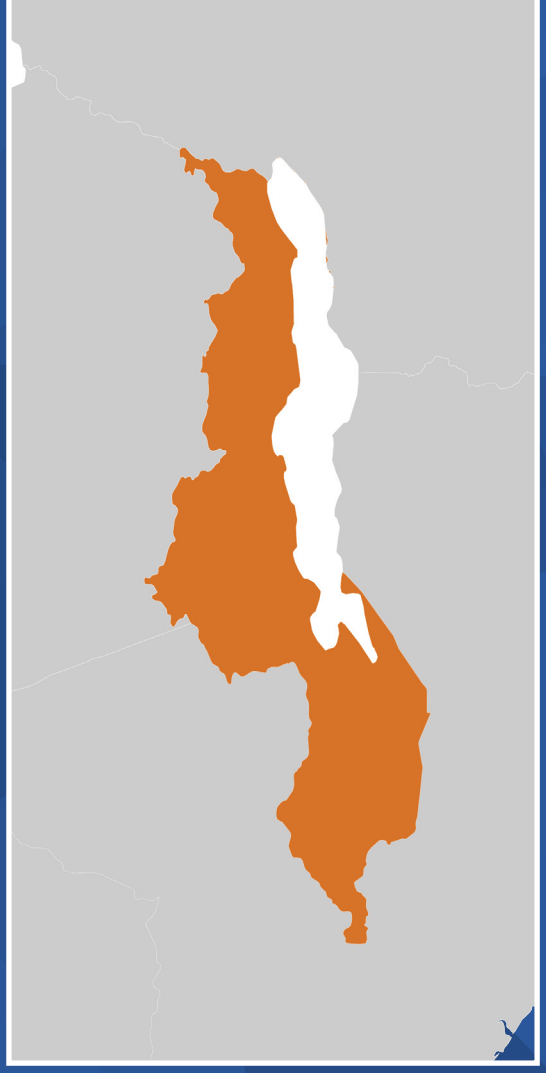

June 2019

COST-EFFECTIVENESS OF MALAWI'S SERVICE LEVEL AGREEMENT WITH THE CHRISTIAN HEALTH ASSOCIATION OF MALAWI

USAID
FROM THE AMERICAN PEOPLE

HP+
HEALTH POLICY PLUS

JUNE 2019

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ABBREVIATIONS

ANC	antenatal care
BCG	Bacillus Calmette-Guerin
CHAM	Christian Health Association of Malawi
CI	confidence interval
DHIS-2	District Health Information System
DSBA	delivery by skilled birth attendants
GDP	gross domestic product
HIV	human immunodeficiency virus infection
ICER	incremental cost-effectiveness ratio
LiST	lives saved tool
MOU	memorandum of understanding
MWK	Malawian Kwacha
NSO	National Statistical Office
PNC	postnatal care
QALYs	quality-adjusted life years
SLAs	service level agreements
USD	United States Dollar
WHO	World Health Organization

ABSTRACT

Objectives: To improve the utilization of maternal and child health services, Malawi has implemented service level agreements (SLAs) with the Christian Health Association of Malawi (CHAM) since 2006. Under SLAs, CHAM facilities provide an essential health package for populations living in rural areas without charging user fees. Recent studies have shown a beneficial impact of SLAs on the use of maternal and child health services. However, the cost-effectiveness of this policy is unknown. This study, conducted by the Health Policy Plus project (funded by the U.S. Agency for International Development) examines the cost-effectiveness of contracting essential health package provision to CHAM facilities to inform policy making.

Methods: The cost-effectiveness analysis was conducted from the governmental perspective. Both financial data and service utilization data were collected from January 2015 through December 2016. Financial data on payments from the government to facilities through SLAs were collected from the CHAM Secretariat and CHAM facilities. The utilization of key maternal and child health services, including antenatal care, postnatal care, delivery by a skilled birth attendant, and vaccinations, were obtained from the district health information system. The impact of SLAs on the utilization of maternal and child health services was examined using propensity score matching and random effects models. Subsequently, improved services were converted to the number of lives saved and quality-adjusted life years gained, using the Lives Saved Tool. Incremental cost-effectiveness ratios were generated by combining costs and effectiveness measures.

Findings: Over the course of two years (2015–2016), a total of $1.5 million (USD) was disbursed to CHAM facilities through SLAs, equivalent to $1.24 per capita for catchment populations. SLAs were associated with a 13.8%, 13.1%, 19.2%, and 9.6% increase in coverage of antenatal care visits, postnatal care visits, delivery by a skilled birth attendant, and bacillus Calmette-Guerin (BCG) vaccinations, respectively. This translates to 434 lives saved (95% confidence internal of 355–512) or 11,161 quality-adjusted life years gained (95% confidence internal of 9,125–13,174). The incremental cost-effectiveness ratio of SLAs was estimated at $134.7/quality-adjusted life years gained (95% confidence internal of $114.1–$164.7).

Conclusions: This study found that the cost per quality-adjusted life years gained for SLAs was $134.7, representing a cost-effectiveness ratio of 0.35 per capita gross domestic product. Based on Malawi's per capita gross domestic product of $381, SLAs proved highly cost-effective. Further refinements on SLAs could be considered to improve value for money of SLAs, such as introducing pay for performance, revising the price list, streamlining the reporting system, and strengthening CHAM facilities' financial and monitoring management capacity.

INTRODUCTION

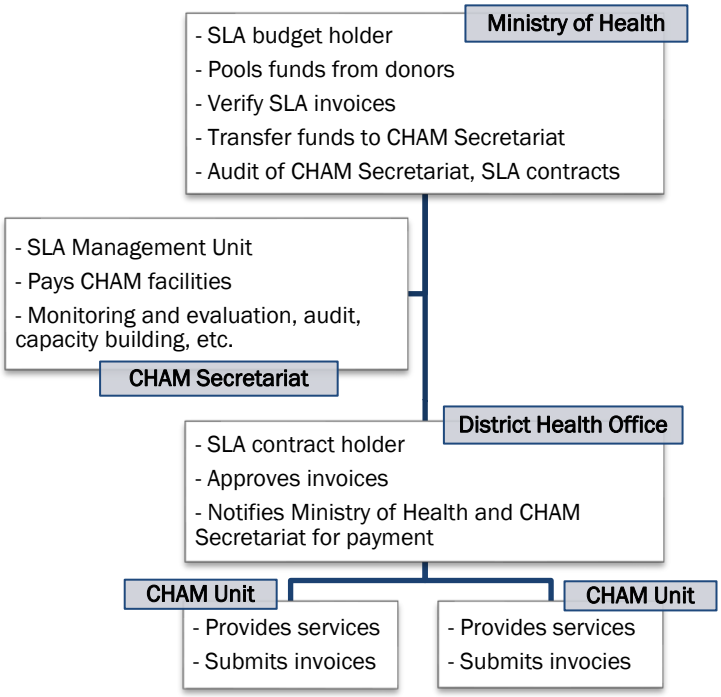
The Government of Malawi has committed to ensuring at least one health center within an eight kilometer reach for every resident of Malawi. Furthermore, the government hopes to ensure universal coverage of an essential healthcare package for all its residents in the near future. While the government is the primary provider of healthcare in Malawi, the Christian Health Association of Malawi (CHAM) has been and continues to be engaged in providing over 35% of all health services delivered to the people of Malawi. CHAM encompasses nongovernmental, religiously-based facilities and training institutions. In remote areas, CHAM facilities provide up to 75% of health services (CHAM, 2017). Currently, an estimated 3.7 million Malawians live in CHAM catchment areas.

