The Boma Health Initiative

# Costing and Investment Case Analysis

April 2019

Foreword

Launched on the 30th of March 2017, the Boma Health Initiative (BHI) is our main strategy for mobilising action at the household and community level for reducing the high rates of ill health and preventable, premature deaths in South Sudan. We defined a cost-effective and high-impact service package that is well aligned with the health priorities of the country which include the integrated community case management, safe motherhood, and the control of common communicable diseases and epidemics. The Ministry of Health (MOH), in collaboration with partners, has developed training materials, registers, and reporting tools for implementing the initiative.

The MOH, with funding from the Government of Canada as well as technical support from the United Nations Children's Fund (UNICEF) and Management Sciences for Health (MSH), developed the Costing and Investment Case Analysis for the Boma Health Initiative that estimates the future costs as well as the deaths that could be averted if the initiative is efficiently implemented. The cost of the BHI has been estimated according to three coverage scenarios while the deaths averted have been estimated according to potential changes in the coverage of key health interventions. It has been demonstrated that under the high coverage scenario, BHI implementation will lead to a significant increase in access to community health services, contributing to significant reduction in preventable deaths over a ten-year period. However, unless current health system bottlenecks are addressed, the BHI will not be able to achieve its full potential.

We are grateful to MSH, UNICEF, non-governmental organisations (NGOs), implementing partners, and MOH staff for their participation and professional inputs in developing the investment case. The process of developing the investment case required obtaining clarity on BHI functions, developing assumptions, setting standards for those assumptions, establishing baselines for services coverage and mortality rates. The assumptions and standards are rooted in our own polices and home-grown practices.
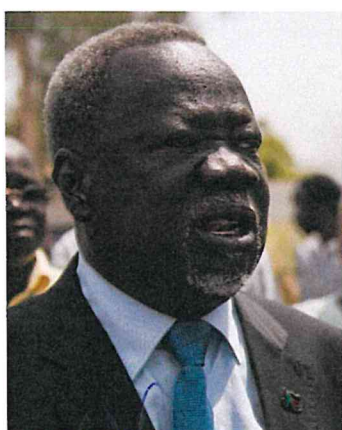
This document will serve as a resource to the MOH, donors, and implementing partners in advocacy and resource mobilisation efforts. The assumptions and standards should guide programme planning, implementation, and the monitoring and evaluation of inputs, processes, outputs, and impact of the BHI.

I call upon all related government Ministries, Departments and Agencies, donors, United Nations agencies, implementing partners, as well as civil society to judiciously use this investment case to advocate and mobilise resources for implementing the BHI as we strive to reduce the considerable number of deaths that may occur by 2028 in the absence of effective community health interventions.

Dr. Riek Gai Kok
Honourable Minister of Health,
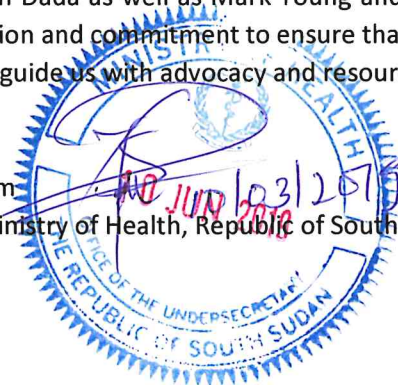Ministry of Health, Republic of South Sudan

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Acknowledgements

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Acronyms

ACT	Artemisinin-based combination therapy
AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal care
BCC	Behaviour change communication
BHC	Boma Health Committee
BHI	Boma Health Initiative
BHT	Boma Health Team
BPHNS	Basic Package of Health and Nutrition Services
CH	County Hospital
CHS	Community health services
CHW	Community health worker
DOTS	Directly observed treatment, short course
FP	Family planning
GFF	Global Financing Facility
GOSS	Government of South Sudan
HHP	Home Health Promoter
HIV	Human Immunodeficiency Virus
HMIS	Health management information system
HPF	Health Pooled Fund
HSSP	Health Systems Strengthening Project
iCCM	Integrated community case management
IPTp	Intermittent preventive treatment of malaria in pregnancy
ITN	Insecticide-treated net
KM	Kilometre
LiST	Lives Saved Tool
LLIN	Long-lasting insecticide treated net
MSH	Management Sciences for Health
MOH	Ministry of Health
NGO	Nongovernmental Organisation
NTD	Neglected tropical disease
ORS	Oral rehydration solution
PBI	Performance-based incentive
PHCC	Primary Health Care Centre
PHCU	Primary Health Care Unit
PNC	Postnatal care
RDT	Rapid diagnostic test
ROSS	Republic of South Sudan
SDG	Sustainable Development Goal
SMOH	State Ministry of Health
SSP	South Sudanese Pound
TB	Tuberculosis
UHC	Universal Health Coverage

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UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
US	United States
USD	United States dollar
WASH	Water, sanitation, and hygiene

Executive Summary

After four decades of civil war, the Republic of South Sudan (ROSS) has sought to build and strengthen its health system which, at the time of gaining independence in 2011, was unable to meet the basic health needs of its people. Amidst a critical shortage of trained health workers and limited access to health services, the country has experienced and continues to experience some of the worst health indicators globally. The estimated under-five mortality rate has declined since 1990 but is still one of the highest in the world at 96 deaths per 1,000 live births.[1] Seventy-five per cent of child deaths are attributed to the preventable diseases of diarrhoea, malaria, and pneumonia.[2] Nearly one in one hundred pregnant women die due to maternity related complications,[3] with only eight per cent of deliveries attended by skilled birth attendants.[4] An estimated 83 per cent of the population lives in rural areas[5] and 75 per cent of the population lives further than one-hour walking distance from a facility.[6] Consequently, the estimated coverage of essential health services (Sustainable Development Goal indicator 3.8.1) is 30 per cent, far below the 42 per cent average of Sub-Saharan Africa.[7]

To address these challenges, the Government of South Sudan (GOSS) launched the Boma Health Initiative (BHI) in March 2017 to improve access to community health services (CHS), strengthen linkages between communities and health facilities, and improve the governance of CHS. The BHI strategy aims to reduce preventable ill health and deaths by increasing the equitable utilisation of services and the participation of communities in health activities, thereby ensuring the sustainability of the community health structure and services.

The BHI is intended to replace the current fragmented CHS that are provided by NGOs with funding from different donors, and under which a variety of preventive, curative, and promotional services are provided. A lack of coordination among partners and government has led to problems such as duplicated and fragmented training, supervision, reporting, and incentives, which have contributed to resource wastage and a lack of clarity on the roles and responsibilities of CHWs.[8] Due to the limited staff capacity and critical shortage of personnel, involvement of Ministry of Health (MOH) staff in programme management and supervision has been minimal. Under the BHI this would change - CHS would be led by the government and would become part of the national health system.

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Through the BHI, trained community health workers (CHWs) will be responsible for delivering a standard integrated package of promotional, preventive, and selected curative health services at the Boma level (i.e., the basic unit of local government). These services will focus on Child Health, the Communicable Disease Control, Safe Motherhood, and Health Management Information System and Surveillance. In addition, CHWs will be trained on disease surveillance and the reporting of service delivery data and vital statistics.

The GOSS and international donors recognise the BHI as a critical strategy for increasing access to essential, lifesaving health services at the community level; however, there is a need to know the future costs, required financing, and expected health impact. Moreover, it is crucial to identify health system bottlenecks that could impede the successful implementation of the BHI.

The MOH, with support from the United Nations Children's Fund (UNICEF) South Sudan and Management Sciences for Health (MSH), developed the BHI Costing and Investment Case Analysis. The objective of this analysis was to make a compelling argument for investing resources in the BHI and to persuade key stakeholders and donors of the public health benefits of the BHI. The results include a comprehensive analysis of the total programme costs, financing gaps, expected health impact, and key bottlenecks. Recommendations are also provided which may be useful in guiding future programming.

In-country data collection took place from November to December 2017 and included consultations with a discussion panel to help define the BHI package of services, incidence and utilisation rates, and service delivery standards. MSH used the UNICEF/MSH Community Health Planning and Costing Tool to analyse the data and to estimate the future costs of the BHI under different coverage scenarios. It was agreed with the MOH that this cost modelling would cover the initial service package as described in Annex 1 of this report (and Annex 2 of the BHI Implementation Guidance document[i]), which is presently being rolled out in 2018. The comprehensive package of services, which is also described in that document, contains other services that can be added later to the costing tool.

The following is a synopsis of the results of the study, which are further described in the body of this report.

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[i] South Sudan Ministry of Health. March 2016. The community health System in South Sudan: "The Boma Health Initiative": a community anchored health system for sustainable health sector development.

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Bottlenecks: The successful implementation and scale-up of the BHI requires addressing a number of bottlenecks within the health system that currently limit the supply of, demand for, and quality of CHS. The current bottlenecks, which may not apply to all areas of the country, are relevant and applicable to the future implementation of the BHI.

The supply of CHS is impeded by frequent stock-outs and the irregular provision of medicines, commodities and supplies, high distribution costs, low levels of pharmaceutical management capacity and reporting, and minimal storage space. While the projected costs include sufficient funding to procure the necessary medicines, commodities and supplies, they do not cover the high distribution costs or the costs of resolving the other supply chain bottlenecks. Also, a lack of qualified personnel (i.e., those who do not meet the recruitment criteria) at the Boma level will likely make the recruitment of CHWs difficult. CHW attrition is a common challenge for community health programmes in South Sudan and it is not clear if the salaries and performance-based incentives included in the BHI will be sufficient to alleviate this problem. Insufficient coverage of CHWs, particularly in large Bomas and in areas experiencing insecurity, represents a barrier to improving access to services.

The demand for CHS is also hampered by a lack of community knowledge and awareness of CHS as well as misinformation (including myths and misconceptions) and gender barriers. These factors could contribute to a low uptake and acceptance of BHI services by some communities. Moreover, a lack of buy-in from the entire community, particularly during the CHW selection process and beginning stages of the BHI implementation, can also lead to distrust and low acceptance of CHS. The promotion of the BHI in communities could help to resolve this issue; however, such promotion costs have not been included in the cost analysis.

The limited capacity of CHWs and supervisors, weak linkages between CHWs and health facilities, and shortages of equipment have been identified as current challenges. However, it assumed that these challenges will be resolved through training and equipping of CHW and supervisors, as planned with the implementation of the BHI.

Recommendations for addressing these bottlenecks are detailed in the report.

Key assumptions for modelling: It is assumed there would be three CHWs per Boma (as per MOH guidelines) resulting in a total of 6,408 CHWs serving all 2,136 Bomas throughout the country. CHWs would receive regular supervision visits from the Payam Health Officer. The programme would be supported and managed by MOH personnel at all levels of the health system. While it is assumed that the GOSS will continue to engage with and rely on NGOs for the implementation of the BHI, this analysis did not include the costs of national and international NGO support. The analysis assumes that training, support, supervision, and management are provided by the MOH and not by the NGOs, as is currently the case.

Scenarios: For this analysis, three BHI scale-up scenarios (2018-2028) were modelled:
- **Low coverage** – coverage increasing by 2 per cent per year[ii] to 30 per cent coverage in 2028;
- **Medium coverage** – coverage increasing by 4 per cent per year to 50 per cent coverage in 2028;
- **High coverage** – coverage increasing by 7 per cent per year to 80 per cent coverage in 2028.

Number of services: It was not possible to collect baseline data showing the numbers of services provided in 2017 or 2018 as aggregated national figures were not available and due to the likely time constraints of collecting data from all of the NGOs. Therefore, it was agreed to assume baseline coverage rates for 2018 as 10 per cent for integrated community case management (iCCM) and antenatal care (ANC)/postnatal care (PNC) services, three per cent for male condoms,[iii] and 100 per cent for community mobilisation for immunisations, communicable disease outreach, and behaviour change communication (BCC). Based on these assumptions, the CHWs would provide a total of 4.4 million health services in 2018.[iv] In 2028, the number of health services would increase to 17.8 million under the low coverage scenario, 30.1 million under the medium coverage scenario, and 48.6 million under the high coverage scenario. In all three scenarios, the majority of services would be for Child Health followed by Communicable Disease Control, and Safe Motherhood.

[ii] Two percent of total need, not two percent of the previous year's level.
[iii] Assumption based on the total population of male adults (15-59 years) and 3% of sexually active males who used a condom in the last sex act in 2016.
[iv] Services are measured in terms of encounters. Examples of an encounter are (1) treating one case of malaria, (2) an ANC visit to a pregnant women, and (3) a BCC talk to a group of people.

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Cost results: The baseline total cost of coverage under the initial package (assuming at least 10 per cent coverage) in its first year (2018) would be US $19.9 million, comprised of US $9.0 million for equipment and training costs and US $10.9 million in recurrent costs. This figure assumes that all of the CHWs would need training and equipment, which may not be the case if some CHWs are already in place and are supported by the MOH and NGOs. The costs in 2028 would US $23.8 million, US $28.5 million and US $35.5 million for the low, medium and high scale-up scenarios, respectively. These 2028 figures include US $6.3 million for the replacement of equipment, which is assumed to be necessary every 5 years. The highest single cost in 2018 is for CHW salaries, which comes to US $7.0 million per year, which includes US $3.8 million per year in performance-based incentives. By 2028, medicines and supplies would be the highest cost under the medium and high coverage scenarios, while CHW salaries would remain the highest single cost under the low coverage scenario. It should be emphasised that these are the costs of the initial package of services from the provider perspective and do not include the costs of NGO support or the cost of removing bottlenecks. All costs were calculated in or converted to 2018 US dollars and do not take inflation into account.

Based on the estimated baseline coverage in 2018, the CHWs would use 38 per cent of their available 35 hours per week and by 2028 they would use 78 per cent under the low coverage scenario. Under the medium and high coverage scenarios, the CHWs would be fully occupied by 2027 and 2024, respectively, and would need 14 per cent and 68 per cent more hours by 2028, respectively.

If CHWs cannot reduce number of interventions or the time spent on certain interventions from 2025 onwards then they would have to spend more time or additional CHWs would need to be recruited. Both of these options would result in increased costs which are not included in this analysis. Additionally, under both the medium and high scenarios it would not be possible to expand the package of services while maintaining the targeted rates of coverage. With the cost of CHW remuneration being a major element of the total cost (and representing a relatively fixed cost), a key aspect of the programme will be to ensure that the time of CHWs is fully utilised and that they work efficiently and productively to maximise the health impact.

In 2019 under the low scenario, the majority of the recurrent costs would be for Child Health (US $7.9 million), followed by Communicable Disease Control (US $6.8 million), Safe Motherhood (US $3.1 million), and Health Management Information System (HMIS) and Surveillance (US $1.9 million). This pattern would remain the same through to 2028 under all three scenarios.

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Health impact: Based on the projected increases in coverage (of the initial package under the high coverage scenario), it is estimated that by 2028 a total of 113,970 deaths could be averted compared to the baseline coverage scenario. These would be comprised of 24,675 neonatal deaths averted, 87,651 child (1-59 months) deaths averted, and 1,644 maternal deaths averted. These only represent the benefits in terms of lives saved and do not take into account reductions in morbidity which would have beneficial impact on areas like education and economic productivity. The mortality and morbidity benefits would be even greater when the comprehensive package of services is implemented.

To further guide the implementation of the BHI, additional research may be necessary. This includes an analysis of which geographic areas are suitable for the initial implementation of the BHI and a costed analysis of the proposed solutions to the bottlenecks. In addition, a feasibility analysis examining the proposed transition of the management of community health programmes from the NGOs to the MOH will be crucial. To date, no other studies on the cost and impact of integrated CHS programmes have been conducted in fragile states similar to South Sudan and therefore there are no directly comparable data from other countries.

**Inclusion of addendum:

Upon validation of this report and the results of the analysis, the MOH requested revisions to certain parameters and assumptions of the cost models. The purpose of these revisions and the corresponding results were to estimate the future costs and financing requirements of the introduction of the BHI in select geographic regions over a five-year period instead of at a national scale over a 10-year period, as modelled in this report. The MOH requested four new modelled scenarios which would reflect different geographical coverage of the programme and assume that CHWs will only serve the 56 per cent of the rural population living more than five kilometres from a functional health facility. The MOH intends to use these results to advocate for and mobilize financial resources from the GOSS and partners for the implementation of the BHI.

The addendum can be found in at the end of this document.

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1. Introduction

1.1. Context of the study

This study follows the recommendations of the 2015 report entitled "Strengthening Primary Health Care through Community Health Workers: Investment Case and Financing Recommendations" (Dahn et al., 2015). The report demonstrates that at the global level, investments in community health can generate significant gains in terms of health, but also economic and societal gains (Figure 1. The pillars of investment case for community health workers).

Figure 1. The pillars of investment case for community health workers

3 million	• Expanding access to key interventions provided by community health workers could prevent up to three million deaths per year.
UHC	• Investment in community health workers will be essential in achieving Universal Health Coverage (UHC), meeting the core capacities of the International Health Regulations, and reaching other critical health objectives.
10:1	• Investment in community health workers in Sub-Saharan Africa can result in an economic return of up to 10:1, due to increased productivity from a healthier population, potentially reducing the risk of epidemics such as Ebola, and the economic impact of increased employment.
Savings	• Scale-up of community health workers can create short-term cost savings in other parts of the health system, including reductions in the number of patients treated at facilities.
Societal benefits	• Community health worker systems yield additional societal benefits including empowerment of women and increases in income for households of paid community health workers.

Source: Dahn B., et al. 2015.[9]

After four decades of civil war, renewed conflict has exacerbated South Sudan's fragile health system which is plagued by a shortage of trained health personnel, low coverage of essential health services, and which experiences some of the worst health indicators globally. The country's under-five child mortality rate remains at 96 deaths per 1,000 live births[10] with the vast majority (75 per cent) of deaths attributed to the preventable diseases of diarrhoea, malaria, and pneumonia.[11] An estimated one in one hundred pregnant women die due to maternity related complications[12] with less than eight per cent of deliveries being attended by skilled birth attendants and only 15 per cent of deliveries occurring in health facilities.[13]

In this context, the role of CHWs is critical in extending access to some basic health services for under-served populations, addressing high rates of preventable maternal and child morbidity and mortality, and reinforcing linkages to the country's primary health care system. Prior to, and after gaining independence in 2011, multiple community level interventions have been introduced to bridge the gap in health services.

However, the majority of community-based programmes have been highly vertical (i.e., disease-focused) and have been led by NGOs with limited involvement of the government. Moreover, programmes have not been harmonised and have lacked a standardised approach to training, supportive supervision, and reporting, among other key programmatic elements.

To improve access to and strengthen the delivery of CHS and further institutionalise the role of CHWs, the President of the ROSS formally launched the National Health Policy (2016-2026) and the BHI in March 2017. The BHI is a community health systems strengthening strategy designed to close the gap between health facilities and communities. It is designed to increase the equitable uptake of CHS and the participation of communities in health activities while promoting ownership and sustainability of CHS and the community health structure. The BHI is expected to significantly reduce ill health and deaths.

The BHI, when established at the Boma health level (i.e., the basic unit of local government), is expected to deliver an integrated package of services. As outlined in the 2016 BHI Implementation Guidelines, the initial package will cover health promotion (e.g., ANC and PNC), disease prevention (e.g., provision of condoms and support for long-lasting insecticide treated net [LLIN] distribution and use), and selected treatment services (e.g., malaria, pneumonia, and diarrhoea diagnosis and treatment for children under five years old). Additional services will be incrementally included to form the expanded, comprehensive package of BHI services once the initial package has been successfully implemented.

The BHI is intended to replace the current fragmented CHS which are provided by NGOs with funding from different donors, and under which a variety of preventive, curative, and promotional services are provided. A lack of coordination among partners and government has led to problems such as duplicated and fragmented training, supervision, reporting, and incentives, which have contributed to resource wastage and a lack of clarity on the roles and responsibilities of CHWs.[14] Due to the limited staff capacity and critical shortage of personnel, involvement of MOH staff in programme management and supervision has been minimal. Under the BHI this would change - CHS would be led by the government and would become part of the national health system.

The BHI will rely on trained, equipped, and salaried CHWs formed into Boma Health Teams (BHTs) comprised of three CHWs per Boma as well as volunteer Home Health Providers (HHPs)[v] with support from Boma Health Committees (BHCs). As per the selection process, CHWs are to be nominated by their community and recommended by the BHC for recruitment into the public service. Moreover, they are to meet a number of eligibility requirements including having a primary education, being a permanent resident in the Boma, and speaking the local language of the community. The MOH (at the Payam, State, Regional, and National levels), with support from its implementing partners, will be responsible for supervising, managing, and supporting CHWs. Also, the MOH and partners will be responsible for equipping, training, and supplying CHWs and supporting the Payam Health Office.

This study was conducted by MSH and UNICEF to provide information on the future costs of and required financing for the BHI as well as the current bottlenecks that may affect its successful implementation. The analysis also estimates the expected health benefits (in terms of lives saved) using the Lives Saved Tool

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[v] The costs of training, equipping, and supporting HHPs are not included in this analysis.

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(LiST). This analysis is intended for the GOSS, donors, and implementing NGO partners to help them with advocacy, planning, and financing.

1.2. Objectives of the analysis

The objectives of this analysis were as follows:

- Model the cost of implementing the BHI nationally;
- Prepare financing options for the national BHI;
- Determine the impact of the investment on deaths averted;
- Identify and analyse key bottlenecks; and
- Provide recommendations to guide the implementation of the BHI.

The cost models corresponding to each scenario and the LiST file corresponding to the high-impact scenario will be provided to the MOH and UNICEF. These models can be used to conduct future analyses including the modelling of alternative scenarios (e.g., expanding the package of services or geographic coverage) and can be adapted for use at the sub-national levels.

1.3. Methodology

Methods and tools

This analysis built upon previous CHS costing and investment case analyses in Sub-Saharan Africa, in particular those conducted in Madagascar[vi] for UNICEF and the Ministry of Health (Ministère de Santé Publique) and in Nigeria[vii] and Burkina Faso[viii] [ix] for the Ministry of Health. MSH also incorporated data and lessons learned in conducting a costing analysis of an iCCM programme implemented by Save the Children in Kapoeta North County, South Sudan in 2014.[x]

The modelling was done using the *Community Health Planning and Costing Tool* (developed by MSH for UNICEF) which has been used in Burkina Faso, Madagascar, Malawi, and Sierra Leone[xi] to support plans for implementing and scaling up national community health programmes. The analysis also draws upon other methodologies which have been used to develop investment frameworks such as the Global

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[vi] Dukhan, Y, Gilmartin, C and D. Collins. "Scaling-up Community Health in Madagascar: Prioritization and Costing of the Health Service Packages." 2017.

[vii] Saya, U. and D. Collins. "The Cost and Impact of Introducing Integrated Community Case Management in Nigeria: Studies from Benue and Kebbi States." 2015.

[viii] Gilmartin, C., Yaya Bocoum, F, and D. Collins. "Dossier d'Investissement en Santé Communautaire au Burkina Faso (2019 – 2023)." 2019.

[ix] Jarrah, Z., C. Gilmartin, and D. Collins. "The Cost and Impact of Integrated Community Case Management (iCCM) in Burkina Faso: Studies from the Nord, Centre-Nord, and Boucle du Mouhoun Regions." 2015.

[x] Jarrah, Z., S. Patel, C. Gilmartin, and D. Collins. "The Cost of Integrated Community Case Management in Kapoeta North County, South Sudan." 2014.

[xi] Management Sciences for Health. *Scaling up Community Health in Madagascar: Prioritization and Costing of the Health Service Packages*. (2017).

Management Sciences for Health. *Modelling the Cost of Community Health Services in Sierra Leone: the Results of Piloting a New Planning and Costing Tool*. (2016).

Management Sciences for Health. *Modelling the Cost of Community Health Services in Malawi: the Results of Piloting a New Planning and Costing Tool*. (2016).

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Financing Facility (GFF) for Reproductive, Maternal, Newborn, Child, and Adolescent Health, and UNICEF's seven-step approach to conducting a situation analysis (Figure 2).

Figure 2. UNICEF seven-step approach to conducting a situation analysis and identifying priority actions in health systems strengthening[xii]
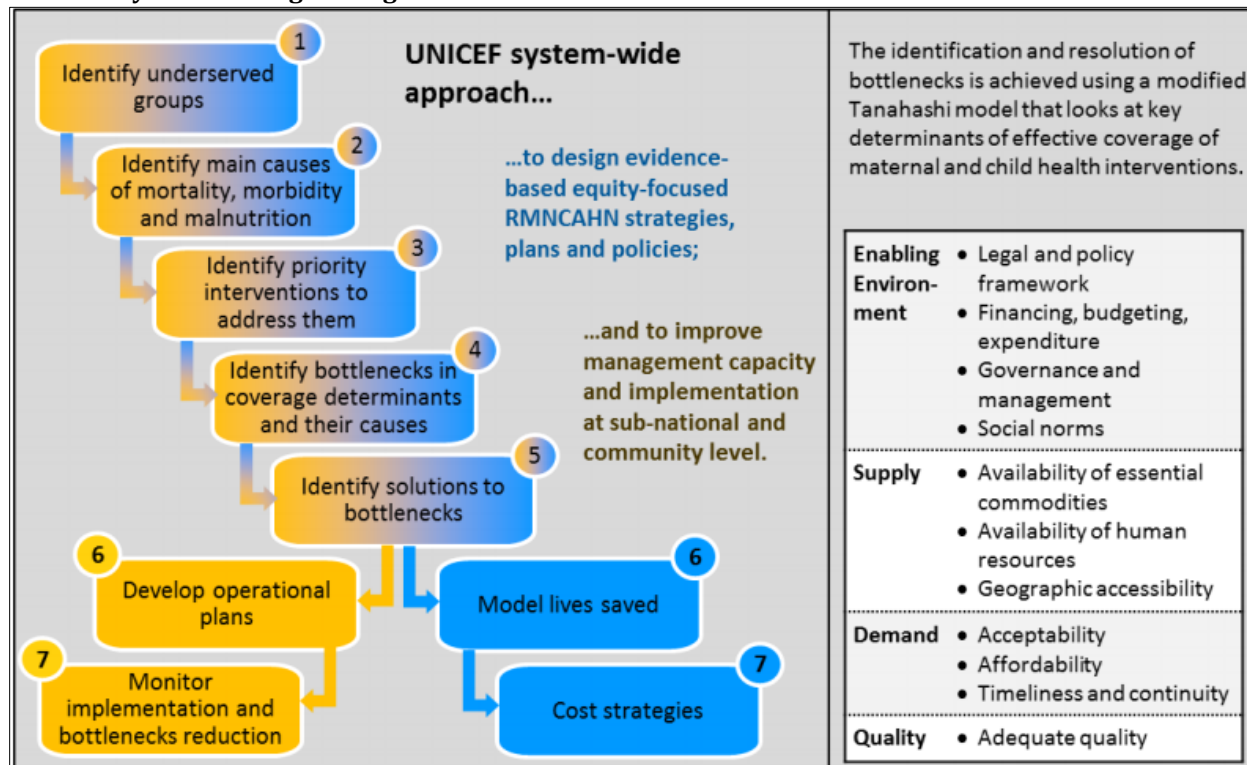
Source: UNICEF (2016).

Using the tool, cost models were developed to estimate the cost of implementing the BHI package under different scenarios. A bottom-up or "ingredient-based" approach was used to calculate the costs. The data used for this analysis are normative and are intended to reflect the cost of providing good quality services according to standard protocols. The normative costs were based on available data – the latest available ROSS national salary scale (2008) was used for salaries and the unit prices for medicines were taken from the International Medical Products Price Guide.[xiii] The costs of meetings, training, and performance-based incentives were provided by the GOSS, while the unit costs of equipment were averages of those provided by NGOs.

