Assessing the Reach, Adoption, Implementation, and Maintenance of the Systems Analysis and Improvement Approach for prevention of mother-to-child transmission of HIV in Manica Province, Mozambique 2018-2021 (the SAIA-SCALE Program)

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Abstract

BACKGROUND Optimal delivery of prevention of mother to child transmission of HIV (PMTCT) programs is challenging, including in Mozambique. The Systems Analysis and Improvement Approach (SAIA) is a multi-component, systems engineering strategy that has demonstrated PMTCT cascade improvement in a previous cluster randomized trial. To facilitate scale-up and improve integration into routine management systems, the SAIA-SCALE trial (NCT03425136) evaluates delivery of SAIA to health facilities by maternal and child health district supervisors, with minimal external support. SAIA-SCALE uses the RE-AIM framework to evaluate essential ingredients for public health impact that are infrequently reported. In this article we report intervention reach, adoption, implementation, and maintenance.

METHODS SAIA-SCALE is a stepped-wedge trial in 36 facilities covering all 12 districts of Manica province, central Mozambique, from 2018—2021. Each district received a one-year intensive phase with external research staff support and financial support, followed by a maintenance phase with only limited financial support. We used data from health management information systems and implementation tracking to assess reach, adoption, implementation, and maintenance of the SAIA strategy using descriptive statistics.

RESULTS SAIA-SCALE reached 36 facilities covering over 146,000 institutional births and 206,000 first antenatal care visits during the study period. Mean scores on two organizational readiness predictors of adoption were 4.82/5 for change commitment and 4.78/5 for change efficacy. Program adoption was 100%—all 12 targeted districts attended initial training, and all targeted 36 facilities initiated the SAIA strategy. Intensive and maintenance phases comprised equal facility-months. Each facility received an average of 1.1 and 1.0 mentorship visits per month from district supervisors during the intensive and maintenance phases, respectively. Across all facilities, 429 workplans were developed during the intensive and 432 during the maintenance phase. Facility staff reported implementing 91.8% of intensive phase workplans, and 85.9% of maintenance phase workplans. Facilities reported adopting into routine practice 70% and 62% of micro-interventions tested during the intensive and maintenance phases, respectively.

CONCLUSIONS Assessment of reach, adoption, implementation, and maintenance revealed the successful integration of a systems engineering strategy for PMTCT into routine healthcare management systems in Mozambique. R-AIM should more frequently be reported alongside effectiveness for a deeper understanding of sustained public health impact of HIV prevention programs.

Trial registration:

ClinicalTrials.gov NCT03425136 (registered 02/06/2018).

Introduction

Addressing the global AIDS crisis is critical for health and human rights reasons. The UNAIDS 95-95-95 goal sets out to have 95% of people living with HIV be tested, 95% of those receive antiretroviral treatment (ART), and 95% of those be virally suppressed by 2030.[1] It is estimated that reaching these targets would avert 21 million AIDS-related deaths and 28 million HIV infections by 2030, primarily in low- and middle-income countries.[2] Prevention of mother-to-child-transmission of HIV (PMTCT) is a cornerstone of the HIV response. In 2013 the World Health Organization (WHO) recommended the Option B + strategy, which includes lifelong ART for all HIV-infected pregnant and postpartum women as a method for improving PMTCT effectiveness.[3] Uptake of Option B + has been rapid and widespread, but not without challenges.[4] Though Option B + simplifies the PMTCT process by eliminating pre-ART eligibility assessment, successful PMTCT still requires completion of a months-long, multi-step care cascade including HIV counseling and testing; ART initiation and adherence; safe delivery; HIV testing through the breastfeeding period; and integration into long-term HIV care for HIV-infected women and children. Implementation strategies that improve PMTCT cascade outcomes are needed to strengthen PMTCT programs at scale.[5]

The Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework is a summative evaluation framework that provides one approach for evaluating PMTCT programs.[6, 7] RE-AIM is one of the most widely used frameworks for implementation science evaluations,[8, 9] and describes key ingredients for public health impact of interventions beyond assessing effectiveness. RE-AIM has been applied to diverse interventions in low- and middle-income countries,[10–16] including pre-exposure prophylaxis (PrEP) interventions for HIV prevention,[10, 13, 16, 17] and early-infant diagnosis of HIV.[14] However, the five elements are not always reported, with adoption and maintenance being the least commonly reported.[8, 18] The four measures beyond effectiveness also align with salient implementation outcomes, including penetration (Reach), Adoption, fidelity (a measure of Implementation), and sustainability (Maintenance).[19] Implementation outcomes are essential to study. They are indicators of the implementation process and success, and act as intermediate outcomes for service and client outcomes.[19, 20] While reporting intervention effectiveness alone can inform decision-makers of whether to further study or adopt an intervention as policy, assessing reach, adoption, implementation, and maintenance are crucial for evaluating whether a program or policy should be funded, scaled-up, and integrated into routine practice.[6]

SAIA is an evidence-based systems engineering approach that demonstrated improvement to the PMTCT cascade in a previous cluster randomized trial in Côte d'Ivoire, Kenya, and Mozambique delivered by NGO staff.[21, 22] We apply the RE-AIM framework to evaluate a dissemination strategy for scaling SAIA, in which SAIA is delivered by maternal and child health district supervisors in Manica province, Mozambique (the SAIA-SCALE trial; NCT03425136).[23] Here we report on reach, adoption, implementation, and maintenance of the SAIA-SCALE program separately from effectiveness. In order to focus this paper on the methods, findings, and implications of these four domains, effectiveness in terms of service and client outcomes will be reported in a future publication.

Methods

Program description

The SAIA implementation strategy packages multiple systems engineering tools applied to complex health-related cascades, including 1) cascade mapping to identify gaps and areas for improvement in the PMTCT cascade,[24, 25] 2) process mapping to map flow of patients through the PMTCT system, and 3) continuous quality improvement (CQI) to test micro-interventions designed to improve PMTCT process and outcomes. SAIA-SCALE builds on the success of the previous trial by testing a scalable dissemination strategy in which district maternal and child health (MCH) and PMTCT supervisors are trained in SAIA and facilitate monthly SAIA cycles with clinic teams at health facilities they supervise. Integrating SAIA into routine management systems was designed with the intent of improving the ability of SAIA to be integrated, scaled-up, and sustained with minimal external support. Detailed descriptions of SAIA and the SAIA-SCALE program have been previously published.[23, 26]

Prior to implementation, project research nurses based at Health Alliance International (HAI)—an international NGO with a long-standing relationship with the Ministry of Health— introduced the program at planning meetings at the provincial and district levels to create a favorable organizational climate. MCH district supervisors were subsequently trained in the SAIA approach by HAI, including how to lead facility teams through the iterative cycles and associated development of workplans and tests of change. Didactic training was followed by 12 months of monthly mentorship visits to study health facilities to conduct SAIA cycles. During the first year of implementation—the “intensive phase”— district supervisors led SAIA cycles during mentorship visits with in-person support from HAI staff. After the 12-month intensive phase, districts transitioned to a “maintenance phase” in which district supervisors independently led SAIA cycles, and external support was limited to transportation reimbursement, mobile credit for data entry, and periodic phone calls with district supervisors. A comparison of external support from during the intensive and maintenance phases is provided in Supplementary Information Table S1. We report implementation details as recommended in the Template for Intervention Description and Replication (TIDieR) checklist (see Supplementary Information Table S2).[31]

Study setting

This study took place in Manica Province, Central Mozambique. Manica is bordered by Zimbabwe to the west and Sofala Province to the east, and has an estimated population of two million.[27] Manica has an estimated adult HIV prevalence of 13.5%.[28] The majority of formal health services is provided through the public sector in Manica, and in Mozambique generally.[29] In Manica there are a total of 125 public sector health facilities.[27] The ratio of physicians and maternal and child health (MCH) nurses per 100,000 inhabitants are 6.4 and 50.5, compared with national averages of 8.7 and 52.6.[30] Ninety-two percent of pregnant women receive at least one ANC visit with a qualified health professional and 71% have an institutional delivery.[28]

