

Source: OPM Mwangaza Mashinani Midline Survey (2020). **Note:** Asterisks indicate statistically significant differences between the two groups: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

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