The normative resources required to provide each health intervention were estimated based on service delivery protocols and standards, thus establishing the standard cost of an intervention (e.g., diagnosing and treating a child for malaria). The standard cost of each intervention was then multiplied by the

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[xii] UNICEF, 2016. "UNICEF Approach to Health Systems Strengthening." A Resource Paper for the UNICEF Strategy for Health 2016-2030. April 2016

[xiii] Management Sciences for Health. International Medical Products Guide. Accessed January 10, 2018. Available at: http://mshpriceguide.org/en/home/

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number of interventions,[xiv] thus providing the total standard cost of the intervention. Indirect costs, such as supervision and management, were allocated to all interventions based on the total time required by the CHWs for each intervention. The total direct and indirect costs for each intervention were then aggregated to provide the total cost of the intervention package. The numbers of services and related costs were projected over a ten-year period (2018-2028). These calculations were carried out automatically in the tool.

Impact on health: The potential impact of the BHI was assessed using SPECTRUM, a software program[xv] that provides decision makers with an analytical tool to support decision-making. MSH used the Lives Saved Tool (LiST) to model the impact of increasing CHS coverage on infant and maternal mortality rates over a period of ten years. The results demonstrate the return on investment in terms of the decline in mortality associated with different levels of coverage of high-impact health interventions. LiST, developed by Johns Hopkins University with funding from the Bill and Melinda Gates Foundation, is a model that estimates the impact (in terms of the life saved of new-borns, children, and mothers) based increases or reductions in the coverage of new-born, child, and maternal health interventions. LiST calculates the impact of scale-up scenarios using two key inputs: the effectiveness of clinical interventions and changes in coverage levels of these interventions.

Bottleneck analysis: Current and potential future bottlenecks were identified by a discussion panel meeting. It was not possible to quantify the effect of the bottlenecks on targeted coverage rates due to time constraints. Nor was it possible to determine solutions for the removal of the bottlenecks and the costs of those solutions for the same reason.

Annex 2 provides an overview of the key data assumptions and sources of data used for this analysis.

Approach and main steps of the analysis
The approach and methodology for this analysis are described in the UNICEF/MSH Community Health Services Planning and Costing Handbook.[xvi] In South Sudan, the work was carried out in several main stages:

(1) *Preliminary work*: This phase included a review of the existing literature and MOH strategies related to community health. This information provided a basis for the situation analysis.
(2) *Data collection*: the data collection took place in South Sudan over a period of three weeks beginning in November 2017. Dr. Alfred Driwale (consultant) met with representatives from the MOH, partners, and NGOs supporting CHS. The visit also included a discussion panel (comprised of representatives of the MOH, UNICEF, and key NGO partners) to determine and validate the package of CHS and incidence and utilisation rates, as well as service delivery standards. Data were entered into the cost models following the mission.

[xiv] For example, the standard cost for treating one case of diarrhea is US $0.29 for ORS and zinc and this is estimated to take a CHW 45 minutes to diagnose and treat a child at the CHW's house, with no time needed for travel.
[xv] SPECTRUM (http://www.avenirhealth.org/software-spectrum.php).
[xvi] UNICEF/MSH. Community Health Services Planning and Costing Handbook. September 2016. Available at www.msh.org.

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(3) *Analysis*: Following the data collection, a consultative validation exercise was undertaken with the MOH and other stakeholders to get feedback on the preliminary results before the analysis was completed.

(4) *Report:* Upon finalising the analysis, a final report and technical brief were completed and submitted to the MOH and UNICEF along with copies of the cost and LiST models.

Data collection

Data were collected on the numbers and types of services, salaries, prices, norms and standards, and bottlenecks. Due to security reasons, these data were collected at the national level in Juba although the data and bottlenecks included in the report reflect those at the sub-national levels.

Data collection from partners. A series of checklists were used to collect the data required for the analysis from the MOH, UNICEF, and implementing NGOs that support community health programmes which helped to determine the input prices used in the cost models.

Discussion panel meeting. The discussion panel meeting was attended by representatives from the MOH, UNICEF, and key NGO implementing partners and was used to identify the package of services, incidence and utilisation rates, service delivery standards (including drugs and supplies required and the estimated time spent per service), and to help identify bottlenecks. See Annex 3 for the list of discussion panel participants.

A number of limitations were identified before and during the course of the analysis. These are further described in Section 7 of the report.

South Sudan - Boma Health Initiative Costing and Investment Case Analysis

2. Country context and situation analysis

After decades of civil war and a short-lived peacetime, the newly independent ROSS has experienced ongoing conflict as well as humanitarian and economic crises, exacerbating the needs of its fragile population and reversing many of the country's previous advances in development. Since 2013, the civil war has uprooted more than four million people including an estimated 1.9 million internally displaced persons[15] and more than two million refugees who have fled to neighbouring countries.[16] Meanwhile,

attacks on civilians and incidents of gender-based violence have been rampant and often go unreported.[17] As of 2018, an estimated seven million people were in need of humanitarian assistance in the absence of basic services such as emergency shelter, housing, healthcare, education, nutrition, and water and sanitation (WASH). At the same time, the country has experienced hyperinflation,[xvii] rising food prices, and a sharp increase in poverty,[xviii] signalling a worsening economic situation.

[xvii] The annual inflation increased by 661.3 percent from July 2015 to July 2016 and by 730 percent from August 2015 to August 2016. Source: World Bank (http://www.worldbank.org/en/country/southsudan/overview)
[xviii] The incidence of poverty has increased from 44.7 percent in 2011 to 65.9 percent in 2015. Source: World Bank (http://www.worldbank.org/en/country/southsudan/overview)

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South Sudan faces unprecedented challenges due to the continued instability. It remains one of the least developed and impoverished countries in the world, ranking 181 out of 188 countries on the Human Development Index.[18] Many South Sudanese have never received formal education and only 27 per cent of the population is literate.[19] Eighty per cent of its estimated 12.3 million people[20] live on less than one US dollar (USD) per day[21] with the majority (85 per cent) of the country's economy concentrated in non-wage work, mainly subsistence agriculture and livestock husbandry.[22] Despite the country's vast oil reserves, production has decreased in recent years while international prices have fallen, intensifying the country's bleak economic outlook.

The renewed conflict and emergency response have detracted efforts to build and strengthen South Sudan's health system which, at the time of independence, was virtually non-existent and therefore has been unable to meet the basic health needs of its people. Following a withdrawal of many international partners,[xix] the country faces a critical shortage of trained health personnel. Plagued by recent and frequent disease outbreaks[xx] as well as ongoing humanitarian emergencies, its limited health workforce is focused on addressing the immediate needs of the population.

South Sudan also has extremely low coverage of essential health services. An estimated 22 per cent of the 1,893 health facilities are non-functional while 955 facilities are operating at 10 per cent capacity due to a lack of trained staff, stock-outs of medicines and supplies, delays in salary payments, and vandalism and looting.[23] There are an estimated 47.6 nurses and midwives per 39,088 persons and one physician per 65,574 persons[24] while access to qualified service providers remains low. An estimated 83 per cent of the population lives in a rural area[25] – only 25.7 per cent of the population lives within one-hour (walking) of a facility and only 28.6 per cent of the population lives within five kilometres (km) of a facility.[26] In the face of these challenges, the coverage of essential health services

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[xix] According to the WHO, by August 2016, one-third of the 67 partner organizations in-country remained, retaining only a skeleton staff. Source: http://www.who.int/features/2016/south-sudan-health-crisis/en/

[xx] In 2017, the country experienced widespread outbreaks of cholera, measles, malaria, hepatitis E and Kala Azar (Leishmaniasis).

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(Sustainable Development Goal indicator 3.8.1)[xxi] is estimated at 30 per cent, far below the 42 per cent average of Sub-Saharan Africa.[27]

With inadequate human resources for health and the limited human resource capacity of the MOH to manage and support the delivery of health services, an estimated 80 per cent of healthcare services are provided by NGOs.[28] To ensure the continuity of services and avoid ad-hoc approaches to the provision of health services, in 2012, international donors launched the Health Pooled Fund (HPF), the Rapid Results Project, and the USAID Health Systems Strengthening Project (HSSP) as mechanisms for coordinating funding for primary health care. These mechanisms sought to align primary health care activities with the Health Sector Development Plan (2012-2016) by subcontracting NGOs to support primary health care activities at the county levels. The NGOs supported health service delivery and system strengthening using a County-based model (as opposed to supporting individual facilities). Whereas the coordination of partners somewhat improved, health service delivery remained largely facility-based. The lack of national guidance to partners for harmonising and standardising the delivery of CHS necessitated the development of the BHI.

2.1. Priority challenges for community health in South Sudan

South Sudan has some of the worst health indicators globally and faces significant challenges which impede the delivery of basic health services.

Child health

While child mortality has decreased in recent years, death rates remain high with the majority due to preventable causes. The under-five mortality rate is estimated at 96 deaths per 1,000 live births (2017) down from 111 deaths per 1,000 live births in 2010 and 256 deaths per 1,000 live births in 1990.[29] The infant mortality rate (< one year) is estimated at 63 deaths per live 1,000 births (2017) which indicates a some decline since 2010 (71 deaths per 1,000 live births) and 1990 (152 deaths per live 1,000 live births).[30]

The vast majority (75 per cent) of child deaths are attributed to diarrhoea, malaria, and pneumonia[31] while malnutrition rates have reached an all-time high and constituted a public health emergency in several parts of the country in 2016-2017.[32] Also, immunisation coverage has decreased since 2012, particularly in conflict areas due to a lack of available staff and breakdown of public health infrastructure. According to the HMIS, in 2017, 75 per cent of children received the measles vaccine (first dose) and 58 per cent received the third doses of both Polio and Pentavalent vaccines before the age of one.[33]

[xxi] Coverage of essential services is based on nine tracer interventions that include RMNCH; infectious diseases; non-communicable diseases; and service capacity and access; among the general and the most disadvantaged population. Source: WHO and World Bank. Tracking Universal Health Coverage: 2017 Global Monitoring Report. 2017.

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The majority of infant deaths occur during the first 28 days of a child's life.[34] Neonatal mortality has experienced a slow decline – there are an estimated 40 deaths per 1,000 live births (2016) from 44 deaths per 1,000 live births in 2010 and 67 deaths per live births in 1990.[35] According to UNICEF, the main causes of neonatal mortality (2015) were intrapartum-related events (36 per cent); pre-term birth complications (24 per cent); sepsis, meningitis and tetanus (18 per cent); pneumonia (nine per cent); and congenital abnormalities (eight per cent).[36] At health facilities, according to the 2016 HMIS report, the leading causes of outpatient morbidity among children under five years were malaria (60.91 per cent of reported deaths), diarrhoea (22.09 per cent), and pneumonia (11.51 per cent).[37]

Maternal health

Maternal mortality in South Sudan is among the highest in the world (789 deaths per 100,000 live births in 2015) and it is assumed to have deteriorated in recent years. An estimated one in one-hundred pregnant women dies due to maternity related complications.[38] The majority of maternal deaths are attributed to direct causes including haemorrhage, retained placenta, obstructed labour, and abortion. Indirect causes such anaemia, poor nutrition, and malaria are major risk factors as is the limited number of facilities able to manage obstetric emergencies.[39]

Access to reproductive health services for women remains critically low. Access to and use of ANC services is also low – in 2010, 46.7 per cent of pregnant women had at least one ANC visit with a skilled professional and only 17 per cent had the four visits.[40] Data from the HMIS indicates that in 2016 coverage of one ANC visit was 50.3 per cent (down from 53 per cent in 2014) and four or more visits was 22.6 per cent (24 per cent in 2014).[41] Skilled birth attendance is estimated to be eight per cent (2015) – an estimated 15 per cent (2015) of women delivered in a health facility with the vast majority of women delivering at home.[42] Common barriers to accessing reproductive health services are a lack of information on available services and their benefits, cultural attitudes and misconceptions, low pregnancy risk perception, and a lack of preparedness by expectant mothers and families.

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As one of the 69 countries signed onto the Family Planning 2020 (FP2020) partnership,[xxii] South Sudan seeks to improve the availability and access to family planning information and services. The country has also committed to reduce maternal mortality by 10 per cent by 2020 and increase modern contraceptive prevalence rate among married women from 5 per cent (FP2020 2016 estimate) to 10 per cent by 2020.[43] As of 2017, the modern contraceptive rate among married women was 3.61 per cent and 2.41 among all women while the unmet need for family planning among married women was 30.55 per cent.[44]

[xxii] Family Planning 2020 (FP2020) is a global partnership that supports the rights of women and girls to decide, freely and for themselves, if, when and how many children they want to have. FP2020 is the result of the 2012 London Summit on Family Planning, where more than 20 governments made commitments to find answers to the political, funding, delivery and socio-cultural barriers to women's access to information, services, and contraceptive products.

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2.2. Community health policy and programmes

Community health priorities and challenges

The role of CHWs is recognised as critical in extending access to essential health services for the country, addressing high rates of preventable maternal and child morbidity mortality, and reinforcing linkages to South Sudan's primary health care system, whilst helping to build community resilience. Prior to and after independence, multiple community level initiatives and programmes were introduced to bring health services closer to the people and bridge the gap between communities and health facilities. Funded by international donors and largely managed by national and international NGOs, the government has had limited ownership and oversight of community health programmes in the absence of a detailed overarching community health framework.

The majority of community health programmes have been donor-driven, vertical (i.e., disease-focused), limited in their scope and geographic reach, and short-term, rarely continuing beyond the ending of donor funding.[45] Moreover, programmes have lacked a harmonised approach to guide their implementation, with, multiple community health programmes and cadres providing a variety of preventive, curative, and promotional services at community level. These include, for example, NGO-supported HHPs and Community Drug Distributors (CBDs). Due to the limited staff capacity and critical shortage of personnel, involvement of MOH staff in programme management and supervision has been minimal. A lack of coordination among partners and government has led to problems such as duplicative and fragmented training, supervision, reporting, and incentives, which have contributed to resource wastage and a lack of clarity on the roles and responsibilities of CHWs.[46]

As outlined in the National Health Policy (2016-2026), the GOSS has committed to strengthening the national health system to ensure universal coverage of the Basic Package of Health and Nutrition Services (BPHNS) in all communities. As part of this policy objective, the GOSS developed the BHI to provide national guidance to all health actors on establishing community health sub-structures as a formal structure of the national health system. These sub-structures are to support the delivery of a range of services and activities including health promotion, disease surveillance, communicable disease control, selected curative services, and reporting of vital registration and health statistics.[47]

CHWs will represent the foundation of South Sudan's health system (Figure 3) – working under the Primary Health Care Units (PHCUs), which are the lowest level of the four tiers: PHCUs, Primary Health Care Centres (PHCCs), County Hospitals (CH), and State and Teaching Hospitals.

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Figure 3. Structure of South Sudan's Health System
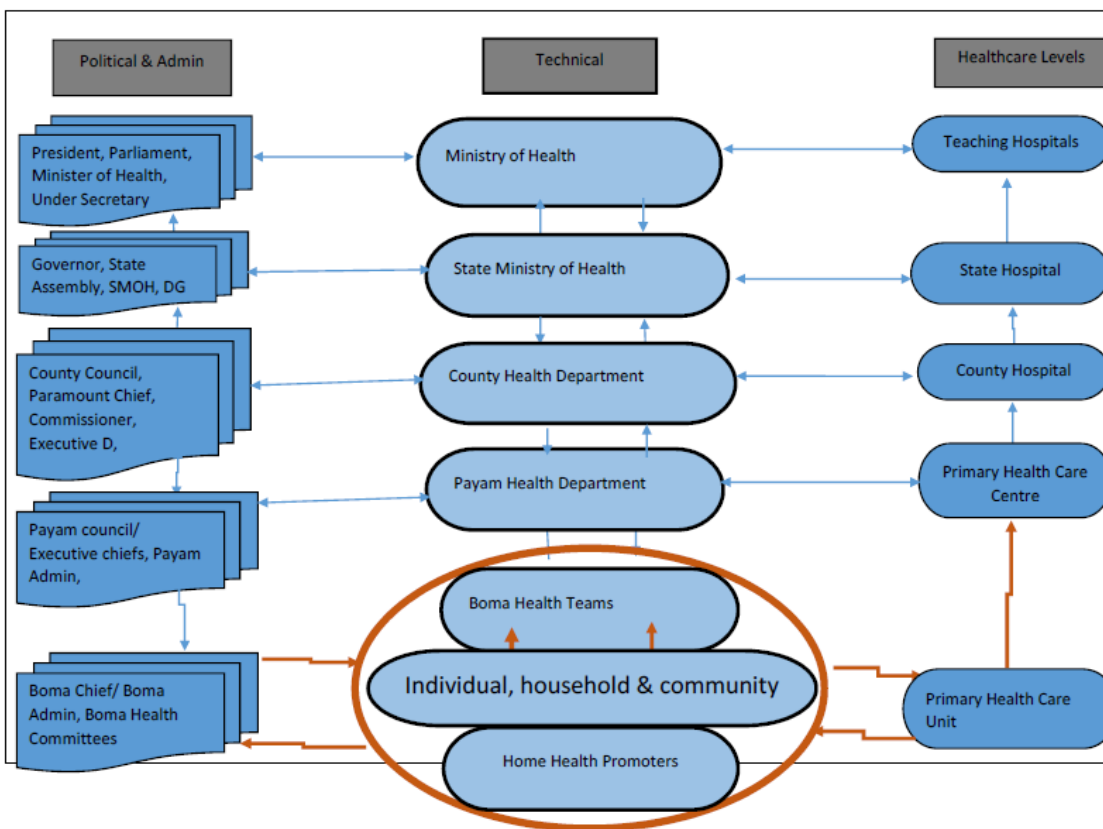
PHCUs serve as the first level of primary care and are located in Bomas (basic units of local government) and provide basic, preventive, promotional, and curative services for an estimated 15,000 persons. Three CHWs will form a BHT and will refer patients to the nearest PHCU. BHT supervisors will be located at a Payam Health Office, which covers an average of four Bomas.

PHCCs serve as the immediate level of referral for the PHCU, providing the same services as PHCUs in addition to laboratory services and maternity and inpatient care. PHCCs serve an estimated 50,000 people and are either located at the Payam headquarters (administrative level between the County and Boma) or at the Boma level depending on whether it is located in an urban or rural area. County Hospitals are located at the County administrative headquarters of local government and serve as referrals for PHCCs and provide the same services at PHCCs in addition to emergency surgical operations, serving a population of 300,000. A county covers, on average, six to seven Payams and there are an average of two to three counties per state and a total of 33 states. State Hospitals serve an estimated 500,000 persons and represent the secondary health care level, employing surgeons, obstetricians, physicians, and paediatricians. Teaching Hospitals provide tertiary care.

The National MOH is responsible for providing overall leadership within the health system by developing policies, guidelines, and standards; engaging in advocacy and resource mobilisation; and supervising healthcare service delivery. The MOH also directly manages the three teaching hospitals. The State Ministry of Health (SMOH) provides leadership for health service delivery and management in each State.

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The County Health Department manages the delivery of PHC services at the Payam, Boma/village levels and the State MOH is responsible for secondary health services. The Payam Health Committee and BHC will oversee health service delivery in the Payams and Bomas including CHS.

Boma Health Initiative

Formally launched in March 2017, the BHI aims to standardise community health cadres, formalise the role of CHWs, and improve access to CHS throughout the country. The BHI is designed to strengthen the community health system by establishing a formal health system structure at the Boma level and deliver an integrated package of promotional, preventive, and selected curative interventions. With health education being a critical pillar throughout, the BHI package of services is focused on four key areas: Child Health (iCCM diagnosis and treatment of common childhood illnesses [malaria, pneumonia and diarrhoea]), Safe Motherhood, Communicable Disease Control (e.g., tuberculosis [TB]), and Vital Registration and Community-Based Surveillance.

The BHI is expected to significantly reduce ill health and deaths by increasing access to, and utilisation of, essential health services and by enhancing the participation of communities in health activities. Moreover, the BHI is expected to foster community ownership and sustainability of CHS. Moreover, the BHI, through the establishment of early warning systems in every Boma, will improve the ability of the health system to detect, investigate, and respond to disease outbreaks. CHWs will also be responsible for reporting vital statistics that will help government with information for planning and monitoring, including data on births and deaths.

The BHI will rely on trained, equipped, and salaried CHWs formed into BHTs. CHWs are to be nominated by their community and recommended by the BHC for recruitment into the public service. CHWs are supposed to meet several eligibility requirements including having a primary education, having a permanent residence in the Boma, speaking the local language of the community, and being interested to work as a CHW for at least five years. CHWs should be between 21 and 55 years of age and not have any other full-time employment. Due to the nature of the services provided, priority is to be given to recruiting women.

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To help ensure that CHS delivery is eventually institutionalised, the MOH at all levels of the health system will support the BHI. National, Regional, and State MOH and personnel at MOH County Health Departments and Payam Health Offices will be involved in the planning, management, and supervision of the BHI. CHWs are expected to be directly supervised by Payam Health Officers. These supervisors will be responsible for programme management, supervision of service delivery, and receiving, compiling, and transmitting service data while providing feedback to BHTs. Health facility staff at the PHCC level will be responsible for managing referrals and storing and distributing BHI medicines and supplies.

However, the ROSS will rely heavily on the support of international donors and implementing NGO partners. Given the scarcity of human resources within the MOH, there will be a need for NGOs to support the MOH in the management of the BHI.

To date, a national training of trainers was conducted and the selection of CHWs has taken place in some Bomas (Jubek and Greater Bahr el Ghazal) in preparation for the implementation of the BHI. Despite the growing momentum for BHI implementation, key questions remain on how it will be financed. According to the MOH, implementing NGOs partners that currently receive funding for primary health care and/or community health programmes are to implement the BHI by reaching all communities and using resources efficiently to maximise health outcomes.

2.3. Bottlenecks in the community health system

A number of major bottlenecks exist in the current health system and these are likely to affect the implementation of the BHI unless they are resolved. These bottlenecks were identified by the discussion panel and are summarised below (Table 1) and described in detail in Annex 4, together with some recommendations for resolving them. The issue of insecurity remains a potential, underlying bottleneck which can both increase the need for services as well as hamper the supply of services and the ability of people to access them.

Table 1. Major bottlenecks in the community health system

Bottleneck	Causes	Effects
Stock-outs of medicines and supplies.	Poor management, insecurity, high distribution costs, and inadequate storage.	Some services cannot be provided – reducing utilisation and damaging community and CHW confidence.
Lack of equipment.	Inadequate funding for providing and replacing equipment; weak logistics and transport systems; and insecurity.	Poor quality of care and lack of confidence of the community in CHWs.
Lack of qualified CHW candidates.	Lack of formal education (and low levels of literacy) and gender barriers.	Insufficient numbers of CHWs which contributes to limited access or CHW burn-out due to overload; poor quality of care due to inadequate skills or inadequate gender balance.
Low acceptance of CHS.	Misinformation, lack of awareness of CHS, myths and misconceptions, and insufficient numbers of female CHWs (gender barriers to care).	Insufficient uptake of services.
Lack of buy-in from community leaders.	Omission of influential community groups in the BHT selection and BHI planning processes (e.g., women, youth groups, elders).	General distrust of the BHI and low acceptance of CHS.
Limited capacity of MOH supervisors and weak linkages between CHWs and health facilities.	Inadequate numbers of qualified supervisors and insufficient training; inadequate involvement of CHWs in health facility services (e.g., for referrals).	Lack of community and CHW confidence, poor quality of care, and poorly functioning referral system with negative consequences for patient health.
Insufficient remuneration for CHWs.	In some cases, the proposed salary and performance-based incentives for CHWs may be less than are currently paid by NGOs.	Low motivation, poor performance by CHWs, and attrition.

3. Package of services and coverage scenarios

3.1. Provision of services

Package of services

To conduct the modelling for this analysis, it was necessary to precisely define the package of CHS supported through the BHI. The list of services (Table 2) is based on the initial service package, outlined in Annex 1 of the BHI Implementation Guidance (MOH, 2016), and was slightly modified based on recent guidance from the MOH and stakeholders, including the discussion panel. For example, one of the modifications was the decision to omit the treatment of TB through directly observed treatment, short course (DOTS) and follow-up and defaulter tracing for TB. These services will likely be included in the

comprehensive package of services and require further training of CHWs. The package of services selected for the cost modelling contains 19 services and activities.

Table 2. Boma Health Initiative package of services

#	Service	Category
1	Malaria diagnosis (with rapid diagnostic test)	Child Health
2	Malaria treatment (with artemisinin-based combination therapy [ACTs])	Child Health
3	Pneumonia diagnosis and treatment (with Amoxicillin)	Child Health
4	Diarrhoea treatment (with oral rehydration solution [ORS] and Zinc)	Child Health
5	Assess children for nutritional status	Child Health
6	Referrals of children with complicated malaria, pneumonia or diarrhoea	Child Health
7	Immunisation (day 1) - monthly mobilisation of mothers and caregivers	Child Health
8	Immunisation (day 2) - monthly Immunisation at post (CHWs update family health register)	Child Health
9	Communicable disease control - outreach visit (malaria, Human Immunodeficiency Virus [HIV], TB, neglected tropical diseases [NTDs]) including LLIN distribution	Control of Common Communicable Diseases
10	Male condom distribution[xxiii]	Control of Common Communicable Diseases
11	Antenatal care promotional visit	Safe Motherhood
12	Childbirth promotional visit (for birth spacing)	Safe Motherhood
13	Postnatal care + maternal and child health nutrition promotional visit	Safe Motherhood
14	BCC - child spacing, adolescent health, gender-based violence	Safe Motherhood
15	Referral of pregnant women for danger signs	Safe Motherhood
16	Maintaining Family Health Information Register (1x annually)	Vital Registration and Community-Based Surveillance
17	Maintaining Health Services Register (weekly)	Vital Registration and Community-Based Surveillance
18	Reporting on services to the Payam Health Office (monthly)	Vital Registration and Community-Based Surveillance
19	Reporting for the Community Based Surveillance System (weekly)	Vital Registration and Community-Based Surveillance

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[xxiii] In the BHI Implementation Guidance document, the provision of male condoms is explicitly mentioned an intervention to prevent the spread of HIV (Annex 1). For the purpose of this analysis, we estimated the impact of condom use on an increase in modern contraceptive prevalence. The analysis did not estimate the potential impact on reductions in HIV incidence.

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Deployment of CHWs

A ratio of three CHWs per Boma was used for this modelling, as per the BHI Strategy. It is assumed that each CHW will be responsible for providing the full package of services in a designated geographic area of the Boma. In total, there would be 6,408 CHWs serving 2,136 Bomas from 2018-2028.[xxiv] It is assumed that 7.5 per cent of these CHWs will drop out each year, based on attrition assumptions provided by the partners. For the cost modelling, it is assumed that replacement CHWs would be engaged and they would be provided with the same training and equipment as the initial group of CHWs.

Based on the guidance of the discussion panel and the direction of the MOH, it was assumed that each CHW would spend an average of 35 hours per week on community health activities for 52 weeks per year.

As per the GOSS civil service payment structure, CHWs would receive an annual salary equivalent of US $501. CHWs would also receive additional performance-based incentives of US $600 (maximum) per year (US $50/month)[xxv] based on completing the following activities:

- Immunisation outreach (one day of community mobilisation and one day of vaccination per month): US $4 x 2 days = US $8
- BCC on safe motherhood (4 days/month): US $4 x 4 days = US $16
- Infectious disease (HIV/TB/malaria) outreach (4 days/month): US $4 x 4 days = US $16
- Monthly reporting to supervisor (1 day/month) = US $10

For the modelling, it was assumed that all CHWs would earn the maximum quantity of performance-based incentives.

[xxiv] The number of Bomas was reported based on MOH/ROSS estimates from the 2008 national census.

[xxv] The monthly performance-based incentive was increased by the MOH from US $25 to US $50 based upon feedback during the April 2018 validation meeting.