Study design

SAIA-SCALE was implemented as a stepped-wedge cluster randomized trial in 36 facilities covering all 12 districts of the Manica province in Mozambique. The three highest volume public sector clinics (based on first antenatal care visits in the year prior to study randomization) offering PMTCT services in each district were selected for inclusion in the study. Districts were the unit of randomization for timing of intervention introduction. The intervention was introduced to 12 health facilities from four districts each year over three waves, beginning in April 2018 and ending in March 2021 (see Supplementary Information, Figure S1 and Table S1 for schematics of the study design and comparison of external support during the intensive and maintenance phases). We report on the proportion of health facilities and estimated proportion of mother-infant pairs that were *reached*; the proportion and determinants of districts and facilities *adopting* the intervention; fidelity to the core elements of *implementation* in the first 12 months of implementation; and the proportion of facilities *maintaining* the core elements of the intervention beyond 12 months. Effectiveness of the SAIA-SCALE program on cascade outcomes will be reported in a later publication.

Ethical approval

This study was reviewed and approved by the Institutional Review Boards of Eduardo Mondlane University/ Maputo Central Hospital in Mozambique (#CIBS FM&HCM70/2017) and the University of Washington in Seattle, USA (#STUDY00000645). Informed consent was received from study participants.

R-AIM measures and data collection

Reach

Reach measures included the number, proportion, and characteristics of health facilities in Manica province included in the study, as well as the number and province proportion of the total number of institutional births and first antenatal care visits in public sector health facilities in the province covered by study facilities during the 3-year study period (April 2018–March 2021). While reach is conceived to be measured at the individual level, we opted to complement our population reach estimates with organizational coverage data as public sector health systems are a means to achieve reach of mother-infant pairs for PMTCT programs. Data on number and proportions of health facilities, births, and antenatal care visits were obtained from health management information systems (HMIS) data from the Ministry of Health. Facility characteristics were collected using the World Health Organization Service Readiness and Availability (SARA) tool modified to include additional questions pertinent to the SAIA-SCALE program, administered in 2018.[32] Questions taken from the SARA covered general facility characteristics, as well as staffing, and availability of essential medicines, testing supplies, and other basic commodities. Questions to document external support and quality improvement initiatives prior to SAIA were added. Service-specific questions covered antenatal care, maternity, postpartum care, and at-risk child services.

Adoption

Adoption measures included the proportion of selected districts and facilities that initiated the SAIA intervention, defined as 1) MCH district supervisors and/or PMTCT focal points from that district attending an initial training in the SAIA method, and 2) facility-level completion of the first SAIA cycle (including cascade analysis, flow mapping, and development of a CQI workplan for the following month). Data on program adoption were collected by study nurses who recorded attendance and details at trainings and mentorship visits. Additionally, we assessed health facility readiness for adoption of the SAIA-SCALE program using two subscale measures of the Organizational Readiness for Implementing Change (ORIC): change commitment and change efficacy.[33,34] *Change commitment* reflects facility staff's shared resolve to implement a change, and *change efficacy* reflects facility staff's shared belief in their collective capacity to implement this change.[35] When organizational readiness of an organization is high, members (facility staff in this case) are more likely to initiate a new intervention.[35] The original ORIC tool, which comprises 12 validated questions that use a 5-point Likert scale,[34] was translated to Portuguese, pre-tested with study staff in Mozambique, and piloted with nurses from non-study facilities to refine language used in the final study tool.

Implementation and maintenance

Implementation measures were assessed for the intensive phase and included frequency of mentorship visits to health facilities; facility staff participation in mentorship visits; development, content, and implementation of workplans; and stated intent to adopt micro-interventions into routine practice. The number of mentorship visits per facility and details of those visits (participation, activities completed, duration, transportation) were collected using a project implementation tracking approach whereby MCH district supervisors filled out a short survey using REDCap data capture tools hosted at the University of Washington on Samsung tablets at the end of each mentorship visit. [36,37] Submitted data were reviewed monthly by study staff in Mozambique to ensure no mentorship visits went unreported. At each mentorship visit workplans containing micro-interventions to test between visits were developed. Workplans were recorded on wall-mounted flip-charts for use at health facilities. MCH district supervisors sent photos of workplans to study staff who then transcribed them into Microsoft Excel (2016) for analysis. Micro-intervention categories were developed by reviewing categories used in a previous SAIA study,[22] and modifying the wording to capture the workplans developed during the SAIA-SCALE program. The resulting categories were (1) service organization, (2) patient education, (3) staff communication improvement, and (4) data quality improvement and use to inform decision-making. The number of micro-interventions per workplan was counted. Where workplans included multiple distinct changes or tasks, they were described as separate "micro-interventions". Each micro-intervention was then assigned to one or more categories. An example workplan table is included in Supplementary Information, Figure S2. Maintenance indicators included all implementation indicators as they occurred during the maintenance phase that followed the one-year intensive phase.

