Dissertation

Assessing Program Sustainability for Public Health in Low-Resource Settings

Mahlet Gizaw

This document was submitted as a dissertation in May 2022 in partial fulfillment of the requirements of the doctoral degree in public policy analysis at the Pardee RAND Graduate School. The faculty committee that supervised and approved the dissertation consisted of Glen Wagner (Chair), Ryan McBain, and Indrani Saran.

This dissertation was funded by the Pardee Dissertation Award for Global Human Progress.

PARDEE RAND GRADUATE SCHOOL

For more information on this publication, visit http://www.rand.org/t/RGSDA2216-1

Published 2022 by the RAND Corporation, Santa Monica, Calif.

RAND® is a registered trademark.

Limited Print and Electronic Distribution Rights

This publication and trademark(s) contained herein are protected by law. This representation of RAND intellectual property is provided for noncommercial use only. Unauthorized posting of this publication online is prohibited; linking directly to its webpage on rand.org is encouraged. Permission is required from RAND to reproduce, or reuse in another form, any of its research products for commercial purposes. For information on reprint and reuse permissions, please visit www.rand.org/pubs/permissions.

The RAND Corporation is a research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier and more prosperous. RAND is nonprofit, nonpartisan, and committed to the public interest.

RAND's publications do not necessarily reflect the opinions of its research clients and sponsors.

Support RAND

Make a tax-deductible charitable contribution at
www.rand.org/giving/contribute.

www.rand.org

Table of Contents

Abstract vi

Chapter 1: The current system of funding and implementation for public health programs in SSA – Two case examples 3

Introduction 3

Methods 4

Case selection 4

Data collection 5

Data analysis 6

Results 6

Key stakeholders 6

Flow of information and resources 7

Discussion 9

Conclusions and Implications 11

Chapter 2: The impact of strategic decrease in development assistance funding for HIV on Anti-retroviral (ART) coverage in SSA– an interrupted time series analysis 12

Introduction 12

Methods 13

Design 13

Data sources 13

Measures 14

Data analysis 15

Sensitivity analysis 16

Results 16

Discussion 22

Conclusions and Implications 23

Chapter 3: Determinants of sustainability within the current system of funding and implementation for public health programs implemented in SSA – a targeted literature review 25

Introduction 25

Methods 26

Literature searches 26

Eligibility criteria and study selection 26

Results 27

Sustainment and how it has been defined 27
Sustainability determinants 27
Discussion 41
Conclusion and Implications 42
Chapter 4: Applying the Program Sustainability Assessment Tool (PSAT) to the SSA context—cognitive key informant interviews 43
Introduction 43
Methods 44
Results 49
Stakeholders 49
Key perspectives 49
Perspectives on sustainability of programs 49
Perspectives on helpfulness of PSAT for role 50
Perspectives on PSAT structure and content 52
Discussion 62
Conclusions and Implications 63
Chapter 5: Psychometric quality assessments of the modified PSAT 64
Introduction 64
Methods 64
Results 66
Summary statistics 66
Validity 68
Reliability 69
Discussion 69
Conclusions and Implications 70
Overall Conclusion 71
References 73
Appendix A: Interrupted time series sensitivity analysis results 78
Appendix B: PSAT tool and scoring instructions 81
Appendix C: Key informant cognitive interview consent and interview protocol 87
Appendix D: Survey consent and survey questions 95
Appendix E: Exploratory factor analysis 108

Tables & Figures

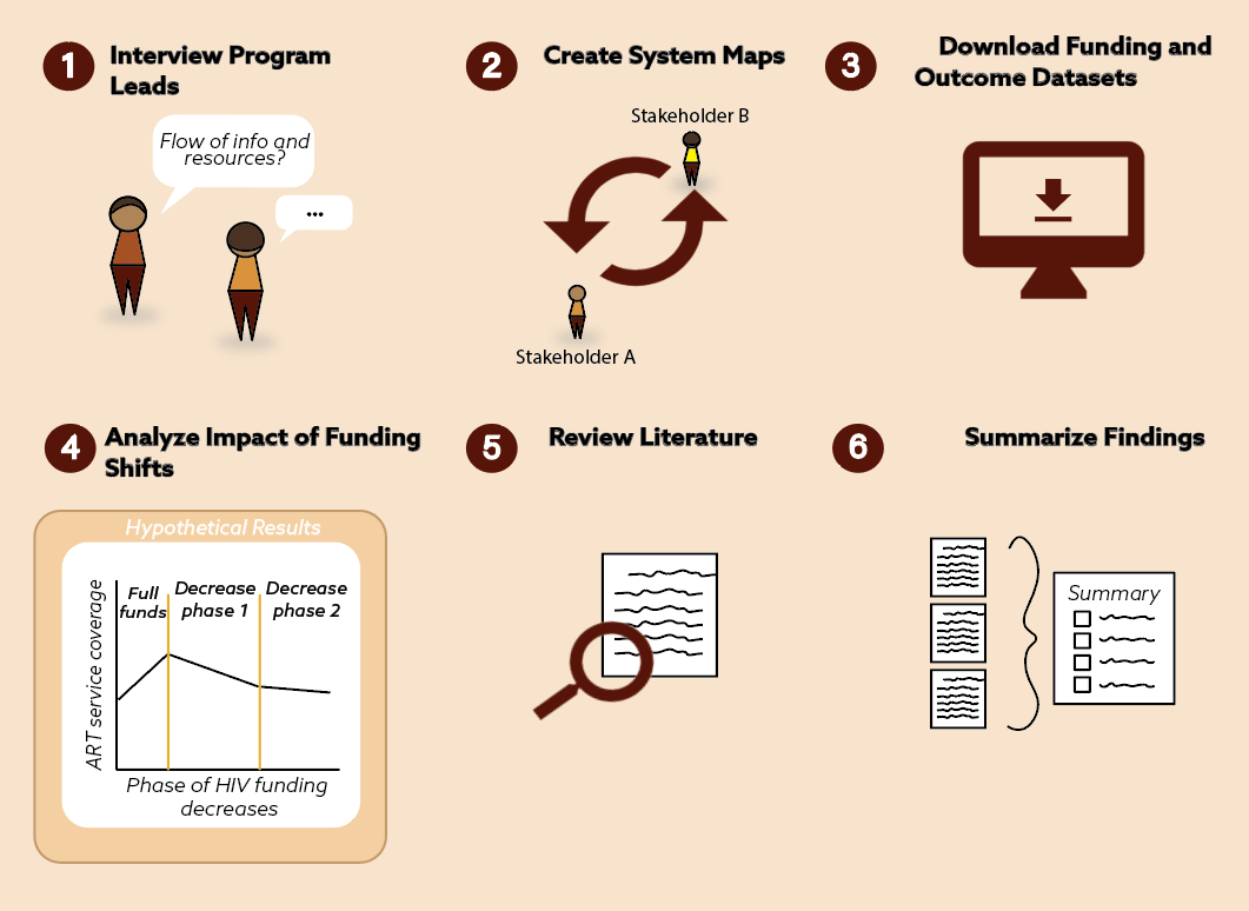
Table 1: Summary statistics 18
Table 2: First year of PEPFAR funding decrease for PEPFAR Focus countries in SSA 19
Table 3: Change in ART service coverage before and after first decrease in PEPFAR funding—nonparametric regression output 20
Table 4: Summary of studies included in literature review 35
Table 5: Comparing determinants of sustainability cited by the PSAT framework versus the SSA framework identified in Chapter 3 48
Table 6: Changes Comparing the Original PSAT and Modified PSAT 53
Table 7: Survey Background Characteristics 67
Table 8: Relative Risk of Sustained Program Activities and Goals to Current Date 68
Table 9: Overall and Category Cronbach's Alpha Levels 69
Table 10: Change in ART service coverage before and after second decrease in PEPFAR funding—nonparametric regression output 79
Table 11: Exploratory Factor Analysis Loadings for 6 Factor Solution 109
Table 12: Exploratory Factor Analysis Loadings for 8 Factor Solution 110
Table 13: Exploratory Factor Analysis Loadings for 13 Factor Solution 111

Figure 1: Phase I—Understanding the context and its implications: Chapters 1-3 1
Figure 2: Phase II—Proposing a solution: Chapters 4-5 2
Figure 3: Flow of information and resources for INDEPTH and Saving Brains 9
Figure 4: HIV spending in PEPFAR Focus countries in SSA before and after decrease in PEPFAR funding 19
Figure 5: Observed and predicted trends in ART coverage before and after first year of PEPFAR allocation decrease among PEPFAR Focus countries in SSA 20
Figure 6: Coefficients of non-parametric regressions for each year after first decrease of PEPFAR funding 22
Figure 7: Literature review selection 27
Figure 8: PSAT Framework [80] 46
Figure 9: Conceptual Framework suggested for SSA*[52]* 47
Figure 10: HIV Spending in PEPFAR Focus Countries in SSA Before and After Second Decrease in PEPFAR Funding 78
Figure 11: Observed Trends in ART coverage before and after second PEPFAR allocation decrease among PEPFAR Focus countries in SSA 79
Figure 12: Coefficients of non-parametric regressions for each year after second decrease of PEPFAR funding 80
Figure 13: Scree plot 108

Abstract

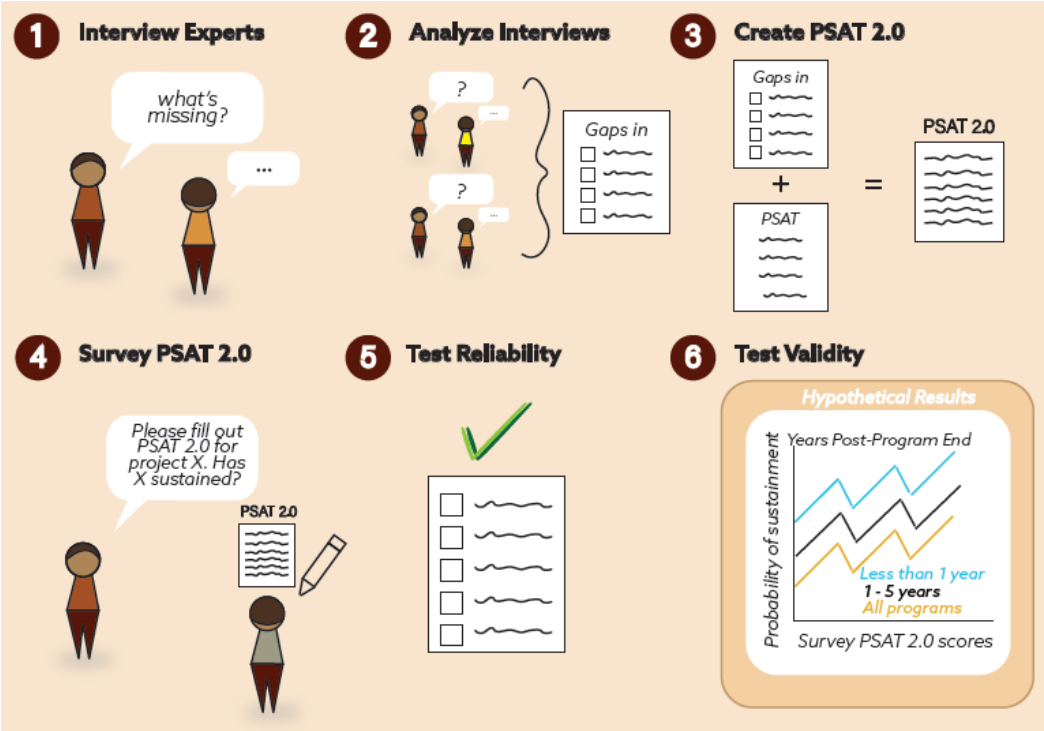
Sustainability has increasingly become a key area of research in implementation science. A program's sustainability—the extent to which it can deliver its intended benefits over time after initial funding has ended—is crucial to and is indicative of whether the program will have real utility in the community for which it was designed. Assessing and planning for sustainability is particularly critical in low-resource settings where various programs are implemented with development assistance funding from external donors, which is nearly always time-limited. While there are several sustainability frameworks, the literature is limited with regards to availability of a validated tool with demonstrated quantifiable benefits for program implementation in low-resource settings. Low- and middle-income countries (LMICs) in Sub-Saharan Africa (SSA) are used to represent low-resource settings in this dissertation project. For the project, I explore the policy problem in the first three chapters and present a solution in the final two chapters. First, I use system maps of two programs to depict the current context for funding and implementation of public health programs in SSA. Next, I demonstrate the impact of shifts in funding on population outcomes by looking at antiretroviral treatment (ART) coverage for HIV in SSA. Then, I present a targeted literature review on determinants of sustainability in the SSA setting. Based on these findings, I identify the program sustainability assessment tool (PSAT) as an appropriate fit and adapt it to the SSA setting based on key informant interviews. Finally, I use psychometric assessments based on a broader pilot survey to evaluate the tool's quality in terms of reliability and validity.

Figure 1: Phase I—Understanding the context and its implications: Chapters 1-3



Note: This figure demonstrates steps taken to understand the policy problem. Steps 1 and 2 are discussed in Chapter 1, Steps 3 and 4 are discussed in Chapter 2. Steps 5 and 6 are discussed in Chapter 3.