For several primary and secondary health services, CHAM charges user fees, whereas those services would be free in the public sector. This creates a barrier to accessing health services for lower-income Malawians living in areas only served by CHAM facilities. Since 2002, the Government of Malawi and CHAM have worked together through a memorandum of understanding (MOU) to create service level agreements (SLAs) to expand access to a defined set of free health services through CHAM facilities in geographic catchment areas where no government/public facilities exist. SLAs are meant to expand access, avoid construction of redundant government facilities, and seek efficiencies in service delivery by having the government reimburse CHAM for selected primary health services, and in turn, for CHAM to eliminate user fees for those services.

In early 2016, the Government of Malawi and CHAM concluded negotiations for a new MOU. Under this MOU, the government will pay health worker benefits (salaries, leave grants, and pension contributions) to eligible CHAM facilities.[1] In response, CHAM will manage the facility-based staff, ensure adequate skills, and submit expenditure reconciliation statements. In addition to staff costs, the Government of Malawi agrees to pay service delivery costs based on "service level agreements" that will be negotiated at a district or city council level looking at the facts on the ground, including other sources of funds for CHAM facilities. Figure 1 shows the roles and responsibility of various actors under the SLAs.

[1] Eligible CHAM facilities are those that: (a) are registered with the Medical Council of Malawi, and (b) provide primary healthcare services outside eight kilometers of a non-paying (i.e., free services provided) facility, or (c) provide services within an eight kilometer radius of a non-paying facility but the catchment population is higher than 7,000 persons, or (d) regardless of above provide services in a hardship area (as decided by the district health officer), or (e) offer complementary secondary or tertiary health services otherwise unavailable in the catchment area. Prior to an SLA commencing, the CHAM facility may be subject to a health facility assessment.

Figure 1. Roles and Responsibilities of Various Actors



These SLAs are subject to funding through overall district/council-level budgets, which are determined by historical costs, year-to-year funding available from national sources (via budgetary appropriations to the Ministry of Health), and the scope of services. Generally, the scope of service provision will be guided by the approved Malawi essential health package. Until the new 2017 essential health package is implemented, the 2011 version is the basis of the schedule of fees and interventions covered in the SLAs. The full list of interventions covered under the SLAs is presented in Appendix Table A1. District health offices have some latitude in determining the scope of the SLAs based on eligible facilities, needs in the catchment area, and services to be covered.

The service delivery costs reimbursed under the SLAs, in addition to health worker salaries, are linked to a performance-based system, and the participating CHAM facilities must submit a monthly invoice detailing the scale and scope of services provided. The actual reimbursements cover 70% of the estimated unit cost by intervention. This 30% reduction is due to the concept of cost-sharing, in which CHAM covers some of the estimated cost of service delivery. The unit costs are based on estimated underlying resource needs of:

- Essential drugs and commodity costs valued at actual market prices
- Overhead costs—utilities, fuel, etc., allocated to the interventions based on the "SLA-client ratio"

A 2016/2017 schedule of fees (70% reimbursement) specified by diagnostic and treatment intervention and covering adult, pediatric, and maternal/newborn areas has been determined, distinguishing rates for hospitals versus health centers.

The district health office through the SLA specifies the monthly financial maximum reimbursement for service delivery costs, based on an estimate of utilization and fees to be paid, allowing for a variance (contingency) of 15%. Excess in the invoice shall not be reimbursed and may be carried over to the next month.

The motivation of the Government of Malawi in entering into these SLAs is to remove inequity in health service access and utilization faced by vulnerable Malawians due to out-of-

pocket payments at health facilities. The ultimate expected outcome of improved access and utilization is improved health status of Malawians, as well as a reduced incidence of catastrophic health expenditures. Furthermore, by entering into this MOU with CHAM, the government avoids spending for construction and subsequent operating costs of new government health facilities in areas where currently none exist within eight kilometers of a catchment population. With these perceived advantages of the SLA MOU, the Health Policy Plus (HP+) project, funded by the U.S. Agency for International Development (USAID), conducted a cost-effectiveness analysis of contracting CHAM facilities using SLAs (under the new or prior MOU) to provide essential health package services to the population where no public health facilities are nearby.

METHODS

Overall Approach

This cost-effectiveness analysis was conducted from the government perspective, meaning that the costs incurred by households and CHAM were not included in the analysis. Additionally, the costs of salaries for CHAM facilities were excluded from the analysis, as these are routine costs that would be incurred by the government whether SLAs are implemented or not (Carlson and Zanardi, 2014).

The policy intervention for analysis is the government's subsidy to CHAM health facilities under an MOU in which 70% of operational costs associated with providing essential health package services, excluding salaries, are covered by the government, while the remaining 30% are co-financed by CHAM. Meanwhile, health facilities under SLAs should not charge patient user fees for the defined package of health services, including maternal and child health services. SLAs started in 2006, however, some facilities stopped SLAs due to delays in payment and could not afford to provide services to the population without user fees. The new SLAs signed in 2016 resume the government's commitment and changes the payment modality, attempting to address the payment delay issue. Most eligible health facilities signed SLAs under the new MOU in January 2016. Due to delay of the administrative process, the implementation of SLAs in many signed facilities did not start until July 2016. For this study, we did not distinguish between SLAs under the historical or new MOU, given that: (1) the number of facilities under the new MOU was likely to be small at the time of the study period, and (2) the facilities under the new MOU might have also been under the old MOU, and therefore, it was impossible to create an intervention group of health facilities that only had SLAs under the new MOU without prior exposure to SLAs. We intended to examine the latest impact of SLAs, thus data for analysis were collected from January 2015 (12 month before the new MOU) to December 2016 (12 months after the new MOU). By the time of study, although some data on cost of SLAs and services were available in 2017, data in 2017 were excluded from the analysis to better fit the time frame for operating the Lives Saved Tool (LiST), which analyzes data by year and we did not have complete data for year 2017.

In this study, the status quo was defined as business as usual, where CHAM facilities continue providing services without the government's subsidy, charging user fee charges when patients seek care in CHAM facilities, which may deter patients from seeking care in CHAM covered areas.