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Management, supervision, meetings, and training

The salaries of MOH personnel, responsible for the management and supervision of community health programmes at all levels of the health system, were included in the analysis, based on the 2008 civil service salary scale and the 2015 exchange rate, prior to the current economic crisis. Management and supervision costs also include per diem and transportation.

It was assumed that the CHWs would participate in monthly group meetings at the Payam level during which they present their community activity reports, obtain feedback on their activities from the supervisor, and replenish their stock of medicines and supplies. It was assumed that each CHW would receive US $5 for attending each meeting as a transportation allowance. It was also assumed that the direct supervisor of the CHWs (Payam Health Officer) would conduct a total of 48 supervision visits per year, visiting the three CHWs at the same time. A total cost of US $5 was assumed for every supervision visit to cover the cost of motorcycle fuel.

Training costs were separated between start-up training and refresher training. Start-up training is assumed to occur only once for each CHW while refresher training is repeated every two years. Start-up and refresher training includes cascade training, i.e., training of trainers (at all levels). The direct training costs such as training materials and per diem were included in the cost modelling. In addition, it was assumed that replacement CHWs would receive start-up training.

The expected utilisation rates of each service were determined based on a mixture of standards from other community health costing studies and refined with assistance from the discussion panel. For example, it was assumed that, on average, every child from 2-59 months of age would have two episodes of malaria per year. Standard treatment guidelines were determined for each service, including the time of the time of the CHW as well as medicines and supplies for malaria, pneumonia, and diarrhoea. At the recommendation of the discussion panel, for this analysis, travel time was not factored into the estimated number of minutes per service. Therefore, these figures may underestimate the actual required time per service. See Annex 5 for the expected utilisation rates and numbers of minutes needed by a CHW for each service.

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3.2. Coverage assumptions

The modelling for the service package was carried out for the period of 2018-2028 for three different coverage[xxvi] (utilisation) levels: *low, medium and high*. The low scenario assumes that the identified bottlenecks will remain largely unresolved; the medium scenario assumes that the bottlenecks will be partially resolved; and the high scenario assumes that the bottlenecks will be completely resolved. Coverage rates were based on the estimated service utilisation according to guidance from the discussion panel, as actual data on the number of CHS provided was not available at the national level and there was insufficient time to collect data from the NGOs (Table 3).

The baseline coverage rates for curative and promotional services were set at 10 per cent while the rates for group preventive services, which are measured in visits to communities, were set at 100 per cent. The baseline rate for providing male condoms was set at 3 per cent based on a recent analysis which reported that three per cent of sexually active males used a condom in the last sex act in 2016 and the expected average utilisation rate is 5.88 monthly visits per year (49% of males 15-59 are sexually active and should collect condoms every month).[48]

The reporting rate for *maintaining the family health information register* (completed once annually) was set at 100 per cent while *maintaining the health services register* (completed weekly) was assumed to be in proportion to the numbers of individual services provided to take into account the volume of services to be recorded. For the modelling, it was assumed that these services were fully provided (100 per cent coverage) beginning in 2018.

The coverage scale-up rates used for individual[xxvii] services were:
- **Low scenario** - coverage increasing by 2 per cent per year[xxviii] to 30 per cent coverage in 2028;
- **Medium scenario** - coverage increasing by 4 per cent per year to 50 per cent coverage in 2028;
- **High scenario** - coverage increasing by 7 per cent per year to 80 per cent coverage in 2028.

These coverage increases can be modified based on the results of the initial implementation of the BHI[xxix] and on the degree of resolution of the identified bottlenecks including the level of insecurity in the country.

[xxvi] In this context the word "coverage" is used to mean utilisation of services, not geographical or another form of coverage.
[xxvii] One provider to one patient
[xxviii] Two percent of total need, not two percent of the previous year's level.
[xxix] Research into the experiences of NGOs providing community health services would be helpful in terms of setting coverage increase rates and maximum targets.

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Table 3. Coverage assumptions

Service	Baseline coverage	Low coverage target	Medium coverage target	High coverage target
	2018	**2028**	**2028**	**2028**
Malaria diagnosis (rapid diagnostic test [RDT])	10%	30%	50%	80%
Malaria treatment	10%	30%	50%	80%
Pneumonia diagnosis and treatment	10%	30%	50%	80%
Diarrhea treatment	10%	30%	50%	80%
Assess children for nutritional status	10%	30%	50%	80%
Referrals of children with complicated malaria, pneumonia or diarrhea	10%	30%	50%	80%
Immunisation (day 1) - monthly mobilisation of mothers and caregivers	100%	100%	100%	100%
Immunisation (day 2) - monthly immunisation at post (CHWs update family health register)	100%	100%	100%	100%
Communicable disease control - outreach visit (malaria, HIV, TB, NTDs)	100%	100%	100%	100%
Male condom provision	3%	23%	43%	73%
Antenatal care promotional visit	10%	30%	50%	80%
Childbirth promotional visit (for birth planning)	10%	30%	50%	80%
Postnatal care + maternal and child health nutrition promotional visit	10%	30%	50%	80%
BCC - child spacing, adolescent health, gender based violence	100%	100%	100%	100%
Referral of pregnant women for danger signs	10%	30%	50%	80%
Maintaining Family Health Information Register (1x annually)	100%	100%	100%	100%
Maintaining Health Services Register (weekly)	10%	30%	50%	80%
Reporting on services to the Payam Health Office (monthly)	100%	100%	100%	100%
Reporting for the Community Based Surveillance System (weekly)	100%	100%	100%	100%

Details on the number of services for each coverage scenario are provided in Annex 6.

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4. Cost of interventions

4.1. Cost of implementation

Number of services provided

Based on the models, in 2018 CHWs would provide 4.4 million health services. In 2028, the number of services would increase to 17.8 million under the low coverage scenario, 30.1 million under the medium coverage scenario, and 48.6 million under the high coverage scenario (Figures 4, 5 and 6 and Tables 9, 10, and 11 in Annex 6). It is important to note that the units of services are different – for example, child health services represent encounters with individual children and promotive BCC services represent encounters with groups of people or communities.

In all three scenarios, the majority of services would be for Child Health which comprises iCCM services for malaria and pneumonia, diarrhoea diagnosis and treatment, referrals, nutrition assessments, and mobilisation for immunisations. The Control of Communicable Diseases is the next largest group of services, comprising condom provision and outreach visits for malaria, HIV, TB, and neglected tropical diseases. Safe Motherhood amounts to fewer services and is comprised of those related to ANC, birth care, referral of pregnant women with danger signs, and BCC on child spacing, adolescent health, gender-based violence. The service figures also include weekly, monthly, and annual registration and surveillance activities carried out by the CHWs.

Figure 4. Total number of services by programme under the low coverage scenario (2018-2028) (millions)

South Sudan - Boma Health Initiative Costing and Investment Case Analysis
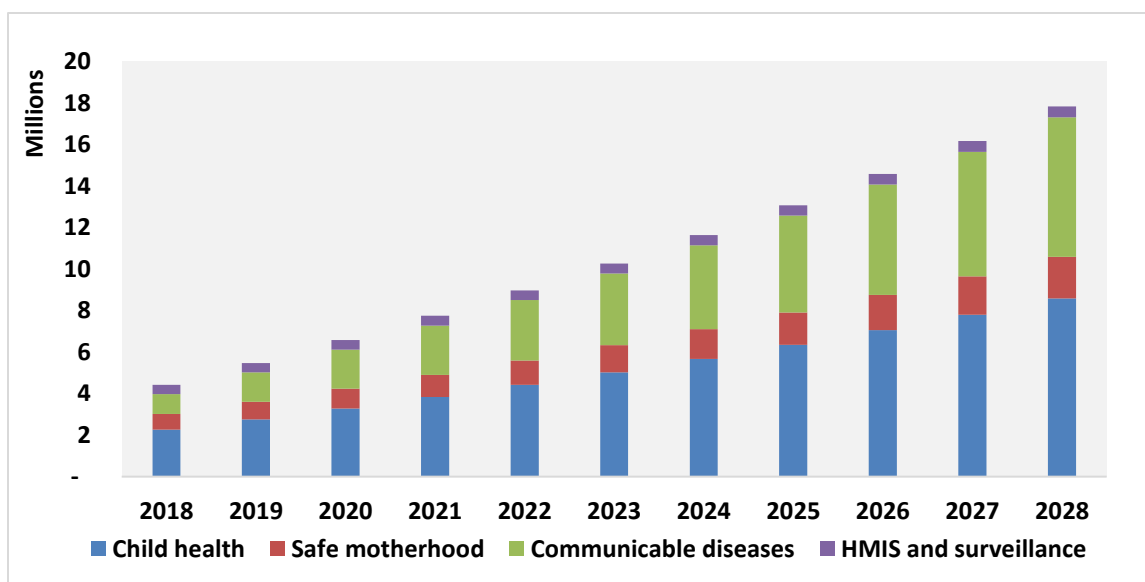
Figure 5. Total number of services by programme under the medium coverage scenario (2018-2028) (millions)
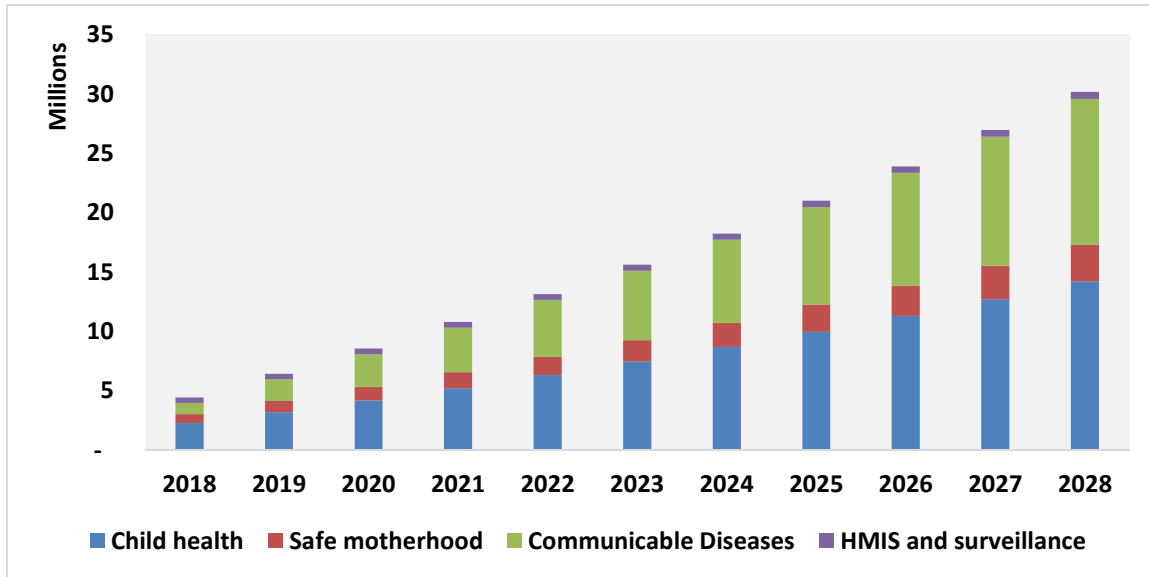
Figure 6. Total number of services by programme under the high coverage scenario (2018-2028) (millions

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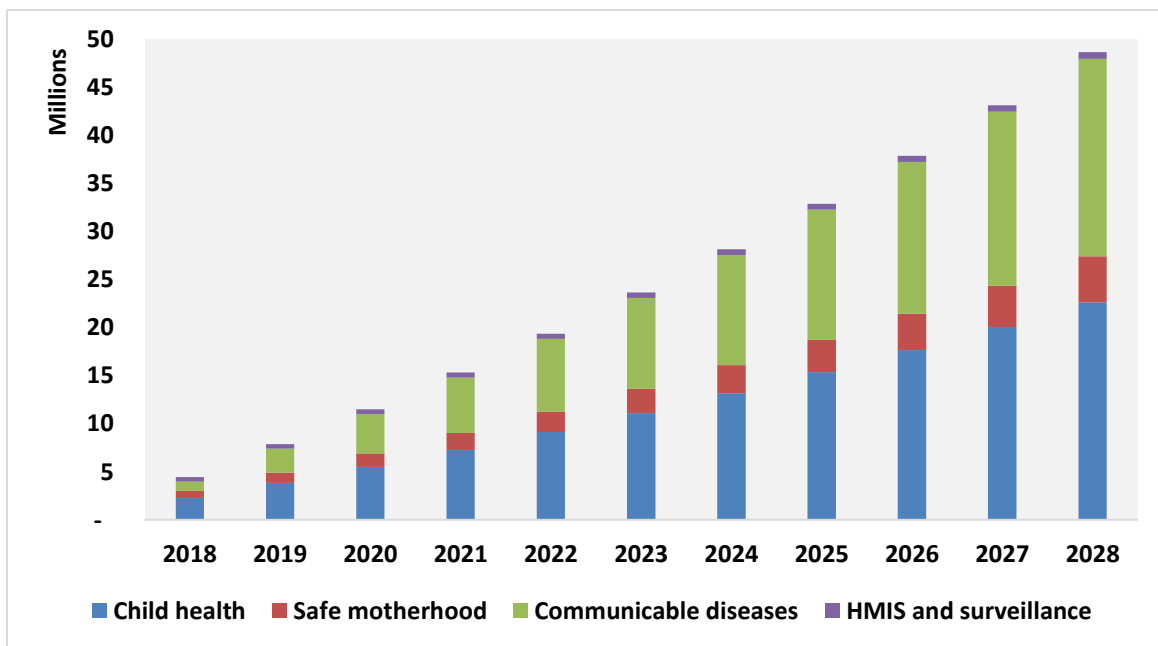
4.2. Total costs by category

The cost of implementing the initial service package in 2018 would be US $19.9 million Figure 7). This figure is higher than in the following years as it includes US $9.0 million for start-up training and equipment costs. The total cost of the low scenario coverage in 2019 of US $13.1 million is more representative of the total annual recurrent costs. The total cost in 2028 of low coverage of the initial package would be US $23.8 million, and under the medium and high coverage scenarios the total cost would be US $28.5 million and US $35.5 million, respectively (Figures 7, 8 and 9 and Tables 15, 16 and 17 in Annex 7). These figures include US $6.3 million for the replacement of equipment (assumed to be every five years).

All costs are expressed in US Dollars and exclude inflation. A population growth rate of 2.9 per cent per year was assumed. It should be noted that the costs for the medium and high coverage scenarios may be understated in the last few years of the models as the projected increased numbers of services appear to be more than the CHWs can cover. Therefore, it may be necessary to engage more CHWs to ensure adequate coverage. The highest single cost in 2018 is for CHW salaries which amount to US $7.0 million, which includes US $3.8 million per year in performance-based incentives (Figures 7, 8 and 9 and Tables 12, 13, and 14). By 2028, medicines and supplies would be the highest cost-drive under the medium and high coverage scenarios, while CHW salaries would remain the highest single cost under the low coverage scenario.

Figure 7. Total costs by input type under the low coverage scenario (2018-2028) (US $ million)

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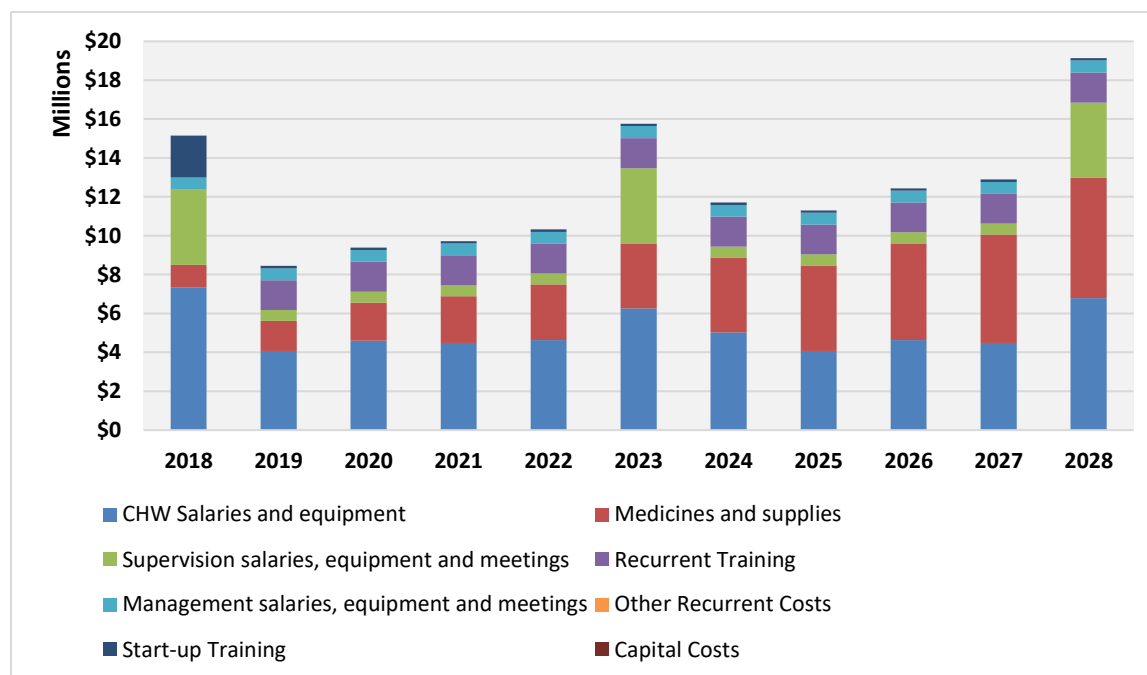
Figure 8. Total costs by input type under the medium coverage scenario (2018-2028) (US $ millions)
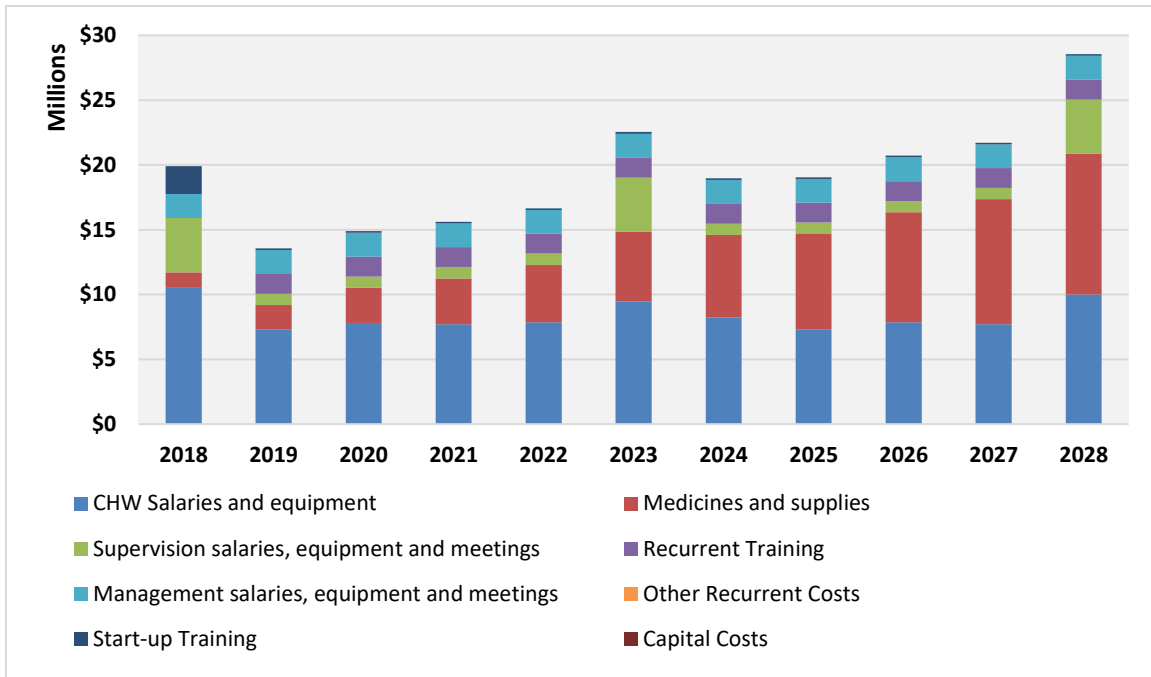
Figure 9. Total costs by input type under the high coverage scenario (2018-2028) (US $ millions)

South Sudan - Boma Health Initiative Costing and Investment Case Analysis
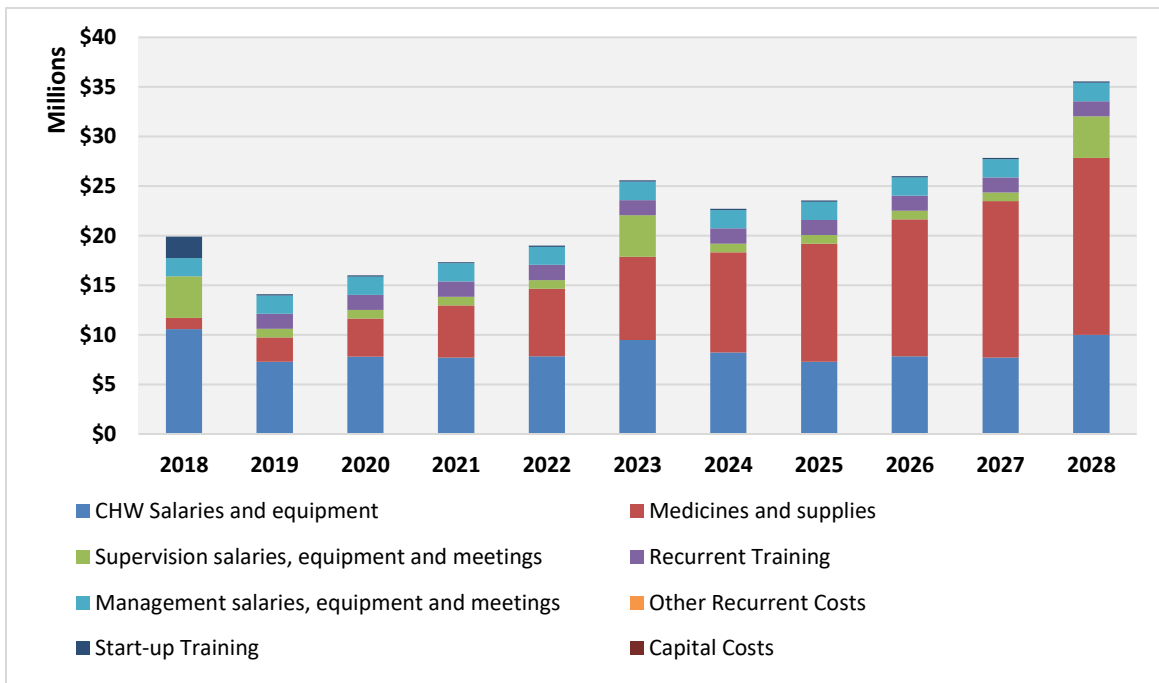
4.3. Total costs by programme

In the first year of the programme (2018), the greatest cost would be for Child Health (US $7.9 million), followed by Communicable Disease Control (US $6.8 million), Safe Motherhood (US $3.1 million), and Vital Registration and Community-Based Surveillance[xxx] (US $1.9 million) (Figures 10, 11 and 12 and Tables 14, 15 and 16). This pattern would remain the same through 2028 under all three scenarios.

Figure 10. Total costs by programme under the low coverage scenario (2018-2028) (US $ millions)
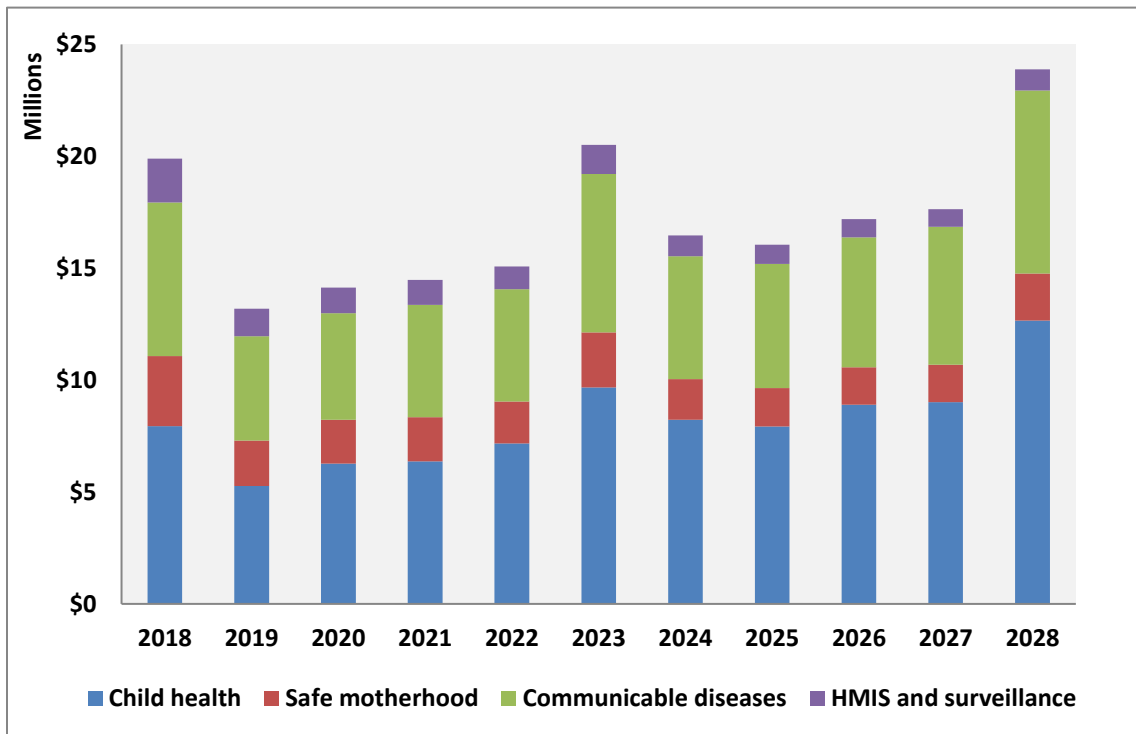
[xxx] Abbreviated in the graphs as *HMIS and Surveillance*.