Figure 2: Phase II—Proposing a solution: Chapters 4-5



Note: This figure demonstrates steps taken to address the policy problem identified based on steps taken in Figure 1. Steps 1,2, and 3 are discussed in Chapter 4. Steps 4,5, and 6 are discussed in Chapter 5. PSAT= Program Sustainability Assessment Tool

Chapter 1: The current system of funding and implementation for public health programs in SSA – Two case examples

Introduction

According to the World Health Organization (WHO), member states of the African Region have difficulty allocating the WHO-recommended 15% of their total government budget to health spending because they have limited capacity to raise public revenue due to challenges in collecting taxes.[1] In settings like this where governments have scarce resources, development assistance from foreign donors can make up a significant portion of total health spending. In 2015, it was estimated that, globally, government health spending averaged about 59.7% of total health spending, whereas development assistance for health made up about 0.5% of total health spending.[2] The proportions were very different in low and middle income countries (LMICs) where government health spending made up about 31.9% of total health spending and development assistance made up about 3.1% of total health spending.[2] Looking at Sub-Saharan Africa (SSA) specifically, government health spending made up about 34.4% of total health spending whereas development assistance accounted for 16.4% of total health spending.[2] The remaining portion of health spending came from out-of-pocket spending (33.7%) and other pre-paid private spending (15.5%).[2] This implies that foreign development assistance makes up an important component of funding for health programs in SSA, amounting to almost half of government health spending in 2015.

Development assistance funding for health comes in three forms: 1) project support (grants or technical assistance); 2) "basket" funding attached to certain health-sector wide priorities and approaches; and 3) other sector specific funding directed to the Ministry of Health or general budget support.[3] Key foreign funders in SSA include: 1) bilateral agencies such as USAID, 2) multilateral or United Nations agencies, 3) global health partnerships, 4) other governments, and 5) non-government organizations.[3, 4] Studies show that donor funding for health programs in LMICs including SSA has generally been volatile and unpredictable over the past decade.[1, 2, 5] Moreover, while countries in SSA receive most of the development assistance for health programs globally, there are a

small number of big donors providing that assistance in the space.[5] As a result, many programs funded externally in SSA deal with limited, unstable and unpredictable source of funding.

This can impact implementation of programs that are funded by external donors. It can also impact continuity of program activities. How program activities are impacted can differ based on the involvement of different stakeholders during design and implementation phases of the program. For example, a program funded by the Global Alliance for Vaccines and Immunizations (GAVI) for provision of diphtheria, tetanus toxoid and pertussis was unable to continue providing routine immunization after GAVI funding phased out in the Democratic Republic of Congo.[6] Lack of funds particularly affected vaccine storage and distribution. Similarly, a malaria prevention program in Benin that created local capacity to make and market bed nets in collaboration with Canadian non-government organizations found that additional funding was needed from external sources to continue the availability of bed nets in some parts of the country.[7] A key challenge was the cost of supplying raw materials for bed net production.

In this chapter, I explore systems of funding and implementation in two cases of public health intervention programs implemented in SSA to show the context in which funders, implementers and other local stakeholders operate. I specifically depict the flow of information and resources in each program.

Methods

Case selection

Two programs that completed implementation in SSA were selected out of convenience with the objective of demonstrating different funding mechanisms and different outcomes for sustainment. The selected programs were Integration of Depression Treatment into HIV care (INDEPTH) and Saving Brains.

INDEPTH was a National Institute for Health (NIH) funded intervention evaluation program for implementing depression care in HIV primary care settings in Uganda. NIH is a part of the United States Department of Health and Human Services and receives its funding from the US government. INDEPTH was implemented across ten HIV clinics

where five clinics were randomly assigned to implement a structured protocol for administering depression care and the remaining five relied on the clinical acumen of trained providers.[8] The program was implemented for 2 years, starting in January 2013.

Saving Brains was a Grand Challenges Canada-funded early childhood development initiative implemented across 26 countries around the world.[9] Grand Challenges Canada is a non-profit organization that receives funding from the Canadian government and other donors including the Bill and Melinda Gates Foundation and USAID. For the Saving Brains initiative across the world, Grand Challenges Canada partnered with Aga Khan Foundation Canada, the Bernard van Leer Foundation, the Bill and Melinda Gates Foundation, The ELMA Foundation, Grand Challenges Ethiopia, the Maria Cecilia Souto Vidigal Foundation, the Palix Foundation, the UBS Optimus Foundation and World Vision Canada.[9] For the purposes of this study, the Saving Brains initiative in Lesotho is explored, for which Grand Challenges Canada received funding from the Bill and Melinda Gates Foundation. The program included an intervention which comprised training caregivers of children up to 6 weeks old on early childhood development, interaction methods with their children, and provision of parental social support and encouragement.[10] The program in Lesotho was implemented from 2017 to 2018.

Data collection

A key decision maker (principal investigator) for each project was interviewed using the following questions:

1) Who are the key stakeholders involved?
2) What is the involvement of each stakeholder during initial study design, implementation, and post-implementation phases?
3) What kind of information is shared between stakeholders?
4) How does information get shared between stakeholders?
5) What does the flow of resources between stakeholders look like?

The participants were interviewed over the phone during which extensive meeting notes were taken on each question.

Data analysis

Based on notes from the phone interviews, key stakeholders were identified for each program. Afterwards, types of information shared from each stakeholder and recipient stakeholder for that specific information was identified. Next, resources shared from each stakeholder and the recipient of resources were identified. Afterwards, the icons were selected for each stakeholder type and different sets of arrows were used to depict the direction and flow of information and resources between the stakeholder types. To ensure accuracy of system maps produced, the interviewees were asked to review and provide feedback on iterations of system maps. System maps were made using Adobe Illustrator. While system mapping is not common, a stakeholder mapping approach is used in the literature as a tool for designing people-led public services.[11] A stakeholder mapping approach depicts the stakeholders involved without necessarily representing the flow of information and/or resources between these stakeholders.

Results

Key stakeholders

The key stakeholders involved in INDEPTH were the NIH, Makerere University, RAND Corporation, the Ugandan Ministry of Health, Mildmay Uganda, ten HIV health clinics and HIV patients in Uganda (Figure 3). NIH provided funding for the intervention and its evaluation. RAND Corporation and Makerere University co-led program activities. Mildmay Uganda was the implementing partner with local presence in Uganda working directly with HIV clinics that provided care to patients. The Ministry of Health kept in communication with Makerere University, RAND Corporation and Mildmay Uganda throughout the different phases of the program.

The key stakeholders involved in Saving Brains Lesotho were the Bill and Melinda Gates Foundation, Grand Challenges Canada, Partners in Health (PIH), the Ministry of Health of Lesotho, the health center that provided primary care, and patients in the catchment area who were served at the health center (**Figure 3**). The Bill and Melinda Gates Foundation and Grand Challenges Canada were the funders. PIH was an implementer with local presence in Lesotho and an international presence in Canada.

PIH worked directly with the implementing health center engaged in provision of services to patients in the community. The Ministry of Health kept in communication with PIH.

Flow of information and resources

The flow of information for INDEPTH was bidirectional, involving information exchange among different stakeholders (Figure 3). Prior to receipt of funding, researchers at RAND Corporation and Makerere University worked with Mildmay Uganda to determine intervention design and feasibility. Mildmay Uganda identified potential participating clinics and assessed general willingness to be involved in the intervention. A representative from the Ministry of Health and district health bureaus were included early in the process to get buy in and assess potential scalability of the intervention. Subsequently, funding was received from the NIH in the form of a grant. This was followed by researchers at RAND Corporation and Makerere University meeting with Mildmay Uganda and selecting clinics to discuss implementation activities. During project implementation, health clinics collected data from the community to help assess effectiveness of the intervention, which was shared with Mildmay Uganda and researchers at Makerere University and RAND Corporation. Furthermore, NIH required annual progress reports on status of implementation activities, any challenges and plans for the remainder of the budget. The researchers also held quarterly workshops with all stakeholders for updates on implementation activities, and to address any challenges.

In the last 6 months of program implementation, all stakeholders convened to discuss opportunities to continue depression care in HIV clinics and scale out to more clinics. Upon completion of implementation activities, a policy brief of findings was presented to other HIV care organizations and the Ministry of Health to encourage scale out of the intervention.

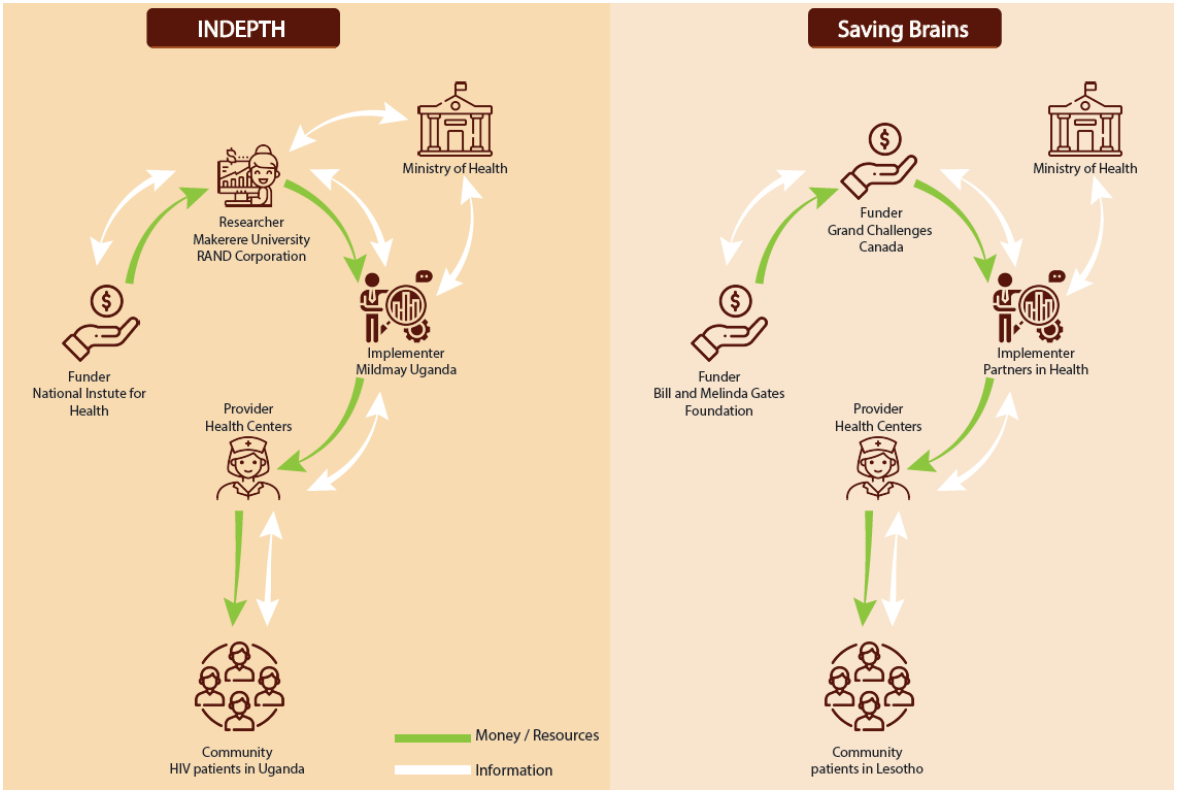
In contrast to the flow of information, the flow of resources for INDEPTH was unidirectional. NIH provided funding to RAND and Makerere university. These organizations distributed resources to Mildmay Uganda which in turn distributed funding to participating clinics, which used the funding for implementation of program activities. Upon completion of the NIH grant, new funding was needed to continue program

activities. The intervention was demonstrated to be effective in that the task shifting approach for depression care yielded depression alleviation among patients.[12] However, program activities continued upon completion of the NIH funding in three clinics out of ten. Program activities did not continue in the remaining seven clinics because of lack of commitment to continue providing the activities among existing staff. Existing providers who were trained in provision of services associated with the intervention did not continue to provide them once initial funding had ended whereas clinic leadership did not pursue continuation of intervention activities.

As with INDEPTH, the flow of information for Saving Brains was bidirectional, involving information exchange among the different stakeholders (Figure 3). Prior to receiving funding, PIH worked with the Ministry of Health in Lesotho to identify childhood development as a local problem and training caregivers on early childhood development as a potential intervention solution. PIH then identified Grand Challenges Canada and its Saving Brains initiative to provide funding for the proposed intervention. Grand Challenges Canada had Bill and Melinda Gates foundation as a sponsor to fund the program. Once funding was received from Grand Challenges Canada, PIH worked with the local health center to provide the intervention to caregivers.

During project implementation, the health center collected data from the community to help assess effectiveness of the intervention, which was shared with PIH. Grand Challenges Canada required quarterly calls with PIH to present updates on program activities and milestones. In addition, it required reports with details on program activities, outcomes, and financial details. Similarly, the Bill and Melinda Gates foundation required reports with updates on program milestones and budget progress. Near the end of implementation, a workshop was organized with stakeholders to provide training for implementing partners on final evaluation of outcomes and dissemination of findings. Upon completion of implementation, a final meeting was held with all stakeholders except community patients to discuss findings and opportunities for scale out. Like INDEPTH, the intervention was shown to be effective in improving early childhood outcomes.[10] Unfortunately, program activities did not continue after the initial funding ended because of lack of new funding.