Results

Reach

Thirty-six health facilities were selected for inclusion in SAIA-SCALE, representing 29% of all public sector health facilities in Manica province (Table 1). During the study period (April 2018–March 2021), those 36 facilities covered 53% of all first antenatal care visits in public sector clinics, 49% of all estimated pregnancies, 52% of all institutional births, and 37% of all estimated pregnancies in Manica province.

Most study facilities were rural (29/36), while 7 were urban (including two district hospitals) (Table 2). The average catchment area per facility was 28,800 people. Only a quarter of facilities had an internet connection. Most facilities received support from multiple NGOs and had at least some quality improvement (QI) training prior to the introduction of the SAIA-SCALE program. Mother-to-mother support groups (75%) and collaboration with community health workers to promote utilization of health services (94%) were common. Study facilities had an average of 12.4 maternal and child health staff, approximately half of which were nurses. Only three of 36 facilities had a physician for maternal and child health. Facility characteristics differed by wave. Wave 1 comprised 5 urban facilities, wave 2 comprised 2 urban facilities, and all wave 3 facilities were classified as rural. Wave 2 and 3 facilities had smaller catchment areas and longer distances to reference labs. Fewer wave 2 and 3 facilities had internet, prior QI training, latrines designated for women, and mother-to-mother support groups. Wave 2 and 3 facilities also had fewer maternal and child health staff on average.

Adoption

Based on definitions set out in the protocol, all study districts adopted SAIA (defined as district MCH supervisors and PMTCT focal points attending the SAIA introductory training). Similarly, all study facilities adopted SAIA (defined as initiating the first SAIA cycle, including conducting cascade analysis, flow mapping, and developing a first monthly workplan) (Table 3).

A total of 205 respondents completed ORIC surveys, ranging from 2–9 respondents per facility. Respondents reported highly positive change commitment, which reflects their shared resolve to implement SAIA in their facility, as well as change efficacy, which reflects their shared belief in their ability to implement SAIA [34] (Table 4). Mean scores for change commitment and change efficacy were nearly identical (4.81 and 4.78, respectively).

Implementation & maintenance

Frequency and details of mentorship visits to health facilities and workplan developed by facilities are shown in Table 5. Study facilities received an average of 1.1 mentorship visits per month during the intensive phase, which dropped to 1.0 during the maintenance phase. Health facility participation increased slightly from the intensive to the maintenance phase (6.57 to 7.58 facility staff attending SAIA cycle meetings). Successful workplan implementation decreased slightly from the intensive to the maintenance phase (92% to 86%), as did adoption of micro-interventions after the tests of change (70% to 62%). The number of micro-interventions proposed per workplan decreased as well (Supplemental

Figure S3). The slight decrease in intensive and maintenance phase measures occurred across all three waves. Mentorship visits were consistent despite the onset of the COVID-19 pandemic (Supplemental Figure S4). Problems identified to address in workplans were most frequently identified in the maternity ward, followed by the at-risk child service, then by antenatal care, and lastly by postpartum care. Approximately half of all micro-interventions proposed were categorized as patient education, followed by re-organization of health services (34%), improving data quality and use (25%), and lastly improving staff communication (4%). Wave 1 facilities on average received more mentorship visits than wave 2 and 3 facilities, and proposed more micro-interventions per round. However, workplan implementation and micro-intervention adoption rates were lower in wave 1 facilities.