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Figure 11. Total costs by programme under the medium coverage scenario (2018-2028) (US $ millions)
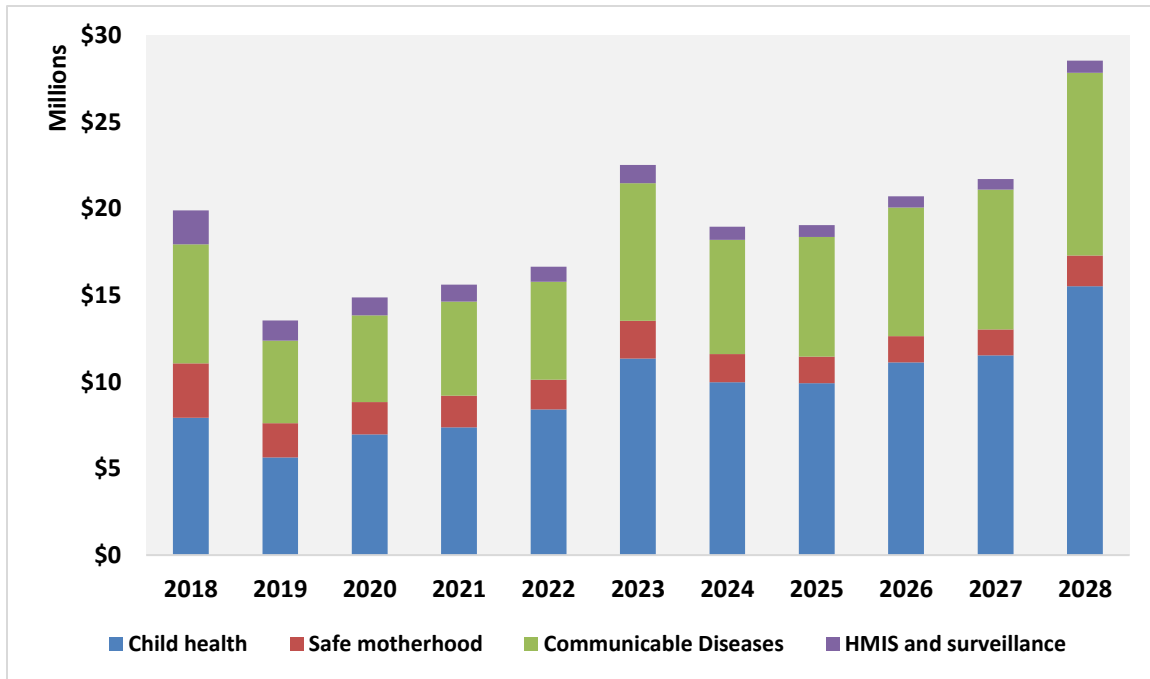
Figure 12. Total costs by programme under the high coverage scenario (2018-2028) (US $ millions)

South Sudan - Boma Health Initiative Costing and Investment Case Analysis
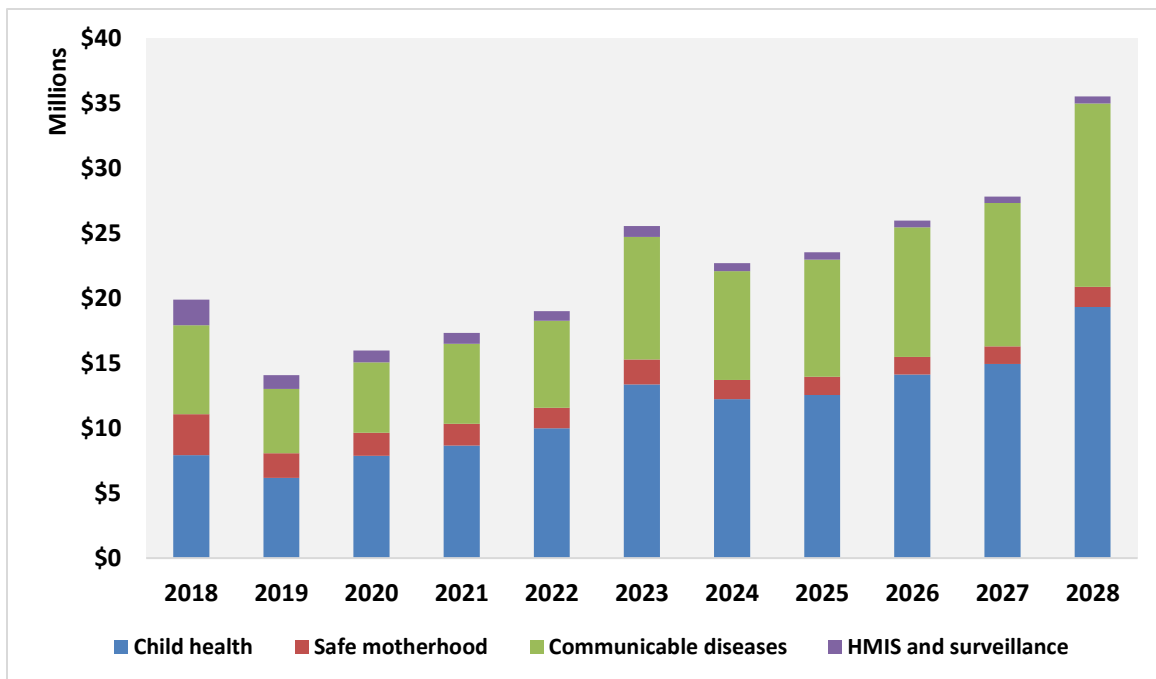
4.4. Costs per capita

The recurrent cost per capita (total population) in the low coverage scenario would be US $1.04 in 2019 and US $1.11 in 2027, while the corresponding figures under the medium and high coverage scenarios would be US $1.07 and US$1.36, and US$1.11 and US$1.75 (Table 4).[xxxi] These increases in costs correspond to the scale-up of services.

Table 4. Recurrent cost per capita (US $)

	Low coverage	Medium Coverage	High coverage
Recurrent cost per capita 2019	$1.04	$1.07	$1.11
Recurrent cost per capita 2027	$1.11	$1.36	$1.75

Note: The per capita costs are based on the total population

4.5. Cost per service

In 2019 the cost of treating a child for malaria,[xxxii] pneumonia, and diarrhoea would be US $1.92, US $2.11, and US $2.05 under the low coverage scenario. In 2027, the cost per service would be less for the low coverage scenario due to economies of scale in terms of the use of CHW time, at US $1.29, US $1.40 and US $1.33, respectively, and less again for the medium coverage scenario at US $1.03, US $1.11 and US $1.04, respectively, and for the high coverage scenario at US $0.95, US $1.02 and US $0.95, respectively.

4.6. Quantities and costs of medicines

The CHS Planning and Costing Tool calculates the required quantity and total cost of each type of medicine and supply. Under all three scenarios, the highest cost in 2018 will be for malaria RDTs, amounting to US $525,047. By 2028, however, the highest cost will be for male condoms, amounting to US $2.6 million under the low coverage scenario and US $8.3 million under the high coverage scenario.

4.7. CHW time utilisation

With the estimated baseline coverage in 2018, the CHWs would use 38 per cent of their available 35 hours per week and by 2028 they would use 78 per cent under the low coverage scenarios. Under the medium and high coverage scenarios, the CHWs would be fully occupied by 2027 and 2024, respectively, and would need 14 per cent and 68 per cent more hours by 2028, respectively. However, these figures assume that most of the services will be provided at, or close to, the homes of the CHWs - if significant travel time is needed the CHWs would require more hours. If CHWs cannot reduce the number of interventions or the time spent on providing certain services in these later years, they would have to spend more time or more CHWs would need to be recruited, both of which would result in increased costs which are not included in this analysis. Moreover, under both the medium and high scenarios, it would not be possible to expand the package of services and maintain the targeted coverage increase rates.

[xxxi] Recurrent costs are costs incurred every year (e.g., drugs and supplies, management, supervision, meetings, refresher training). The costs in 2018 includes start-up costs and in 2028 includes equipment replacement costs so the costs for 2019 and 2027 are more representative of recurrent costs.
[xxxii] Excluding the cost of rapid testing.

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5. Current financing and financing gaps

The total amount of resources needed to finance the community health programme would be $19.9 million in 2018, which include the initial training and equipment costs. In 2019, the total resources needed would be US $13.1 million, US $13.5 million, and US $14.0 million under the low, medium and high coverage scenarios, respectively. These figures are expressed in US Dollars and exclude inflation.

It was not possible to analyse the financing gaps due to the lack of data on current and projected financing commitments. Given the economic difficulties experienced by South Sudan, coupled with future economic uncertainties, it is unknown exactly which elements of the programme will be financed by the GOSS and which elements will be financed by donors. Government salaries are estimated to amount to US $4.8 million per year, comprised of US $1.2 in management salaries, US $309,600 in direct supervisor (Payam Health Officer) salaries, and US $3.2 million in CHW salaries (which excludes US $3.8 million in performance-based incentives which are assumed to be paid by partners) (

Table 5). This would leave the balance to be funded by donors to be US $15.1 million in 2018 and US $19.0 million in 2028 under the low coverage scenario; US $23.7 million in 2028 under the medium scenario; and US $30.7 million in 2028 under the high coverage scenario.

Table 5. Amount of resources (US $ million) needed for the BHI

	Total 2018	Govt 2018	Donors 2018	Total 2028	Govt 2028	Donors 2028
Low coverage	19.9	4.8	15.1	23.8	4.8	19.0
Medium coverage	19.9	4.8	15.1	28.5	4.8	23.7
High coverage	19.9	4.8	15.1	35.5	4.8	30.7

It is important to note that some of the costs are already being covered by the donors through services provided by NGOs and therefore, only some of the modelled costs may be additional. For example, existing CHWs (supported by NGO community health programmes) may not require extensive training or new equipment, if still usable.

Details on the total costs by input and by programme can be found in Annex 7 and Annex 8, respectively.

6. Impact of investment in community health on deaths averted

This analysis presents the estimated impact of the initial package of services under the high coverage scenario over the years 2018-2028. The impact figures were estimated by deducting the 2018 figures (assuming that coverage does not change) from the estimated increased coverage figures over the ten years. Further details on LiST and the impact methodology can be found in Annex 9.

The initial services package that was costed in the models and that is covered in the LiST tool includes BCC (for exclusive breastfeeding, complementary feeding-education only, insecticide-treated net [ITN] use, handwashing with soap), community mobilisation for vaccinations, condom distribution, iCCM (treatment of under-five diarrhoea, malaria, and pneumonia), and malaria prevention (promotion of ITN distribution).[xxxiii]

It is important to note that the health interventions and coverage scenarios presented in this section are based on the assumptions of the 2018 coverage used in the modelling and on the changes in impact based on the assumed contributions of the interventions. Estimating the contributions of promotive interventions to outcomes in a particular environment is extremely difficult without extensive research. For example, the contribution of community-level promotion of antenatal promotional care on the actual provision of that care in a facility depends not just on the numbers of women reached by the promotion and the quality of the promotion but also to factors such as access to the facility, transport costs, and perceived quality of care of the facility services.

The annual increases in coverage have been interpolated from 2018 to 2028 resulting in a linear increase over the ten-year period and therefore do not correspond exactly to the annual figures for the utilisation of services in the cost models. The main interventions in LiST that are likely to be affected by the initial package interventions are shown in Annex 10, together with the national baseline (2018)[xxxiv] coverage rates and the assumed result of scaling up the initial package of BHI services under the high coverage scenario. Details on the coverage rates of each scenario are shown in Annex 6.

[xxxiii] The impact of implementing the comprehensive package of services would be greater due to the addition of services for family planning and reproductive health, IPTp, and malaria case management for adults.

[xxxiv] It should be noted that these levels of coverage do not relate exclusively to the community level but also to the health facility level.

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Estimated impact for baseline scenario

Details on the expected causes of under-five and maternal deaths (2018-2028) without changes in coverage are provided below (Figures 13 and 14). Therefore, the neonatal and under-five mortality rates would remain unchanged as would the maternal mortality ratio (Table 6 and Figures 15-17). Between 2018 and 2028, without any change in intervention coverage, there would be a total of 365,083 under-five deaths and 29,744 maternal deaths.

However, it is important to note that these mortality estimates, which are based largely on national household survey data, may not reflect more recent national trends. According to the 2016 HMIS Report, the leading cause of mortality among children under five years (2014-2016) were malaria (60.91 per cent) followed by pneumonia (11.51 per cent), diarrhoea (22.09 per cent).[49]
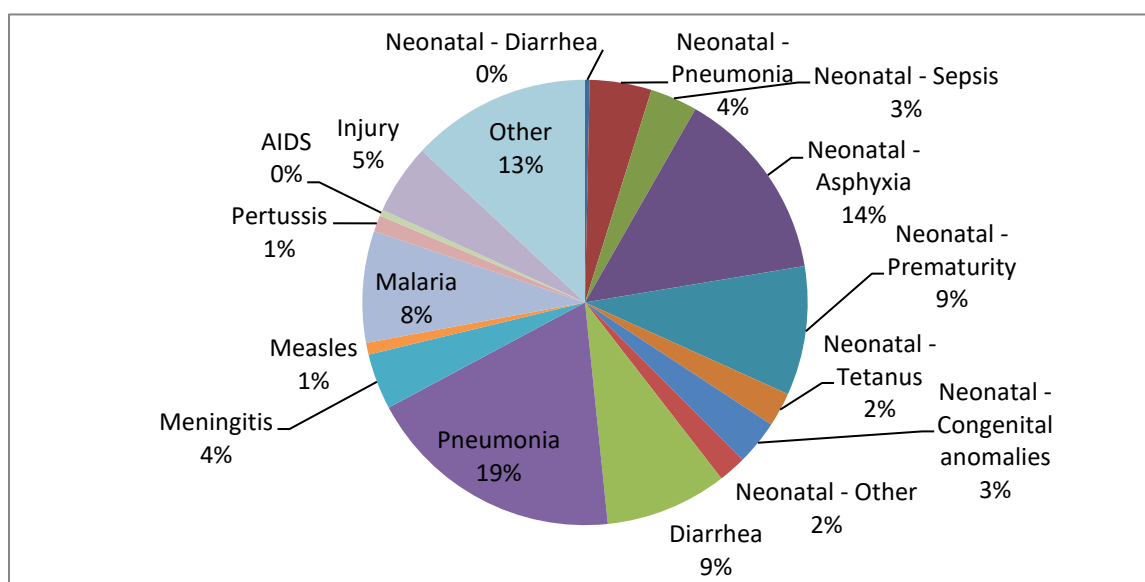
Figure 13. Under-five deaths by cause (2018-2028)

Source: Lives Saved Tool (2018) using national data.

Based on the projected increases in coverage of the initial package under the high coverage scenario, the LiST modelling indicates that the neonatal and under-five mortality rates and maternal mortality ratio would reduce considerably by 2028 (Table 6 and Figures 15-17). Due to the increased coverage of health interventions, it is estimated that by 2028 a total of 113,970 deaths could be averted compared to the baseline coverage scenario (Table 7). These would be comprised of 24,675 neonatal deaths averted, 87,651 child (1-59 months) deaths averted, and 1,644 maternal deaths averted.

Figure 14. Maternal deaths by cause (2018-2028)
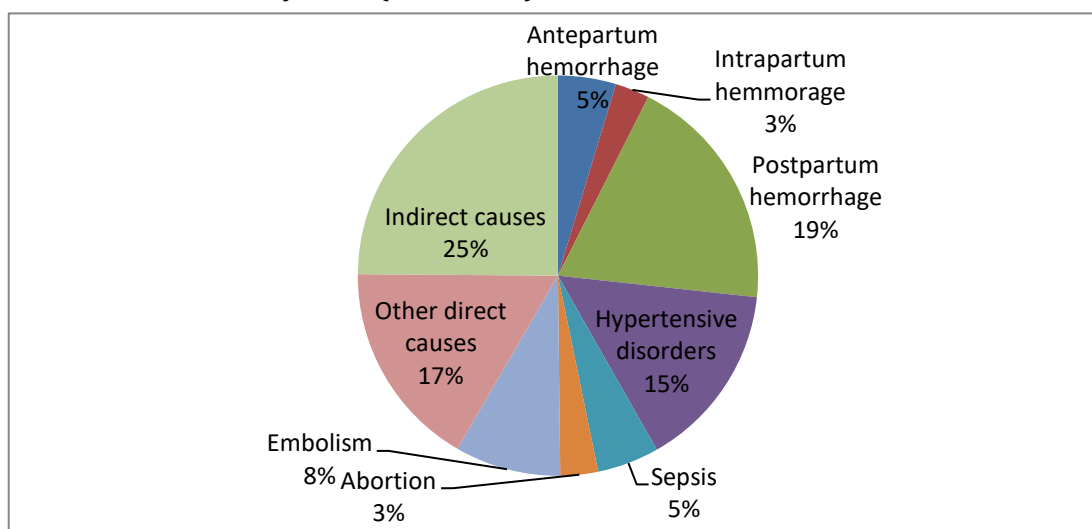
Source: Lives Saved Tool (2018) using national data.

Table 6. Mortality rates by impact year (Source: Based on illustrative scenarios as determined by the MOH and UNICEF)

Baseline scenario											
Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Maternal mortality ratio (per 100,000 live births)	789.2	790.1	790.1	790.0	788.6	788.4	790.1	790.7	791.4	792.9	793.1
Under-five mortality rate (per 1,000 live births)	96.0	95.1	94.3	93.9	93.7	93.9	93.9	93.9	93.9	93.9	93.9
Neonatal mortality rate (per 1,000 live births)	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9	37.9
Initial package of services - high impact scenario											
Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Maternal mortality ratio (per 100,000 live births)	789.2	788.9	788.2	787.3	785.2	784.4	785.8	786.0	786.5	788.0	753.8
Under-five mortality rate (per 1,000 live births)	96.0	90.5	85.0	80.5	76.2	72.3	68.6	65.0	61.5	58.1	54.5
Neonatal mortality rate (per 1,000 live births)	37.9	37.1	36.3	35.5	34.8	34.1	33.3	32.6	32.0	31.3	30.2

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Table 7. Lives saved by impact year

Initial package of services - high impact scenario												
Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	*Total*
<1 month	0	369	787	1,228	1,688	2,131	2,596	3,121	3,651	4,194	4,910	*24,675*
1-59 months	0	2,173	3,831	5,180	6,464	7,650	9,196	10,782	12,433	14,118	15,824	*87,651*
Maternal	0	17	41	69	98	126	157	191	226	262	457	*1,644*
Total lives saved	0	2,559	4,659	6,477	8,250	9,907	11,949	14,094	16,310	18,574	21,191	***113,970***

Source: Based on illustrative scenarios as determined by the MOH and UNICEF.

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Figure 15. Maternal mortality ratio (2018-2028)
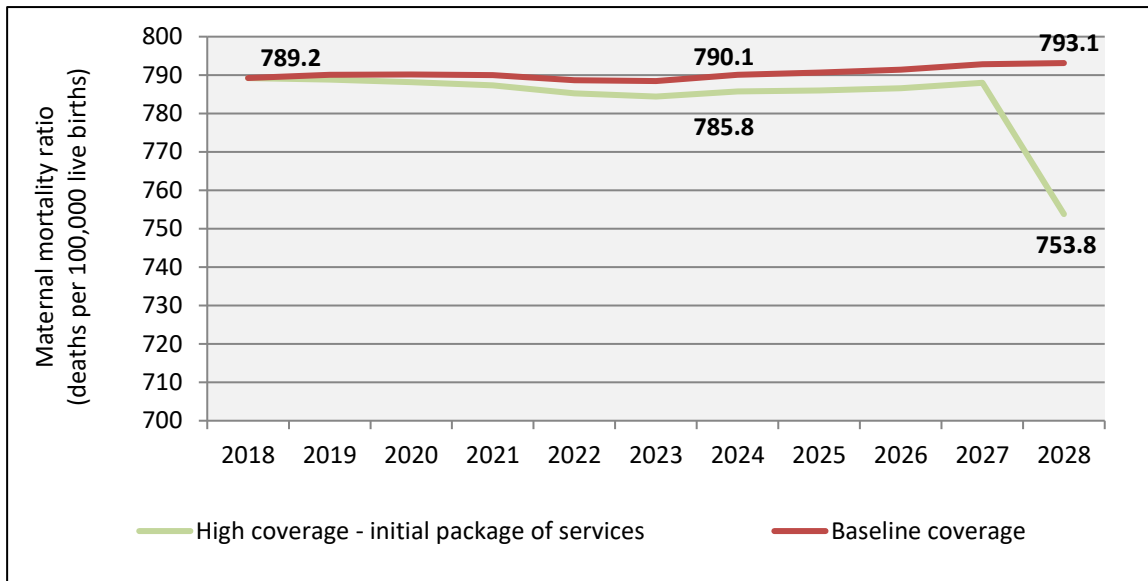
Source: Based on scenarios determined by the MOH and UNICEF.

**According to Johns Hopkins University, LiST impact projections often show sharp declines in mortality which are likely due to the modelled percentage for institutional or health facility deliveries. LiST allocates births into categories based upon the percentage of births at health facilities. Sudden sharp declines in maternal mortality are likely due to the percentage of births which cross a certain threshold and therefore correspond to greater reductions in maternal mortality. This can be seen in Figure 15 in the year 2028.

Figure 16.Under-five mortality rate (2018-2028)

Source: Based scenarios determined by the MOH and UNICEF.

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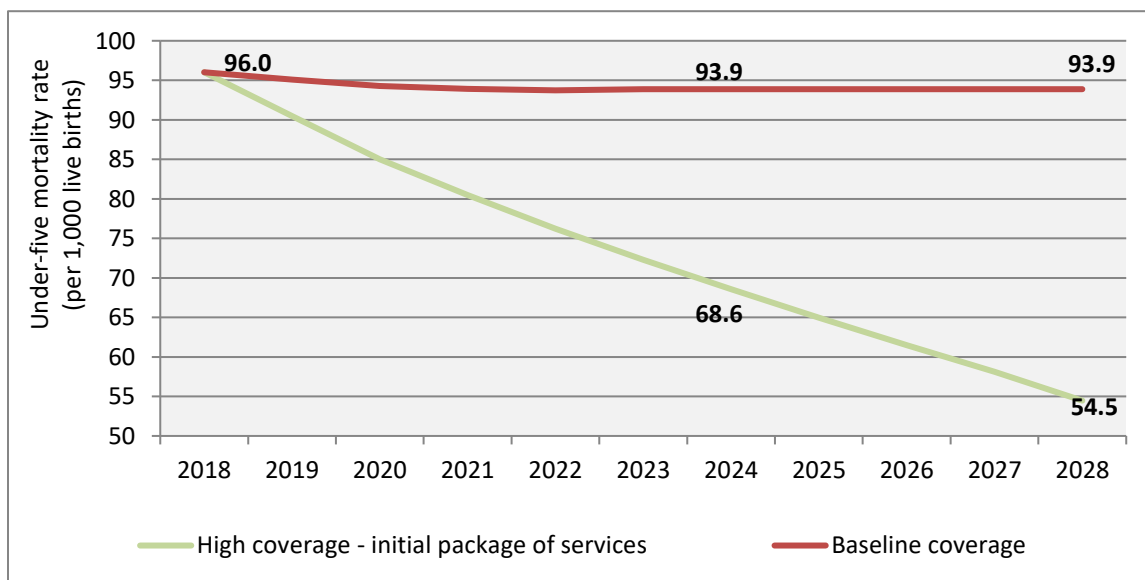
Figure 17. Neonatal mortality rate (2018-2028)

Source: Based on scenarios determined by the MOH and UNICEF.

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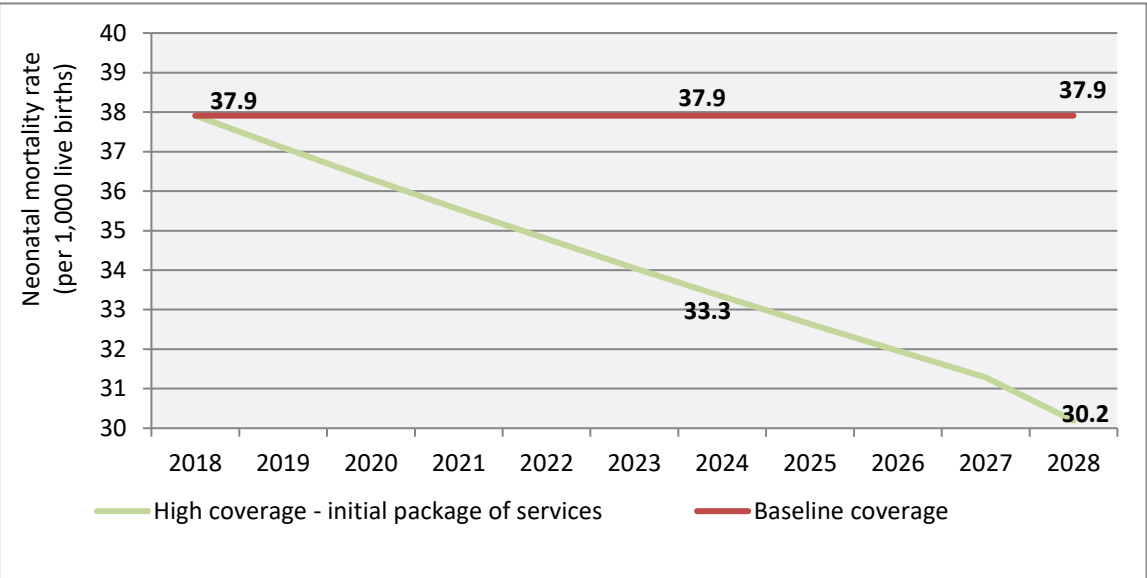
7. Limitations of the analysis

A number of limitations were recognised in the design of the analysis while others were encountered during the course of the analysis.

The analysis was carried out using secondary data collected from the MOH and partners. Due to time and budget constraints as well as security concerns, it was not possible conduct interviews with CHWs and supervisors to validate service delivery protocols and bottlenecks. The bottlenecks analysis, in particular, was limited as it was based only on the views of the discussion panel participants which did not include CHWs and their supervisors.

The costs of reducing or removing some of the bottlenecks are not included in the analysis. For example, the costs required for strengthening the supply chain in order to minimise stock-outs have not been included. The impact of the bottlenecks on the ability of the programme to scale up the numbers of services is taken into account to some degree in the choice of the coverage scenario – for example if the bottlenecks are deemed to have a significant impact on utilisation then the low coverage scenario may be the most likely scenario.

In estimating the time required for each service it was assumed that services would be provided at the home of the CHW (i.e., CHW travel time is not included). The exceptions are immunisation mobilisation and support, communicable disease control, and BCC. However, it may be that promotional visits for ANC, childbirth, and PNC require visits to women's houses, in which case the time allocated is under-estimated. Additional costs related to insecurity or corruption (e.g., replacing lost medicines, supplies, and equipment) has not been included in this analysis. Also, inflation in the purchasing power of the US Dollar is not taken into account in the cost projections which means that the costs will be understated to some degree, especially in later years. Further, the cost of CHW and direct supervisor travel is based on average data for a rural area. The actual costs may be more in remote rural areas or less in urban areas.

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While it is assumed that the GOSS will continue to engage with national and international non-governmental partners in the implementation of the BHI, this analysis did not include the overhead costs of NGO support. This analysis also did not consider any of the costs related to volunteer HHPs who, as key members of the BHT, will play an essential role in mobilising the population and supporting the CHWs. It is assumed that the CHWs will provide training and support to the HHPs as part of their activities.

No capital costs were included in this analysis other than the cost of the equipment needed by the CHWs, supervisors, and managers. These are treated as capital costs in the years that the equipment is to be purchased. The alternative method of depreciating the capital costs each year was not used because governments and donors usually charge capital costs when they are incurred.

The costs included in this analysis are from the provider perspective while the costs incurred by patients are not taken into account. Also, all the costs are financial costs as opportunity costs are not included.

Under the medium and high coverage scenarios, the CHWs would be fully occupied by 2027 and 2024, respectively, and would need 14 per cent and 68 per cent more hours by 2028, respectively. If CHWs cannot reduce number of services provided or the time spent on certain interventions in these later years, they would have to spend more time or more CHWs would have to be recruited. Both of these options which would result in increased costs which are not included in this analysis.

The impact analysis has several limitations related to the data needed to estimate the lives saved accurately:
- Some of the interventions included in the LiST model do not exactly correspond to the interventions included in the BHI package of services;
- The coverage data used in LiST is different from the data used in the cost modelling. For the cost analysis, MSH has defined coverage as the *number of services and activities provided by CHWs (i.e., utilisation)*. However, in LiST, coverage is defined as the *proportion of the population that receives the health intervention among those that needed it*. It would be incorrect to assume that the increase in the number of services provided and activities conducted by CHWs (as per the costing models) equates to an increase in the proportion of the population in need receiving the health intervention (as per the LiST models).
- National 2017 coverage data was unavailable for CHS in South Sudan (i.e., it is unknown exactly how many services CHWs provided in 2017). Because LiST quantifies the number of lives saved based on annual coverage increases from the baseline coverage rates, it is impossible to know exactly the number of lives saved which could be attributed to CHWs.
- It was not possible to quantify the impact of activities conducted by CHWs in increasing the adoption of health behaviours or increasing the coverage of health interventions provided at the health facility level. This represents a major constraint in projecting the impact of CHW interventions and activities which are mostly promotional. For instance, there are a number of health interventions which CHWs promote but do not *directly* provide, such as ante-natal care. Without significant research it is not possible to estimate the impact of these promotional

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interventions on the numbers of preventive or curative interventions. In the absence of these data, assumptions were made on judgement.