Figure 3: Flow of information and resources for INDEPTH and Saving Brains



Discussion

To the best of my knowledge, while the literature is extensive on the stakeholders involved in the system of funding and implementation for public health programs in SSA, this chapter presents the first depiction of system maps based on case examples in that context. The system maps in this chapter suggest that there generally is a funder, a stakeholder that seeks the funding—which can be an implementing agency (like PIH) or a research organization (like RAND corporation), a government entity, an implementer with local presence, sites of intervention implementation, and patients in the community who are recipients of the intervention. The flow of resources is generally unidirectional going from the funder to the community whereas the flow of information is generally bidirectional being shared among stakeholders. In terms of sustainment after initial funding phased out, there were challenges in sustaining the program because of lack of funding for Saving Brains and because of lack of commitment to continue providing services from providers and clinic leadership who received training for INDEPTH.

The findings from this study align with what is available in the literature in terms of key stakeholders involved and challenges for sustainment. For INDEPTH, providers and clinic leadership commitment was crucial in continuing program activities in three out of ten clinics. Similarly, Blanchet and colleagues identified a network of funders working with the Ministry of Public health in Somaliland, and community-based organizations involved played critical roles in maintaining commitment for and sustaining physical rehabilitation services in the community. [13] In terms of challenges for sustainment, funding was a key challenge that was apparent for sustaining the intervention from the Saving Brains initiative in Lesotho. Similarly, a study of vaccines in the Democratic Republic of Congo found that lack of funds for vaccine storage and distribution was a barrier for assuring accessibility of vaccines in the long term after the primary donor phased out funding.[6] Similarly, a health service quality improvement program in Zambia found that community ownership and commitment of district managers facilitated implementation of the program and encouraged stakeholders to seek funding to continue the intervention after initial phase of funding phased out.[14] Furthermore, Sarriot and colleagues found that donor funding has a direct positive association with factors like political stability, international organization involvement, community health governance, and additional funding for an intervention program expanding community health services in an intervention program for malaria, pneumonia, and diarrhea.[15]

However, this analysis had several limitations. First, the system maps do not represent the magnitude of information or resources shared across stakeholders. For example, a large amount of information would be collected from the community to inform program effectiveness and efficiency. However, the amount of information going directly from Ministry of Health to implementors or funders is likely not the same amount. However, the arrows used in both scenarios are the same. Secondly, the system maps do not demonstrate the flow of information and resources at different phases of implementation. The level of involvement of each stakeholder may vary during pre- and post-implementation phases. Finally, the analysis only includes data from the literature and only one key stakeholder from each project.

For future research, it would be valuable to conduct a broader data collection with key informant interviews across all types of stakeholders in an intervention program and have the system maps reviewed by these stakeholders rather than just the principal investigators to ensure accurate depiction of the system at hand. In addition, it would yield more information had there been system maps for each phase of implementation (pre-implementation/ program design phase, implementation phase and post-implementation phase) to show a more complete picture of the system.

Conclusions and Implications

In general, INDEPTH and Saving Brains show two slightly different systems of flow of information and resources for public health programs implemented in the SSA context. In both cases, the Ministry of Health was involved in discussions regarding intervention and feasibility of scale up. There were multiple funders in Saving Brains whereas there was one main funder for INDEPTH. In the case of Saving Brains, the presence of a secondary funder involved more reporting needed to keep both funders informed compared to just the NIH for INDEPTH. In both cases, the Ministry, the funder, and implementing partners collaborated to execute program goals and activities in the communities they worked in. This implies that each stakeholder had a role to ensure implementation of program activities. In both cases, the interventions were proven effective and stakeholders were convened to identify ways for sustaining the program beyond the initial funding. Unfortunately, neither program has sustained to-date due to lack of new sources of funding or lack of commitment from key stakeholders. This implies that program effectiveness is not sufficient to continue program activities after initial funding ends. Commitment from key stakeholders, and continuous availability of new funding that replenishes phased out funding are also essential to continue program activities after initial funding ends.

Chapter 2: The impact of strategic decrease in development assistance funding for HIV on Anti-retroviral (ART) coverage in SSA– an interrupted time series analysis

Introduction

As discussed in chapter 1, funding that can take over after initial development assistance ends plays an important role for sustainment of program activities. In this chapter, I look at how changes in donor funding priorities can affect population health outcomes. I look specifically at funding for the HIV/AIDS epidemic and its role in access to HIV care for patients. Two of the prominent international funders to address the HIV/AIDS epidemic globally have been the US President's Emergency Plan for AIDS Relief (PEPFAR) and The Global Fund. Since 2003, PEPFAR has provided over $85 billion of funding for the HIV/AIDS response in over 50 countries.[16] Similarly, The Global Fund has disbursed close to $22 billion globally between 2002 and 2020.[17] Between 2005 and 2019, almost $49 billion of allocations from PEPFAR were in SSA out of the total $51.5 billion in allocations.[18] Similarly, almost $15 billion of disbursement out of a total of $22 billion from The Global Fund were in SSA.[17]

In the early 2000s when the epidemic started, PEPFAR identified 15 "Focus" countries for concerted resources: Botswana, Cote d'Ivoire, Ethiopia, Guyana, Haiti, Kenya, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Tanzania, Uganda, Zambia and Vietnam.[19] Nonetheless, PEPFAR has shifted its funding priorities in recent years. In particular, the key emphasis has transitioned through three phases from start to present date. In the first phase, the main aim was building a rapid emergency response (2003-2007), whereas the second phase was aimed at transitioning to sustainable country programs (2008-2012), and the third phase was aimed at sustainable control of HIV/AIDS (2013-2019).[20, 21] With each transition, PEPFAR has reduced funding for countries to align with the strategy.[20, 21] Transitions in funding have led to decreases in investment in antiretroviral treatment (ART) for HIV by PEPFAR.[21]

It is known that PEPFAR funding has been directly associated with access to ART services. As of 2011, PEPFAR funding was associated with ART service availability for close to 4 million individuals,[22] implying that availability of PEPFAR funding has directly

impacted the increase in ART service coverage. However, it is not clear how funding reductions have impacted access to ART services. Reductions in funding can impact ART service coverage unless new funding takes over to maintain the coverage. Otherwise, given that PEPFAR is one of the largest funders for HIV/AIDS, this transition can reduce access to ART services among people living with HIV. In this chapter, I explore the impact of PEPFAR funding reduction on ART coverage among PEPFAR Focus countries in SSA.

Methods

Design

An interrupted time series approach was used to compare ART service coverage rates before and after PEPFAR funding reductions. This approach was selected because:

1. actual PEPFAR expenditure data was not available and PEPFAR funding allocation data was used as a proxy measure, and
2. a funding reduction policy (i.e. "treatment") was implemented at one specific point in time for all countries in the sample.

The pre-treatment period for each country is the period of PEPFAR funding until the first funding allocation decrease was observed. The year of funding decrease differed across countries. The post- treatment period included the remaining time periods in the data. The pre- treatment period saw PEPFAR allocations increase for all countries and thus included Phase I (rapid emergency response). The post-treatment period included Phase II (sustainable country programs) and Phase III (sustainable control of HIV/AIDS).

The study sample included all PEPFAR Focus countries in SSA. Namely, it included Botswana, Cote d'Ivoire, Ethiopia, Kenya, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Tanzania, Uganda, and Zambia. For each country included, data spanned from years 2000 through 2019.

Data sources

Country-level PEPFAR allocations for all PEPFAR countries in SSA were collected from the Foundation for AIDS Research (amfAR) database of PEPFAR expenditures and allocations for years 2005-2019.[18] Expenditure data were not available for most of the years so PEPFAR allocation data was used as a proxy to identify years of funding

reductions. The Global HIV/AIDS spending data from the Institute for Health Metrics and Evaluation (IHME)[23] was used to collect data on country-level spending on HIV/AIDS for 2000-2019 including total spending, government spending, development assistance funding, out of pocket spending and other private prepaid spending. The AIDSinfo database by UNAIDS[24] was used to collect outcome data on country-level ART service coverage for 2000-2019. The World Development Indicators database was used to collect data on covariates including HIV prevalence, GDI per capita, government effectiveness index, and proportion of urban population.[25] Finally ART price data was not available from one source for all years from 2000 to 2019. Thus, average ART prices offered by pharmaceutical companies to LMICs for years 2001-2011 were taken from reports published by Doctors Without Borders.[26-36] Best ART prices offered for LMICs for years 2012-2019 were taken from ART market reports published by the Clinton Health Access Initiative.[37-41] Prices were available in both sources for the year 2012. However, there was a 25% difference in the estimated average price comparing the two sources. The estimate from the Clinton Health Access Initiative was $293 per patient per year whereas the estimate from Doctors Without Borders was $220 for 2012.

Measures

ART coverage is the outcome variable represented by the percentage of individuals aged 15 and above living with HIV who have access to ART.[24] Counts of those who have access to ART are identified based on registries of people who receive ART aggregated at the country level and submitted to UNAIDS.

PEPFAR allocation is the main “treatment” variable. It represents the annual planned amounts of funding i.e., the budgeted amount by PEPFAR as opposed to actual amount spent.

Several time-varying covariates were included for the analysis, based on a review of indicators that have been incorporated in prior multi-country analyses of HIV treatment coverage.[42]

Government expenditure on HIV was included to account for changing HIV-specific government spending that can increase as funding from PEPFAR decreased. It represents actual government resources spent on HIV programs, which include HIV treatment services.

Out of pocket expenditure was included in the model to account for HIV-specific out of pocket expenditure that can change over time.

Other prepaid private expenditure was included to account for private expenditure from other sources (e.g., private insurance) that are HIV-specific.

Development assistance expenditure included HIV expenditure from development partners including PEPFAR, Global Fund and others. It was considered but not included in the model to avoid double accounting for PEPFAR funding. However, the trends in development assistance expenditure were observed for descriptive purposes to see if trends followed PEPFAR funding trends.

All expenditure data was reported in thousands of 2019 US dollars.

Urbanization rate was included as a proxy for ease of access to HIV care. It represents the annual proportion of the population living in urban areas for each country.

Gross Domestic Product per Capita (GDP per capita) was included as a measure of economic capacity for each country.

Government effectiveness index by the World Bank was included as a measure of governance. Each country is rated on variables that assess the quality of public services, policy, and credibility of government commitment to improve these qualities.[43]

HIV prevalence was included as a measure of the burden of disease within country that can impact policy decisions on ART coverage.

ART price was included as a measure of average yearly cost of treatment for an adult based on average prices offered to LMIC settings.

Data analysis

Impact models representing pre- and post- periods were generated. Non-parametric interrupted time series models were used to assess the effects of transitions in PEPFAR funding strategy on ART coverage (Equation 1). Standard errors were clustered by country.

$$Y_{it} = \beta_0 + \beta_1 years_pre + \sum_{t=1}^{10} \gamma_t year_post_t + \beta_3 \text{ART price}_{it} + \beta_4 GDP\ per\ Capita_{it} + \beta_5 \text{HIV prevalence}_{it} + \beta_6 \text{Urban Population}_{it} + \beta_7 \text{Government Expenditure}_{it} + \beta_8 \text{Government Effectiveness}_{it} + \epsilon_{it} \quad \text{[Equation 1]}$$

Where,

Y_{it} is annual ART service coverage for country i at year t

β_0 is the intercept (Average ART coverage at start of treatment period)

β_1 is the estimated trend of ART coverage prior to treatment period indicator

γ_t is the estimated level deviation of ART coverage in each post-treatment period from what the level would have been had the pre-treatment trend persisted

$\beta_3 - \beta_8$ are the estimated trends for the corresponding time-varying control variables for country i at year t

All analyses were conducted in Stata.

Sensitivity analysis

Since PEPFAR funding allocation did not decrease continuously after the cutoffs used in the primary analysis, sensitivity analyses were conducted repeating all analyses but with a cutoff for treatment period assigned during the second decrease of PEPFAR funding allocation, which is closer to the sustainable control of HIV/AIDS phase (second decrease of allocation around 2013). All countries had funding allocations decrease continuously after this cutoff period.

Results

Average ART service coverage among PEPFAR Focus countries increased from 8% to 51% comparing pre and post first decrease of PEPFAR allocation (Table 1). Although countries experienced their first funding allocation decrease at the end of the pre-period and a second allocation decrease a few years after, the average allocation observed across all countries in the sample during the post period is higher than the average allocation observed during the pre- period (Table 1). This is likely because there are less years of allocation data available in the pre-period (4 years of allocation data for all 12 countries and compared to all 10 years of allocation data in the post period). The average ART price decreased significantly to about half of what it was in the pre- period. Looking at expenditures, out of pocket and other private spending on HIV did not change significantly comparing the pre and post periods. However, development assistance funding for HIV more than doubled and government health spending also doubled

comparing pre- and post-periods. In addition, development assistance spending on HIV averaged about 194 million US dollars whereas PEPFAR allocations averaged about 235 million US dollars indicating that actual expenditures were likely lower than allocated or budgeted amounts since development assistance expenditures included all development assistance whereas PEPFAR allocations only included budgeted amounts by PEPFAR. Most PEPFAR Focus countries experienced their first PEPFAR funding allocation decrease in 2009 (Table 2).