Discussion

Given persistent mother-to-child HIV transmission in resource-limited settings with high HIV burden, identifying effective implementation strategies that can be scaled through routine management structures is critical. The SAIA-SCALE program tested an approach for delivering a multi-component system engineering strategy through district-level PMTCT management systems in order to evaluate a model for further scale-up. Reach, adoption, implementation, and maintenance are determinants of whether this strategy is viable and should be considered for wider scale and long-term adoption in Mozambique and elsewhere.

Targeting the highest volume facilities in each district allowed for high coverage and geographic coverage throughout a province of over two million inhabitants while working in a relatively low proportion of public facilities. The 29% of public facilities in Manica province included in the program covered 53% of first antenatal care visits and 52% of institutional deliveries during the study period. High utilization of public sector health services enabled a high proportion of total pregnancies and births in the province to be reached. The sampling strategy involved selecting the three highest volume health facilities from each district, which resulted in SAIA-SCALE reaching rural populations as some districts in Manica province are predominantly rural. However, our sampling strategy did not reach the smallest and most remote facilities. Sampling the highest volume facilities in the province as a whole (rather than by district) would have resulted in reaching an even higher proportion of pregnancies and births, but at the cost of not reaching rural populations throughout the province. Focusing on higher volume facilities also resulted in covering higher density areas where HIV prevalence is typically higher, which aligns well with the goal of targeting a PMTCT program to where it is most needed. In order to scale this approach province-wide, additional resources would be required that would likely make the program less efficient, where district supervisor would need to travel to smaller, more remote facilities, which would increase costs and the burden on their time. Remote mentorship via audio or video calls is one potential strategy for reaching more remote facilities that has shown promise in previous studies,[38,39] and is a priority area for further research.

Organizational readiness survey results indicate that facility staff felt highly committed and confident in their peers' ability to implement the SAIA strategy. This aligns with adoption indicators – as 100% of

districts and facilities included in the study adopted the SAIA intervention. Given 100% adoption, change commitment and change efficacy cannot be assessed as determinants on adoption in this study. However, our assessment of change commitment and change efficacy demonstrated little variation across study facilities. Given that our study targeted district health systems leadership as disseminating agents, included buy-in from provincial leadership, and included support from an external non-governmental organization that has worked in Manica province since 1987, it is logical that both district and facility staff universally adopted the intervention. In Mozambique, health policy is set centrally and disseminated throughout the public healthcare system (including provincial, district, and facility levels). It is likely that this in such hierarchical systems the primary driver of adoption is buy-in from higher levels rather than healthcare workers' commitment or motivation. Thus, in Mozambique the success of further scale-out efforts may be dependent on initially targeting buy-in at provincial and district levels.

Fidelity—defined as mentorship and improvement cycles being carried out—was high during both the intensive phase and during the maintenance phase with limited external support. Mentorship visits, workplan development, and implementation of proposed workplan tasks were relatively stable from the intensive implementation to the maintenance phase, and adoption of micro-interventions into routine practice decreased only slightly from 70% to 62%. Mentorship visits during intensive implementation slightly exceeded the target of one visit per facility-month, then decreased to one visit per facility-month during the maintenance phase. The number of micro-interventions proposed per workplan decreased from the intensive to maintenance phase. This could indicate facilities being less ambitious when external staff were not present at workplanning meetings, or may reflect an increase in experience over the course of the study and a corresponding shift toward more feasible and efficient workplanning. There was a slight decrease in workplans being implemented, and slight decrease in micro-interventions being adopted into routine practice (six and eight percentage points, respectively), which could indicate a decay in motivation over time due to the long duration of exposure to SAIA and/or due to external research staff not being present at monthly SAIA cycles. An alternative explanation is that some level of saturation had been reached in which the largest issues had been addressed or the issues remaining were more difficult to fix and thus ultimately proposed solutions were abandoned. However, as workplans were fully implemented and micro-interventions adopted the majority of the time in both implementation and maintenance phases, and given the minor decrease observed from implementation to maintenance phase, it is unlikely that this decrease reflects a meaningful decrease in motivation. Rather, this indicates that the reduced level of support during the maintenance phase was sufficient to support continued implementation. Staff turnover at the district level would likely halt implementation during the maintenance phase, in which case a booster intervention and additional training would be required.