Cost Estimation

We obtained a list of CHAM facilities from the CHAM Secretariat and cross-checked the list against CHAM facilities in the district health information system (DHIS-2), from which the indicators on utilization of health services were abstracted. A total of 149 CHAM facilities were available in the DHIS-2 for collecting data on SLA payment. Payment from the government to CHAM facilities under SLAs is based on agreed unit prices and the quantity of services provided by health facilities. The services include common health services for both adults and children. Given the challenge of obtaining data on detailed services paid through SLAs for each facility, the costs of SLAs were obtained using a macro-costing approach, which collected aggregate invoiced payments to health facilities from district health offices.

To obtain the cost of SLAs from CHAM facilities, a researcher visited both the CHAM Secretariat and CHAM facilities. All CHAM facilities were asked about their SLA status from January 2015 to December 2016 for each month, and amount of payment or expected payment through SLAs. If facilities did not have the data, we retrieved invoiced amount from the accounting department at the Ministry of Health. Facilities were paid in Malawian Kwacha (MWK); all costs were converted to U.S. dollars (USD) based on the mid-year

exchange rate when expenses occurred (USD 1 = MWK 496.4 in 2015; USD 1 = MWK 713.8 in 2016) (World Bank, 2017).

Effectiveness Estimation

Compared to the status quo, it is expected that removing user fees by contracting with CHAM would improve the coverage of key maternal and child health services, including antenatal care (ANC), postnatal care (PNC), delivery by skilled birth attendants (DSBA), vaccinations, and so on. DHIS-2 data on utilization of health services was the major data source for estimating the coverage of key maternal and child health services (Ministry of Health, 2017). The selection of these indicators for the analysis was primarily because (1) these indicators were available in the DHIS-2, and (2) they could be modeled by LiST.

We abstracted data from the DHIS-2 on ANC, PNC, DSBA, bacillus Calmette-Guerin (BCG) vaccine, polio vaccination, and pentavalent vaccination. These indicators were chosen based on availability, accuracy, and priority in managing illnesses in Malawi. These data were routinely collected and recorded. The definition of each selected variable is as follows:

1. Coverage of ANC: Total number of pregnant women who made at least one ANC visit at a health facility during pregnancy divided by the estimated number of pregnant women in the catchment area.
2. Coverage of DSBA: The total number of deliveries by trained personnel divided by the estimated number of pregnant women in the catchment area.
3. Coverage of PNC: Total number of women who made at least one postpartum care visit two weeks after delivery at a health facility divided by the estimated number of pregnant women in the catchment area.
4. Coverage of BCG vaccination: Total number child receiving BCG vaccination divided by the estimated number of children under the age of one.
5. Coverage of polio vaccination: Total number of child receiving polio vaccination divided by the estimated number of children under the age of one.
6. Coverage of pentavalent vaccination: Total number of children receiving pentavalent vaccination divided by the estimated number of children under the age of one.

Some equally essential health services, such family planning, HIV, and malaria, were excluded due to lack of data or incapacity of using Lives Saved Tool (LiST), the software to convert the coverage of health services to the number of lives saved, to model health outcomes. In the case of family planning, no data was reported in the DHIS-2 on provision of services and it was challenging to convert facility visits for family planning services to coverage due to the fact that there are many contraceptive approaches with different duration of protection.

To examine the impact of SLAs on the selected indicators, we first used a propensity score matching approach (Austin, 2011) to match the SLA group and the non-SLA group on three factors—type of facility (hospitals, community hospitals, and health centers), the number of staff, and the size of the catchment population (for the first quarter when there were a reasonable number of facilities with SLAs)—an approach similar to the one applied by Manthalu et al. (2016). Propensity score matching allows the SLA group and non-SLA group to be balanced on several covariates, producing more valid results when examining SLA effects. As the SLA status changed over the observation period, we matched health facilities based on SLA status on January 2015. The propensity scores were estimated with the Probit model:

$$p(SLA=1)=\Phi(\beta_0+\beta_1 hftype+ \beta_2 staff+\beta_3 pop)$$

In the formula, p is the probability of a health facility being under an SLA with the government, hftype represents the type of health facility (i.e., health center, community hospital, and hospital), staff represents the number of staff working in the health facility, and pop represents the size of the catchment population. Φ is the cumulative normal density function, while βs are coefficients estimated from the Probit model. The propensity scores were estimated for each health facility in January 2015, and then health facilities were matched using the nearest neighbor approach, with 1:1 matching. In January 2015, there were 49 facilities with SLAs out of the total 149 CHAM facilities in the DHIS-2 database; we selected an additional 49 CHAM facilities without SLAs to match them. Thus, we used 98 CHAM health facilities for the impact evaluation based on 1:1 matching. Balancing tests were conducted and we found no statistical differences for the three matching factors between SLA and non-SLA groups for January 2015.

To examine the impact of SLAs on the selected six indicators on coverage of health services, we assumed that the change of SLA in the following month was exogenous to prior status, and the following regression model was used:

$$HScov_{it} = \beta_0 + \beta_1 SLA_{it} + \alpha_i + \varepsilon_{it}$$

In the formula, $HScov_{it}$ is the coverage of health services for *i*th facility at time (*t),* which was obtained or derived from the DHIS-2, SLA is the status of the health facility with or without an SLA, α_I is the individual impact of the health facility, ε_{it} is random noise, and βs are coefficients estimated from the regression model. We conducted both the random effects and fixed effects model and selected the random effects model because Hausman tests were mostly not statistically significant between the two types of the models and because the random effects model is more efficient in estimating the impact with smaller standard errors. Among all the coefficients, β_1 represents the effect of SLAs on the coverage of health services, while β_0 shows the average coverage of health services for health facilities without SLAs. A positive value of β_1 means SLAs contribute to the improvement of coverage of health services. Stata 15 and R were used to conduct the statistical analysis.

Once we estimated the impact of SLAs on the coverage of key maternal and child health services using the above regression model, we obtained estimates of the coverage of key maternal and child health services with or without SLAs, and used them as parameters for the Lives Saved Tool (LiST) to estimate the potential lives saved from SLAs. Using LiST, we estimated the number of lives saved due to the improvement of health services from SLAs. As SLA status changed over time, we used the average yearly population size in the analysis in order to be consistent with the cost estimation.