Considering trends during the study period, total HIV spending was mainly driven by development assistance and government spending among PEPFAR Focus Countries in SSA (Figure 4). Overall total spending on HIV had very similar trends to development assistance funding, which took a sharp decrease as expected when PEPFAR funding decreased and then stayed flat afterwards (Figure 4). However, government spending on HIV showed a steady increase throughout the study period. ART coverage also increased throughout 2000-2019 for PEPFAR Focus countries in SSA. In fact, it continued to increase even after PEPFAR funding decreases started (**Error! Reference source not found.**). Nonparametric regressions showed that the upwards trend in ART coverage rates observed during the post period were significantly higher than would be expected had there not been PEPFAR funding decreases after controlling for time-varying covariates including ART prices, GDP per capita, HIV prevalence, proportion of urban population, government health spending for HIV, out of pocket spending for HIV, other private prepaid spending for HIV and government effectiveness (Figure 5, Figure 6). None of the control variables had significant impact on ART coverage except for ART prices (Table 3).

Sensitivity analysis results where the time cut-off was the second decrease in funding allocation showed that deviations of ART coverage in the post period were positive for all years similarly to the primary analysis. However, none of the observed deviations in the post period were statistically significant (Appendix A). In addition, all covariates except private prepaid spending had significant impact on deviations on ART coverage in the post period.

Table 1: Summary statistics

Variable	Mean (SD) during study period	Mean (SD) prior to first decrease	Mean (SD) after first decrease	p-value*
ART coverage (%)	31.2 (26.7)	8.0 (10.1)	51.2 (19.3)	***< 0.001***
PEPFAR allocation (millions)[i]	235.0 (155.0)	198.2 (141.2)	251.9 (158.5)	***0.032***
ART price per person per year ($)	306.9 (144.2)	417.7 (146.3)	218.3 (51.7)	***< 0.001***
GDP per capita ($)	2,089.9 (1,938.4)	1,801.8 (1,714.4)	2,338.8 (2,087.8)	***0.035***
HIV prevalence (%)	8.8 (6.6)	9.1 (6.4)	8.5 (6.8)	0.519
Proportion urban (%)	36.1 (15.7)	33.1 (14.4)	38.7 (16.4)	***0.006***
Development assistance spending on HIV (millions)	193.5 (149.8)	109.3 (101.0)	266.2 (147.4)	***< 0.001***
Government health spending on HIV (millions)	153.3 (315.6)	100.8 (187.3)	198.7 (389.5)	***0.018***
Government effectiveness index	-0.38 (0.52)	-0.41 (0.55)	-0.35(0.49)	0.38
Out of pocket spending on HIV (millions)	20.9 (36.6)	6.9 (11.9)	10.2 (18.0)	0.105
Other private prepaid spending on HIV (millions)	8.6 (15.5)	25.6 (39.4)	16.7 (33.7)	0.066

* p-value from two sample t-test comparing pre and post first decrease in PEPFAR funding reported

[i] Note PEPFAR allocation data is only available starting from 2005 although PEPFAR funding started in 2003. Number of observations for pre period for PEPFAR allocation is 55 whereas post period is 125.

Figure 4: HIV spending in PEPFAR Focus countries in SSA before and after decrease in PEPFAR funding

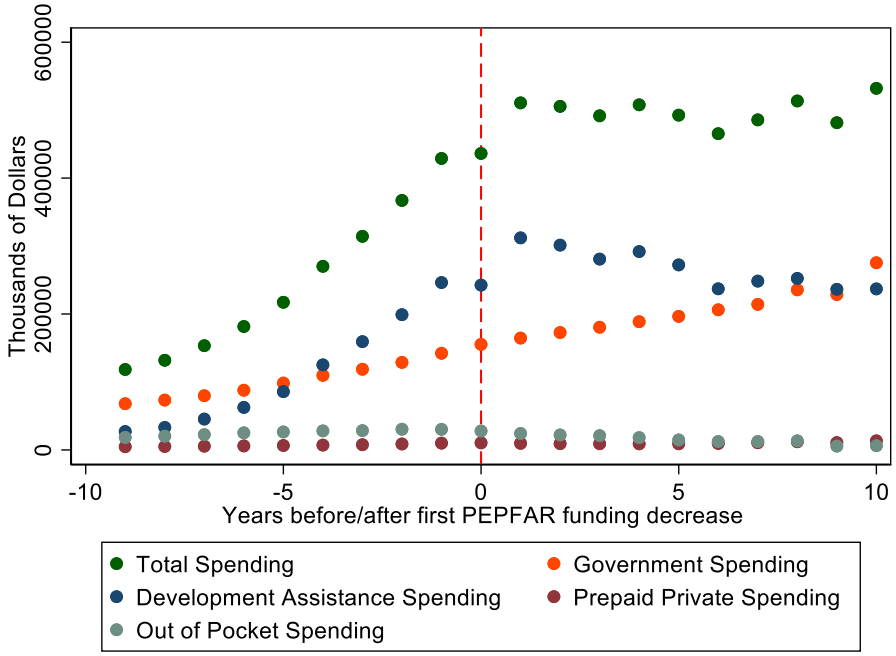


Table 2: First year of PEPFAR funding decrease for PEPFAR Focus countries in SSA

Country	Year
Botswana	2009
Cote d'Ivoire	2010
Ethiopia	2009
Kenya	2011
Mozambique	2009
Namibia	2009
Nigeria	2009
Rwanda	2009
South Africa	2009
Tanzania	2009
Uganda	2010
Zambia	2012

Figure 5: Observed and predicted trends in ART coverage before and after first year of PEPFAR allocation decrease among PEPFAR Focus countries in SSA

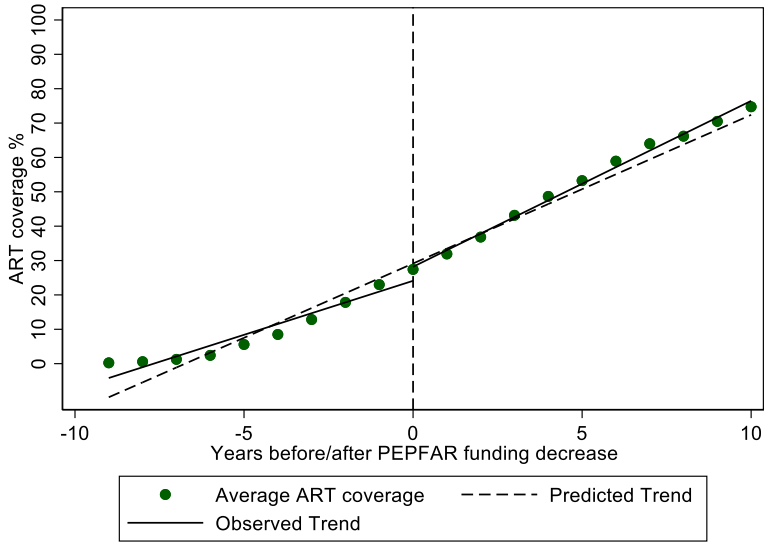


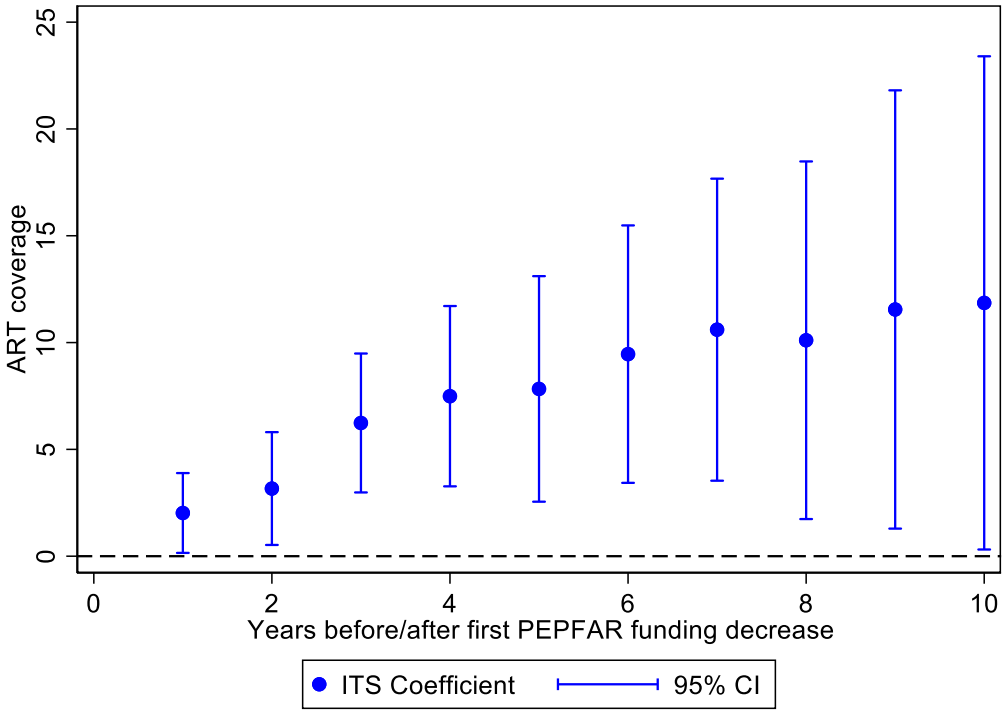
Table 3: Change in ART service coverage before and after first decrease in PEPFAR funding—nonparametric regression output

VARIABLES	Model 1
Pre-trend	4.324***
	(0.545)
Year 1 post	2.023**
	(0.953)
Year 2 post	3.167**
	(1.347)
Year 3 post	6.237***
	(1.659)
Year 4 post	7.490***
	(2.153)
Year 5 post	7.830***
	(2.693)
Year 6 post	9.459***
	(3.074)
Year 7 post	10.60***
	(3.607)
Year 8 post	10.11**
	(4.270)
Year 9 post	11.55**

	(5.234)
Year 10 post	11.86**
	(5.889)
ART price	0.0217**
	(0.00898)
GDP per capita	1.68
	(4.02)
HIV prevalence	0.179
	(0.843)
Proportion urban	-0.323
	(0.364)
Government spending on HIV (thousands of 2019 USD)	-1.16e-05
	(7.58e-06)
Government effectiveness index	5.448
	(5.185)
Out of pocket spending on HIV (thousands of 2019 USD)	-5.36e-05
	(4.75e-05)
Private prepaid spending on HIV (thousands of 2019 USD)	0.000233
	(0.000179)
Observations	215
Number of countries	12

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 6: Coefficients of non-parametric regressions for each year after first decrease of PEPFAR funding



Discussion

The findings in this chapter suggest that ART coverage continued to increase among PEPFAR Focus countries in SSA even after PEPFAR funding decreased. This finding aligns with the literature. According to Boah and colleagues (2021), ART coverage has increased from 0% to an estimated 92% looking at 54 countries in Africa from 2000 to 2018.[44] ART service coverage increases have been observed at the country level in Botswana, which saw an increase from 0% to 93% by 2017.[45] Countries in SSA were particularly expected to meet a coverage of 81% by 2030.[46] In addition, the literature also supports the result that total spending on HIV/AIDS among LMICs including those in SSA has increased from 2000 to 2016 with the share from development assistance increasing from 33% to 46% during that timeframe.[47] This is despite PEPFAR funding reductions.[20, 21] Furthermore, the literature also demonstrates that government spending on HIV has increased. It has specifically increased at an estimated annual rate

of about 9% from 2000 to 2017.[48] This suggests that gaps created by PEPFAR funding reductions have likely been taken over by other development assistance funding since government spending did not have a significant impact on ART coverage in the current analysis. The fact that ART coverage continued to increase even after PEPFAR funding reductions shows that ART service activities sustained beyond initiation of phase out of PEPFAR funding. The observed sustainment of activities is likely also a result of less funding needed resulting from lower ART drug costs for patients on ART. According to the literature, the price of ART in LMICs per patient per year have in fact decreased from $810 to $147 going from 2001 to 2020.[26, 41]

This analysis has some limitations. It is unable to identify the reasons for sustained ART activities. First, development assistance funding by other organizations that could have covered the funding gap could not be included due to lack of data. This is a key time-varying covariate. In addition, budgeted PEPFAR allocations were used rather than PEPFAR expenditures to identify years when funding started decreasing. Allocations do not always align with actual expenditures. For future research, a panel data regression approach can be used to observe the association between expenditures and ART coverage rates. This analysis also considers the policy of allocation reduction and does not consider the magnitude of reduction. Some countries may experience a large decrease in funding whereas others may experience a small decrease in funding which can impact ART service coverage. In addition, although the first funding decrease was used as an indicator for “treatment period”, some countries did not have a continuous decrease of PEPFAR funding allocation for the rest of the study period. Sensitivity analysis was conducted using year of the second funding decrease to identify the treatment period; however, there were 7 or fewer years of data available per country in the post period based on this cut-off. More data is needed to observe potentially lagged effects after funding reductions.

Conclusions and Implications

This analysis suggests that PEPFAR funding decreases did not negatively impact access to ART services among PEPFAR focus countries in SSA. Rather, it implies that

coverage of services continued to increase implying sustained ART services. This is likely because of HIV spending from other sources such as other development assistance sources. Overall, this analysis demonstrates that intervention activities can sustain and positive outcomes for patients can continue even after initial funding phases out. Future research is needed with data from expenditures from development assistance sources including other funders like the Global Fund and with more years of data.