- Demonstrating the impact of CHWs in terms of mortality averted (i.e., lives saved) is too narrow and does not consider the other health and economic benefits of CHWs. For example, evidence suggests that investing in CHWs results in a 10:1 return when accounting for increased productivity due to a healthier population, avoiding high-cost health crises (e.g., epidemics), and the economic impact of increasing employment.[50] However, this analysis does not consider these benefits when framing the investment case for the BHI.

Finally, this analysis only presents the costs and impact associated with the training and provision of an *initial* package of services. It does not include the costs of any additional training and equipment needed for the services to be added in future years to expand the initial package into the comprehensive package of services.

8. Discussion

It is generally useful to compare the costs of health interventions across countries; however, very few studies have assessed the costs of comprehensive (i.e., multiple disease or health area) packages of CHS – as opposed to vertical community health programmes such as those focused on malaria, TB, or nutrition. A literature review conducted in 2015 found, for example, that out of 31 published articles on CHW costs or economics, only one covered a multiple disease package of services that include curative, preventive, and promotional services (Bowser et al, Mozambique, 2015).

Costing studies (led by MSH) of comprehensive CHS packages have been conducted in Malawi, Sierra Leone, and Madagascar; however, the circumstances of those countries and the packages of services are different than those in South Sudan. Studies of iCCM costs, which are included in the BHI, have been carried out in a number of countries (including South Sudan); however, the costs of these packages are not comparable with those of more comprehensive packages. In summary, no studies of the cost and impact of integrated CHS programmes have been

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conducted in fragile states similar to South Sudan[xxxv] and therefore there are no directly comparable data from other countries.

The cost of CHW salaries and incentives are a major element of the total cost and represent a relatively fixed cost. A key aspect of the programme will be to ensure that the time of CHWs is fully utilised and that they work efficiently and productively to maximise the health impact and investments in the BHI. It should be noted that the performance-based incentive payments are based on the completion of outreach visits and reporting and not on the numbers of individual cases treated or preventive services provided. Therefore, these performance-based incentive payments may not necessarily incentivise increases in numbers of individual persons reached.

The modelling indicates that the ratio of three CHWs per Boma will be under-utilised in the first few years after initiation. A cost-effective solution could be to initially train only one or two CHWs per Boma, especially if it is difficult to identify qualified CHW candidates or if there are funding shortages. An alternative would be to accelerate the scaling up of the package, although this would partly depend on the removal of the bottlenecks. Another alternative would be to expand the package of services but this would require additional training. The modelling also indicates, however, that, if the rate of scaling up of coverage is according to the medium or high scenarios, there will be insufficient CHWs in the later years. At this stage, it is too early to know the degree to which services will be utilised and the impact of those services. Therefore, it will be important to have a functioning monitoring and evaluation system in place to allow for programmatic adaptation as needed.

The cost and impact modelling are based on the premise that this is a new national CHW programme. It does not take into account any additional costs related to the transition of services from NGOs or to the continued roles of NGOs in supporting the implementation. It also assumed that all CHWs and supervisors need to be completely trained and equipped, as opposed to some not needing additional training or replacing of existing equipment. It also does not take into account the cost of developing transition plans or support from the donors and/or NGOs for implementation of the programme.

While the impact of successfully implementing and scaling up the BHI is likely to be significant in terms of lives saved, there will also be economic savings due to reduced morbidity. In some cases, these savings may relate to the

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[xxxv] According to the 2017 Fragile States Index the most fragile states were South Sudan, Somalia, Central African Republic, Yemen, Syria and Sudan (in order of severity).

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reduced need for treatment of common diseases at health facilities, although greater access to CHWs will also result in more utilisation of facility-based services where barriers to access are removed. More generally, economic savings will be felt by healthier families who can be more productive. However, there are significant challenges to the implementation of the BHI, including insecurity in some areas of the country, supply- and demand-side bottlenecks, and the funding required for the implementation of the national programme.

Additional research may be necessary to further guide the implementation of the BHI:

- A feasibility study assessing which geographic areas are suitable for immediate BHI implementation. This study should take into consideration the overall functionality and capacity of the health system (including the governance structures linked to CHS) and the absorptive management capacity of the MOH in general and in the context of security issues, mobile (semi-nomadic) and returning populations, and other bottlenecks.

- A mapping of existing CHW programmes with details on their location and distribution, capacity and role, remuneration and utilisation data to get a better understanding of workload and the viability of absorbing the CHWs into the national system

- An analysis of the impact of the bottlenecks on utilisation and the identification of appropriate solutions and the costs of those solutions.

- An analysis of the actual utilisation of facility-based services to serve as a baseline for evaluating health system changes resulting from the implementation of the BHI. to the national NHIs.

- A detailed cost-effectiveness analysis, taking into account the economic and financial costs, both for CHWs and for beneficiaries. This should include out-of-pocket and opportunity costs of beneficiaries for accessing services.

- Mapping of existing resources by programme, resource type and source, particularly in priority areas where initial scale up is anticipated.

- An assessment of the impact of context-specific financial and non-financial incentives on CHW performance and retention.

- An analysis on the role and impact of gender dynamics on the implementation of CHS in the context of South Sudan from the beneficiary and provider perspective.

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9. Conclusions and recommendations

Based on the baseline coverage assumptions used in the models, it is estimated that, if the initial package of the 19 BHI services is implemented throughout South Sudan, a total of 4.4 million services would be provided in 2018. By 2028, the number of services would increase to 17.8 million under the low scale-up scenario and 30.1 million and 48.6 million services under the medium and high scale-up scenarios, respectively.

The total cost in the first year of implementation (2018) would be US $19.9 million, which includes US $9.0 million for start-up equipment and training costs. The cost in 2028 would US $23.8 million, US $28.5 million and US $35.5 million for the low, medium, and high scale-up scenarios, respectively. These 2018 figures include US$6.3 million for the replacement of equipment.

The degree to which these scale-up targets can be achieved will depend on the security situation in the country as well as several potential bottlenecks that were identified in this analysis. Solutions to these bottlenecks and the cost of resolving them could not be ascertained due to the lack of time and resources available.

The cost of CHW salaries and performance-based incentives are a major element of the total cost. Therefore, a key aspect of the programme will be to ensure that time of CHWs is fully utilised and that they work efficiently and productively to maximise the health impact and investments in the BHI. The modelling indicates that the ratio of three CHWs per Boma will be under-utilised in the first few years after initiation. A cost-effective solution could be to initially train only one or two CHWs per Boma, especially if it is difficult to identify qualified CHW candidates or if there are funding shortages. An alternative would be to accelerate the scaling up of the initial package, although this would partly depend on the removal of the bottlenecks. Another alternative would be to expand the package of services, but this would require additional training. The modelling also indicates, however, that, if the rate of scaling up of coverage is according to the medium or high scenarios, there will insufficient CHWs in the later years, and the cost of engaging additional CHWs is not included in the models. At this stage, it is too early to know the degree to which services will be utilised and the impact of those services, so it will be important to have a good monitoring and evaluation system in place to allow for adaptation of the package.

Based on the projected increases in coverage of the initial package under the high coverage scenario, it is estimated that, by 2028 a total of 113,970 deaths could be averted compared to the baseline coverage scenario. These would be comprised of 24,675 neonatal deaths averted, 87,651 child (1-59 months) deaths averted and 1,644 maternal deaths averted.

The results of this analysis do not reflect all of the costs of implementing the BHI since the models only include the initial package of services. The models do not reflect the implementation of the expanded package of services nor the costs of the NGO support. Additional research would benefit the implementation of the BHI including, but not limited to, a feasibility study assessing which geographic areas are suitable for immediate BHI implementation; a cost analysis of removing CHS bottlenecks; and a study on the packages, utilisation, access, and resources use for services currently provided by NGOs.

Annexes

Annex 1. Initial package of services

The initial package of services is described in the BHI Implementation Guidance document.[xxxvi]

Communicable Diseases	
Diseases	**Interventions by the CHWs**
Malaria	• Health education: for awareness, prevention and treatment • Commodity distribution: ITN and appropriate use • Treatment: use of ACT in case management • Mobilisation: environmental measures
HIV	• Health education: awareness, prevention, and treatment • Commodity distribution: condoms • Mobilisation: mobilisation for VCT, treatment, and PMTCT
Tuberculosis	• Health education: awareness, prevention, and treatment • Referrals: presumptive cases or sputum to diagnostic centres • Treatment: DOTS, follow ups, and defaulter tracing
Diseases of epidemic potential	• Health education, prevention, treatment where possible • Community-based surveillance
Child Health	
Priority area	**Interventions by the CHWs**
Immunisation	• Health education: awareness for immunisation uptake • Mobilisation: mobilisation of communities for outreach services • Vaccination: carry out vaccination
Nutrition	• Health education: nutrition education, maternal-infant-young child feeding • Growth monitoring: screening for nutritional status and advice • Referral: further management and follow up visit of the child upon discharge
Malaria, diarrhoea, and pneumonia	• Health education: WASH • Treatment: diagnose and treat • Referral: further management in health facilities
Maternal Health	
Priority area	**Interventions by the CHWs**
Safe motherhood	• Health education on: ANC including micronutrient supplementation, safe deliveries, PNC, care of the newborn, family planning • Referrals: referrals for assisted deliveries. • Maternal death surveillance and response
First Aid	
Priority areas	• Awareness creation on common hazards and accidents • Basic interventions at site • Referral
Community Information System	
Priority area	**Interventions by the CHWs**
Community HMIS	• Reporting: regular activity reporting
Vital statistics	• Family records: births and deaths registration

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[xxxvi] South Sudan Ministry of Health. March 2016. The community health System in South Sudan: "The Boma Health Initiative": a community anchored health system for sustainable health sector development.

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Annex 2. List of key data assumptions and sources

Category of data	Reference value	Source
Economic and demographic data		
Baseline year of analysis	2018	
Period of analysis	2018-2028	
Total population	12,323,420	South Sudan National Bureau of Statistics (2017)
Annual population growth rate	2.9%	World Bank (2016)
Applied currency	All costs were inputted in USD. This includes MOH salaries, in accordance with a new circular.	Based on guidance from Ministry of Health (March 14, 2018)
Average household size	6.0	South Sudan DHS 2010 Final 2010 Report
Number of Regions	3	National Bureau of Statistics
Number of States	33	National Bureau of Statistics
Number of Counties	80	National Bureau of Statistics
Number of Payams	516	National Bureau of Statistics. Population Projections for South Sudan by Payam (From 2015-2020)
Number of Bomas	2,136	2008 Census
Programme data		
Geographic coverage	CHWs will cover all geographical areas (both rural and urban). It is assumed that three CHWs will cover one Boma.	Based on BHI guidance
Categories of CHWs		
Desired ratio of CHW per population	3 CHWs per newborn for Maternal and newborn health, 1 for Child Health, 1 for non-communicable and communicable diseases)	Boma Health Initiative
Attrition rate of CHWs	7.5%	Discussion panel assumption (2017)
Number of hours worked per CHW per week	35 hours per week	Assumption from Dr. Alfred Driwale. Note, however, the civil service standard is 40 hours per week.

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Annual salary	US $501.36 (assumes an exchange rate of 4.5 SSP per 1 US dollar)	Based on guidance from the Regional Office and drawing from the 2008 civil service salary scale (Grade 17): $41.78 per month
Performance-based incentives (monthly)	US $50/month (minimum)[xxxvii]	Based on activities conducted: • Immunisation outreach - 1 day community mobilisation and 1 day vaccination (2 days/month): $4 x 2 days = $8 • Safe motherhood outreach (4 days/month): $4 x 4 days = $16 • Infectious disease (HIV/TB/Malaria) outreach (4 days/month): $4 x 4 days = $16 • Monthly reporting - brings report to supervisor (1 day/month) = $10
Categories of supervisors		
Type of supervisor	One category of *direct* supervisor: Payam Health Officer	Boma Health Initiative
Desired ratio of CHWs per supervisor	13 CHWs per direct supervisor (1 supervisor will cover 1 Payam which has an average of 4.1 Bomas)	Calculation based on administrative units
Per cent of time for supervision	60%	Discussion panel assumption (2017)
Annual salary	US $999.96	Based on guidance from the Regional Office and drawing from the 2008 civil service salary scale (Grade 17): US $$83.33 per month
Package of interventions		
BHI package of services	See section 3 for a detailed description	Boma Health Initiative
Supervision		
On-site supervision (Payam Supervisor)	The Payam Supervisor visits each Boma once a month (48 visits/year) (USD 5 per Payam Supervisor per visit to cover the cost of fuel). (USD 5 for overnight stay for one third of the supervisory visits i.e., 13 visits)	MOH budget estimate for GAVI
On-site supervision (County Supervisor)	The County Supervisor visits each Payam (and selected Bomas) once in a quarter (7 payams per quarter). This totals 28 visits per year @$40 each per county. (USD 15 to cover transport and USD 25 to cover overnight stay in the field)	MOH budget estimate

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[xxxvii] The monthly performance-based incentive was increased by the MOH from US $25 to US $50 based upon feedback during the April 2018 validation meeting.

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On-site supervision (State Supervisor)	The State Supervisor visits each county (and nearby Payams/Bomas) every 4 months (1 x 4 days per county x 2 counties per state). This totals 6 visits per year @$40 each per state. (USD 15 to cover transport and USD 25 to cover overnight stay in the field).	MOH budget estimate
On-site supervision (National and Regional Supervisors)	The National/Regional Coordinator(s) visits each state (and selected counties, Payam and Bomas) annually. 5 days on average per visit (1 x 32 states x 5 days per year). This totals 32 visits per year @$600 each (USD 550 to cover air transport and USD 50 to cover overnight stay in the field)	MOH budget estimate *Note: Jubek state is excluded.*
Monthly group supervision	One meeting per month (US $5 per CHW per meeting to cover transportation costs).	MOH budget estimate for GAVI
Training		
Initial and refresher training for CHWs	• *Comprehensive Training of CHWs* (6 days), once only at a cost of US $259 per participant per session. • *Programme module specific trainings (assume 3 days), every 1 year to cover their respective module of BHI Service Package at a cost of US $230 per participant per session. (Number of CHWs x 1 specific module x USD 230).*	Derived from MOH draft budgets for BHI implementation. N.B.: The programme module specific training will take place annually for refresher training purposes. N.B.: 1CHW will be trained in maternal and newborn health, 1 CHW in child health, 1 CHW in non- and communicable diseases.
Initial and refresher training for direct supervisors (Payam Health Officers)	• *Comprehensive Training in BHI service package* (6 days), once only at a cost of US $814 per participant per session • *Technical programme specific training* (1 day), every year at a cost of US $116 per participant per session.	Derived from MOH draft budgets for BHI implementation
Training and refresher training for capacity development	• *Comprehensive training in BHI service package* for County Health Officers – 80 participants at a cost of US $300 per participant per session, once only. • *BHI TWG and facilitators' orientation (2 days) – 34 participants at a cost of US $85 per participant per session (ensure government staff are prioritised), once only* • *Training of master trainers— 4 participants at a cost of US $155 per participant per session* • *Regional BHI training of trainers (6 days) – 32 participants at a cost of US $1,273 per participant per session, once only.*	Derived from MOH draft budgets for BHI implementation
CHW equipment		

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Equipment used by CHWs	• Respiratory Rate Timer ($10.00 replaced every 2 years) • Beads for Counting Respiratory Rate ($18.00 replaced every 2 years) • Jags and cups for preparing ORS ($3.00 replaced every 2 years) • MUAC Tapes ($3.34 replaced every 1 year) • IEC materials for BHI($7.00 replaced every 3 years) • BHT illustration Charts ($7.00 replaced every 5 years) • BHI handbook ($7.00 replaced every 5 years) • Family Health Information Register ($10.00 replaced every year) • BHI Service Information Register ($10.00 replaced every year) • BHI reporting tools ($5.00 replaced every year) • Megaphone ($70.00 replaced every 5 years) • Mobile Phone ($200.00 replaced every 5 years) • Gum Boots ($20.00 replaced every 3 years) • Rain Coat ($25.00 replaced every 3 years) • Torch ($20.00 replaced every 5 years) • Identity cards ($5.00 replaced every 4 years) • Umbrella ($20.00 replaced every 2 years) • Heavy duty gloves ($15.00, purchased once) • Coat/jacket ($3.00 replaced every 3 years) • Metallic box ($150 replaced every 5 years) • Back pack ($75 replaced every 3 years) • Bicycles ($250 replaced every 5 years) • Sharps box, replaced every 1 year ($0.76 per box)	Discussion panel assumption (2017) based on partner input & further to MOH discussion
Mark-up on equipment for transportation, storage, management, and distribution	19.5%	Discussion panel assumption (2017) based on partner input
Medicines and commodities		
Medicines provided to CHWs	• Artesunate/Amodiaquine 2-11months - tablets - 25mg/67.5mg (3 tabs) - 1 treatment (3 tabs) $0.25 • Artesunate/Amodiaquine 1-5 years - tablets - 50mg/135mg (3 tabs) - 1 treatment (3 tabs) $0.34 • Malaria rapid diagnostic tests-RDT Pf- 1 diagnostic test kit $0.63	International Medical Products Price Guide

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	• ORS low osm. 20.5g/1L (non-flavoured) - Per 1 sachet $0.06 • Zinc 2-6 months - Per tablet - $0.01 • Zinc 6-59 months - Per tablet - $0.01 • Amoxicillin - Capsules and tablets - 250mg • (dispersible) 2-12 months (6 tabs)" - Per tablet - $0.03 • Amoxicillin - Capsules and tablets - 250mg • (dispersible) 1-5 years (12 tabs)" - Per tablet $0.03 • Male condom – 54 mm size - $0.0311 each	
Mark-up on medicines	10%	Discussion panel assumption (2017) based on partner input
Standard Treatment Guidelines		
Norms and standards of treatment per service	See Annex 5	Validated by discussion panel
Supervisor equipment		
Equipment used by CHW direct supervisors	• Motorcycles ($5,000 replaced every 5 years) • Mobile phones ($200 replaced every 5 years) • Miscellaneous office items ($120 replaced every year i.e., $10 per month) • Family health information database ($10 replaced every year) • BHI services information database ($10 replaced every year) • Payam BHI reporting form ($5 replaced every year)	Discussion panel assumption (2017) based on partner input

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Annex 3. Discussion panel participant list

#	First name	Surname	Organisation	Email address
Boma Health Initiative Costing and Investment Case Discussion Panel – 24 November 2017
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18	Makoy	Yibi	MOH	--
19	Solomon	Anguei Mayout	MOH	angueiditmayout@gmail.com
20	Simon	Dada	UNICEF	sdada@unicef.org
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Annex 4. Bottlenecks

The following section provides an analysis of the *current* bottlenecks within the community health system which are relevant and applicable to the future implementation of the BHI. The bottlenecks are categorised according to the following categories: (1) supply of services; (2) the demand for services; and (3) quality of services.

A common theme is the lack of funding and challenges related to priority setting and the allocation of scarce resources for community health. Given the limited financial resources among the GOSS and donors in the context of substantial health system and development challenges in South Sudan, prioritising scarce resources for community health is not without its challenges. For instance, there are increasing demands for the GOSS and donors to allocate resources to non-health sector activities (e.g., education initiatives) and to health facility services.

For each category of bottleneck, there are series of recommendations offered for addressing them. The following bottlenecks and recommendations were reported and reviewed by three working groups within the discussion panel and supplemented with additional research.

Supply bottlenecks

Availability of essential medicines, supplies, and equipment: According to the discussion panel, one of the main barriers to the delivery of CHS is the irregular supply and stock-outs of medicines, health supplies, and equipment. Stock-outs are reportedly widespread due to the number of vertical supply chain systems within South Sudan and the lack of available data,[xxxviii] it is not possible to quantify the level of stock-outs at health facilities or among community health programmes which, at the time of this analysis, were largely supported by NGOs. At present, key factors contributing to the irregular supply and stock-outs of essential commodities are weak logistics systems in the context of parallel supply chains, limited financial resources to cover high distribution costs for medicines and supplies, low levels of pharmaceutical management capacity and reporting, and limited storage space. While some of these challenges may be reduced when or if medicines, supplies, and equipment are procured and distributed through an integrated supply chain system coordinated by the MOH, this is likely to take time and, therefore, this may remain a barrier to achieving high coverage of CHS.

- *Weak logistics systems in the context of parallel supply chains* – South Sudan has a number of independent and vertical supply chain systems that are largely run by donor-supported organisations and lack oversight from the MOH.[xxxix] Each system has their own storage and

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[xxxviii] A 2010 assessment found stock-outs in 67 percent of health facilities based on the availability of tracer medicines. Source: Rajkotia, Yogesh, Stephanie Boulenger, and Willa Pressman. July 2007. Southern Sudan Health System Assessment. Bethesda, MD: Health Systems 20/20 project, Abt Associates Inc.

[xxxix] All procurement of medicines and vaccines in South Sudan is conducted by donors, the largest ones being the Health Pooled Fund, the Global Fund, UNICEF and UNFPA. As of 2017, the ROSS was not procuring any medicines. Each of these donors has strict procurement rules and regulations but this also implies that there are a number of parallel procurement channels. (Carasso et al., 2017. UNICEF assessment of the health and education supply chain in South Sudan, short version, July 2017).

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distribution methods which typically involve implementing NGO partners procuring/and or supplying products into the country all the way to the health facility and eventually to the Boma level.[51] The lack of capacity and involvement of the MOH and coordination among partners poses several potential challenges for the successful implementation of the BHI. If the MOH does not have oversight of the supply chain systems and remains reliant on implementing partners, it will be difficult to coherently monitor the stocks levels of CHWs for refill and ensure a coordinated approach to the procurement and distribution of products to the Boma level.

- *Limited financial resources in the face of high distribution costs* – According to the discussion panel, the current ROSS budget allocation for medicines and supply chain strengthening is inadequate.[xl] This has contributed to a reliance on donor funding for essential medicines at the PHCU, PHCC, and Boma levels. Moreover, implementing partners report incurring exorbitant costs for the transportation of supplies which is often done by airplane due to the limited road network (which is often in a poor state of repair), flooding, and the remoteness of facilities and communities.[52] The continued reliance on non-pooled procurement for the BHI will likely contribute to both higher transactional costs and higher total prices paid for products.[53] While procurement may be centralised under the BHI, inadequate human capacity and operational financial resources for County health departments and implementing NGOs may prevent stocks from reaching the facility and community levels as planned or on time.[54]

- *Limited pharmaceutical management capacity and reporting* – Most health facilities do not have adequate staff who have been trained on reporting stock levels. Moreover, health facilities lack the needed tools (e.g., stock cards, issue and receipt voucher, dispensing registers, prescription forms) to ensure reporting happens regularly.[55] Health facility, County, and State stores often lack the Logistics Management Information System for making informed decisions at all levels of the health system including at the Boma level. Also, Central Medical Stores are reportedly under-staffed and lack both the physical and technical capacity to procure, store, and distribute medicines to health facilities.[56] Also, because most health facilities lack the management capacity and physical infrastructure, the majority of supplies from the MOH only arrive so far as the county medical stores.[57] This lack of management capacity and reporting can lead to an accumulation of expired or damaged medicines.[58] With the introduction of the BHI, it is expected that CHWs will obtain medicines on a monthly basis at the Payam level from the PHCC.

- *Insufficient storage space* – The BHI is expected to require more products and storage space at all levels of the health system. Currently, the GOSS Central and State Medical Stores reportedly lack proper storage facilities and an inventory control system which would limit public medicine distribution by the Central Medical Stores.[59] Moreover, according to the discussion panel, many functional health facilities are not on the list of the Central Medical Stores to receive medicines. This may result in health facilities referring patients to CHWs (if adequately supplied), assuming they are regularly supplied. Moreover, not all Bomas have functional health facilities to store

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[xl] Information to support this is unavailable.

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medicines for the BHI, which presents a significant challenge for its successful implementation. Distance to supply chain points could also represent a major barrier for CHWs to have an adequate stock of medicines and supplies. While this analysis models the cost of equipping CHWs with a metallic box for storage, transportation for medicines and supplies, and training on inventory management and reporting, these initiatives may not be sufficient to address the aforementioned current bottlenecks.

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*Recommendations***:**
- Integrate existing vertical health supply chains with a focus on promoting greater coordination among donors, implementing partners, and the MOH. Enable the MOH to provide more oversight of the supply chain system and, through training, build the capacity of MOH personnel to assume coordination of pharmaceutical management activities.
- In the short-term, conduct pooled procurement to reduce transactional costs and costs of productions through price negotiation.
- Train MOH and NGO staff at all levels on stock reporting while ensuring that reporting tools are available at the health facility and among CHW supervisors.
- Train CHWs on inventory management and reporting.
- Leverage supply chain data for improved decision-making and monitoring the stocks of CHWs to prevent stock-outs.
- Expand the functionality of existing health facilities to store and receive medicines.
- Provide CHWs with a means of transportation and storage boxes for accessing and storing medicines and supplies from their supply chain point.

Availability of human resources: It is estimated that the national implementation of the BHI will require 6,408 trained CHWs (three per Boma). CHWs will be recruited by their communities based on specific selection criteria which including being a permanent resident of his or her locality, the ability to speak the local language, and being literate and having numeric skills necessary for the job. According to the BHI Strategy, CHWs are to be between the ages of 21-45 years and at least one of the three CHWs per Boma must be a woman. Identifying and recruiting CHWs that meet these selection criteria will be a challenge in many communities given the limited pool of eligible candidates. Moreover, given the dearth of qualified human resources throughout the country, and the expansion of the numbers of States, Counties and Payams which will require more management staffing, it will also be difficult to recruit qualified personnel at the *County, Payam, and State level* to support the management of the BHI and the supervisions of CHWs.

- *There is a limited pool of qualified personnel at the Boma level to serve in the CHW role*. Among existing community health programmes, it has proved challenging to identify and recruit CHWs and HHPs. After decades of war, many South Sudanese have never received a formal education and only 27 per cent of the population is literate.[60] It is assumed that women have lower rates of literacy. With the introduction of the BHI, it is likely that a number of Bomas will be unable to identify candidates with the requisite literacy skills who have at least a primary level education. In the likely event in which women may not meet the selection criteria, BHTs will face challenges

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delivering gender- sensitive messaging and services (e.g., targeting women who are experiencing complications of child birth and during the post-natal period). The inability to meet the needs of the population and provide gender-sensitive messaging will result in reduced confidence among communities in the BHI and CHWs.

- *BHT selection process* – The selection of BHTs is expected to be led by the community under the supervision of the BHC. Among existing community health programmes, it has been observed that some BHTs have been selected by BHCs who have not been sensitised on the principles and selection criteria of the BHI. Consequently, this leads to the selection of unqualified people which may also create resentment among the community. A lack of adherence to BHI processes and guidance is a serious bottleneck to the selection of qualified BHTs. In addition, in many areas of the country, the current boundaries of Bomas are not well-established and are further complicated by population movements which can hinder the BHT selection process and the implementation of the BHI.

- *Attrition of BHTs – Attrition* is reportedly common among CHWs and therefore limits the availability of services at the community level while increasing programme costs required for re-training. According to implementing partners at the discussion panel, attrition rates typically range from five to 10 per cent due to a variety of reasons ranging from the displacement of populations (i.e., due to violence), misconduct of individual CHWs, death, marriage (and moving to a different locality), and better more lucrative job prospects. The loss of trained NGO-supported HHPs and community health personnel was also identified as a bottleneck for the future implementation of the BHI given their roles within the community health structure.

- *Limited financial incentives* – The level of CHW salaries stated in the BHI Strategy (ROSS Grade 17) are likely to contribute to CHW attrition as they are reportedly lower than what many existing community health programmes currently offer to HHPs and other community health personnel. The introduction of performance-based incentives is intended to mitigate attrition.