Cost-Effectiveness Analysis

We used key parameters from Malawi preloaded in LiST (e.g., age structure of the population), and adjusted the population size to the size of the catchment population in CHAM covered areas. LiST was developed by researchers at Johns Hopkins University and was incorporated into the Spectrum software suite. LiST aims to estimate the impact of different interventions on maternal and child health outcomes. It has been widely applied in projecting the health impact of interventions and is advocated by the United Nations Children's Fund (UNICEF) for decision making (Boschi-Pinto et al., 2010; Stenberg et al., 2014). LiST produced the number of lives saved from improved coverage of services. We used the average age of pregnant women (NSO and ICF, 2017) and Malawi specific life tables (WHO, 2017) to convert the number of lives saved to quality-adjusted life years (QALYs) saved (Sassi, 2006; Shepard et al., 2015), which is a standardized outcome for cost-effectiveness analysis studies. The conversion used 3% as the discount rate. An incremental cost-effectiveness ratio (ICER) was generated using the following formula:

$$\text{ICER} = \frac{\text{Incremental costs of contracting out services/capita}}{\text{QALYs gained/capita}}$$

Uncertainty of Cost-Effectiveness Analysis

To estimate the uncertainty of the ICER, the independence of the six indicators included in the analysis was assumed. Thus, 39.2% confidence intervals (CI) for each indicator were used to estimate the 95% CI of the ICER. The assumption of independence produced more conservative estimates of 95% CI of the ICER.

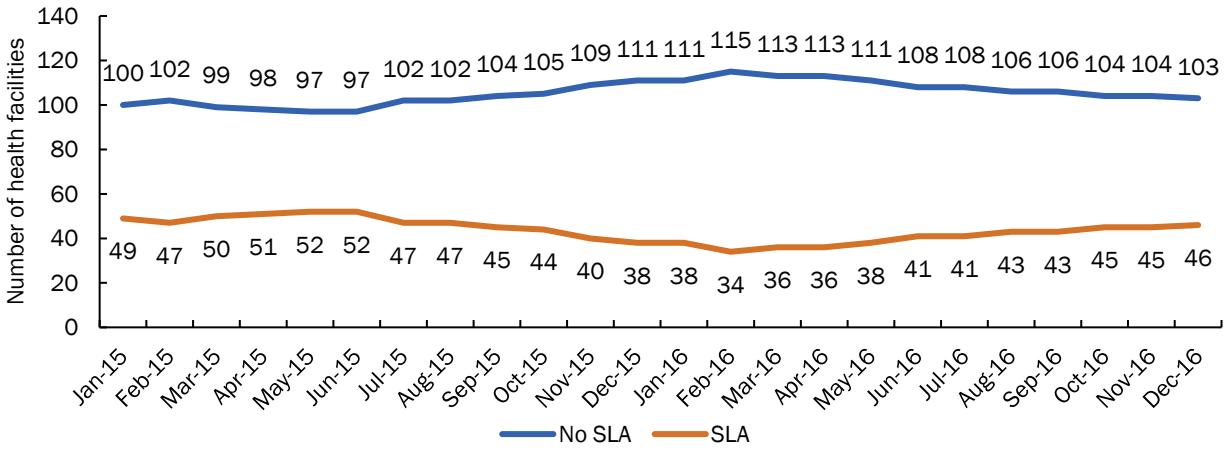
FINDINGS

General Characteristics

Figure 2 shows the SLA status from January 2015 through December 2016 for 149 CHAM facilities in the DHIS-2 database. The number of health facilities with SLAs declined from 49 in January 2015 to 34 in February 2016 and then increased gradually to 46 in December 2016. Although some facilities signed new SLAs in January 2016, they did not implement SLAs until July 2016.

The population covered by SLA facilities over the two years was estimated, on average, at 1.22 million, ranging from 0.84 million in February 2016 to 1.45 million in July and August 2015. The average population of 1.21 million accounted for 6.7% of the total population in Malawi, which is the population parameter used in LiST.

Figure 2. Service Level Agreement Status of 149 CHAM Facilities



After the propensity score matching, the three matching characters (type of health facility, number of staff, and catchment population) of the 49 facilities with SLAs were compared to 49 matched facilities without SLAs in January 2015. Table 1 shows the comparison results. Within the SLA group, there were more hospitals and fewer health centers in January 2015, however, the difference was not statistically significant.

Table 1. Characteristics of 98 Matched Facilities

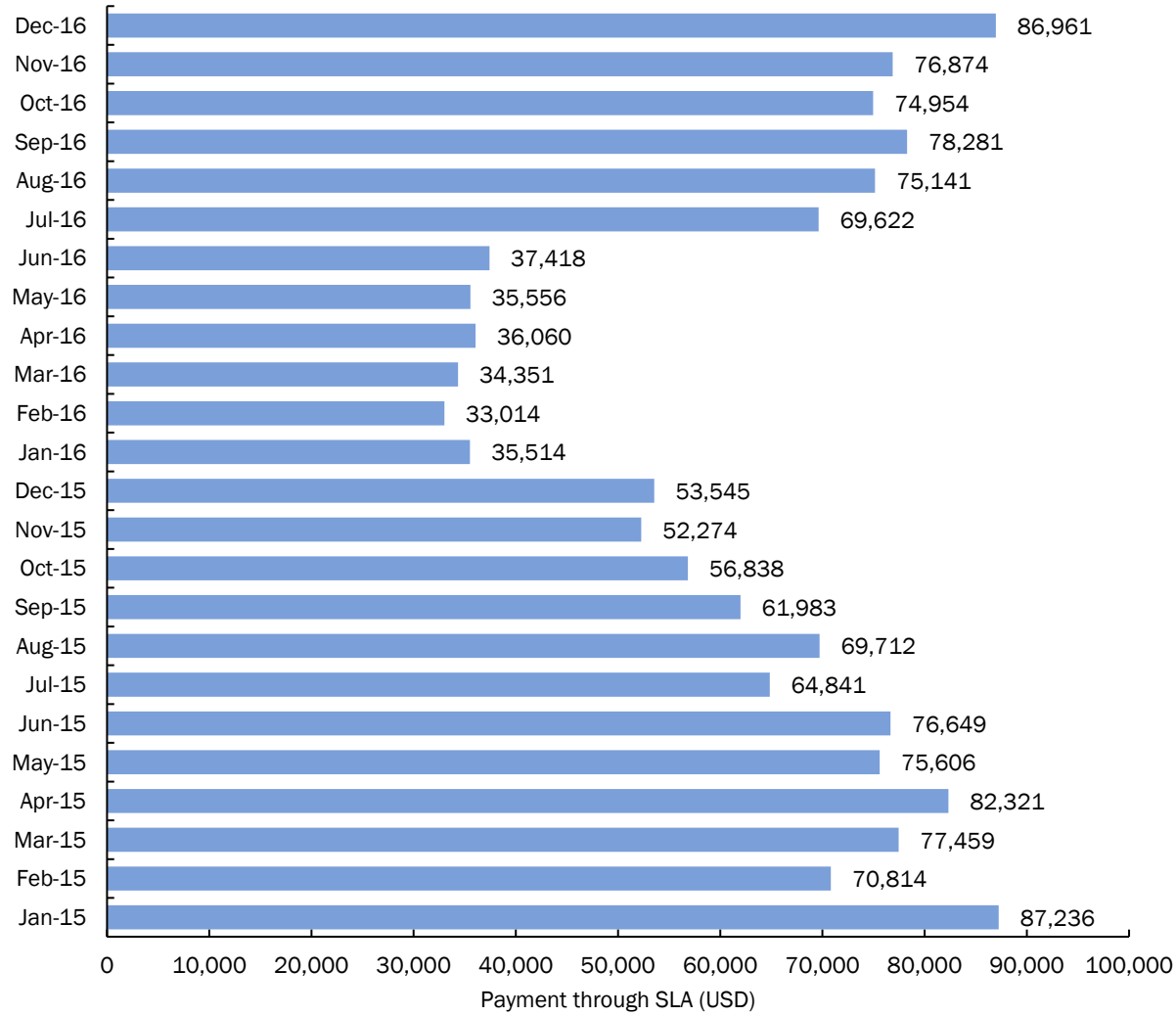
Characteristics	No SLA (n=49)	SLA (n=49)	Diff	X^2 or t value*
Facility type				
Hospital	7 (14.3%)	15 (30.6%)	-16.3%	4.05
Community hospital	10 (20.4%)	10 (20.4%)	0.0%	
Health center	32 (65.3%)	24 (49.0%)	16.3%	
Population	23,856 ±2,450	28,034 ±2626	-4178	-1.16
ln (staff)**	3.75 ±0.11	4.07 ±0.14	-0.32	-1.87