Chapter 3: Determinants of sustainability within the current system of funding and implementation for public health programs implemented in SSA – a targeted literature review

Introduction

Sustainability has increasingly become a key area of research in implementation science. In the literature, it has been defined as the extent to which a program or an intervention can deliver its intended benefits over time after initial, usually external, funding has ended.[49, 50] A program's sustainability is crucial to and is indicative of whether the program will have real utility in the society or community for which it was designed. At any point in time, a program's sustainment is the successful, "continued use of an innovation in practice".[51] Several sustainability frameworks—that is, conceptual models for sustainability-- are available in the literature.[49, 52] However, the research is limited with regards to concrete, quantified associations between determinants, i.e. barriers and facilitators of sustainability, and sustainment outcomes.

Assessing and planning for sustainability is particularly crucial in low resource settings where various programs are implemented with development assistance funding from external donors, which is nearly always time-limited.[1, 3] Parties involved in implementing the programs in these settings hope that local entities will be able to garner the resources to sustain the program beyond the life-span of the initial stream of funding. However as seen in chapter 1, it is challenging to do so once the initial stream of funding has expired.[1, 3] Using sustainability enabling criteria, frameworks, and validated assessment tools can provide useful insights to fill potential gaps at early design phases of interventions or provide lessons learned post-implementation. Understanding gaps in determinants of sustainability and how they relate to sustainment may help to plan for the improved likelihood of program sustainment beyond expiration of initial external funding.

In this chapter, I aim to identify the determinants of sustainability within the current system of funding and implementation for public health programs implemented in SSA. For this, I conducted a targeted literature review to present evidence on key components needed to sustain public health programs implemented in SSA.

Methods

Literature searches

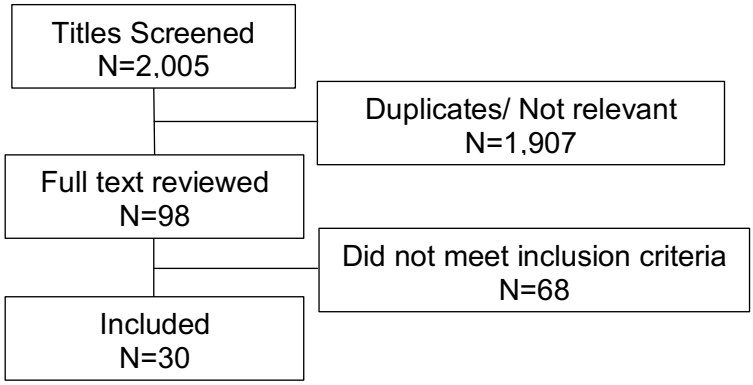
The literature review was designed to capture studies reporting on how sustainability is defined in the literature and the key determinants needed to sustain public health programs implemented in SSA .

The databases used for this search were PubMed, Google Scholar and EBSCOhost. Google was also searched for publications in the gray literature. The search strategy that was applied to all databases included using context-specific keywords (e.g., “low-income” AND “country” OR “Africa” OR “Ethiopia” OR “Zimbabwe”, etc.) along with a keyword for sustainability (e.g., “sustain”, “sustainability”, “sustainment” , etc.). The search was limited to studies published in the last 30 years. Titles and abstracts of publications were screened for relevance to the objectives of the literature search. Bibliographies of full text articles selected from the databases were further scanned to identify additional relevant publications. A broader google search was also conducted with the same search terms to identify reports and other documents in the gray literature.

Eligibility criteria and study selection

Key inclusion criteria were 1) published after 1990, 2) written in English, 3) discussed reasons/determinants for sustainment of a public health intervention, and 4) intervention was implemented in SSA. 2,005 article titles were identified for screening based on the literature search and review of bibliographies. Of the 2,005 that had their titles/abstracts reviewed, studies that did not appear relevant or were duplicates were removed (N=1,907) (Figure 7). The remaining 98 articles were retrieved for full text assessment. Of the 98, those that did not meet the inclusion criteria upon review of the full text were excluded (N=68). A total of 30 publications were selected.

Figure 7: Literature review selection



Results

Of the 30 articles identified, 20 used qualitative methods only, six used quantitative methods only, and four used mixed methods (Table 4). Overall, the literature is diverse in terms of methodology, definition of sustainment, and identified determinants of sustainment.

Sustainment and how it has been defined

The term *sustainment* has not been clearly defined in the literature in the SSA context. Some studies use sustainment and sustainability interchangeably. However, most studies identified sustainment by looking at whether program activities continued after end of initial stream of funding. [53-57] Others identified it in ways that were context-specific—namely as retention of workers, [53, 58-60] routine use of intervention after initial implementation, [6, 61, 62] improvement in quality of program,[14] or the extent to which patient outcomes were sustained after implementation.[15] Other definitions that were used in studies include program fidelity, expansion, and workforce satisfaction/motivation. [63-65]

Sustainability determinants

Some key determinants for sustainability identified in the SSA context from the literature include: 1) community ownership and buy-in; 2) community awareness and participation; 3) working within existing resources; 4) infrastructure; 5) funding; 6) leadership support; and 7) program evaluation/assessment. The literature is unclear on

whether all these determinants are needed or some combination of them is sufficient for sustainment.

Community ownership

18 studies in the review referred to community ownership/ buy-in as a determinant of sustainment (Table 4). 14 of these studies were qualitative whereas two were quantitative and two were mixed methods studies. All studies referred to a version of political will, buy-in and/or commitment from local stakeholders as "community ownership". In Benin, researchers studying the sustainability/sustainment of a malaria prevention intervention using bed nets interviewed stakeholders to find that pride of community members in participating in the program and empowerment of relevant stakeholders to take ownership motivated them to continue the program.[7] Similarly, researchers of a study investigating the effects of a health service quality improvement program in Zambia conducted stakeholder interviews to find that community ownership and commitment of district managers facilitated implementation of the program and may have encouraged stakeholders to seek funding to continue the intervention.[14] In Somaliland, researchers who interviewed stakeholders about the use of sustainability indicators—i.e. determinants, defined by stakeholders during program implementation found that the selected indicators were not related to sustainment two years after implementation/adoption.[13] The stakeholders in the study identified service provision, organizational and financial capacity, community capacity, an enabling context/ environment, and fulfilment of program outcomes as key determinants. The authors indicated that the selected determinants were not associated to sustainment two years after program completion because the NGO which brought in initial funding was considered the "owner" of the program by community members and was expected to continue leading the intervention; consequently, there was no community ownership to continue when funding from the NGO expired. The NGO phased out of the intervention because the NGO intended for community stakeholders to take it on. These examples demonstrate that community ownership has a key role in enabling sustainment.

Sarriot and colleagues conducted a quantitative study to examine the expansion of community health services via the integrated community case management program (iCCM) for malaria, pneumonia, and diarrhea.[15] The authors defined community ownership by autonomy and leadership of local district teams and community support for iCCM utilization and found that both were positively associated with actual program utilization and program continuation. Amazigo and colleagues conducted a mixed-methods study where they interviewed relevant stakeholders and then administered a survey across 9 countries.[57] The authors found that community ownership predicted community level program sustainment. One way community ownership can enable sustainment is by reducing stigma around the disease targeted by the intervention, normalizing discussions around the disease and its intervention, and creating a social structure around the intervention. A study considering community directed treatment of river blindness found that community ownership and involvement reduced stigma around the disease.[61] Studies looking at community-based HIV/AIDS interventions in Zimbabwe and Tanzania had similar findings that community involvement reduced stigma about HIV.[65, 66]

Community awareness

22 studies in the review referred to community awareness as a determinant of sustainment (Table 4). 16 of these studies were qualitative whereas four were quantitative and two were mixed methods studies. Studies showed that to have community ownership, community awareness and buy-in are important predictors of sustainment. In Burkina Faso, Somasse and colleagues conducted interviews and focus groups with stakeholders in an intervention of community-based management of acute malnutrition. The authors found that community buy-in, which was defined as participation of volunteers in the community, demonstrated a form of community ownership,[56] which is essential for sustainability. Similarly, Rasschaert and colleagues conducted focus groups about an HIV care model in Mozambique to find that embedding the program in the community, increasing awareness, and involving local stakeholders in intervention development and implementation processes created community buy-in and ownership.[67] Ghiron and colleagues conducted interviews on scaling up an environment and health project

implemented in Uganda and Kenya demonstrating that constant community engagement, i.e., participation in program activities, enabled project scale up/sustainment.[64] Similarly, Osawa and colleagues conducted a self-administered survey in Zimbabwe to find that community understanding of a home-based HIV/AIDS program was positively associated with sustainment as defined by workforce motivation, satisfaction and retention.[65] Specifically, authors found a positive association between community understanding of program and staff outcomes. Lack of community awareness and buy in can hinder intervention implementation and sustainment. This was apparent in HIV intervention programs in Mali, Zambia, Kenya and Nigeria, where lack of awareness about programs resulted in low enrollment and retention rates.[62, 68, 69] Similarly, researchers of a health service intervention that used a cancer registry in Tanzania found that lack of awareness and clarity on the program was a challenge for implementation.[70] Researchers of several other studies have shown that lack of community education presented challenges to sustainment . [61, 65-67, 71, 72]

Working within existing resources

12 studies in the review referred to working within existing resources as a determinant of sustainment (Table 4). Nine of these studies were qualitative whereas two were quantitative and one was a mixed methods study. According to these studies, integrating interventions with existing resources in the system can make transition from external third-party implementer/funder "ownership" to community ownership smoother. For example, researchers of a community nutrition program for pregnant women in the Gambia suggested that building the intervention onto pre-existing social structures such as working with already known community leaders enabled continuation of ongoing efforts for the intervention.[71] However, the authors found that working within resources ended up limiting the program's sustainability because staff were overstretched due to lack of infrastructure. Blanchet and colleagues had similar findings in Somaliland, where working within existing resources did not help sustain a program due to limited capacity at the Ministry of Public health and lack of political will. [13] Researchers of a study on village-based health care in rural Cameroon conducted a quantitative study to find that using churches as a key setting for intervention facilitated community outreach and enabled

sustainment of the program for over nine years.[55] Others conducting a study of sustaining a health and environment project in Uganda and Kenya leveraged the existing human resource system to implement the intervention after a pilot phase, which enabled a smooth transition into scale-up.[52] Finally, Humphries and colleagues conducted a mixed methods study of a capacity building initiative across several countries in southern Africa where they conducted interviews and fielded a survey.[73] The authors concluded that insufficient efforts directed at integrating administrative structures with programming was associated with lower level of perceived ownership of programming and lower capacity to sustain the project.

Infrastructure

26 studies in the review referred to infrastructure as a determinant of sustainment (Table 4). 18 of these studies were qualitative whereas six were quantitative and two were mixed methods studies. To integrate an intervention within pre-existing resources, it is critical that there is infrastructure. In the literature, infrastructure refers to physical facilities, reliable resources for facilities such as medication and equipment, a trained, motivated health workforce, leadership supporting the intervention and efficient processes to allocate resources to programs. Researchers looking at sustainment of NGO capacity building for HIV programs across five countries in southern Africa, and an urban health project in Tanzania both found that having the structure to support programs such as an administrative structure, and a health facility board leadership enabled the programming to be sustained.[73, 74] The authors found that having a structure such as this can be associated with a program being able to continue securing funding and buy-in from local stakeholders. [73, 74] Additionally, availability of a government body working in the topic area of intervention can be helpful. Where there is weak infrastructure, it will be challenging to sustain a program. [67] In Mozambique, weak health infrastructure and coverage hindered community-based health programs in the region from being sustained.[67] The authors had similar suggestions in Zambia where a fragile health care system with limited technical and financial resources from the Ministry of Health had challenges to maintaining HIV interventions.[75]

Studies showed that infrastructure also facilitates program adoption—the decision of an organization/community to commit to and initiate the intervention, which can be related to sustainment.[50] Researchers of an HIV prevention intervention program in Zambia found that the intervention's adoption among clinics additional to those—i.e. scale out, and retention of staff in clinics where intervention initially started was critical for sustainment.[60] Researchers of another study on an eye care program suggested that interventions were more likely to be sustained and adopted when the interventions were easy to understand, test and integrate/fit into the existing infrastructure / system additionally to there being a infrastructure to support them.[54] This study particularly focused on the relationship between the intervention and the pre-existing infrastructure and the perceived fit of the two.