> *Recommendations***:**
> - Revisit the selection criteria of CHWs and make exceptions where there is a limited pool of qualified CHW candidates and/or consider recruitment of CHWs from outside of the community. Where eligible candidates are limited, engage with private sector partners (e.g., NGOs) and community health structures to identify qualified candidates.
> - Ensure CHW coordination with HHPs and other community health personnel (e.g., traditional birth attendants) while delineating clear roles and responsibilities to avoid overlap of functions.
> - Train BHCs on the principles and recruitment criteria of the BHI and encourage BHCs to sensitise their communities on the role of CHWs and the services they are trained to provide.
> - Harmonise the incentives among existing implementing partners to reflect the CHWs' workload, opportunity costs, and the environment in which they work.
> - Provide on-time compensation to CHWs for salaries, per diem payments, transport reimbursement, and performance-based incentives. Coordinate with donors to promote on-time provision of performance-based incentives so as to avoid frustration among CHWs and attrition. Programme managers supporting CHWs must consider how performance-based incentives will be paid in a timely manner as well as how results and activities will be verified on a regular basis.
> - Ensure CHWs also receive nonfinancial incentives to improve their motivation and capacity to encourage the provision of high-quality services. Non-financial incentives could include regular training, supervision, public recognition, and professional development opportunities.

Geographical accessibility: As per the BHI Strategy, each Boma should be covered by a team of three CHWs. However, given disparate issues of physical distance (between populations, CHWs, and health facilities), geographic accessibility, population size, and insecurity, the distribution of CHWs may be insufficient and should therefore be adapted to ensure adequate coverage of populations, where necessary.

- *Insufficient coverage of BHTs in large Bomas* – The provision of CHS by three member BHTs will limit access to services in communities which are located in large Bomas. Whereas current iCCM programmes rely on one community distributor for 30 households to maximise access to services,[xli] this formula will be unsustainable for the national implementation of BHI given the lack of financial resources. Accessing services offered by CHWs and the PHCU (for referrals and other essential services) will remain a challenge given issues of distance, as only 28.6 per cent of the population lives within five km of a facility[61] and those living in rural areas may still be far from CHWs. Whereas, the BHI strategy recommendation of three CHWs per Boma is more suitable for sedentary communities it may prove challenging for mobile and semi-nomadic communities in search of water and pasture as well as in urban Bomas with larger populations. Also, during the rainy season, many communities are inaccessible[62] and therefore are at risk of going without care.

[xli] According to discussion panel participants.

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- *Insecurity* – in many areas of the country, insecurity, often due to violent clashes, represents a barrier to accessing services and can also contribute to attrition among CHWs and other health personnel. The lack of trained personnel (including CHWs) prevents survivors of violence from accessing and receiving appropriate services.[63]

> *Recommendations***:**
> - Conduct a mapping to determine the number of CHWs, their location, and their capacity and regularly update this database to address current supply of and need for CHWs. Mapping should complement existing health facility surveys (such as the 2018 *Service availability and readiness assessment*) and consider CHWs' proximity to existing health facilities and identifying their functionality in serving as referral centres.
> - Ensure coverage of three CHWs per Boma with each CHW responsible for covering a designated *geographic* area of the Boma (as opposed to training CHWs to provide different packages of services) which should reduce household economic costs (e.g., for travel). *N.B.: on 9 April 2018, the MOH agreed upon this standard for geographic coverage and determined that training CHWs on different packages of services would likely be inefficient and lead to inequitable access to care.*
> - In urban areas, consider increasing the number of CHWs to ensure adequate population coverage.
> - In rural Bomas covering large geographic areas, consider adapting the recommended ratio of three CHWs per Boma to ensure adequate coverage of CHS (e.g., by ratio of CHWs per population instead of by community). Moreover, consider increasing financial incentives to cover CHW travel costs in areas requiring substantial travel between households.
> - Encourage the recruitment and selection of CHWs from within mobile and nomadic communities which often are without access to care.
> - Incorporate CHW training modules on the provision of care and referrals for survivors of violence and internally displaced persons.
> - Expand mobile outreach interventions to reach inaccessible communities.

Demand bottlenecks

Acceptability and affordability: The demand of CHS in South Sudan can be limited by issues of acceptability (notably cultural norms, gender barriers, local politics, poverty, and lack of knowledge and awareness of services) and the affordability of accessing CHS.

- *Lack of knowledge, awareness, and misinformation* – Among communities, a lack of correct information on the BHI and its benefits can discourage members of the community from seeking CHS. According to the discussion panel, the acceptance of CHS by communities can be impeded by a lack of awareness of the BHI as well as cultural beliefs, attitudes, and practices which may consider CHS services to be inappropriate. Communities which are not informed about the objectives and benefits of the BHI may not effectively come to understand the important role of

the community which will likely impede the success of the BHI. Also, myths and misconceptions about CHS are widespread and can represent barriers to access. For example, according to the discussion panel, in some communities it is believed that if a breastfeeding mother has sexual intercourse, her child will develop diarrhoea and begin vomiting. Consequently, the control measures will involve excluding the mother from social gatherings and other social interactions. As a remedy, an elderly woman would burn grass in the evening for the mother to step on. Another example reported by the discussion panel is that a malnourished child is suggestive of the child being fathered by a man other than the husband of the mother. In the context of such beliefs and in the absence of effective BCC, BHI services may not be accepted and utilised by the communities.

- *Lack of buy-in from community leadership* and stakeholders - If community leaders are not effectively involved at every stage of BHI implementation, there may be general mistrust and limited acceptability of the BHI. The omission of powerful and influential groups in the BHT selection and BHI planning processes could lead to resistance. These groups may include women groups, youth groups, and elders. Moreover, if the selection of CHWs is not led or accepted by the community, this can lead to general distrust of the BHI and low acceptance of CHS. According to the discussion panel, the selection of CHWs within new administrative structures may potentially demobilise communities from participating in BHI if the selection is coordinated from the old administrative units.

- *Gender barriers* – Gender inequality is pervasive in many communities in the context of patriarchal norms.[64] For this reason, the BHI strategy strongly recommends at least one of the three CHWs to be a woman. However, gender-based prejudices among communities may limit acceptance of CHS provided by female CHWs, especially those services that target men (e.g., the promotion of safe motherhood through the skilled birth attendance at facilities). Such biases may even extend to young CHWs who may be perceived as inexperienced.

- *Affordability* **–** While the provision of services is free-of-charge under the BHI, patients can incur out-of-pocket expenses for accessing care including but not limited to travel expenses, buying medicines during stock-out periods, and informal user fees.

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> *Recommendations***:**
> - Involve key local stakeholders in the BHT selection and implementation processes to ensure buy-in, recognition, and acceptability from the community.
> - Strengthen the ability of community health leaders and structures (particularly BHCs and Payam councils) to manage community health initiatives and support CHWs.
> - Adapt BCC messaging to address local myths and misconceptions and to encourage care seeking from CHWs.
> - Ensure the community BHT selection processes includes the recruitment of female CHWs to reduce gender barriers to services.
> - Mitigate financial barriers to access by reducing the costs to households for health services (safe delivery kits, conditional cash transfers, etc.) and educating the communities that CHS provided through the BHI are free-of-charge.

Quality bottlenecks

Adequate quality of services: The low capacity of CHWs and supervisors, poor linkages between CHWs and health facilities, limited equipment, and a lack of data, will impede the quality of CHS and the effective and efficient implementation of the BHI.

- *Human resources capacity for service delivery and supervision* – The BHI package of service is designed to be comprehensive and address many of priority health challenges faced by communities. However, the capacity of CHWs and supervisors may negatively impact the quality of services provided. Some CHWs may have low literacy and most of the proposed Payam Health Officers will be new to community health programing. Moreover, health facilities are poorly staffed, overloaded, and may not have requisite skills to support the supervision of the BHI. It should be noted that not all Bomas have health facilities which will complicate the referral process.

- *Poor linkages between CHWs and health facilities* – Poor communication and a lack of referral and counter referral networks between CHWs and health facilities will affect the quality of care provided to patients.

- *Limited equipment* – CHWs will require adequate equipment to function in their role and deliver quality services. These include metallic boxes for storing medicines, a megaphone, mobile phone, uniform, registers and reporting forms, and a bicycle, among other items. CHW supervisors will require transportation in the form of a motorbike to provide timely and adequate supervision. This analysis has included the initial and replacement costs of providing CHWs and supervisors with these aforementioned items. According to the discussion panel, the replacement costs of equipment are a bottleneck among *existing* community health programmes from supplying CHWs and supervisors with the needed equipment thus affecting the quality of care.

- *Quality of data:* BHI implementation will be monitored through the HMIS and CHWs are to receive registers, reporting forms, and summary sheets. The BHI includes a one-day training on the HMIS and reporting but this may be inadequate for CHWs to effectively learn reporting standards. This is likely to affect the data quality, accuracy, timeliness and completeness of data reporting. Currently, community data collection tools are not linked to the HMIS. Therefore, there is neither a complete picture of the numbers and types of services provided through existing community health programmes nor data on the completeness of reporting.

Recommendations:
- Ensure sufficient human resources at the Payam level to carry out CHW supervision.
- Establish referral and counter-referral networks between CHWs and health facilities to improve the continuum of care.
- Plan for short- and long-term programme costs, identifying the resource needs to sustain CHWs and supervisors (e.g., equipment and training).
- Conduct on-the job CHW training and supervision to ensure compliance with standard operating procedures and reporting guidelines.
- Support the development of community data collection tools which can be subsequently linked to the HMIS.
- Expand social accountability mechanisms (e.g., community feedback days) within the community to improve the quality of service provision.

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Annex 5. Expected utilisation rates and CHW minutes per service

The expected utilisation rate for each service and the number of minutes required by a CHW to provide a good quality service are shown in Table 8 below. This analysis used national estimates of incidence rates, where possible, and regional estimates when national estimates were not available. At the recommendation of the discussion panel, for this analysis, travel time was not factored into the estimated number of minutes per service. Therefore, these figures may underestimate the actual required time per service.

Table 8. Package of services - utilisation rates and CHW time per service

Service	Programme	Service type	Target population group	Target population number (2018)	Expected Utilisation rate per year	Number of services (2018)	CHW minutes per service[xlii]	Notes
Malaria diagnosis (RDT)	Child Health	Curative	Children 2-59 months	1,888,115	4 cases of fever	7,552,460	15	
Malaria treatment	Child Health	Curative	Children 2-59 months	1,888,115	2 cases	3,776,230	40	
Pneumonia diagnosis and treatment	Child Health	Curative	Children 2-59 months	1,888,115	0.28 cases	528,672	45	
Diarrhea treatment	Child Health	Curative	Children 2-59 months	1,888,115	3.3 cases	6,230,780	45	
Assess children for nutritional status	Child Health	Curative	Children 2-59 months	1,888,115	1 child assessed	1,888,115	2	It is assumed that this service would be integrated with iCCM services and therefore take two minutes per child.
Referrals of children with complicated malaria, pneumonia or diarrhea	Child Health	Curative	Children 2-59 months	1,888,115	0.60 cases[xliii]	1,128,673	10	

[xlii] At the recommendation of the discussion panel, for this analysis, travel time was not factored into the estimated number of minutes per service. Therefore, these figures may underestimate the actual required time per service.

[xliii] Estimate based on 10% of treated malaria, pneumonia and diarrhea cases and 5% of children assessed for malnutrition, rounded to 0.60.

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Immunisation (day 1) - monthly mobilisation of mothers and caregivers	Child Health	Preventive	CHW catchment area	6,408	12 monthly visits	76,896	180	Target population 2,136 Bomas * 3 CHW areas
Immunisation (day 2) - monthly Immunisation at post (CHWs update family health register)	Child Health	Preventive	CHW catchment area	6,408	12 monthly visits	76,896	180	Target population 2,136 Bomas * 3 CHW areas
Communicable disease control promotion - outreach visit (malaria, HIV, TB, NTDs)	Control of Common Communicable Diseases	Preventive	CHW catchment area	6,408	52 weekly visits	333,216	300	Target population 2,136 Bomas * 3 CHW areas
Male condom distribution[xliv]	Control of Common Communicable Diseases	Preventive	Male adults	3,544,525	5.88	625,254	10	It was assumed that condom provision (by a CHW) would occur once per month at which time male adult would receive 12 condoms. This quantity based on previous modeling in Madagascar.
Antenatal care promotional visit	Safe Motherhood	Promotional	Pregnant women	461,158	4 times per woman	1,844,632	25	
Childbirth promotional visit (for birth planning)	Safe Motherhood	Promotional	Pregnant women	461,158	1 time per woman	461,158	20	
Postnatal care + maternal and child health nutrition promotional visit	Safe Motherhood	Promotional	Pregnant women	461,158	4 times per woman	1,844,632	40	

[xliv] In the BHI Implementation Guidance document, the provision of male condoms is explicitly mentioned an intervention to prevent the spread of HIV (Annex 1). Nevertheless, for the purpose of this analysis, we estimated the impact of condom use on an increase in modern contraceptive prevalence.

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BCC - child spacing, adolescent health, gender-based violence	Safe Motherhood	Promotional	CHW catchment area	6,408	52 weekly visits	333,216	120	Target population 2,136 Bomas * 3 CHW areas
Referral of pregnant women for danger signs	Safe Motherhood	Preventive	Pregnant women	461,158	0.1 case	46,116	20	
Maintaining Family Health Information Register (1x annually)	Vital Registration and Community-Based Surveillance	Reporting	CHW catchment area	6,408	1 time per year	6,408	300	Target population 2,136 Bomas * 3 CHW areas
Maintaining Health Services Register (weekly)	Vital Registration and Community-Based Surveillance	Reporting	CHW catchment area	6,408	52 weekly activities	333,216	60	Target population 2,136 Bomas * 3 CHW areas
Reporting on services to the Payam Health Office (monthly)	Vital Registration and Community-Based Surveillance	Reporting	CHW catchment area	6,408	12 monthly activities	76,896	60	Target population 2,136 Bomas * 3 CHW areas
Reporting for the Community Based Surveillance System (weekly)	Vital Registration and Community-Based Surveillance	Reporting	CHW catchment area	6,408	52 weekly activities	333,216	60	Target population 2,136 Bomas * 3 CHW areas

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Annex 6. Coverage numbers

Table 9. Numbers of services under low coverage scenario

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
TOTAL	4,425,467	5,473,266	6,578,799	7,744,534	8,973,044	10,266,992	11,629,148	13,062,384	14,569,681	16,154,139	17,818,967
Malaria diagnosis (RDT)	755,246	932,578	1,119,560	1,316,602	1,524,132	1,742,590	1,972,438	2,214,152	2,468,226	2,735,174	3,015,529
Malaria treatment	377,623	466,289	559,780	658,301	762,066	871,295	986,219	1,107,076	1,234,113	1,367,587	1,507,765
Pneumonia diagnosis and treatment	52,867	65,280	78,369	92,162	106,689	121,981	138,071	154,991	172,776	191,462	211,087
Diarrhea treatment	623,078	769,377	923,637	1,086,197	1,257,409	1,437,637	1,627,261	1,826,675	2,036,286	2,256,519	2,487,812
Assess children for nutritional status	188,812	233,145	279,890	329,151	381,033	435,648	493,110	553,538	617,056	683,794	753,882
Referrals of children with	112,867	139,369	167,312	196,759	227,773	260,420	294,770	330,893	368,863	408,757	450,654
Immunization (day 1) - monthly mobilization of mothers and caregivers	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896
Immunization (day 2) - monthly immunization at post (CHWs update family health register)	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896
Communicable disease control - outreach visit (malaria, HIV, TB, NTDs)	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216
Antenatal care promotional visit	184,463	227,775	273,444	321,570	372,257	425,614	481,753	540,790	602,845	668,045	736,520
Childbirth promotional visit (for birth planning)	46,116	56,944	68,361	80,392	93,064	106,404	120,438	135,198	150,711	167,011	184,130
Postnatal care + maternal and child health nutrition promotional visit	184,463	227,775	273,444	321,570	372,257	425,614	481,753	540,790	602,845	668,045	736,520
BCC - child spacing, adolescent health, gender based violence	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216
Referral of pregnant women for danger signs	4,612	5,694	6,836	8,039	9,306	10,640	12,044	13,520	15,071	16,701	18,413
Maintaining Family Health Information Register (1x annually)	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408
Maintaining Health Services Register (weekly)	33,322	39,986	46,650	53,315	59,979	66,643	73,308	79,972	86,636	93,300	99,965
Reporting on services to the Payam Health Office (monthly)	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896
Reporting for the Community Based Surveillance System (weekly)	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216
Male condom provision	625,254	1,072,311	1,544,771	2,043,732	2,570,334	3,125,760	3,711,239	4,328,047	4,977,508	5,660,999	6,379,946

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Table 10. Numbers of services under medium coverage scenario

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
TOTAL	**4,425,467**	**6,429,559**	**8,546,463**	**10,781,044**	**13,138,363**	**15,623,667**	**18,242,411**	**21,000,254**	**23,903,069**	**26,956,964**	**30,168,264**
Malaria diagnosis (RDT)	755,246	1,088,008	1,439,434	1,810,328	2,201,524	2,613,886	3,048,314	3,505,740	3,987,134	4,493,501	5,025,882
Malaria treatment	377,623	544,004	719,717	905,164	1,100,762	1,306,943	1,524,157	1,752,870	1,993,567	2,246,750	2,512,941
Pneumonia diagnosis and treatment	52,867	76,161	100,760	126,723	154,107	182,972	213,382	245,402	279,099	314,545	351,812
Diarrhea treatment	623,078	897,606	1,187,533	1,493,521	1,816,257	2,156,456	2,514,859	2,892,236	3,289,385	3,707,138	4,146,353
Assess children for nutritional status	188,812	272,002	359,859	452,582	550,381	653,471	762,078	876,435	996,783	1,123,375	1,256,471
Referrals of children with	112,867	162,597	215,115	270,543	329,006	390,631	455,554	523,913	595,855	671,529	751,090
Immunization (day 1) - monthly mobilization of mothers and caregivers	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896
Immunization (day 2) - monthly immunization at post (CHWs update family health register)	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896
Communicable disease control - outreach visit (malaria, HIV, TB, NTDs)	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216
Antenatal care promotional visit	184,463	265,737	351,571	442,159	537,705	638,422	744,528	856,251	973,827	1,097,503	1,227,534
Childbirth promotional visit (for birth planning)	46,116	66,434	87,893	110,540	134,426	159,605	186,132	214,063	243,457	274,376	306,884
Postnatal care + maternal and child health nutrition promotional visit	184,463	265,737	351,571	442,159	537,705	638,422	744,528	856,251	973,827	1,097,503	1,227,534
BCC - child spacing, adolescent health, gender based violence	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216
Referral of pregnant women for danger signs	4,612	6,643	8,789	11,054	13,443	15,961	18,613	21,406	24,346	27,438	30,688
Maintaining Family Health Information Register (1x annually)	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408
Maintaining Health Services Register (weekly)	33,322	46,650	59,979	73,308	86,636	99,965	113,293	126,622	139,951	153,279	166,608
Reporting on services to the Payam Health Office (monthly)	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896
Reporting for the Community Based Surveillance System (weekly)	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216
Male condom provision	625,254	1,501,235	2,427,498	3,406,220	4,439,668	5,530,191	6,680,230	7,892,321	9,169,094	10,513,283	11,927,724

Table 11. Numbers of services under high coverage scenario

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
TOTAL	**4,425,467**	**7,863,999**	**11,497,960**	**15,335,809**	**19,386,342**	**23,658,679**	**28,162,306**	**32,907,059**	**37,903,152**	**43,161,202**	**48,692,210**
Malaria diagnosis (RDT)	755,246	1,321,152	1,919,245	2,550,917	3,217,612	3,920,828	4,662,127	5,443,123	6,265,496	7,130,990	8,041,411
Malaria treatment	377,623	660,576	959,623	1,275,458	1,608,806	1,960,414	2,331,063	2,721,561	3,132,748	3,565,495	4,020,706
Pneumonia diagnosis and treatment	52,867	92,481	134,347	178,564	225,233	274,458	326,349	381,019	438,585	499,169	562,899
Diarrhea treatment	623,078	1,089,951	1,583,377	2,104,506	2,654,530	3,234,683	3,846,254	4,490,576	5,169,034	5,883,067	6,634,164
Assess children for nutritional status	188,812	330,288	479,811	637,729	804,403	980,207	1,165,532	1,360,781	1,566,374	1,782,748	2,010,353
Referrals of children with	112,867	197,439	286,821	381,220	480,854	585,946	696,729	813,444	936,344	1,065,687	1,201,744
Immunization (day 1) - monthly mobilization of mothers and caregivers	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896
Immunization (day 2) - monthly immunization at post (CHWs update family health register)	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896
Communicable disease control - outreach visit (malaria, HIV, TB, NTDs)	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216
Antenatal care promotional visit	184,463	322,681	468,761	623,042	785,876	957,632	1,138,690	1,329,442	1,530,300	1,741,689	1,964,054
Childbirth promotional visit (for birth planning)	46,116	80,670	117,190	155,760	196,469	239,408	284,672	332,361	382,575	435,422	491,014
Postnatal care + maternal and child health nutrition promotional visit	184,463	322,681	468,761	623,042	785,876	957,632	1,138,690	1,329,442	1,530,300	1,741,689	1,964,054
BCC - child spacing, adolescent health, gender based violence	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216
Referral of pregnant women for danger signs	4,612	8,067	11,719	15,576	19,647	23,941	28,467	33,236	38,257	43,542	49,101
Maintaining Family Health Information Register (1x annually)	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408
Maintaining Health Services Register (weekly)	33,322	56,647	79,972	103,297	126,622	149,947	173,272	196,597	219,923	243,248	266,573
Reporting on services to the Payam Health Office (monthly)	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896	76,896
Reporting for the Community Based Surveillance System (weekly)	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216	333,216
Male condom provision	625,254	2,144,622	3,751,588	5,449,953	7,243,669	9,136,837	11,133,717	13,238,732	15,456,472	17,791,710	20,249,393

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Annex 7. Total costs by input type

Table 12. Total cost by input type – low coverage scenario (2018-2028) (US $)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
CHW Salaries	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344
CHW Equipment	3,509,766	225,637	754,009	646,803	792,297	2,415,699	1,175,175	225,637	792,297	646,803	2,944,071
Medicines and supplies	1,152,795	1,546,729	1,962,542	2,401,170	2,863,589	3,350,808	3,863,878	4,403,889	4,971,970	5,569,297	6,197,086
Supervision Salaries	309,600	309,600	309,600	309,600	309,600	309,600	309,600	309,600	309,600	309,600	309,600
Supervision Equipment	3,320,499	15,416	15,416	15,416	15,416	3,320,499	15,416	15,416	15,416	15,416	3,320,499
Supervision Visits	547,243	547,243	547,243	547,243	547,243	547,243	547,243	547,243	547,243	547,243	547,243
Recurrent Training (CHWs)	-	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840
Recurrent Training (Supervisors)	-	60,024	60,024	60,024	60,024	60,024	60,024	60,024	60,024	60,024	60,024
Recurrent Training (Managers)	-	-	-	-	-	-	-	-	-	-	-
Management Salaries	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145
Management Equipment	24,139	4,780	4,780	4,780	4,780	24,139	4,780	4,780	4,780	4,780	24,139
Management Meetings	601,700	601,700	601,700	601,700	601,700	601,700	601,700	601,700	601,700	601,700	601,700
Other Recurrent Costs	-	-	-	-	-	-	-	-	-	-	-
Start-up Training (CHWs)	1,660,100	124,611	124,611	124,611	124,611	124,611	124,611	124,611	124,611	124,611	124,611
Start-up Training (Supervisors)	420,168	-	-	-	-	-	-	-	-	-	-
Start-up Training (Managers)	68,236	-	-	-	-	-	-	-	-	-	-
Capital Costs	-	-	-	-	-	-	-	-	-	-	-
Total	19,900,735	13,196,069	14,140,254	14,471,676	15,079,588	20,514,652	16,462,755	16,053,229	17,187,969	17,639,803	23,889,302

Table 13. Total cost by input type – medium coverage scenario (2018-2028) (US $)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
CHW Salaries	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344
CHW Equipment	3,509,766	225,637	754,009	646,803	792,297	2,415,699	1,175,175	225,637	792,297	646,803	2,944,071
Medicines and supplies	1,152,795	1,907,232	2,704,456	3,546,315	4,434,728	5,371,686	6,359,258	7,399,592	8,494,917	9,647,548	10,859,886
Supervision Salaries	309,600	309,600	309,600	309,600	309,600	309,600	309,600	309,600	309,600	309,600	309,600
Supervision Equipment	3,320,499	15,416	15,416	15,416	15,416	3,320,499	15,416	15,416	15,416	15,416	3,320,499
Supervision Visits	547,243	547,243	547,243	547,243	547,243	547,243	547,243	547,243	547,243	547,243	547,243
Recurrent Training (CHWs)	-	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840
Recurrent Training (Supervisors)	-	60,024	60,024	60,024	60,024	60,024	60,024	60,024	60,024	60,024	60,024
Recurrent Training (Managers)	-	-	-	-	-	-	-	-	-	-	-
Management Salaries	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145
Management Equipment	24,139	4,780	4,780	4,780	4,780	24,139	4,780	4,780	4,780	4,780	24,139
Management Meetings	601,700	601,700	601,700	601,700	601,700	601,700	601,700	601,700	601,700	601,700	601,700
Other Recurrent Costs	-	-	-	-	-	-	-	-	-	-	-
Start-up Training (CHWs)	1,660,100	124,611	124,611	124,611	124,611	124,611	124,611	124,611	124,611	124,611	124,611
Start-up Training (Supervisors)	420,168	-	-	-	-	-	-	-	-	-	-
Start-up Training (Managers)	68,236	-	-	-	-	-	-	-	-	-	-
Capital Costs	-	-	-	-	-	-	-	-	-	-	-
Total	19,900,735	13,556,572	14,882,168	15,616,821	16,650,727	22,535,530	18,958,135	19,048,932	20,710,916	21,718,054	28,552,102

Table 14. Total cost by input type – high coverage scenario (2018-2028) (US $)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
CHW Salaries	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344	7,057,344
CHW Equipment	3,509,766	225,637	754,009	646,803	792,297	2,415,699	1,175,175	225,637	792,297	646,803	2,944,071
Medicines and supplies	1,152,795	2,447,986	3,817,328	5,264,032	6,791,437	8,403,002	10,102,327	11,893,147	13,779,337	15,764,926	17,854,088
Supervision Salaries	309,600	309,600	309,600	309,600	309,600	309,600	309,600	309,600	309,600	309,600	309,600
Supervision Equipment	3,320,499	15,416	15,416	15,416	15,416	3,320,499	15,416	15,416	15,416	15,416	3,320,499
Supervision Visits	547,243	547,243	547,243	547,243	547,243	547,243	547,243	547,243	547,243	547,243	547,243
Recurrent Training (CHWs)	-	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840	1,473,840
Recurrent Training (Supervisors)	-	60,024	60,024	60,024	60,024	60,024	60,024	60,024	60,024	60,024	60,024
Recurrent Training (Managers)	-	-	-	-	-	-	-	-	-	-	-
Management Salaries	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145	1,229,145
Management Equipment	24,139	4,780	4,780	4,780	4,780	24,139	4,780	4,780	4,780	4,780	24,139
Management Meetings	601,700	601,700	601,700	601,700	601,700	601,700	601,700	601,700	601,700	601,700	601,700
Other Recurrent Costs	-	-	-	-	-	-	-	-	-	-	-
Start-up Training (CHWs)	1,660,100	124,611	124,611	124,611	124,611	124,611	124,611	124,611	124,611	124,611	124,611
Start-up Training (Supervisors)	420,168	-	-	-	-	-	-	-	-	-	-
Start-up Training (Managers)	68,236	-	-	-	-	-	-	-	-	-	-
Capital Costs	-	-	-	-	-	-	-	-	-	-	-
Total	19,900,735	14,097,326	15,995,040	17,334,538	19,007,436	25,566,846	22,701,204	23,542,487	25,995,336	27,835,432	35,546,304