Approximately half of the micro-interventions tested related to educating patients (including calling new mothers to encourage retention in care). This could indicate that micro-interventions were selected to address one of the main barriers to successful PMTCT scale up, which is postpartum retention in care. [40] However, it could also indicate focusing on individual patient responsibility rather than more costly and difficult to address systemic issues. Focusing on patient education over systemic issues is not unique to our study. A review of published knowledge translation interventions found that patient

education was the most common type of intervention, with 58% of interventions being at the patient level (versus health system or providers).[41] The second most common category of micro-interventions in SAIA-SCALE was service organization (including service reorganization such as task shifting). This could reflect the success in other settings of using alternative entry points to engage women, such as community-groups and mother-to-mother support groups.[5]

Transitioning from an efficacy trial to a scaled-up implementation strategy and effectiveness trial is challenging and not always successful. A recent study in Uganda found that the intensive "demonstration" phase facilities had sustained outcomes, while scale-up facilities had outcomes decline after implementation ended.[42] In our study, minimal sustained funding led to sustained program outputs, which may increase the likelihood of sustained PMTCT cascade outcomes. Maintenance of the SAIA-SCALE program up to 24-months post intensive support was high. A systematic review found that the most commonly reported barrier to program sustainment was funding ending.[32] Our study is an example of maintenance happening despite a large reduction in external support, while maintaining funding for key input (transportation). There are other factors that could have led to high maintenance. A recent review found that progress monitoring, stakeholder participation, integration with existing policies, and training can contribute to sustainability,[43] all of which were present in the SAIA-SCALE program. Future research could study maintenance for longer than 24 months, and compare different levels of external support to find the most efficient sustainment strategy as well as determinants of sustainment beyond just financial support – all of which are recognized research priorities.[44,45]

Limitations

While the stepped wedge cluster randomized trial design enabled measuring maintenance for 24 months for wave 1 facilities, it also restricted measuring maintenance to 12 months for wave 2 facilities, and to no maintenance measurement for wave 3 facilities. Full adoption is a positive outcome for the program, but limited our ability to assess predictors of adoption. Two implementation and maintenance measures were only available as self-reported data: Workplan implementation and micro-intervention adoption into routine practice; self-reported data is subject to recall and desirability bias.

Conclusions

The RE-AIM framework is one of the most used frameworks; however, adoption and maintenance are not always reported. We focused this paper on reach, adoption, implementation, and maintenance to give these lesser-reported factors more attention. We used a novel implementation tracking system to provide a view of the inner workings of the SAIA strategy, yielding valuable findings that will contribute to an understanding of intervention effectiveness in a future publication. The SAIA-SCALE strategy was implemented across Manica province, testing its suitability for adoption and implementation in a broad range of settings. Manica is similar to other provinces in Mozambique in terms of population distribution and the health system. Thus, our findings indicate the SAIA-SCALE strategy would be broadly applicable

across much of Mozambique, and may be feasible in other low income countries with centralized public health systems.

Declarations

Ethics approval and consent to participate

This study was reviewed and approved by the Institutional Review Boards of Eduardo Mondlane University/ Maputo Central Hospital in Mozambique (#CIBS FM&HCM70/2017) and the University of Washington in Seattle, USA (#STUDY00000645). Informed consent was received from study participants.

Consent for publication

NA.

Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available due the study being in progress but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Author contributions

KS, KA, SG, BW, FC, and JC2 conceptualized and designed the study. JC2, MA, FA, EC, and IR developed materials, oversaw implementation, and collected registry and implementation data. ETV, XAI, FM, RN, YS, and IR coordinated between the SAIA-SCALE program and the Mozambique health system. KR and JC

designed data collection tools. JC analyzed the data and prepared the manuscript. CH, CI, QF, and AD aided in interpreting the data. All authors reviewed and approved the final manuscript.