The literature indicates that infrastructure further enables the presence of a motivated, well trained, and sufficient workforce that is not over-stretched with responsibilities.[52] Lack of trained health workers can be in terms of lack of health worker coverage and presence of under-trained health workers which can both be detrimental to sustainability. In Tanzania, researchers found that sustaining a cancer registry intervention would be challenging because of the need for continued training and staff perception that the intervention was peripheral to medical treatment.[70] Researchers of a study of community-based HIV programming in Zimbabwe found that absence of policy and training for intervention staff was a challenge for sustainment.[65] This was also observed in a capacity building initiative across several countries in southern Africa, where no development of accredited training material hindered program sustainment despite the presence of infrastructure, intervention champions and leadership support.[73] Similarly, researchers of a pragmatic trial of handing out vouchers to provide economic support and improve tuberculosis outcomes in South Africa found that treatment fidelity was threatened by misperception by staff who rationed the vouchers to eligible patients instead of giving them to all eligible patients as intended by the intervention.[63] Even when well trained, staff being overworked and burned out because of inadequate workforce coverage hindered intervention sustainment in several studies. Health care workforce usually gets overworked and burned out due to lack of funding for additional resources. [60, 67, 76]

Funding

14 studies in the review referred to funding as a determinant of sustainment (Table 4). Two of these studies were quantitative whereas 11 were qualitative and one used a mixed methods approach. Studies showed that in a setting like SSA where resources are limited, lack of funding is one of the main factors that hinder sustainability of program in the long term. For example, researchers of a mixed-methods study of vaccines in the Democratic Republic of Congo found that lack of funds for vaccine storage and distribution was a barrier for assuring accessibility of vaccines in the long term after the primary donor has phased out funding.[6] Similarly, researchers of malaria prevention programs in Benin interviewed stakeholders to find that interventions had to be discontinued because of the lack of funding to continue provision of services.[7] It is crucial that local entities secure a stable source of funding that will replace the initial stream of funding in order to sustain a program. Sarriot and colleagues conducted a quantitative study with a causal loop analysis to examine the expansion of community health services via the integrated community case management program (iCCM) for malaria, pneumonia, and diarrhea.[15] The authors found that donor funding has a direct positive association with political stability, international organization involvement, community health governance, and additional funding.

Leadership support

16 studies in the review referred to leadership as a determinant of sustainment (Table 4). 3 of these studies were quantitative whereas 11 were qualitative and 2 used mixed methods. Half of the studies defined sustainment as program continuation whereas the others defined it as workforce retention, intervention effectiveness and routine intervention use. Ahluwalia and colleagues conducted a qualitative study and identified the presence of “champions”, those who advocate for the intervention of interest, and village leadership support as key features common to villages where an emergency transport systems intervention was sustained in Tanzania.[59] Supportive leadership was also cited as a useful component for sustainability in other studies.[6, 52, 61] Researchers of a study of community-based treatment of river blindness in Nigeria found that the

absence of structured leadership to transfer financial responsibility for the intervention presented a challenge to sustaining the program.[61] Even when funds are available, the absence of national and regional institutions as a structured mechanism for allocating funds hindered a vaccine program from sustaining in the long term.[6] Finally, Osawa and colleagues looked at organization-specific management, managerial support and its impact on sustainment as measured by workforce motivation and satisfaction.[65] The authors found that managerial support was positively associated with workforce outcomes.

Program evaluation or assessment

Finally, 16 studies in the review referred to leadership for program evaluation as a determinant of sustainment (Table 4). Three of these studies were quantitative whereas 12 were qualitative and one used a mixed methods approach. Studying a vaccine program, Le Gargasson and colleagues suggested that leadership for program monitoring and evaluation is needed for program sustainability.[6] The importance of monitoring and evaluation activities within programs was also highlighted by Sebotsa and colleagues who studied an intervention for addressing iodine-deficiency.[72] The authors suggested that monitoring and evaluation efforts in the program were needed to sustain low prevalence rates and eventually eradicate iodine deficiency among patients. The authors in this study referred to regular assessment of program activities and patient outcome results as "monitoring and evaluation" efforts. Researchers of another study of a community-based management of malnutrition intervention found that frequent monitoring and evaluation of cases of malnutrition and how they were addressed was crucial for the program.[56] Unfortunately, the program did not sustain because of barriers such as lack of financial support and insufficient community awareness. Blanchet and colleagues also came to similar conclusions in Somaliland where program assessment and planning/ learning was identified as a determinant for sustainment yet the project failed to sustain due to lack of sufficient infrastructure.[13] Overall review of the literature suggests that program evaluation is a necessary but not sufficient determinant for sustainment.

Table 4: Summary of studies included in literature review

	Source	Country	Assessment type	Methods used	Statistical significance if quantitative	Definition of sustainment	Determinants of sustainability cited in each publication						
							Community ownership / buy-in (N= 18)	Community awareness / Participation (N= 22)	Working within existing resources (N= 10)	Infrastructure (N= 26)	Funding (N= 14)	Leadership (N= 16)	Program evaluation (N= 16)
1	Abbey, 2014 [58]	Ghana	Qualitative and Quantitative	Structured interviews and focus groups	Community approval of community health workers was associated with community health worker retention (β=0.84 p < 0.001)	Workforce retention	+	+					
2	Ahluwalia, 2010 [59]	Tanzania	Qualitative	Interviews	N/A	Workforce retention	+	+		+	+	+	
3	Ajayi, 2012 [53]	Nigeria	Qualitative	Focus groups	N/A	Workforce retention Program continuation	+	+		+		+	+
4	Amazigo, 2007 [57]	Cameroon, Chad, Democratic Republic of Congo, Ethiopia,	Qualitative and Quantitative	Interviews, community level instrument measuring community ownership/	Positive association between community level score and sustainability	Program continuation	+	+					

		Malawi, Nigeria, Sudan, Tanzania, Uganda		participation	(β=0.612, p = 0.001)								
5	Aubel, 1996 [71]	Gambia	Qualitative	Interviews	N/A	Program continuation		+	-	+			
6	Blanchet, 2014 [13]	Somaliland	Qualitative	Interviews	N/A	Program continuation	+		-	+	+	+	+
7	Blanchet, 2014 [54]	Ghana	Qualitative	Hospital report reviews	N/A	Program continuation		+	+	+			+
8	Eliason, 1999 [55]	Cameroon	Quantitative	Active/Closed status of clinic	Positive association with support from traditional leaders, integration with local resources, felt need in community, community trust in project promoter (p-values not reported)	Program continuation	+	+	+	+	+	+	
9	Ghiron, 2014 [64]	Uganda, Kenya	Qualitative	Interviews	N/A	Expansion to more settings	+	+				+	
10	Harpha	Tanzania	Qualitative	Interviews	N/A	Institution capacity			+	+	+		

	m, 2002 [74]												
11	Humphries, 2011 [73]	Botswana, Lesotho, Namibia, South Africa, Swaziland	Qualitative and Quantitative	Survey on perceptions of change and ownership	Decrease in perceived ownership associated with lower capacity to sustain project (p-values not reported)	Program continuation			+	+		+	
12	Iwelunmor, 2016 [52]	Several countries (literature review)	Qualitative	Systematic Review of literature	N/A	Program continuation	+	+	+	+	+	+	+
13	Le Gargasson, 2013 [6]	Congo	Qualitative and Quantitative	Interviews	N/A	Routine intervention use				+	+	+	+
14	Lutge, 2014 [63]	South Africa	Qualitative	Interviews	N/A	Program fidelity			-	+			+
15	Mbanefo, 2010 [61]	Nigeria	Qualitative	In-depth interviews	N/A	Routine intervention use	+	+	+	+	+	+	+
16	Mutale, 2017 [14]	Zambia	Qualitative	Interviews	N/A	Program quality improvement	+	+		+			
17	Osawa, 2010[65]	Zimbabwe	Quantitative	Self-administered survey	Positive association between community understanding program	Workforce motivation and satisfaction		+		+		+	+

					and staff outcomes (β=0.38, p < 0.001) Positive association between organization leadership support and staff outcomes (β=0.645, p < 0.001)								
18	Rashed, 1997 [7]	Benin	Qualitative	Interviews	N/A	Program continuation	+	+	+	+	+		
19	Rasschaert, 2014 [67]	Mozambique	Qualitative	Focus groups	N/A	Program continuation	+	+	+				
20	Roura, 2009 [66]	Tanzania	Qualitative	Interviews	N/A	Patient retention	+	+	+				+
21	Sarriot, 2015 [15]	Rwanda	Quantitative	Causal loop analysis	Positive association with community support, perceived quality, community health governance, political will (p-values not reported)	Patient outcomes	+		+	+	+		+

22	Sebotsa, 2007 [72]	Lesotho	Qualitative	Interviews	N/A	Patient outcome		+		+		+	+
23	Sharma, 2013 [68]	Kenya, Zambia, Nigeria	Qualitative	Interviews	N/A	Program continuation	+	+	+	+	+	+	+
24	Somasse, 2013 [56]	Burkina Faso	Qualitative	Interviews and Focus groups	N/A	Program continuation	+	+	+		+		+
25	Teguete, 2012 [62]	Mali	Quantitative	Outcome measures (detection rates of screening intervention) and process measures (% women screened positive and received treatment)	Infrastructure positively associated with sustainability outcome measures (p-values not reported)	Routine intervention use		+		+			
26	Torpey, 2010 [75]	Zambia	Qualitative	Case study	N/A	Program continuation Effective management and implementation	+	+		+	+	+	+
27	Vamos, 2014 [60]	Zambia	Quantitative	Surveys assessing clinic environment, job	High clinic burden, staff burn out negatively associated	Workforce retention Program continuation			+	+			

				satisfaction, burnout	with workforce retention/ program continuation (p-values not reported)								
28	Walsh, 2012 [69]	Zambia	Qualitative	Interviews	N/A	Program ownership and continuation	+	+		+	+		
29	Wandeler, 2012[76]	Lesotho, Mozambique, Zimbabwe	Quantitative	Survey of % retention of patients in program and patient outcomes	Low retention in care associated with lower likelihood of sustainability (p-values not reported)	Patient outcomes/ intervention effectiveness		+		+			+
30	Zullig, 2014 [70]	Tanzania	Qualitative	Interviews	N/A	Program continuation			+	+	+	+	+

Discussion

Planning for sustainability is particularly crucial in low resource settings like SSA where various programs are implemented with development assistance funding from external donors, which is nearly always time-limited.[1, 3] However, it is challenging to do so once the initial stream of funding has expired.[1, 3] The literature identified in this review refers to some common themes regarding what is needed to sustain a public health program in SSA. The literature suggests: community ownership and buy-in, community awareness and participation, working within existing resources, infrastructure, funding, leadership support, and program evaluation/assessment as key determinants of sustainability for public health programs implemented in SSA.

The findings in this review can be complementary to what is in the literature regarding implementation strategy to enable program sustainment. Other studies have suggested systematic ways to plan for program implementation and sustainment, including implementation mapping and a collaborative organizational approach to selecting and tailoring implementation strategies (COAST-IS). Implementation mapping refers to conducting a needs assessment and stakeholder, outcomes of interest, theoretical methods, and implementation strategies, protocols and outcomes.[77] On the other hand, COAST-IS refers the use of intervention mapping to select and tailor implementation strategies to their specific contexts.[78] These approaches of having systematic processes for planning and selecting implementation strategy can be helpful in effective implementation of public health programs. Additionally, including components that integrate the determinants for sustainability identified in this literature review to approaches such as COAST-IS and implementation mapping can be helpful to enable continuation of program activities and potentially goals and outcomes in the long-term.

However, this literature review is limited in that it does not assess whether all determinants cited in the literature are necessary to achieve sustainment or whether a certain combination is sufficient. Furthermore, the role of each component for sustainment is not quantified since there were only ten studies that included quantitative methods and not all of them reported effect sizes of the determinant of interest predicting sustainment.

Future research is needed with a wider scoped systematic literature review and meta-analysis to quantify the role of each determinant for sustainability.

Conclusion and Implications

In conclusion, determinants of sustainability were identified from the literature based on public health programs in the SSA setting. Using these determinants can provide useful insights to fill potential gaps at early design phases of interventions or provide lessons learned post-implementation. Understanding gaps for these determinants can help to plan for the improved likelihood of program sustainment beyond expiration of initial external funding.

Chapter 4: Applying the Program Sustainability Assessment Tool (PSAT) to the SSA context—cognitive key informant interviews

Introduction

There are several conceptual frameworks for sustainability in the literature. The Dynamic Sustainability Framework involves "continued learning and problem solving, ongoing adaptation of interventions with a primary focus on fit between interventions and multi-level contexts, and expectations for ongoing improvement as opposed to diminishing outcomes over time."[49] The Dynamic Sustainability Framework suggests that "for optimized public health benefit, the evidence-based decisions need to be made for an intervention to fit a constantly changing context." [49] On the other hand, the program sustainability assessment tool framework cites components including political support, funding stability, partnerships, organizational capacity, program evaluation, program adaptation, communication (with stakeholders and the public), and strategic planning for public health impact.[79, 80]

To date, only one framework has been suggested in the literature specifically for the SSA context.[52] The key components of the SSA framework include the intervention itself, the socio-cultural and community context, and the organizational setting.[52] The SSA framework identifies factors at the intersection of these three key components as important drivers of long-term sustainment. Key determinants for sustainment included in this framework include 1) community ownership and buy-in, 2) community awareness and participation, 3) working within existing resources, 4) infrastructure, 5) funding, 6) leadership support, and 7) program evaluation/assessment. In addition, the authors of the SSA framework also suggested factors such as politics, policy and intervention fit, similarly to the dynamic sustainability framework. As of yet, there appear to be no peer reviewed publications that have investigated the applications of the SSA framework.

Furthermore, there is no evidence of a validated sustainability assessment tool that has been used in the SSA context. However, there has been a tool developed, validated, and used in the US context to assess program sustainability. The Program Sustainability

Assessment Tool (PSAT) was developed to assess program capacity for sustainability based on program context.[79, 80] The PSAT was developed in and has been implemented for evaluation of public health programs in US domestic settings.[79, 81, 82] Across the studies that have implemented it, authors have found that it was useful to guide a mixed-methods evaluation for a program's capacity to be sustained. In these instances of its application, the tool was used to survey key stakeholders and plan for sustainability of the interventions of interest. However, there is limited literature on its application in low-resource settings such as SSA. In this chapter, I propose a modified PSAT based on key informant interviews with different stakeholders for public health programs implemented in SSA.