* None is statistically significant ** ln (staff) is the natural logarithm of the number of staff in health facilities

Cost Estimation

Over the two years (2015–2016), a total of $1.5 million (USD) was disbursed to CHAM facilities through SLAs, with an average of $1,434 per facility per month ranging from $935 in January 2016 to $1,890 in December 2016. This was equivalent to an average of $1.24 per capita in the catchment area. Consistent with the pattern of SLA status shown in Figure 1, payment to CHAM facilities through SLAs declined until February 2016, but increased gradually since then (Figure 3).

Figure 3. Total Payments through Service Level Agreements per Month



Impact of Service Level Agreements on Key Maternal and Child Health Services

Figures 4–9 show the average coverage of six maternal and child health services among SLA and non-SLA facilities in each month. In general, the coverage of ANC, PNC, DSBA, and BCG vaccination was consistently higher in SLA facilities relative to non-SLA facilities. But the coverage of pentavalent and polio vaccine did not show a consistent pattern. This suggests that SLAs contributed more to the improvement of utilization of maternal and child health services than to coverage of pentavalent and polio vaccine. In some months, the coverage for any ANC visit and BCG vaccination exceeded 100%, primarily due to the fact that the

denominator for the coverage was an estimated number based on national statistics rather than the actual number of pregnant women in the catchment areas.