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Annex 8. Total costs by programme

Table 15. Total costs by programme – low coverage scenario (2018-2028) (US $)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Child Health	7,936,662	5,262,681	6,266,401	6,373,618	7,176,523	9,667,874	8,231,176	7,931,221	8,895,669	9,010,304	12,666,321
Safe Motherhood	3,136,973	2,034,795	1,969,084	1,968,563	1,862,209	2,470,991	1,808,692	1,717,625	1,684,583	1,681,190	2,093,642
Control of Common Communicable Diseases	6,869,037	4,670,051	4,754,536	5,016,654	5,021,801	7,066,426	5,494,532	5,550,122	5,795,587	6,162,375	8,179,878
Community based HMIS and Surveillance	1,958,063	1,228,542	1,150,232	1,112,841	1,019,056	1,309,361	928,355	854,261	812,130	785,933	949,460
Total	19,900,735	13,196,069	14,140,253	14,471,676	15,079,588	20,514,652	16,462,755	16,053,228	17,187,969	17,639,802	23,889,301

Table 16. Total costs by programme – medium coverage scenario (2018-2028) (US $)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Child Health	7,936,662	5,648,517	6,966,754	7,375,964	8,417,111	11,343,084	9,976,119	9,925,620	11,135,253	11,535,938	15,523,927
Safe Motherhood	3,136,973	1,976,998	1,872,342	1,833,987	1,716,947	2,180,763	1,632,192	1,544,486	1,509,387	1,494,241	1,780,349
Control of Common Communicable Diseases	6,869,037	4,767,448	4,999,977	5,436,551	5,651,454	7,962,257	6,598,030	6,896,480	7,425,455	8,077,183	10,546,278
Community based HMIS and Surveillance	1,958,063	1,163,609	1,043,094	970,318	865,215	1,049,426	751,794	682,345	640,820	610,691	701,548
Total	19,900,735	13,556,572	14,882,167	15,616,820	16,650,727	22,535,529	18,958,135	19,048,931	20,710,916	21,718,054	28,552,102

Table 17. Total costs by programme – high coverage scenario (2018-2028) (US $)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Child Health	7,936,662	6,179,143	7,887,488	8,659,770	10,008,237	13,383,055	12,241,009	12,552,956	14,130,136	14,943,854	19,346,238
Safe Motherhood	3,136,973	1,901,941	1,760,047	1,692,056	1,574,876	1,914,830	1,479,701	1,403,320	1,372,039	1,354,257	1,550,866
Control of Common Communicable Diseases	6,869,037	4,935,529	5,424,888	6,156,138	6,701,711	9,438,511	8,370,807	9,034,531	9,976,694	11,047,716	14,109,286
Community based HMIS and Surveillance	1,958,063	1,080,713	922,616	826,573	722,612	830,449	609,688	551,679	516,467	489,604	539,912
Total	19,900,735	14,097,326	15,995,039	17,334,538	19,007,436	25,566,845	22,701,204	23,542,486	25,995,336	27,835,431	35,546,303

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Annex 9. Impact analysis methodology using the Lives Saved Tool (LiST)

Description of LiST

LiST, developed by the Institute for International Programmes (IIP) at Johns Hopkins Bloomberg School of Public Health and funded by the Bill & Melinda Gates Foundation, is a model that estimates the impact of scaling up health and nutrition interventions on newborn, child, and maternal health. LiST was originally created as a part of the work for the Child Survival Series that was published in The Lancet in 2003. LiST estimates the impact of a selected group of maternal, neonatal and child health (MNCH) interventions on health outcomes a as way to quantify the potential effectiveness an intervention or package of interventions.[65] Since its initial development, LiST has served many functions for health policy makers, researchers and implementers, including to:

- Quantify the possible impact of scale-up of various intervention packages at a global level (e.g., scale-up scenarios to assess intervention coverage needs to meet the child health-related SDGs);[66]
- Analyse and re-prioritise health policy packages at a national level (e.g., examine the potential impact of the roll-out of CHWs who will increase access to treatment for malaria, pneumonia and diarrhoea);[67] and
- Evaluate the impact of health programmes that have measured intervention coverage level changes.

Overall, LiST provides policy makers, planners, researchers and implementers an evidenced-based approach for assessing the health impact of MNCH interventions as they make decisions on how to best improve the health of their populations.

How does LiST Work?

LiST has been described as a linear, mathematical model that is deterministic as it shows a fixed relationship between inputs and outputs; the outputs of each projection will remain the same each time the model is run with identical inputs.[68] LiST sits as module within a larger suite of software called the Spectrum. LiST is typically run with three other modules within Spectrum:
- DemProj: projects population by age and sex using populations demographic information,
- AIM: examines the impact of HIV/AIDS, and,
- FamPlan: analyses the cost and impact of family planning programmes.

The LiST module interacts with the information in the other three modules in order to produce the impact of MNCH interventions. At a high level, LiST calculates the impact of scale-up scenarios using two key inputs: effectiveness of clinical interventions and the changes in coverage levels of those interventions. In order to estimate the impact of interventions on mortality, LiST uses the effectiveness or efficacy, which is described in terms of reductions in cause-specific mortality as opposed to overall mortality. Efficacy is

defined as in terms of the reductions of a cause of death or risk factor. Below illustrates the basic calculation that LiST makes to determine the impact of an intervention:

> *For example, there may be 10,000 diarrhoea deaths in children aged 1-59 months, and the proposed intervention is the introduction of a new vaccine that would be 50 per cent effective in reducing diarrhoea mortality. If coverage reaches 50 per cent, diarrhoea mortality among children would be reduced to 7,500 (=10,000 – (10,000 *0.5 *0.5)). If a second or a third intervention is added, the same approach is followed, although the impact of the additional diarrhoea intervention(s) would be applied to the residual diarrhoea deaths. Following the previous example, if the second new diarrhoea intervention is also 50 per cent effective and coverage reaches 50 per cent, diarrhoea mortality would fall to 5,625 (=7,500 – (7,500 *0.5 *0.5). By using cause-specific efficacy and applying each intervention to the residual deaths remaining after the previous intervention, LiST ensures that double counting is avoided and the potential impact of multiple interventions is not erroneously inflated.[69]*

The primary inputs for LiST are coverage levels of maternal and child health interventions and the outputs are changes in population-level risk factors, such as wasting and stunting rates, or causes specify mortality. Interventions can be linked to multiple interventions, and LiST prevents double-counting when examining the impact of changes in coverage of multiple interventions at the same time. Importantly, one of the key assumptions in LiST is that mortality rates and the cause of death structure will not change dynamically and that differences will be in response to differences in intervention coverage rates.

LiST uses an age structure and set of interventions that mirror the continuum of care principle as shown below in Figure 18.

Figure 18. Continuum of care
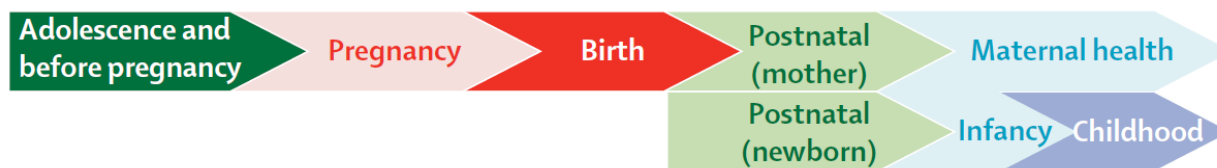
LiST uses the following age periods: pregnancy among women aged 15-49 and 0-1, 1-5, 6-11, 12-23 and 24-59 months for children under the age of five. In LiST, impact in one age period is taken into account in the next age period. As a result, "if interventions that have an impact on neonatal health are scaled up, more children would be expected to survive that period and will subsequently be exposed to the risk of death during the 1-59 month period. Therefore, the number of deaths in this age group will increase even though the rate of mortality will remain the same.[70]

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Impact Assessment of the BHI in South Sudan

LiST can be used to examine the impact of coverage changes at a global and national level as the programme has preloaded datasets that are updated regularly. The pre-loaded data is usually compiled from large population-based surveys, such as the Demographic and Health Surveys (DHS) and/or Multiple Indicator Cluster Surveys (MICS) and/or World Population Prospects (United Nations), among others. The detailed methodology is described below and a detailed list of coverage level indicators and their corresponding data sources is also embedded. Baseline projection files used for the analysis are available upon request from the authors.

Demographic and Mortality data:

This analysis used the pre-loaded national baseline files available from the LiST module for South Sudan which included preloaded total fertility rates (TFR), contraceptive method mix data, as well as HIV prevalence rates, among other key data. However, some modifications to the pre-loaded figures were made based on more recent data (Table 18).

Table 18. Key assumptions for impact analysis

Data variable	National Estimate (2018)	Source
Total population	12,323,420	South Sudan National Bureau of Statistics
Neonatal mortality rate	40 deaths per 1,000 live births	2017 estimate. United Nations Inter-agency Group for Child Mortality Estimation. Levels and Trends in Child Mortality: Report 2018.
Infant mortality rate	63 deaths per 1,000 live births	2017 estimate. United Nations Inter-agency Group for Child Mortality Estimation. Levels and Trends in Child Mortality: Report 2018.
Under-five mortality rate	96 deaths per 1,000 live births	2017 estimate. United Nations Inter-agency Group for Child Mortality Estimation. Levels and Trends in Child Mortality: Report 2018.
Incidence of diarrhoea	3.3	Fischer Walker et al. "Diarrhoea Incidence in Low- and Middle-Income Countries in 1990 and 2010: A Systematic Review." BMC Public Health 12 (March 21, 2012): 220.[xlvii]
Skilled birth attendance	8%	HMIS 2016 data.
Pentavalent vaccine coverage	59%	2016 estimate. 2017 Draft Update on the Situation of Children and Women in South Sudan.
Polio vaccine coverage	58%	2016 estimate. 2017 Draft Update on the Situation of Children and Women in South Sudan.
Measles (single dose) vaccine coverage	75%	2016 estimate. 2017 Draft Update on the Situation of Children and Women in South Sudan.

[xlvii] Data for South Sudan or similar conflict-affected countries was not found.

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Scale-up scenarios and projections:

LiST allows the user to model the scale-up of specific clinical interventions, such as the coverage of ORS for the treatment of childhood diarrhoea and the coverage of insecticide treated nets to prevent childhood malaria. LiST uses the effectiveness of each intervention and the affected fraction of the population to calculate the impact of interventions. LiST does not allow one to model the scale-up of a health systems intervention. For example, it will not model the impact of the scale-up of an iCCM programme as a whole.

To estimate the impact of the BHI, this analysis only estimated the impact of the high coverage scenario, as described in this report (Table 19). However, it should be noted that many interventions included in the BHI packages of services do not correspond to the interventions included in LiST.

Table 19. LiST coverage scenarios

Initial package of service – high coverage										
Intervention	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Periconceptual											
Modern contraceptive rate	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.750	5.00
Pregnancy											
IPTp – intermittent preventive treatment of malaria during pregnancy	19.24	23.32	27.39	31.47	35.54	39.62	43.70	47.77	51.85	55.92	60.00
Childbirth											
Skilled birth attendance	8.0	11.2	14.4	17.6	20.8	24.0	27.2	30.4	33.6	36.8	40.0
Health facility delivery[xlviii]	8.0	10.2	12.4	14.6	16.8	19.0	21.2	23.4	25.6	27.8	30.0
Breastfeeding											
Promotion (home/ community delivery platform)	41.14	45.03	48.92	52.80	56.69	60.57	64.46	68.34	72.23	76.11	80.00
Preventive											
Clean postnatal practices	0.00	4.00	8.00	12.00	16.00	20.00	24.00	28.00	32.00	36.00	40.00
Chlorohexidine	0.00	4.00	8.00	12.00	16.00	20.00	24.00	28.00	32.00	36.00	40.00
Complementary feeding – education only	49.40	51.46	53.52	55.58	57.64	59.70	61.76	63.82	65.88	67.94	70.00
Improved sanitation -	6.72	8.05	9.38	10.71	12.03	13.36	14.69	16.02	17.34	18.67	20.00

[xlviii] In South Sudan, it is reported that 15% of women deliver in a health facility. However, LiST does not allow health facility delivery to be higher than skilled birth attendance which is estimated at 8%). Therefore, for the purpose of this analysis, the health facility delivery rate was changed to 8%.

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Utilisation of latrines or toilets										
Hand washing with soap	17.00	19.30	21.60	23.90	26.20	28.50	30.80	33.10	35.40	37.70	40.00
Other										
Insecticide Treated Net/Indoor Residual Spraying - households protected from malaria	34.2	36.78	39.36	41.94	44.52	47.1	49.68	52.26	54.84	57.42	60
Vaccines										
BCG - Single dose	64.00	65.60	67.20	68.80	70.40	72.00	73.60	75.20	76.80	78.40	80.00
Polio – Three doses	58.00	60.20	62.40	64.60	66.80	69.00	71.20	73.40	75.60	77.80	80.00
Pentavalent	59.00	61.10	63.20	65.30	67.40	69.50	71.60	73.70	75.80	77.90	80.00
Measles – Single dose	75.00	75.50	76.00	76.50	77.00	77.50	78.00	78.50	79.00	79.50	80.00
Curative										
ORS – oral rehydration solution	38.60	42.74	46.88	51.02	55.16	59.30	63.44	67.58	71.72	75.86	80.00
Zinc for treatment of diarrhoea	3.10	10.79	18.48	26.17	33.86	41.55	49.24	56.93	64.62	72.31	80.00
Oral antibiotics for pneumonia	47.30	50.57	53.84	57.11	60.38	63.65	66.92	70.19	73.46	76.73	80.00
ACTs – Artemisinin compounds for treatment of malaria	2.77	10.50	18.22	25.94	33.66	41.39	49.11	56.83	64.55	72.28	80.00

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Annex 10. Health impact coverage assumptions

The health impact assumptions are shown in Table 20. The table is divided into sections to fit on each page for easier reading.

Table 20. BHI initial package interventions mapped to LiST interventions

Section 1.

BHI initial package interventions	BHI model baseline 2018	BHI model target 2028 (high coverage scenario)	Contribution to health intervention in LiST	Health intervention (LiST)	National baseline coverage per LiST (2018)	Result of scaling up initial service package under high coverage scenario (2028)	Baseline data source
1. Childbirth promotion for birth planning	10%	80%	Indirect	Modern contraceptive rate	2.54%	5.0%	Nationally representative data
2. BCC – child spacing[a]	100%	100%	Indirect				
3. Male condom provision	3%	73%	Direct				
Antenatal care promotion	10%	80%	Indirect	IPTp	19.2%	60.0%	Drawn from DHS, MICS, and representative household surveys.
1. Antenatal care promotion	10%	80%	Indirect	Skilled birth attendance	8.0%	40.0%	Update on the Situation of Children and Women in South Sudan. 2017
2. Referral of pregnant women for danger signs	10%	80%	Indirect				
1. Antenatal care promotion	10%	80%	Indirect	Health facility delivery	11.7%	30.0%	Drawn from DHS, MICS, and representative household surveys.
2. Referral of pregnant women for danger signs	10%	80%	Indirect				

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Section 2.

BHI initial package interventions	BHI model baseline 2018	BHI model target 2028 (high coverage scenario)	Contribution to health intervention in LiST	Health intervention (LiST)	National baseline coverage per LiST (2018)	Assumed result of scaling up initial service package under high coverage scenario (2028)	Baseline data source
Postnatal care and nutrition promotion	10%	80%	Indirect	Breastfeeding promotion (community delivery platform)	41.1%	80.0%	Coverage data for this indicator are not typically available. As a proxy, the level of breastfeeding promotion is set by default to equal the per cent of children 1-5 months of age that are exclusively breastfed.
Postnatal care and nutrition promotion	10%	80%	Indirect	Clean postnatal practices	0.0	40.0%	Coverage data for this proxy indicator are drawn from DHS, MICS, and other nationally representative household surveys.
Postnatal care and nutrition promotion	10%	80%	Indirect	Chlorohexidine	0.0	40.0%	National data unavailable.
Postnatal care and nutrition promotion	10%	80%	Indirect	Complementary feeding – education only	49.4%	70.0%	Drawn from DHS, MICS, and representative household surveys.
Communicable disease control – outreach visits (malaria, HIV, TB, NTDs)[a]	100%	100%	Indirect	Improved sanitation - Utilisation of latrines or toilets	6.7%	20%	WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation (http://www.wssinfo.org/). Data are available for all countries from 1996 to 2012.

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Section 3.

BHI initial package interventions	BHI model baseline 2018	BHI model target 2028 (high coverage scenario)	Contribution to health intervention in LiST	Health intervention (LiST)	National baseline coverage per LiST (2018)	Assumed result of scaling up initial service package under high coverage scenario (2028)	Baseline data source
Communicable disease control – outreach visits (malaria, HIV, TB, NTDs)[a]	100%	100%	Indirect	Hand washing with soap	17.0%	40.0%	Curtis VA, Danguah LO, Aunger RV. Planned, motivated and habitual hygiene behaviour: An eleven country review. Health Education Research 2009; 24(4): 655-73. http://www.ncbi.nlm.nih.gov/pubmed/19286894. Table 3 of this paper provides data for a small set of countries (Ghana, Kenya, Kyrgyzstan, Madagascar, Peru, Senegal, Tanzania, and Uganda). All other countries are set by default to 17per cent, the global average cited in the paper.
Male condom provision	3%	73%	Direct	Modern contraceptive rate[xlix]	2.5%	5.0%	Hudgins, Anthony, Michael Egharevba, Dr. Michael Tekie. South Sudan Maternal Health and Family Planning Commodity Requirements and Financing Need, 2014–2016.
Assess children for nutrition status	10%	80%	Indirect	Not included in LiST			

[xlix] For this analysis, the modern contraceptive rate was used to estimate the impact of scaling up condom use. This may not adequately reflect the impact of condom usage on mortality.

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Section 4.

BHI initial package interventions	BHI model baseline 2018	BHI model target 2028 (high coverage scenario)	Contribution to health intervention in LiST	Health intervention (LiST)	National baseline coverage per LiST (2018)	Assumed result of scaling up initial service package under high coverage scenario (2028)	Baseline data source
Communicable disease control – outreach visits (malaria, HIV, TB, NTDs)[a]	100%	100%	Indirect	Insecticide Treated Net/Indoor Residual Spraying - households protected from malaria	34.2%	60.0%	Coverage data for this indicator are drawn from DHS, MICS, and other nationally representative household surveys. This includes Malaria Indicator Surveys.
BCC - adolescent health, gender based violence[a]	100%	100%	Indirect	Not included in LiST			
Reporting on community-based surveillance[a]	100%	100%	Indirect	Not included in LiST			
Immunisation mobilisation and registration[a]	100%	100%	Indirect	BCG - Single dose	64.0%	80.0%	HMIS data (2017)
Immunisation mobilisation and registration[a]	100%	100%	Indirect	Polio – Three doses	58.0%	80.0%	HMIS data (2017)
Immunisation mobilisation and registration[a]	100%	100%	Indirect	Pentavalent	59.0%	80.0%	HMIS data (2017)
Immunisation mobilisation and registration[a]	100%	100%	Indirect	Measles – Single dose	75.0%	90.0%	HMIS data (2017) 2017 Draft Update on the Situation of Children and Women in South Sudan.

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Section 5.

BHI initial package interventions	BHI model baseline 2018	BHI model target 2028 (high coverage scenario)	Contribution to health intervention in LiST	Health intervention (LiST)	National baseline coverage per LiST (2018)	Assumed result of scaling up initial service package under high coverage scenario (2028)	Baseline data source
Diarrhoea treatment <5	10%	80%	Direct	ORS – oral rehydration solution	38.6%	80.0%	Drawn from DHS, MICS, and representative household surveys.
Diarrhoea treatment <5	10%	80	Direct	Zinc for treatment of diarrhoea	3.1%	80.0%	Drawn from DHS, MICS, and representative household surveys.
Pneumonia diagnosis and treatment <5	10%	80%	Direct	Oral antibiotics for pneumonia	47.3%	80.0%	Drawn from DHS, MICS, and representative household surveys.
1.Malaria diagnosis (RDT) <5 2.Malaria treatment <5	10% 10%	80% 80%	Direct Direct	ACTs – Artemisinin compounds for treatment of malaria	2.8%	80.0%	Drawn from DHS, MICS, and representative household surveys.
Referrals of children with complicated malaria, pneumonia or diarrhoea	10%	80%	Indirect	Not included in LiST			

[a] 100per cent coverage in the baseline year relates to the number of group encounters made. Scaling up of services would take place through increases in numbers of people reached.

South Sudan - Boma Health Initiative Costing and Investment Case Analysis

Addendum 1 - Revisions to BHI cost models

Context

Upon validation of this report and the results of the analysis, the MOH requested revisions to certain parameters and assumptions of the cost models. The purpose of these revisions and the corresponding results is to estimate the future costs and financing requirements of the introduction of the BHI in select geographic regions over a five-year period instead of at a national scale over a 10-year period, as originally modelled in this report. The MOH intends to use these results to advocate for and mobilize financial resources from the GOSS and technical and financial partners.

Key changes to models

Given the difficulties of mobilizing funding for the implementation of the BHI at a national scale, the MOH requested that the cost models be adapted to align with more realistic levels of available funding. The initial models, which are detailed in this report, assumed that the entire population of the country would be covered by the BHI and that utilization rates would start at 10 per cent and reach 70 per cent of need in 2028 in one model, 50 per cent need in another model, and 30 per cent of need in the third model. The original three models also assumed scaling up from 10 per cent utilization in the first year to 70 per cent, 50 per cent, and 30 per cent in 2028, respectively. Under the new scenarios, the utilization rate for each scenario was set at 70 per cent of the total need for each of the five years modelled.

The MOH requested four new scenarios which would reflect different geographical coverage of the programme and would assume that CHWs will only serve the 56 per cent of the rural population living more than five kilometres from a functional health facility. The geographical coverage, numbers of CHWs and numbers of services under each scenario for the first year are described below and in Addendum Table 1.

- **Low geographic coverage** – 30 per cent of rural areas will be covered through the BHI which corresponds to 2.07 million people served by CHWs.
- **Medium geographic coverage** – 50 per cent of rural areas will be covered through the BHI which corresponds to 3.45 million people served by CHWs.
- **High geographic coverage** – 80 per cent of rural areas will be covered through the BHI which corresponds to 5.52 million people served by CHWs.
- **Complete geographic coverage** – 100 per cent of rural areas will be covered through the BHI which corresponds to 6.9 million people served by CHWs.

Addendum Table 1. Geographic coverage scenarios – year 1

	100% geographic coverage	80% geographic coverage	50% geographic coverage	30% geographic coverage
Regions	3	3	3	3
States	33	80% of 33	50% of 33	30% of 33
Counties	80	80% of 80	50% of 80	30% of 80
Payams	516	80% of 516	50% of 516	30% of 516
Bomas	2,136	80% of 2,136	50% of 2,136	30% of 2,136
Target population *(i.e. those living 5km and more from health facility)*	6,901,115	5,520,892	3,450,558	2,070,335

Total services	19,324,909	15,459,930	9,662,451	5,797,472
Community Health Workers (CHWs)	28,755	23,004	14,378	8,627
Average CHWs per Boma	13	13	13	13
Average services per capita	2.8	2.8	2.8	2.8
Average services per CHW	672	672	672	672

In addition to these changes, the MOH requested several revisions to the assumptions used in the previous models which are detailed in Addendum Tables 1 and 4. These changes include those to the ratios of CHWs and supervisors per population and changes to the financial incentives received. The MOH also requested modifications to the unit costs of medicines and equipment; the package of CHW and supervisor equipment, as well as the replenishment frequency of specific equipment items. The MOH also made minor revisions to the initial standard treatment guidelines, reducing the time per certain promotive services. Lastly, the MOH requested that the results exclude the MOH management salaries thereby reflecting only the additional financial resources requested from donors and the GOSS.

Results

Services and Cost projections
Based on the revised models, in the first year CHWs would provide between 5.7 million and 19.3 million services depending on the scenario (Addendum Table 2). The majority of services would be for child health and the control of common communicable diseases. The numbers of services would increase in subsequent years due to population growth.

The total cost in the first year would be US$36.1 million with 100 per cent geographic coverage, US$28.9 million with 80 per cent geographic coverage, US$18.1 million with 50 per cent geographic coverage, and US$10.8 million with 30 per cent geographic coverage (Table 3). The cost is less in the following years because the first year includes start-up costs for initial training and equipment. The total cost for each programme in every year would be highest for child health interventions under all scenarios, followed by control of common communicable diseases.

Addendum Table 2. Total number of services and costs by scenario

	Year 1	Year 2	Year 3	Year 4	Year 5
Total services					
100% scenario	19,324,909	19,849,471	20,389,238	20,944,659	21,516,192
80% scenario	15,459,930	15,879,573	16,311,389	16,755,729	17,212,952
50% scenario	9,662,451	9,924,737	10,194,619	10,472,333	10,758,096
30% scenario	5,797,472	5,954,835	6,116,770	6,283,395	6,454,856
Total costs (US$)					
100% scenario	36,189,696	30,600,584	32,317,294	34,401,935	34,071,502
80% scenario	28,953,676	24,482,236	25,856,066	27,523,470	27,258,965
50% scenario	18,100,096	15,305,472	16,163,836	17,205,769	17,040,941
30% scenario	10,864,077	9,187,122	9,701,831	10,327,301	10,228,404

In year two, the cost of implementation would reduce considerably as the initial start-up costs would be incurred in year one. These initial costs would include the cost of start-up training for CHWs, supervisors, and managers as well as the initial purchase of equipment (e.g. supervisor motorcycles,

metallic boxes and torch lamps for CHWs), much of which would not need replacing until after the fifth year of implementation.

In all modelled scenarios, the highest single cost driver in year one would be for CHW performance-based incentives which would vary with the number of CHWs that would be deployed through the programme (Addendum Table 3). The cost of performance-based incentives is expected to be funded by external non-GOSS funding. In year two of the programme, the recurrent cost of CHW training would comprise an increasing share of the total costs.

Potential impact

Based on the projected increases in coverage of the initial package under the high coverage scenario, it is estimated that by year five of the program a total of over more than 36,000 deaths could be averted in the 100 per cent coverage scenario compared to the baseline coverage scenario. The vast majority of these would be deaths among children under five years old with the under-five mortality rate reducing from 96 deaths to 73 deaths per 1,000 live births after five years in all coverage scenarios. These only represent the benefits in terms of estimated lives saved and do not take into account reductions in morbidity which would have a beneficial impact on areas like education and economic productivity.