Methods

The framework

The PSAT framework cites nine main components for sustainability: 1) political (internal and external) support, 2) funding stability, 3) partnerships (between program and stakeholders), 4) organizational capacity, 5) program evaluation, 6) program adaptation, 7) communication (with stakeholders and the public), 8) public health impact and 9) strategic planning (Figure 8). The components for sustainability in the PSAT framework have some overlap with the SSA framework identified in the literature (Figure 8**Error! Reference source not found.**,Table 5), suggesting that it may be appropriate to apply the PSAT to the SSA setting.

The tool selected

As is, the PSAT includes 8 main categories with 5 questions each. Within each of these components, it has 5 items that are scored to assess sustainability. For each item, respondents are asked to rate their responses on a scale of 1 (to little or no extent) to 7 (to a very great extent). The tool further includes definitions and scoring instructions for each category (Appendix B).

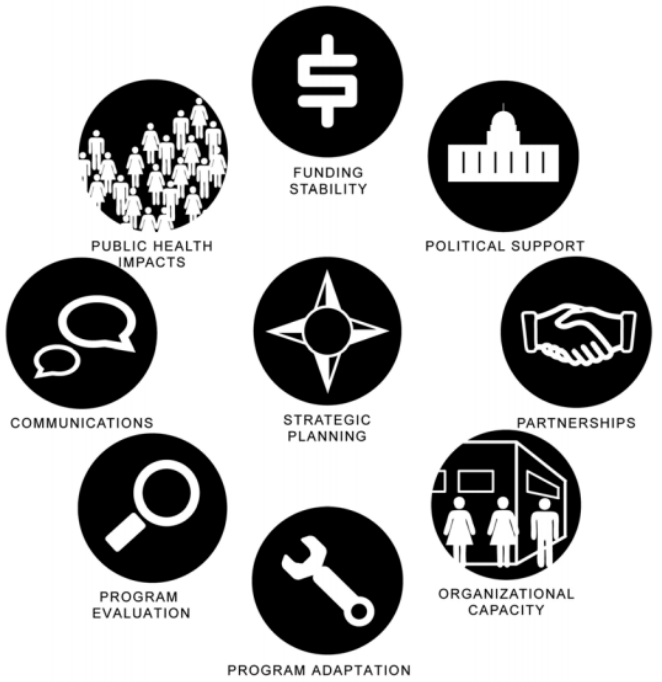
Key informant interviews

Key informant interviews were conducted with implementers, ministry officials, researchers/funders and providers involved in program implementation in SSA. Interviewees were asked about potential gaps on the PSAT, particularly for the SSA context. During the interviews, they were asked to go through each question and definition included in the PSAT and asked for feedback. Findings from interviews were used to create a modified-PSAT. A convenience sample of 24 stakeholders (six funders, five ministry officials, six implementers, and eight providers) in Uganda and Lesotho were approached to provide feedback based on snowball sampling. They were identified based on involvement in public health program implementation. Participants were identified using convenience sampling. Of those, 15 (four funders, three ministry officials, three local implementers and five providers) completed the interviews. Participants were recruited if they were currently involved in program implementation and have experience with completion of ≥1 programs in the SSA setting. Participants were asked questions about 1) challenges they have experienced to sustain programs, 2) usefulness of a tool like PSAT for their role, and 3) perspectives on the structure, wording, and items included in the PSAT. Participants were asked to review each item in the PSAT, identify any confusing wording, any missing item for each category, or any other changes they would suggest for the tool. Interviews were conducted via virtual calls, audio-recorded and transcribed. The interview protocol and consent documents are presented in Appendix C.

Data analysis

Interview transcripts were analyzed using theme-based analysis in Dedoose.[83] Transcripts were coded with participant role and content was coded according to the key themes outlined in the interview guide: challenges to sustain programs, usefulness of a tool like PSAT, and perspectives on gaps regarding structure, wording and items included in the PSAT. Findings from the interviews were summarized and used to create a modified PSAT. In this chapter, I present the modified PSAT and key themes that emerged based on the analysis regarding the usefulness of the tool and challenges to sustain the program.

Figure 8: PSAT Framework [80]



Funding Stability
making long-term plans based on a stable funding environment

Political Support
internal and external political environment which influences program funding, initiatives, and acceptance

Partnerships
the connection between program and community

Organizational Capacity
the resources needed to effectively manage the program and its activities

Program Adaptation
the ability to adapt and improve in order to ensure effectiveness

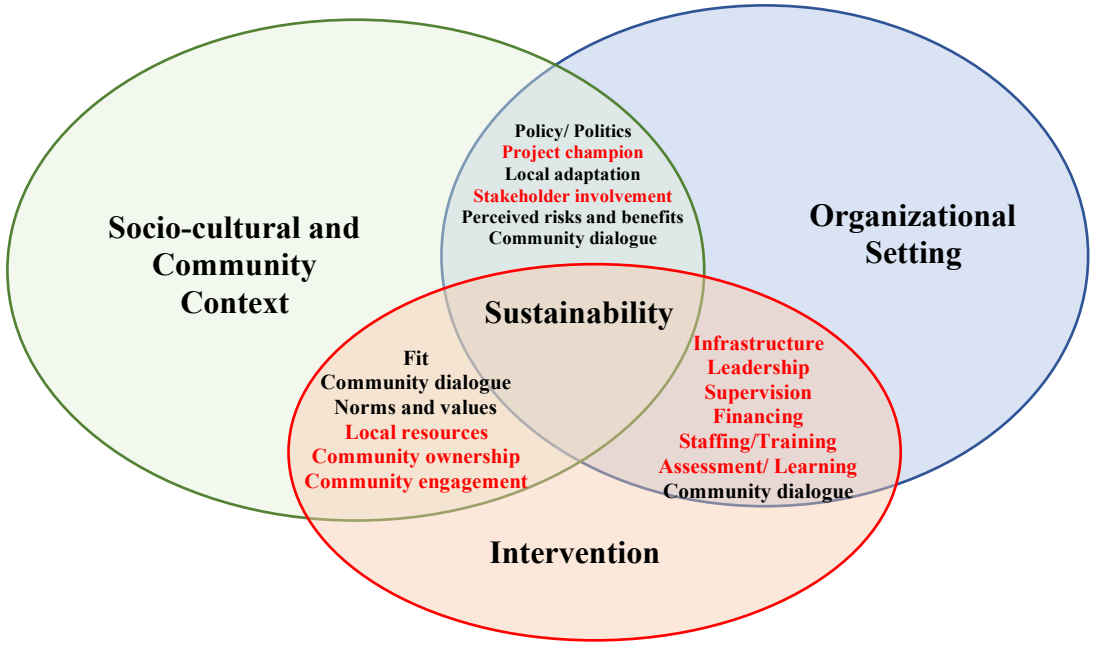
Program Evaluation
monitoring and evaluation of process and outcome data associated with program activities

Communications
the strategic dissemination of program outcomes and activities with stakeholders, decision-makers, and the public

Public Health Impacts
the program's effect on the health attitudes, perceptions, and behaviors in the area it serves

Strategic Planning
the process that defines program direction, goals, and strategies

Figure 9: Conceptual Framework suggested for SSA*[52]*



Policy/politics—principles of action by stakeholders related to the intervention and the local context of implementation

Project champion—local driver of intervention

Local adaptation—tailoring to unique, local context

Stakeholder involvement—participation of stakeholders

Perceived risks and benefits—perceived impact and potential drawbacks

Community dialogue—conversation between stakeholders

Fit—suitability between core intervention elements and contextual factors

Norms and values—cultural aspects valued by the local community

Local resources—physical, financial, and human resources

Community ownership—community buy-in and leadership

Community engagement—community buy-in and participation

Infrastructure—physical facilities, reliable resources for facilities including staff and leadership

Leadership—supportive decision-makers

Supervision—management of daily activities

Financing—funding

Staffing/ Training—human resources available

Assessment/ Learning—program evaluation and key takeaways

Note: Factors in red text represent determinants that have been in the literature included in the review in chapter 3

Table 5: Comparing determinants of sustainability cited by the PSAT framework versus the SSA framework identified in Chapter 3

Framework	**Determinants of sustainability cited**							
PSAT Framework	Political support	Funding stability	Partnerships	Organizational capacity	Program evaluation	Program adaptation	Communication	Public Health Impacts
SSA Framework	Policy Politics Norms and values	Financing	Community dialogue Stakeholder involvement	Leadership Supervision Staffing/ training	Assessment/ Learning Supervision	Local adaptation	Community dialogue	Perceived risks and benefits
Literature review findings from chapter 3	Community support	Funding	Community support	Infrastructure	Program evaluation/ assessment	Working within existing resources	Community participation	Program outcomes/ perceived program outcomes

Results

Stakeholders

A total of 15 key informants (four funder, three ministry officials, three local implementers and five providers) completed these interviews. Ten of them were female and 5 were male. Of these, 11 indicated they had experience making decisions on program activities, management, or finances. The remaining 4 participants were mainly involved with provision of services to patients. 14 participants were involved in implementation of programs in Uganda. Of the 14, one was a US-based funder that worked with teams with local presence in Uganda, Kenya, and South Africa. One participant was involved in program implementation in Lesotho.

Key perspectives

Participants stated that overall sustainability of programs was challenging, a tool like the PSAT would be helpful for someone in their role and identified areas of improvement on the set up and structure of the tool. They discussed challenges for sustaining programs—such as funding, and how the PSAT can be used in their context. They further went through all contents of the tool and provided suggestions on changes.

Perspectives on sustainability of programs

Participants suggested that sustaining programs was challenging mainly because of a lack of funding. Participants highlighted that lack of funding occurred for reasons such as 1) misalignment of priorities between the funder and local stakeholders, 2) lack of intervention integration into a pre-existing system, and 3) lack of leadership to take the programs on once initial stream of funding expires.

> *"We have found ourselves in many situations having to make adjustments to program focus, to align with stakeholder needs. But I would say that until more recently, most of what we implemented was 100% donor funded, and therefore, we would find ourselves*

between funding cycles anxious about the continuity of programs."—Implementer

"Generally, it's very difficult to sustain many of the projects that we have partly because we have quite a bit of challenges with getting our government to commit the required funding for the health sector. I think that's broadly a challenge in Africa, generally, having a lot of essential programs sustained by external funding … if I use the HIV program as an example, about 75, 80 percent of the funding for our HIV programs is externally supported by partners like the PEPFAR program, the Global Fund program, and then being subsidized by several other partners, the UN agencies. So, you find the direct funding to activities beyond investments in infrastructure and health workers could be just about 15%. So that in itself is a challenge broadly for public health programs, the level of commitment and investment … by the government so much that even when you see it's a valuable program sustaining it is a problem. We worry about… what happens if one day the PEPFAR program … decides that [it]'s not giving us funding anymore." –Funder

"Yeah, I think it's a difficult and thorny issue. I think majority of programs don't survive the cessation of external funding. In my experience, what might facilitate that is that many times the external funding, it is also matched with an external vision-bearer. So, when the external funding ceases and if that is also simultaneous with the external vision bearing moving on, then it's my experience that many institutions and programs really struggle with sustainability."
–Implementer

Perspectives on helpfulness of PSAT for role

All stakeholder types recognized the usefulness of a tool like the PSAT. Implementers, funders, and ministry officials indicated that a tool like PSAT would be

helpful for their roles and responsibilities. They particularly recognized that it would help inform how to address potential gaps for sustainability in their organizations/ programs. On the other hand, providers indicated that it would be useful overall but recognized that it would be particularly useful for implementers and decision makers.

> *"I think it would. I think when I read it this morning, one of the things I did was copy it to my sustainability and partnership management team leads because I thought, well, it's interesting. It asks important questions. But I also thought that depending on where the organization is on the journey to sustainability, it may require adaptations here and there. Some organizations will be at the starting stage, so definitely they need to think about the very basics. But when I sent it out to the team, I thought, okay, what this tells me is we have to have a structured way of measuring where we are at in terms of progress towards sustainability of our total organization, of our business units, of the separate entities within our group and all of that. The questions might need to be tweaked here and there to adapt to any specific organization, but definitely a tool [like this] is important."*
> – Implementer

> *"If you are at the helm of a new program to be introduced in a health setting, for example, because I work in the health sector, I think the items here would be a good way to assess whether you'll be able to sustain that program…whether it would be for the implementer or for the person who is bringing the program, the donor, probably both. I believe… it would be useful."* –Funder

> *"Yes, I think it could be [inaudible] because it looks at the different facets that could make a program sustainable. So, when you use it to assess, then it would help you to see what is available and what*

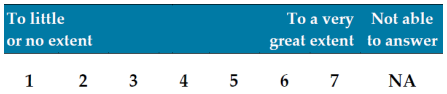
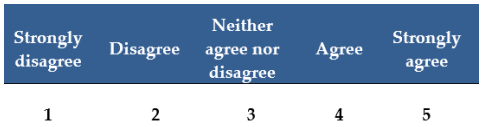
is missing, and then you'll be able to build on from the gaps, which will improve the program performance" –Ministry Official

"Yes, the tool is useful … it can be useful with the program implementers to evaluate and know where the gaps are so that they bridge those gaps before the program [is] enacted." –Provider

Perspectives on PSAT structure and content

Participants expressed difficulty deciding between the rating levels of 1-7. Based on this feedback, I revised the response scale to a 5-level Likert scale (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree). In addition, participants identified 1) questions that needed to be rephrased, 2) questions that needed to be added, and 3) questions that needed to be removed for each category. They further suggested edits for definitions provided. The PSAT was revised based on these suggestions. All suggestions were included in the revised PSAT (revisions included are shown in Table 6).