Figure 4. Coverage of any Antenatal Care Visit

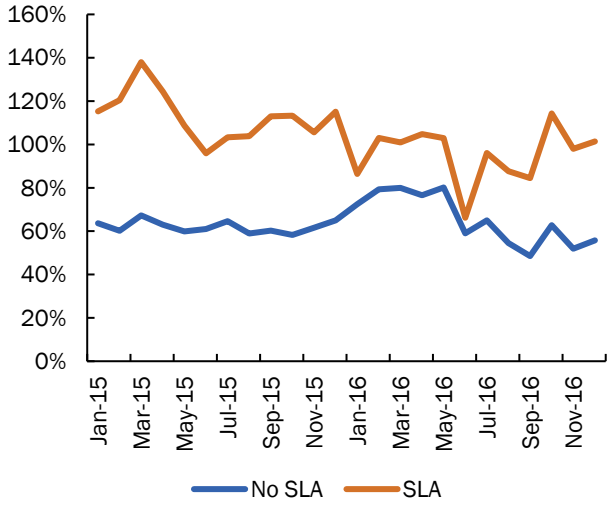


Figure 5. Coverage of Postnatal Care Visit

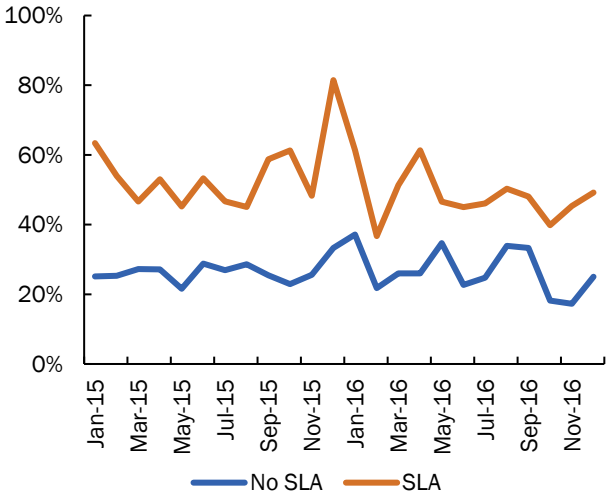


Figure 6. Coverage of Delivery by Trained Personnel

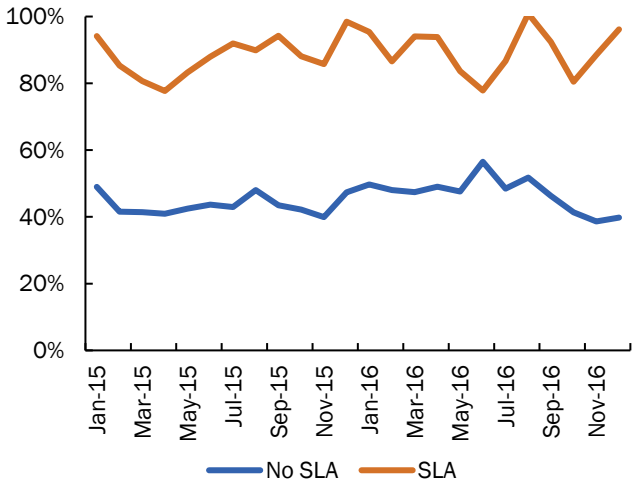


Figure 7. Coverage of BCG Vaccination

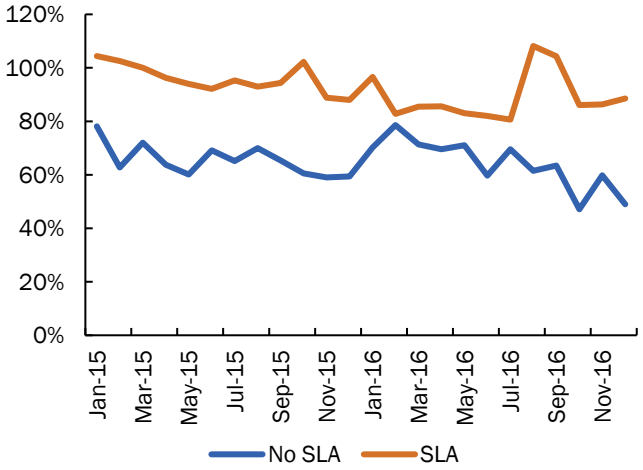


Figure 8. Coverage of Pentavalent Vaccination

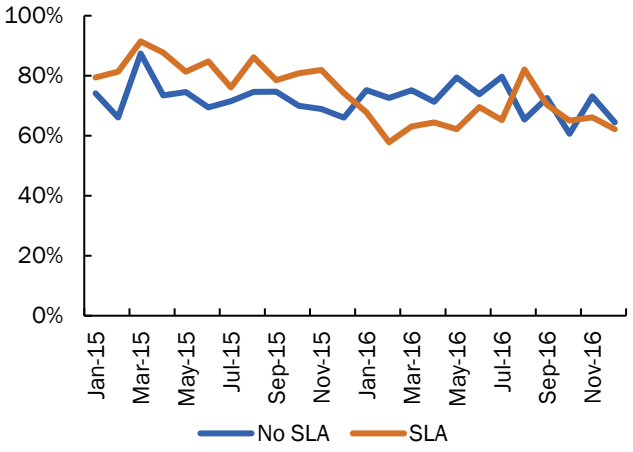
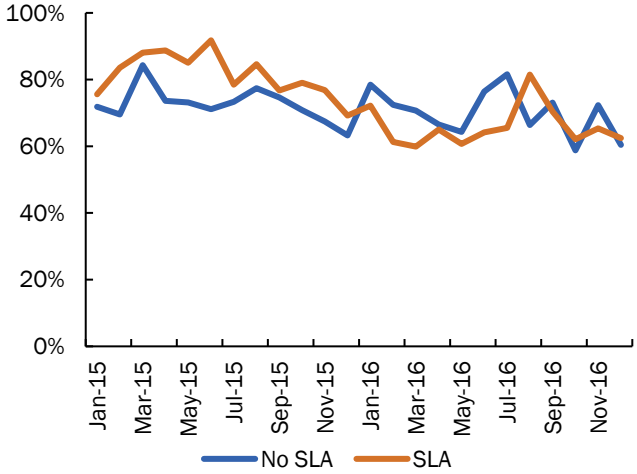


Figure 9. Coverage of Polio Vaccination



As shown in Table 2, SLAs improved the use of any antenatal care visit by 13.8%, postnatal care by 13.1%, delivery by skilled birth attendant by 19.2%, and BCG vaccination by 9.6%. The impact of SLAs on the four indicators was statistically significant ($p < 0.05$). However, the impact of SLAs on pentavalent vaccine and polio vaccine was not statistically significant, although it pointed in a positive direction. The regression model in Table 2 did not control

for seasonal impact; the results that controlled for the time effect are shown in Appendix Table A2.

Table 2. Regression Model Examining the Impact of Service Level Agreements on Maternal and Child Health Services

Variable	ANC	PNC	DSBA	BCG	Pentavalent	Polio
SLA	0.138*	0.131**	0.192***	0.096*	0.036	0.044
Constant	0.791***	0.310***	0.578***	0.770***	0.745***	0.737***

* p < 0.05, ** p < 0.01, *** p < 0.001

Estimation of Lives Saved and Quality-Adjusted Life Years Saved

LiST estimated that improvement in the six indicators translates to a total of 434 lives saved over the two years (2015–2016), with a 95% CI of 355–512 lives saved, including 370 lives saved for children under the age of five, and 64 lives saved for pregnant women. The key parameters used in LiST are presented in Appendix Table A3 and the number of lives saved by causes of death is shown in Appendix Table A4. Based on Malawi's life table, an estimate of 11,161 QALYs was gained from the implementation of SLAs, with a 95% CI of 9,125–13,174 QALYs (Table 3).

Table 3. Lives Saved and Quality-Adjusted Life Years Gained from Service Level Agreements

	Lives saved			QALYs gained		
	Point estimate	Lower bound	Upper bound	Point estimate	Lower bound	Upper bound
Pregnant women	64	54	73	1,487	1,255	1,696
Children	370	301	439	9,674	7,870	11,478
Total	434	355	512	11,161	9,125	13,174

Incremental Cost-Effectiveness Ratio

Table 4 shows the ICER of SLAs in comparison with the status quo (without SLAs). The ICER for SLAs in terms of cost per life saved was estimated at $3,463 (USD), with a 95% CI of $2,936–$4,234. When translating into cost per QALY gained, ICER was estimated as $134.7, with 95% CI of $114.1–$164.7 per QALY gained. The gross domestic product (GDP) per capita in Malawi in 2015 was $381.4 (World Bank, 2017). As the ICER was less than the GDP per capita, our conclusion is that SLAs are highly cost-effective.

Table 4. Incremental Cost-Effectiveness Ratio of Service Level Agreements

	Cost/life saved			Cost/QALY gained		
	Point estimate	Lower bound	Upper bound	Point estimate	Lower bound	Upper bound
Total	$3,463	$4,234	$2,936	$134.7	$164.7	$114.1

DISCUSSION

Service level agreements have been implemented in Malawi since 2006, and a recent evaluation (Manthalu et al., 2016) and this study both found a positive impact of SLAs on increasing the use of maternal and child health services. As to the cost-effectiveness analysis of SLAs, ideally, the ICER of SLAs in Malawi should be judged against that of alternative programs within the country, but we could not identify any cost-effectiveness studies for other maternal and child health programs in Malawi. However, as another criterion for judging the cost-effectiveness of an intervention, the World Health Organization (WHO) Commission on Macroeconomics in Health and Medicine suggested that an intervention with a cost per QALY less than the country's per capita GDP is highly cost-effective (WHO, 2009). This study found that the cost per QALY gained was $134.7. As Malawi's 2015 per capita GDP was $381, the cost-effectiveness ratio is 0.35 per capita GDP. Thus, SLAs proved highly cost-effective.

Consistent to another study on the impact of SLAs on utilization of maternal and child health services (Manthalu et al., 2016), our results also demonstrate a favorable effect of SLAs on maternal and child health services. In this study, the major increases in the utilization of health services were for antenatal care, postnatal care, delivery by skilled birth attendant, and BCG vaccination. Except for antenatal care and BCG vaccination, these services generally have a low baseline. For example, delivery by a skilled birth attendant had a baseline of 57.8% while postnatal care had a based line of 31.0%. User fee exemptions have greater impact on coverage of such services compared to services with high coverage, such as pentavalent and polio vaccination. Although antenatal care visits usually have relatively high coverage, they too will likely increase when packaged with delivery by a skilled birth attendant in SLAs.