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Tables

Table 1. Proportion of health facilities and population in Manica province, Mozambique reached

Reach variable	Reached by SAIA-SCALE n (% of Manica total)
Public sector health facilities	36 (29%)
First antenatal visits	206,916 (53%)
Estimated total pregnancies	206,916 (49%)
Institutional deliveries	146,634 (52%)
Estimated total births	146,634 (37%)

Antenatal care visits, pregnancies, institutional deliveries, and births are for the time period April 2018–March 2021. Pregnancies and total births are estimated using Manica averages for percentage of pregnant women receiving an antenatal care visit (92.3%) and institutional birth (71.3%).[28]

Table 2. Overview of SAIA-SCALE study facilities

Facility variables	Overall	Wave 1	Wave 2	Wave 3
Setting				
Facility type				
Urban, n (%)	7 (19%)	5 (42%)	2 (17%)	0 (0%)
Rural, n (%)	29 (81%)	7 (58%)	10 (83%)	12 (100%)
Catchment population per facility, mean in thousands (SD)	28.8 (2.97)	43.1 (5.75)	19.7 (2.85)	23.0 (3.35)
Distance to reference lab, mean in km (SD)	50.0 (10.3)	24.6 (5.87)	53.1 (17.3)	73.4 (23.7)
Internet connection, n (%)	9 (25%)	5 (42%)	2 (17%)	2 (17%)
Services				
External support				
None, n (%)	2 (5.6%)	2 (17%)	0 (0%)	0 (0%)
One, n (%)	11 (31%)	4 (33%)	1 (8%)	6 (50%)
More than one, n (%)	23 (64%)	6 (50%)	11 (92%)	6 (50%)
Previous Quality Improvement training, n (%)	22 (61%)	9 (75%)	8 (67%)	5 (42%)
Missing, n (%)				2 (17%)
CD4 testing on-site, n (%)	14 (39%)	3 (25%)	5 (42%)	6 (50%)
Collaboration with community health workers to promote utilization of health services, n (%)	34 (94%)	11 (92%)	11 (92%)	12 (100%)
Mothers-to-mothers support group, n (%)	27 (75%)	12 (100%)	8 (67%)	7 (58%)
Infrastructure				
Weekly power outage typical in rainy season, n (%)	22 (61%)	12 (100%)	4 (33%)	6 (50%)
Missing, n (%)	2 (5.6%)			2 (17%)

Water supply on premises, n (%)	28 (78%)	9 (75%)	9 (75%)	10 (83%)
Missing, n (%)				1 (8%)
Improved latrine for women with menstrual hygiene products, n (%)	11 (31%)	9 (75%)	2 (17%)	0 (0%)
Staffing				
MCH nurses per facility, mean (SD)	5.9 (0.76)	8.8 (1.3)	5.3 (1.3)	3.6 (0.91)
MCH physicians per facility, mean (SD)	0.083 (0.047)	0.17 (0.39)	0.083 (0.29)	0 (0)
Total MCH staff per facility, mean (SD)	12.4 (1.8)	17.9 (10.4)	13 (12.6)	6.3 (5.3)

SD = standard deviation, MCH = maternal and child health

Table 3. Measures of adoption: Study districts attending the initial training and facilities completing the first SAIA cycle

Adoption variable	Total in project	Completing initial milestone
Districts that attended training	12	12 (100%)
Facilities that initiated SAIA	36	36 (100%)

Table 4. ORIC results for two sub-constructs: change commitment and change efficacy

ORIC subscales	Combined (n=205)	Wave 1 (n=82)	Wave 2 (n=63)	Wave 3 (n=60)
	Mean [95% CI]	Mean [95% CI]	Mean [95% CI]	Mean [95% CI]
Change commitment (out of 5)	4.82 [4.76-4.87]	4.95 [4.92-4.99]	4.68 [4.56-4.81]	4.81 [4.72-4.91]
Change efficacy (out of 5)	4.78 [4.72-4.84]	4.93 [4.88-4.97]	4.63 [4.50-4.76]	4.78 [4.66-4.90]

Change commitment is a 5-point Likert scale based on 5 items from the ORIC questionnaire. Change efficacy is a 5-point Likert scale based on 7 items from the ORIC questionnaire. Values were calculated by averaging facility-averages.

Table 5 is available in the Supplementary Files section.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Table5.docx
- AdditionalFileSupplementaryInformation.docx