Addendum Table 3. Cost by input by scenario

Complete coverage scenario - 100% geographic coverage (70% services coverage)					
Cost by Input (USD)	Year 1	Year 2	Year 3	Year 4	Year 5
CHW Salaries	$2,484,432	$2,556,490	$2,630,621	$2,706,912	$2,785,450
CHW Performance-Based Incentives	$8,626,500	$8,876,700	$9,134,100	$9,399,000	$9,671,700
CHW Equipment	$6,969,072	$740,132	$1,409,959	$2,917,723	$1,492,944
Medicines and supplies	$5,760,900	$5,927,966	$6,099,878	$6,276,773	$6,458,801
Supervision Salaries	$1,238,400	$1,238,400	$1,238,400	$1,238,400	$1,238,400
Supervision Equipment	$1,991,683	$6,166	$252,814	$6,166	$252,814
Supervision Visits	$1,472,220	$1,488,900	$1,506,060	$1,523,720	$1,541,900
Recurrent Training (CHWs)	$0	$9,643,351	$9,922,982	$10,210,760	$10,507,012
Recurrent Training (Supervisors)	$0	$51,600	$51,600	$51,600	$51,600
Recurrent Training (Managers)	$0	$0	$0	$0	$0
Management Salaries	$0	$0	$0	$0	$0
Management Equipment	$0	$0	$0	$0	$0
Management Meetings	$70,880	$70,880	$70,880	$70,880	$70,880
Other Recurrent Costs	$0	$0	$0	$0	$0
Start-up Training (CHWs)	$7,204,565	$0	$0	$0	$0
Start-up Training to replace CHWs lost to attrition	$0	$0	$0	$0	$0
Start-up Training (Supervisors)	$355,204	$0	$0	$0	$0
Start-up Training (Managers)	$15,840	$0	$0	$0	$0
Capital Costs	$0	$0	$0	$0	$0
Total	**$36,189,696**	**$30,600,584**	**$32,317,294**	**$34,401,935**	**$34,071,502**
High coverage scenario - 80% geographic coverage (70% services coverage)					
Cost by Input (USD)	Year 1	Year 2	Year 3	Year 4	Year 5
CHW Salaries	$1,987,546	$2,045,174	$2,104,531	$2,165,530	$2,228,342
CHW Performance-Based Incentives	$6,901,200	$7,101,300	$7,307,400	$7,519,200	$7,737,300
CHW Equipment	$5,575,257	$592,100	$1,127,986	$2,334,179	$1,194,346
Medicines and supplies	$4,608,720	$4,742,373	$4,879,902	$5,021,420	$5,167,040
Supervision Salaries	$990,720	$990,720	$990,720	$990,720	$990,720
Supervision Equipment	$1,593,346	$4,933	$202,251	$4,933	$202,251
Supervision Visits	$1,177,776	$1,191,116	$1,204,856	$1,218,976	$1,233,516
Recurrent Training (CHWs)	$0	$7,714,616	$7,938,516	$8,168,608	$8,405,545

Recurrent Training (Supervisors)	$0	$41,280	$41,280	$41,280	$41,280
Recurrent Training (Managers)	$0	$0	$0	$0	$0
Management Salaries	$0	$0	$0	$0	$0
Management Equipment	$0	$0	$0	$0	$0
Management Meetings	$58,624	$58,624	$58,624	$58,624	$58,624
Other Recurrent Costs	$0	$0	$0	$0	$0
Start-up Training (CHWs)	$5,763,652	$0	$0	$0	$0
Start-up Training to replace CHWs lost to attrition	$0	$0	$0	$0	$0
Start-up Training (Supervisors)	$284,163	$0	$0	$0	$0
Start-up Training (Managers)	$12,672	$0	$0	$0	$0
Capital Costs	$0	$0	$0	$0	$0
Total	**$28,953,676**	**$24,482,236**	**$25,856,066**	**$27,523,470**	**$27,258,965**

Medium coverage scenario - 50% geographic coverage (70% services coverage)					
Cost by Input (USD)	Year 1	Year 2	Year 3	Year 4	Year 5
CHW Salaries	$1,242,259	$1,278,288	$1,315,354	$1,353,456	$1,392,768
CHW Performance-Based Incentives	$4,313,400	$4,438,500	$4,567,200	$4,699,500	$4,836,000
CHW Equipment	$3,484,657	$370,078	$705,003	$1,458,862	$746,495
Medicines and supplies	$2,880,449	$2,963,984	$3,049,939	$3,138,388	$3,229,401
Supervision Salaries	$619,200	$619,200	$619,200	$619,200	$619,200
Supervision Equipment	$995,841	$3,083	$126,407	$3,083	$126,407
Supervision Visits	$736,120	$744,460	$753,040	$761,860	$770,960
Recurrent Training (CHWs)	$0	$4,821,838	$4,961,654	$5,105,380	$5,253,669
Recurrent Training (Supervisors)	$0	$25,800	$25,800	$25,800	$25,800
Recurrent Training (Managers)	$0	$0	$0	$0	$0
Management Salaries	$0	$0	$0	$0	$0
Management Equipment	$0	$0	$0	$0	$0
Management Meetings	$40,240	$40,240	$40,240	$40,240	$40,240
Other Recurrent Costs	$0	$0	$0	$0	$0
Start-up Training (CHWs)	$3,602,408	$0	$0	$0	$0
Start-up Training to replace CHWs lost to attrition	$0	$0	$0	$0	$0
Start-up Training (Supervisors)	$177,602	$0	$0	$0	$0
Start-up Training (Managers)	$7,920	$0	$0	$0	$0
Capital Costs	$0	$0	$0	$0	$0
Total	**$18,100,096**	**$15,305,472**	**$16,163,836**	**$17,205,769**	**$17,040,941**

Low coverage scenario - 30% geographic coverage (70% services coverage)					
Cost by Input (USD)	Year 1	Year 2	Year 3	Year 4	Year 5
CHW Salaries	$745,373	$766,973	$789,178	$812,074	$835,661
CHW Performance-Based Incentives	$2,588,100	$2,663,100	$2,740,200	$2,819,700	$2,901,600
CHW Equipment	$2,090,843	$222,047	$422,983	$875,317	$447,897
Medicines and supplies	$1,728,269	$1,778,389	$1,829,964	$1,883,032	$1,937,640
Supervision Salaries	$371,520	$371,520	$371,520	$371,520	$371,520
Supervision Equipment	$597,505	$1,850	$75,844	$1,850	$75,844
Supervision Visits	$441,676	$446,676	$451,816	$457,116	$462,576
Recurrent Training (CHWs)	$0	$2,893,103	$2,976,862	$3,063,228	$3,152,202
Recurrent Training (Supervisors)	$0	$15,480	$15,480	$15,480	$15,480
Recurrent Training (Managers)	$0	$0	$0	$0	$0
Management Salaries	$0	$0	$0	$0	$0
Management Equipment	$0	$0	$0	$0	$0
Management Meetings	$27,984	$27,984	$27,984	$27,984	$27,984
Other Recurrent Costs	$0	$0	$0	$0	$0
Start-up Training (CHWs)	$2,161,495	$0	$0	$0	$0
Start-up Training to replace CHWs lost to attrition	$0	$0	$0	$0	$0
Start-up Training (Supervisors)	$106,561	$0	$0	$0	$0
Start-up Training (Managers)	$4,752	$0	$0	$0	$0
Capital Costs	$0	$0	$0	$0	$0
Total	**$10,864,077**	**$9,187,122**	**$9,701,831**	**$10,327,301**	**$10,228,404**

Discussion

The four geographic scale-up models and corresponding results contained within this addendum are based on the assumption that the programme will be able to achieve high utilization of services beginning in year one through year five. In other words, the models assume that the current bottlenecks within the community health system (which have been identified in this report) will have largely been resolved, thereby removing considerable barriers to the supply and demand of CHS.

Failure to resolve the current bottlenecks impacting the delivery of CHS will affect the costs of programme implementation. For example, if certain supply- and demand-side bottlenecks persist, thereby limiting the uptake of services, the cost of medicines and supplies would likely reduce. If CHW performance-based incentives and salaries are not paid on time to CHWs, CHWs may experience low motivation which could contribute to poor programme performance or CHW attrition. This could limit the number of services provided (and reduce the cost of medicines and supplies) but also increase the costs required for re-training of newly recruited CHWs.

The models also assume that the cost of programme implementation is the same for all geographical areas of South Sudan. In other words, the models do not consider the potential higher costs associated with addressing the logistical and security challenges of implementing in hard-to-reach areas or areas currently experiencing conflict.

Conclusions

The revised models provide the MOH with evidence to advocate for and mobilize domestic and external financial resources for the implementation of the BHI programme in select geographic areas. Further revisions can be made as needed based on the availability of funding and priorities.

Addendum Table 4. Key changes to models

Category of data	Revised models (October 2018)	Previous model (national BHI implementation)
General		
Period of analysis	5 years (no specific start year indicated)	2018-2028
Population to be covered by the BHI	Baseline (year 1) coverage population: – Low geographic coverage: 2.07 million people (30% of rural areas) – Medium geographic coverage: 3.45 million people (50% of rural areas) – High geographic coverage: 5.52 million people (80% of rural areas) – Complete geographic coverage: 6.9 million people (100% of rural areas)	Baseline (2018) coverage population: 12,323,420 people covered by the BHI.
Geographic coverage[I]		
Number of Regions	– Low geographic coverage: 3 – Medium geographic coverage: 3 – High geographic coverage: 3 – Complete geographic coverage: 3	3
Number of States	– Low geographic coverage: 10 – Medium geographic coverage: 17 – High geographic coverage: 26 – Complete geographic coverage: 33	33
Number of Counties	– Low geographic coverage: 24 – Medium geographic coverage: 40 – High geographic coverage: 64 – Complete geographic coverage: 80	80
Number of Payams	– Low geographic coverage: 155	516

[I] In the revised models, programme coverage is based on the population living in rural areas as opposed to the number of targeted Regions, States, Counties, Payams, and Bomas. However, in the revised models, the number of administrative levels influence the quantity of training, supervisions, and meetings conducted at each level.

	– Medium geographic coverage:258 – High geographic coverage: 413 – Complete geographic coverage: 516	
Number of Bomas		2,136
CHWs		
Number of CHWs	The number of CHWs varies depending on the coverage scenario: – Low geographic coverage scenario (30% coverage of rural areas): 8,626 CHWs – Medium geographic coverage scenario (50% coverage of rural areas): 14,377 CHWs – High geographic coverage scenario (80% coverage of rural areas): 23,004 CHWs – Complete geographic coverage scenario (100% coverage of rural areas): 28,755 CHWs	6,408 CHWs It is assumed that there would be three CHWs per Boma.
Geographic coverage	CHWs will cover all geographical areas > 5 km from a health facility. It is assumed 1 CHW (BHT) will cover 40 households (HH), i.e. 240 people.	CHWs will cover all geographical areas (both rural and urban). It is assumed that three CHWs will cover one Boma.
Desired ratio of CHW per population	Each CHW will provide the basic start up package of services for his/her respective catchment area of 40 households, i.e. 240 people in year 1. See above for details on the number of people to be covered under each scenario.	3 CHWs per newborn for Maternal and newborn health, 1 for Child Health, 1 for non-communicable and communicable diseases). Each CHW will cover approximately 1,596 people in year 1. This was calculated by dividing the total rural population 10,228,439
Number of hours worked per CHW per week	20 hours per week	35 hours per week
Annual salary	US $86.40 (assumes CHWs will earn a monthly salary of US $7.20 which is equivalent to 925 SSP at official rate of SSP 130 : USD $1)	US $501.36 (assumed an exchange rate of 4.5 SSP per 1 US dollar)
Performance-based incentives (monthly)	US $25 per month per CHW (maximum)	US $50 per month per CHW (maximum)

Supervisors		
Type of supervisor	One category of direct supervisor: Payam Health Supervisor who will work for NGO (not MOH)	One category of direct supervisor: Payam Health Officer
Desired ratio of CHWs per supervisor	20 CHWs per direct supervisor (2 supervisors will cover 1 Payam which has an average of 4.1 Bomas)	13 CHWs per direct supervisor (1 supervisor will cover 1 Payam which has an average of 4.1 Bomas)
Number of supervisors	The number of direct CHW supervisors varies depending on the coverage scenario: – Low geographic coverage scenario (30% coverage of rural areas): 310 supervisors – Medium geographic coverage scenario (50% coverage of rural areas): 516 supervisors – High geographic coverage scenario (80% coverage of rural areas): 826 supervisors – Complete geographic coverage scenario (100% coverage of rural areas): 1,032 supervisors	516 supervisors
Per cent of time for supervision	100%	60%
Annual salary	US $1200	US $999.96
On-site supervision (Payam Supervisor)	A supervision visit costs $5 (for fuel) and covers 3 CHWs at a time. It is assumed that the Payam Health Supervisor would conduct 84 visits per year per (7 visit x 12 months) totaling $420. Note: It is assumed there will be no overnight stays and costs	The Payam Supervisor visits each Boma once a month (48 visits/year) (USD 5 per Payam Supervisor per visit to cover the cost of fuel). (USD $5 for overnight stay for one third of the supervisory visits i.e., 13 visits)
On-site supervision (County Supervisor)	The County Supervisor visits each Payam (and selected Bomas) once in a quarter (7 payams per quarter). This totals 28 visits per year @ $25 each per county. (US $10 to cover transport and $15 to cover overnight stay in the field).	The County Supervisor visits each Payam (and selected Bomas) once in a quarter (7 payams per quarter). This totals 28 visits per year @$40 each per county. (US $15 to cover transport and US $25 to cover overnight stay in the field).
On-site supervision (State Supervisor)	This totals 4 visits per year @ US $40 each per state. (US $15 to cover transport and US $25 to cover the overnight stay in the field).	The State Supervisor visits each county (and nearby Payams/Bomas) every 4 months (1 x 4 days per county x 2 counties per state). This totals 6 visits per year @$40 each per state. (US $15 to cover transport and

		US $25 to cover overnight stay in the field).
On-site supervision (National and Regional Supervisors)	The National/Regional Coordinator(s) will perform 1 visit per quarter (selected states, counties, Payam and Bomas) annually. This totals 5 days on average per visit (1 x 16 visits x 5 days per year). This totals 16 visits per year @ $600 each ($550 to cover air transport and $50 to cover overnight stay in the field).	The National/Regional Coordinator(s) visits each state (and selected counties, Payam and Bomas) annually. 5 days on average per visit (1 x 32 states x 5 days per year). This totals 32 visits per year @$600 each (US $550 to cover air transport and US $50 to cover overnight stay in the field)
Monthly group supervision	One meeting per quarter (i.e. four times per year); $5 per CHW per meeting to cover transportation costs.	One meeting per month (US $5 per CHW per meeting to cover transportation costs).
Initial and refresher training for CHWs	• Comprehensive Training of CHWs (12 days), (6 days X 2 = 12 days in total during their first year at a total cost of $250.55 per participant). • Programme module specific trainings (assume 3 days), every 1 year to cover refresher training or additional modules of BHI Service Package at a cost of US $75.36 per participant per session.	• Comprehensive Training of CHWs (6 days), once only at a cost of US $259 per participant per session. • Programme module specific trainings (assume 3 days), every 1 year to cover their respective module of BHI Service Package at a cost of US $230 per participant per session. (Number of CHWs x 1 specific module x US $230).
Initial and refresher training for direct supervisors (Payam Health Officers)	• Comprehensive training in BHI service package (6 days), once only at a cost of US $344.19 per participant per session. • Technical programme specific training (1 day), every year at a cost of US $50 per participant per session.	• Comprehensive Training in BHI service package (6 days), once only at a cost of US $814 per participant per session • Technical programme specific training (1 day), every year at a cost of US $116 per participant per session.
Training and refresher training for capacity development	• Training of master trainers— participants at a cost of $240 per participant per session every two years. – Low geographic coverage scenario (30% coverage of rural areas): 20 participants. – Medium geographic coverage scenario (50% coverage of rural areas): 33 participants. – High geographic coverage scenario (80% coverage of rural areas): 53 participants. – Complete scenario (100% coverage of rural areas): 66 participants.	• Comprehensive training in BHI service package for County Health Officers – 80 participants at a cost of US $300 per participant per session, once only. • BHI TWG and facilitators' orientation (2 days) – 34 participants at a cost of US $85 per participant per session (ensure government staff are prioritised), once only • Training of master trainers— 4 participants at a cost of US $155 per participant per session

		• Regional BHI training of trainers (6 days) – 32 participants at a cost of US $1,273 per participant per session, once only.
Equipment used by CHWs	• Respiratory Rate Timer ($4.82 replaced every 2 years) • Beads for Counting Respiratory Rate ($5.00 replaced every 2 years) • Jags and cups for preparing ORS ($3.00 replaced every 2 years) • 2 MUAC Tapes ($0.076 replaced every 1 year) • IEC materials for BHI ($7.00 replaced every 3 years) • BHT illustration Charts ($7.00 replaced every 5 years) • BHI handbook ($6.81 replaced every 5 years) • Family Health Information Register ($5.74 replaced every year) • BHI Service Information Register ($5.74 replaced every year) • BHI reporting tools ($5.00 replaced every year) • Megaphone ($59.25 replaced every 5 years) • Gum Boots ($5.00 replaced every 3 years) • Rain Coat ($25.00 replaced every 3 years) • Torch ($4.00 replaced every 5 years) • Metallic box ($30.00 replaced every 5 years) • Back pack ($20.00 replaced every 3 years) • Box of clean disposable gloves (4.30 per box), replaced every 1 year • Sharps box, replaced every 1 year ($0.76 per box)	• Respiratory Rate Timer ($10.00 replaced every 2 years) • Beads for Counting Respiratory Rate ($18.00 replaced every 2 years) • Jags and cups for preparing ORS ($3.00 replaced every 2 years) • MUAC Tapes ($3.34 replaced every 1 year) • IEC materials for BHI($7.00 replaced every 3 years) • BHT illustration Charts ($7.00 replaced every 5 years) • BHI handbook ($7.00 replaced every 5 years) • Family Health Information Register ($10.00 replaced every year) • BHI Service Information Register ($10.00 replaced every year) • BHI reporting tools ($5.00 replaced every year) • Megaphone ($70.00 replaced every 5 years) • Mobile Phone ($200.00 replaced every 5 years) • Gum Boots ($20.00 replaced every 3 years) • Rain Coat ($25.00 replaced every 3 years) • Torch ($20.00 replaced every 5 years) • Identity cards ($5.00 replaced every 4 years) • Umbrella ($20.00 replaced every 2 years) • Heavy duty gloves ($15.00, purchased once) • Coat/jacket ($3.00 replaced every 3 years) • Metallic box ($150 replaced every 5 years) • Back pack ($75 replaced every 3 years)

		• Bicycles ($250 replaced every 5 years) • Sharps box, replaced every 1 year ($0.76 per box)
Medicines provided to CHWs	• Artesunate/Amodiaquine 2-11months - tablets - 25mg/67.5mg (3 tabs) - 1 treatment (3 tabs) $0.25 • Artesunate/Amodiaquine 1-5 years - tablets - 50mg/135mg (3 tabs) - 1 treatment (3 tabs) $0.34 • Malaria rapid diagnostic tests- RDT Pf- 1 diagnostic test kit $0.30 • ORS low osm. 20.5g/1L (non-flavoured) - Per 1 sachet $0.06 • Zinc 2-6 months - Per tablet - $0.01 • Zinc 6-59 months - Per tablet - $0.01 • Amoxicillin - Capsules and tablets - 250mg (dispersible) 2-12 months (6 tabs)" - Per tablet - $0.02 • Amoxicillin - Capsules and tablets - 250mg (dispersible) 1-5 years (12 tabs)" - Per tablet $0.02 • Male condom – 54 mm size - $0.0311 each	• Artesunate/Amodiaquine 2-11months - tablets - 25mg/67.5mg (3 tabs) - 1 treatment (3 tabs) $0.25 • Artesunate/Amodiaquine 1-5 years - tablets - 50mg/135mg (3 tabs) - 1 treatment (3 tabs) $0.34 • Malaria rapid diagnostic tests- RDT Pf- 1 diagnostic test kit $0.63 • ORS low osm. 20.5g/1L (non-flavoured) - Per 1 sachet $0.06 • Zinc 2-6 months - Per tablet - $0.01 • Zinc 6-59 months - Per tablet - $0.01 • Amoxicillin - Capsules and tablets - 250mg • (dispersible) 2-12 months (6 tabs)" - Per tablet - $0.03 • Amoxicillin - Capsules and tablets - 250mg • (dispersible) 1-5 years (12 tabs)" - Per tablet $0.03 • Male condom – 54 mm size - $0.0311 each
Equipment used by CHW direct supervisors	• Motorcycles ($1,250 replaced every 5 years) • Mobile phones ($200 replaced every 2 years) • Miscellaneous office items ($120 replaced every year i.e., $10 per month) • Payam BHI reporting form ($5 replaced every year)	• Motorcycles ($5,000 replaced every 5 years) • Mobile phones ($200 replaced every 5 years) • Miscellaneous office items ($120 replaced every year i.e., $10 per month) • Family health information database ($10 replaced every year) • BHI services information database ($10 replaced every year) • Payam BHI reporting form ($5 replaced every year)

Addendum 2 – SRH/FP services package

This addendum is prepared to complement the above The Boma Health Initiative Costing and Investment Case Analysis prepared by MoH with financial support from Canada and technical support from UNICEF and Management Services for Health (MSH). MOH, UNFPA, WHO and UNICEF prepared this addendum to inform relevant sector ministries at national and states levels, Donors community and other stakeholders regarding the additional investments needed to ensure availability of comprehensive community-based health services. Implementing BHI at scale would substantially contribute towards achievement of SDGs including reducing maternal and child mortality, women empowerment and gender equality, fulfil FP 2020 targets for South Sudan and ultimately Universal Health Coverage.

Health Community based SRH/SMH/FP/AYSRH information and service package

South Sudan among few countries with the worst reproductive health indicators. The maternal mortality rate is estimated at 789/100,000 live births. Childbearing begins early with 31% of the 15-19-year-old women having commenced childbearing. About 52% of women are married before 18 years and 9% before age 15 years. Early marriage and childbearing is associated with school dropout, health risk during and after childbirth, divorce, rejection by parents, stigma, and unsafe abortion. Although 91% of women have ever given birth, only 10% of births actually take place in the presence of skilled health personnel. Contraceptive prevalence rate is at 4.5% (mCPR of 1.7%).

Adolescents (young people aged between 10 and 19 years) have health care needs that are distinct from those of adults, particularly in the area of sexual and reproductive health and rights (SRHR). Neglect of their specific health needs leads to negative outcomes such as unwanted pregnancies, early marriages, sexually transmitted infections, and sexual violence.

Community SRH/HIV Service

The South Sudan BHI is a community-based approach in which households and communities take an active role in health-related and development issues. Its goal is to enhance community access to health care at the household and community levels through: building the capacity of BHWs in collaboration with Community Health Volunteers (CHVs) to provide health services at the community level; strengthen household/community-facility linkages; and raise the community's awareness of its rights to health.

The uptake of SRH-HIV services is largely influenced by social and cultural factors in a given community; therefore, understanding a community's perspectives is important. BHWs are members of the community and thus have certain advantages over service providers because they can easily and effectively access and communicate with clients in need of RH-HIV services as equals. They can develop culturally acceptable RH-HIV messages for their communities and adapt the health care system to better suit the client's needs since they are linked to health facilities. They work collaboratively with existing Community Health Committees, Community Health Volunteers, and Champions and key opinion leaders.

The BHWs will be trained using integrated curriculum that comprises the basic modules and the technical modules to equip them with the appropriate knowledge and skills to offer community-based health

promotion, prevention and basic treatment services including; 1) Maternal and newborn health, 2) Family planning, 3) HIV/AIDs and 4) GBV and 5) Adolescent and Youth SRH.

Integrated SRH-HIV services package

The BHWs are expected to provide accurate information about SRH and HIV. The provision of information should be supported by information, education and communication (IEC) materials that are culturally sensitive and contextualized to the community's needs.

i.Safe Motherhood:

Promotion of use of skilled care during pregnancy care, childbirth and after birth is the main intervention addressed in the integrated packages. The SMH package has critical component which address postpartum haemorrhage prevention. The SMH service package include the following:

> **ANC**

- Registration of pregnant women and referral linkage for ANC and delivery in health facility
- Information on birth planning and complication readiness
- Provision of nutritional advise
- Distribution of Mama kits to pregnant women during third trimester
- Provision of Misoprostol for prevention of post-partum haemorrhage
- Ferrous Sulphate/folic acid tablets
- Pregnancy
- Counselling on Post-partum family planning

> **Labour and Delivery:**
- Referral linkage for facility delivery
- Mama kit (first contact)
- Provision of Misoprostol (first contact)
- Counselling on PPFP
- Counselling and appointment for PNC

> **Post- natal care:**

- Counselling on resumption of menstruation, sexual activity, sexually transmitted diseases, including HIV/AIDS, and safer sex
- Counselling on danger signs for post-natal complications both for mother and the newborn
- Identify, register and refer cases with puerperal complications including obstetric fistula as well as newborn complications
- Counselling and provision of PPFP
- For newborn care *(Please refer to costed document)*

ii.Family planning:

The focus is on the promotion of family planning for birth spacing and healthy timing of pregnancy. When appropriately designed and implemented, community health programs can increase use of contraception, particularly where unmet need is high, access is low, and geographic or social barriers to use of services exist. BHWs are particularly important to reducing inequities in access to services by bringing information, services, and supplies to women and men in the communities where they live and work rather than requiring them to visit health facilities, which may be distant or otherwise inaccessible. It also addresses newly married young couples, post-partum and post abortion periods- these are missed opportunities in most cases.

FP services package:

- FP information and counselling
- Combined oral contraceptives (COCs) to new and revisit clients
- Progesterone only pills (POPs) to new and revisit clients
- Male Condom as a means of birth spacing and HIV/STI prevention
- Emergency contraceptive pills
- Sayana Press (to new and revisit clients in hard-to-reach areas where BHWs have been trained)

iii. Adolescent and Youth Sexual Reproductive health

Integration of SRHR services into the community health system is important as it may help make the SRHR services compatible with the local structures and thus appropriate and accessible by adolescents. It enhances knowledge and uptake of services to prevent unplanned pregnancies, HIV/STI and sexual and gender-based violence.

AYSRH Service package

The BHWs work with Boma Health Committee and other community owned resource persons (Youth Peer Educators, Youth clubs & Groups) in order to provide the following services:

- Conduct ASRH sensitization meetings in the community targeting adolescent & youth clubs and groups.
- Conduct community dialogues with parents and young people in the community on ASRH.
- Disseminate youth friendly and culture and age appropriate SRH/HIV messages to adolescent and youth at family and community level using youth friendly IEC/BCC materials.
- Establish referral linkage for adolescent and youth who need farther health and social services and follow up.
- Facilitate access to condoms and family planning commodities to sexually active young people.
- Encourage the adolescents and youth to take voluntary counselling and HIV test
- Provide basic counselling to adolescents and youth on premarital and early marriages
- Identify pregnant adolescent and refer them for the antenatal visits and facility delivery
- Provide deworming tablets to adolescent
- Provide folic acids and treated mosquito nets to pregnant adolescent.
- Engage adolescent & youth in provision of services and decision-making process at the community level.

Gender Based Violence

In 2018, a total of 5,140 cases of GBV were reported to GBVIMS data gathering organizations. Women and girls continued to be disproportionately affected by GBV incidents, with 98 % of incidents affecting female survivors while 2% of the reported incidents involved male survivors. Compared with 2017, GBV cases reported by male survivors showed a reduction from 5% to 2%. The high proportion of female survivors reflects entrenched gender inequality in South Sudan of which violence against women and girls is a means of maintaining structural power imbalances in society that underpin the patriarchal status quo.'

Gender-Based Violence Service Package

The BHWs work with Boma Health Committee and other community owned resource persons will provide the following services;

- Community sensitization and information dissemination against acts of Gender-based Violence and reporting mechanisms
- Basic psychosocial support
- Provide information on Referrals

List of drugs, medical supplies and RH kits

S/N	Item Description	Unit	Dose
1	Misoprostol tablets	200mcg, tablet	
2	Combined oral contraceptives		
3	Progestin only pills		
4	Emergency contraceptive pill		
5	Sayana Press		
6	Ferrous sulphate+ folic acid tablets		
7	Chlorhexidine 7.1% gel		
8	Mama kits		
9	Menstrual Health Management kit (MHM)		
10	Dignity kits		

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