The CHAM facilities under SLAs are located in remote areas where there is no public facility within eight kilometers. Populations living in these places encounter not only physical barriers to access, but very likely substantial financial barriers. Some pregnant women have to spend a substantial amount of time walking to facilities to receive care. In addition, the potential travel costs and time spent on the way to the health facility deters pregnant women from seeking care in public facilities that are far away. Thus, contracting services to CHAM likely has further benefits at the client level by improving both physical access and potential financial burden, at least saving transportation costs. For this reason, from a societal perspective, which include costs borne by households, SLAs, perhaps, could be even more cost-effective. Further cost-benefit analysis of SLAs from the client perspective would quantify additional efficiencies.

One benefit of contracting with CHAM facilities is that CHAM facilities generally have better quality of care than public facilities (Abiiro et al., 2014). In Malawi, besides financial barriers, low quality of care becomes another major reason for not seeking care in the public sector (Abiiro et al., 2014; Munthali et al., 2014). Quality issues include shortages of personnel and facilities, lack of medicines, over-crowding, poor health worker attitudes, and inadequate clinical skills of personnel to address the population's health concerns. CHAM facilities have generally been found to enjoy a reputation for better quality of care in Malawi's health service delivery (SHOPS Project, 2012).

For this paper, the cost-effectiveness analysis compares SLA with non-SLA CHAM facilities. The counterfactual scenario could also be a case in which the government builds health facilities where CHAM facilities under SLAs are located. We conclude that contracting CHAM facilities using SLAs is cost-effective in comparison to establishing the government's own health facilities. First, building new facilities requires a significant amount of upfront investment to build health facilities, purchase equipment, and recruit and train health personnel, costs which do not need to be incurred if the government contracts to CHAM

facilities. If recurrent costs for running a public facility, such as salaries for health workers (e.g., doctors and nurses), medicines, and cost of water and electricity, were similar to those for running CHAM facilities, assuming the coverage of key maternal and child health services increases in the same magnitude as what is estimated in this paper, contracting with CHAM would save the government the substantial upfront costs required to invest in establishing new facilities, along with the 30% operation costs co-financed by CHAM facilities.

Second, only if/when newly established facilities are much more efficient in providing health services than CHAM facilities and the savings of operational costs could offset the upfront costs, would it be better to establish government facilities instead of contracting CHAM facilities. Even so, we have to assume that establishing government facilities would have the same impact as contracting CHAM, which may not be realistic, given that CHAM facilities have better quality care and new facilities would have to compete with CHAM facilities for patients. Third, the major efficiency gains for public facilities generally comes from personnel costs. Because salaries for personnel for CHAM facilities under SLAs have already been regulated by the government, the likelihood of generating savings from personnel costs is slim. Thus, from the government's perspective, contracting with CHAM facilities to provide an essential package of services is likely to be cost-effective compared to the scenario of establishing public facilities to replace CHAM facilities.

Several challenges to implementing SLAs, such as a lack of clear guidelines, delayed payment of bills, and poor communication, were identified from prior studies (Chirwa et al., 2013; Bowie and Mwase, 2011). Among them, delay in payment is a major concern for CHAM facilities to implement SLAs. Prior to the new MOU being signed in January 2016, district health offices played a vital role in managing the implementation of SLAs. They were responsible for providing funds for SLA services, health worker salary costs, and procuring essential drugs, equipment, medical supplies, and transport for referral (Chirwa et al., 2013; Government of Malawi and CHAM, 2016). District health offices also shouldered the responsibility of verifying services provided by CHAM facilities. Due to inadequate funding from the central level, lack of efficient validation system, and other issues, payment from the district health office to CHAM facilities was often delayed, which resulted in cancellation of SLAs in some facilities. To address this issue, under the new MOU, payment to CHAM facilities, including funds for services and health provider salaries, goes through the CHAM Secretariat instead of the district health office. Since the CHAM Secretariat already manages CHAM facilities and ensures compliance with reporting systems and other processes and procedures, expanding the Secretariat's role to include management and disbursement of SLA funds to health facilities should substantially improve the administration of the SLAs and may also help reduce delays in facility payments, making for a stronger and more efficient public-private partnership.

Although SLAs prove to be cost-effective, the following potential refinements could be considered to enhance SLAs' value for money:

1. **Strategic contracting based on performance.** As mentioned earlier, the Government of Malawi uses an output-based approach to pay CHAM facilities for health services, which provides a financial incentive to provide services. However, coverage of key maternal and child health services remains low in some facilities with SLAs, and additional incentives for achieving a set goal for those facilities may help accelerate the pace of covering a more vulnerable population.

2. **Refine price list for services.** The price list was developed through a Ministry of Health consultation with the CHAM Secretariat and may not necessarily reflect the costs of service provision. More detailed costing analysis of essential health services within CHAM facilities would be useful to refine the price list.

3. **Streamline the reporting system to reduce reporting burden.** Falsification of reporting health services was reported under SLAs, and it distorted the relationship between district health offices and CHAM facilities (Chirwa et al., 2013). Under the new MOU, the Ministry of Health would need to better monitor the performance of the CHAM Secretariat, ensuring that services are reported accurately.

4. **Enhance capacity of CHAM facilities.** As the CHAM Secretariat assumes more responsibility for financial management and service validation under the new MOU, it is important to strengthen CHAM's capacity in both areas (SHOPS Project, 2012).

It should also be underscored that this study only looked at 6 out of 94 health services included in Malawi's essential health package. The Ministry of Health should continue to apply this type of assessment to other services in the essential health package to generate further information on the cost-effectiveness of SLAs to cover other preventative or curative health services.

Additionally, the Ministry of Health should consider how it will ensure access to all elements of its essential health package in CHAM SLA areas. In remote locations where the CHAM facility is the only health service delivery point, the government may need to identify additional public-private partnerships to ensure full access to health services that the CHAM facility may not provide, either due to ideological reasons (such as contraceptive methods) or capacity. These additional considerations may or may not affect the cost-effectiveness of contracting for a full range of health services.

LIMITATIONS

Several limitations should be acknowledged. First, the cost-effectiveness analysis was conducted from a pure government perspective, and the cost only captures payments to CHAM facilities under SLAs. It does not account for the resources that CHAM facilities have to raise for 30% of the costs. If the costs borne by CHAM facilities are included, the ICER will increase by 42.9% (30%/70%*100%) proportionally, and the point estimate for ICER would be $192.4 per QALY gained, accounting for 50.4% of per capita GDP. Second, for the effectiveness measures, the study focuses on maternal and child health but neglects curative treatment for common illnesses that are included in SLAs, which may result in an underestimation of the effectiveness of SLAs.

Third, we used Malawi's national statistics—such as population growth and allocation of institutional deliveries by level of health facilities—as parameters for modeling in LiST. These parameters may not accurately reflect the statistics in the catchment area where SLA facilities are located. Since the SLAs are being implemented in remote catchment areas, it is likely that poverty and fertility rates are higher than the national average (Aassve, 2006). Assuming that the impact of SLAs on the coverage of health services in the SLA implementation areas is the same as the national average, this would result in more lives saved, and SLAs would be more cost-effective.

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APPENDIX

Table A1. Services Covered under Service Level Agreements

Services for children under 5	Services for children between 5–14 years old	Services for maternal and newborn health
Abscess, inpatient	Abscess, inpatient	3rd degree tear
Abscess, outpatient	Abscess, outpatient	Anemia, mild
Asthma	Asthma	Anemia, severe
Atopic dermatitis	Atopic dermatitis	Antenatal care
Blood transfusion, Malawi Blood Transfusion Service	Blood transfusion, Malawi Blood Transfusion Service	Antepartum hemorrhage
Blood transfusion	Blood transfusion	Blood transfusion, Malawi Blood Transfusion Service
Burns	Burns	Blood transfusion
Chicken pox	Chicken pox	Cesarean section
Conjunctivitis	Conjunctivitis	Cesarean section 7 days after birth
Dysentery	Dysentery	Eclampsia
Fracture and dislocation, inpatient	Fracture and dislocation, inpatient	Emergency hysterectomy
Fracture and dislocation, outpatient	Fracture and dislocation, outpatient	Examination under anesthesia
Gastroenteritis, inpatient	Gastroenteritis, inpatient	Evacuation
Gastroenteritis, outpatient	Gastroenteritis, outpatient	Gastroenteritis, mild
Malaria, inpatient	Malaria, inpatient	Gastroenteritis, severe
Malaria, outpatient	Malaria, outpatient	Induced labor
Malnutrition, severe	Measles	Laparotomy
Measles	Meningitis	Malaria, non-severe
Meningitis	Osteomyelitis	Malaria, severe
Osteomyelitis	Otitis media, outpatient	Manual removal
Otitis media, outpatient	Pertussis	Meningitis
Pertussis	Pneumonia, inpatient	Manual vacuum aspiration
Pneumonia, inpatient	Pneumonia, outpatient	Newborn complication, inpatient
Pneumonia, outpatient	Scabies	Newborn complication, outpatient
Scabies	Schistosomiasis	Obstetric scanning
Schistosomiasis	Severe sepsis	Pneumonia, mild
Severe sepsis	Severe anemia	Pneumonia, severe
Severe anemia	Tetanus	Pre-referral management
Tetanus	Urinary tract infection	Pre-referral management, newborn
		Preterm labor
		Premature rupture of membranes
		Sepsis
		Sickle-cell
		Tear-episiotomy
		Tubal ligation
		Urinary tract infection
		Vacuum extraction
		Vaginal delivery
		Vaginal delivery, twins

Table A2. Random Effects Model Examining the Impact of Service Level Agreements on Utilization of Key Maternal and Child Health Services

Variable	ANC	PNC	DSBA	BCG	Pentavalent	Polio
SLA	0.127*	0.136**	0.174***	0.059	0.008	0.009
Month 1	Reference					
Month 2	-0.002	-0.061	-0.106**	-0.104*	-0.029	0.028
Month 3	0.138*	-0.081	-0.120***	-0.063	0.118**	0.117*
Month 4	0.054	-0.037	-0.129***	-0.101*	0.047	0.083
Month 5	-0.043	-0.106*	-0.087*	-0.130*	0.028	0.070
Month 6	-0.105	-0.030	-0.054	-0.101*	0.022	0.096*
Month 7	-0.055	-0.075	-0.042	-0.114*	-0.023	0.027
Month 8	-0.081	-0.070	-0.022	-0.094	0.039	0.077
Month 9	-0.038	-0.025	-0.035	-0.124*	0.005	0.026
Month 10	-0.047	-0.038	-0.074*	-0.112*	-0.008	0.018
Month 11	-0.080	-0.070	-0.101**	-0.191***	-0.016	-0.016
Month 12	-0.028	0.085	-0.027	-0.198***	-0.063	-0.072
Month 13	-0.184*	-0.016	-0.116**	-0.163*	-0.036	0.032
Month 14	-0.067	-0.218**	-0.194***	-0.209**	-0.106	-0.06
Month 15	-0.074	-0.134*	-0.160***	-0.228***	-0.056	-0.065
Month 16	-0.069	-0.083	-0.162***	-0.238***	-0.076	-0.067
Month 17	-0.056	-0.112	-0.200***	-0.238***	-0.061	-0.103
Month 18	-0.357***	-0.175*	-0.194***	-0.272***	-0.033	-0.029
Month 19	-0.151	-0.157*	-0.169***	-0.253***	-0.044	0.000
Month 20	-0.238**	-0.090	-0.051	-0.087	0.017	0.044
Month 21	-0.280***	-0.094	-0.106*	-0.100	-0.039	-0.007
Month 22	-0.037	-0.209**	-0.214***	-0.287***	-0.126*	-0.123
Month 23	-0.181*	-0.150*	-0.170***	-0.255***	-0.074	-0.052
Month 24	-0.145	-0.138	-0.129**	-0.293***	-0.130*	-0.112
Constant	0.850***	0.371***	0.673***	0.922***	0.765***	0.735***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A3. Key Parameters Used in the Lives Saved Tool

Common parameters	
Population size	1,209,205
Fertility rate	4.95

Health service	Coverage (no SLA, %)	Coverage (SLA, %)
ANC	79.1	92.9
Skilled birth attendance	57.8	76.9
PNC	31.0	44.1
BCG vaccination	77.0	86.6
Pentavalent vaccination	74.5	78.1
Polio vaccination	73.7	78.1

Table A4. Lives Saved by Causes for Both Children under Age Five and Pregnant Women*

Causes	Point estimate	Lower bound	Upper bound
Children under age five			
Neonatal–Sepsis	116	98	135
Neonatal–Pneumonia	32	26	36
Neonatal–Asphyxia	138	119	158
Neonatal–Prematurity	71	61	81
Neonatal–Tetanus	2	2	2
Diarrhea	-1	0	-1
Pneumonia	10	0	20
Meningitis	3	0	6
Measles	-1	-1	-1
Malaria	-1	0	-1
Pertussis	4	0	8
Injury	0	0	-1
Other	-3	-3	-3
Subtotal	**370**	**302**	**439**
Pregnant women			
Antepartum hemorrhage	7	6	8
Postpartum hemorrhage	21	18	24
Hypertensive disorders	20	17	23
Sepsis	13	11	15
Other direct causes	2	1	2
Subtotal	**63**	**53**	**72**
Total	**433**	**355**	**511**

*Results are slightly different from Table 3 due to rounding.

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