Table 6: Changes Comparing the Original PSAT and Modified PSAT

Original PSAT	Modified PSAT	Rationale for change
Overall		
Response options: 	**Response options:** 	• Several participants had dDifficulty differentiating between levels (example 5 vs 6) • Several participants expressed the NA option enabled them to default to that and did not think it necessary
Definitions		
Environmental Support: Having a supportive internal and external climate for your program	**Environmental Support:** Having a supportive internal and external setting for your program	• Several participants had confusion regarding he term climate and aggreed with a suggestion of term setting instead
Funding Stability: Establishing a consistent financial base for your program	**No change**	
Partnerships: Cultivating connections between your program and its stakeholders	**No change**	
Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities	**No change**	

Program Evaluation: Assessing your program to inform planning and document results	**No change**	
Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness	**No change**	
Communications: Strategic communication with stakeholders and the public about your program	**Communications:** Strategic exchange of information with stakeholders and the public about your program	• Several participants suggested to remove term communication from the definition
Strategic Planning: Using processes that guide your program's direction, goals, and strategies	**No change**	
Items in scale		
Environmental Support		
1. Champions exist who strongly support the program	1. There were advocates who support the program	• Several participants expressed that "Champion" is not a common term and advocates is
2. The program has strong champions with the ability to garner resources	2. The program had advocates with the ability to garner resources	• Several participants expressed that "Champion" is not a common term and advocates is and the word strong is subjective
3. The program has leadership support from within the larger organization	3. The program has leadership support from within the organization	• Several participants expressed that the term larger made the statement confusing
4. The program has leadership support from outside of the organization	**No change**	

5. The program has strong public support	5. The program has support from local stakeholders	• Several participants expressed "public" is synonymous with government and does not include the broader community
Funding Stability		
1. The program exists in a supportive state economic climate	1. The program exists in a supportive state economic setting	• Several participants expressed confusion regarding he term climate and agreed with a suggestion of term setting instead
	2. The program exists in a supportive socio-political setting	• A participant suggeted to include newly added item because the socio-political context can also affect funding
2. The program implements policies to help ensure sustained funding	3. The program implements strategies to help ensure sustained funding beyond initial funding cycle	• Several participants expressed confusion about timeline and aggreed with a suggested additional phrase
3. The program is funded through a variety of sources	4. The program is funded through balanced contribution from a variety of sources	• Several participants expressed confusion about the term variety and suggested additional phrase because the proportion of funding coming from various sources is important as well
4. The program has a combination of stable and flexible funding	5. The program had stable funding beyond initial funding cycle	• Several participants expressed confusion about timeline of the question and aggreed with suggested phrase
5. The program has sustained funding	6. The program has flexible, unrestricted funding beyond initial funding cycle	• Several participants expressed confusion about timeline of the question and aggreed with suggested phrase

Partnerships		
1. Diverse community organizations are invested in the success of the program	1. Diverse organizations (government, private, non-profit and community organizations) are invested in the success of the program	• Several participants suggested defining different kinds of organizations instead of limiting to just community organizations for clarity
2. The program communicates with community leaders	2. The program communicates with local leaders from diverse organizations (government, private, non-profit and community organizations)	• Several participants suggested definition for different kinds of organizations instead of limiting to just community organizations for clarity
3. Community leaders are involved with the program	3. Diverse organizations (government, private, non-profit and community organizations) are engaged in the development of program goals	• Several participants suggested definition for different kinds of organizations instead of limiting to just community organizations for clarity • A participant suggested identifitying components of the program design and implementation instead of just stating program for clarity
4. Community members are passionately committed to the program	4. Local leaders from diverse organizations (government, private, non-profit and community organizations) are engaged in the development of program activities	• Several participants suggested removing this question and replacing it because “passionately committed” is vague and subjective • Several participants suggested definition for different kinds of organizations instead of limiting to just community organizations for clarity • Several participants suggested identifitying components of the program design and

		implementation instead of just stating program for clarity
5. The community is engaged in the development of program goals	5. Diverse organizations (government, private, non-profit and community organizations) are engaged in implementation of program activities	• Several participants suggested definition for different kinds of organizations instead of limiting to just community organizations for clarity • Several participants suggested identifitying components of the program design and implementation instead of just stating program for clarity
Organizational Capacity		
1. The program is well integrated into the operations of the organization	**No change**	
2. Organizational systems are in place to support the various program needs	**No change**	
3. Leadership effectively articulates the vision of the program to external partners	**No change**	
	4. Leadership effectively articulates the vision of the program to internal staff	• A participant suggested adding communication to internal staff because that is also perceived as essential
4. Leadership efficiently manages staff and other resources	5. Leadership effectively manages staff and other available resources	• Several participants suggested clarifying "other" includes available resources

	6. Leadership has appropriate succession plans in place	• A participant suggested adding succession plans for leadership because that is also perceived as essential
5. The program has adequate staff to complete the program's goals	7. The program has adequately trained staff to complete program activities	• A participant suggested training and motivation are needed to have adequate staff because that is also perceived as essential
	8. The program has motivated staff to complete the program's goals	• A participant uggested training and motivation are needed to have adequate staff because that is also perceived as essential
Program Evaluation		
1. The program has the capacity for quality program evaluation	**No change**	
2. The program reports short term and intermediate outcomes	2. The program reports short-term, intermediate, and long-term change in outcomes compared to baseline	• A participant suggested adding in long term along with short term and intermediate
	3. The program evaluates implementation processes	• A participant suggested adding in evaluation of implementation of processes because that is also perceived as essential
3. Evaluation results inform program planning and implementation	**No change**	
4. Program evaluation results are used to demonstrate successes to funders and other key stakeholders	**No change**	

5. The program provides strong evidence to the public that the program works	6. The program provides evidence to the public that the program works	• Several participants suggested to remove the word strong because it is subjective
Program Adaptation		
1. The program periodically reviews the evidence base	**No change**	
2. The program adapts strategies as needed	**No change**	
3. The program adapts to new science	2. The program adapts to new evidence	• Several participants suggested switching the order of questions 2 and 3 because question 1 discusses reviewing the evidence base already • A participant suggested replacing the word science with evidence
4. The program proactively adapts to changes in the environment	**No change**	
5. The program makes decisions about which components are ineffective and should not continue	**No change**	
Communications		
1. The program has communication strategies to secure and maintain public support	1. The program had communication strategies to secure and maintain support from local stakeholders (government, private, non-profit and community organizations).	• Several participants suggested defining different kinds of organizations instead of limiting to just public which is synonymous with government in their context

2. Program staff communicate the need for the program to the public	**No change**	
3. The program is marketed in a way that generates interest	**No change**	
4. The program increases community awareness of the issue	**No change**	
5. The program demonstrates its value to the public	5. The program demonstrated its value to local stakeholders (government, private, non-profit and community organizations).	• Several participants suggested definition for different kinds of organizations instead of limiting to just public which is synonymous with government in their context
	6. The program had a mechanism in place to communicate findings/lessons learned regularly	• A participant suggested adding new item about communication of lessons learned specifically
Strategic Planning		
1. The program plans for future resource needs	2. The program planned for other long-term resource needs	• A participant suggested switching the order of 1 and 2 and replacing future resource needs to "other long term resource needs" to refer to resources beyond financial
2. The program has a long-term financial plan	**No change**	
	No change	

3. The program's goals are understood by all stakeholders	4. The program's goals were understood by stakeholders (government, private, non-profit and community organizations)	• Several participants suggested definition for different kinds of stakeholders
5. The program clearly outlines roles and responsibilities for all stakeholders	5. The program clearly outlined roles and responsibilities for all stakeholders (government, private, non-profit and community organizations)	• Several participants suggested definition for different kinds of stakeholders
	6. The program involved key stakeholders (government, private, non-profit and community organizations) in strategic planning	• A participant suggested adding involvment of stakeholders in planning stages
	7. The program conducted risk assessments to account for changing settings	• A participant suggested the need for risk assessments

Discussion

In this analysis, I found that sustainability was compromised by misalignment of priorities between the funder and local stakeholders, lack of intervention integration into a pre-existing system, and lack of leadership to take the programs on once initial stream of funding expires. This aligns with previous evidence on challenges for sustaining programs in SSA. In a study of community-based treatment of river blindness in Nigeria, authors found that the absence of structured leadership to transfer financial responsibility for the intervention presented a challenge to sustain the program.[61] In another study, on immunization programs in the Democratic Republic of Congo, authors found that the absence of national and regional institutions as a structured mechanism for allocating funds hindered a vaccine program from sustaining in the long term even when funds are available.[6]

Furthermore, participants interviewed found that a tool like the PSAT would be helpful to identify gaps in sustainability of programs. This too aligns with findings in the literature in broader contexts. Stakeholders in a chronic disease program found that filling the PSAT helped them identify gaps for sustainability, and determine elements of the program they intended to sustain.[81] Similarly, authors found that the PSAT funding stability was lowest rated and needed for sustaining the intervention in a study of pediatric asthma care coordination. Authors further supplemented the PSAT with open ended qualitative questions to capture gaps beyond scores on the PSAT. In both instances—which were set in the US, the PSAT was used to survey key stakeholders and plan for sustainability of the interventions of interest.

This analysis adds value in that it is the first application of the PSAT or any similar tool in SSA. However, it is limited in that most of the key informants included had experience in Uganda. It is possible that results from Uganda may not be generalizable to all parts of SSA. Additionally, while this analysis suggests modifications to the PSAT, there needs to be an objective, quantifiable assessment of the quality of the modified PSAT to assess the reliability and validity of the tool.

Conclusions and Implications

Overall, findings from the interviews indicated that sustaining programs has been challenging. Respondents also suggested that the PSAT is useful for decision-makers at implementing, ministry, and funding levels. These findings complement the findings from the literature review in chapter 3. Cognitive interviews in other contexts may be needed to apply the modified PSAT to other contexts. In addition, a psychometric assessment of the modified tool is needed to quantify the quality of the tool.

Chapter 5: Psychometric quality assessments of the modified PSAT

Introduction

As discussed in previous chapters, the PSAT was developed in and has been implemented for evaluation of public health programs in US domestic settings.[79, 81, 82] Across the studies that have implemented it in the US, authors have found that it was useful to guide a mixed-methods evaluation for a program's capacity to be sustained. The tool was used to survey key stakeholders and plan for sustainability of the interventions of interest. In chapter 4, key informant interviews were used to modify the PSAT to the SSA setting. Structural and content changes were made based on key informant suggestions. Participants of the interviews and the overlap between the SSA framework for sustainability and the PSAT framework for sustainability suggested the PSAT was an appropriate tool to adapt to the SSA setting. In this chapter, I measure the quality of the modified tool from chapter 4 using psychometric assessments. I specifically measure the validity and reliability of the tool based on a web-based survey conducted among decision-makers who were involved in public health program implementation in SSA.

Methods

The modified PSAT has a total of 48 items. In this analysis, I aimed to conduct reliability and construct validity calculations.

Data collection

A web-based survey, including the modified PSAT, was fielded to a convenience sample of decision makers who were involved in the implementation of public health programs in SSA. To be selected for inclusion, participants were required to respond in the survey about programs that completed implementation in SSA ≥ 1 year ago. A total of 43 decisionmakers were approached, of whom 21 responded to the survey. Random sampling was attempted from the NIH database of principal investigators;[84] however only 2 participants responded from the database out of 20. Thus, convenience snowball sampling was used to identify and recruit the remainder of participants.

For a tool with 48 items to achieve power of 80% at an alpha value of 0.05 for reliability calculations, the literature suggests a minimum sample size of 11 based on Bonet's

sample size requirement calculations.[85, 86] For confirmatory factor analysis with 6 or more factors and a coefficient of congruence of 0.98, the literature suggests a minimum sample size of 110.[87, 88] For validity calculations, the literature suggests a minimum sample size of n=100 +50i (where i is the number of independent variables in a model).[89] Thus, the sample from this study was sufficient for reliability calculations yet under powered for confirmatory factor analysis and validity calculations.

Measures

To assess validity, I measured program sustainment, recall bias, program duration and overall PSAT score. To assess reliability, I used the overall PSAT score and the scores for each category within the PSAT.

Sustainment: Two questions were asked regarding program sustainment. Participants were asked whether program activities are still occurring in the current date and whether program outcomes have continued to current date.

Recall bias: To account for recall bias, participants were asked how long ago the program they answered questions about was completed. This variable was used as a covariate in the regressions assessing construct validity.

Program duration: Participants were asked how long the program was implemented for in the initial phase of funding. This too was added as a covariate in the regressions assessing construct validity.

PSAT score: Like the original PSAT, each of the 8 categories in the tool had average scores. The average PSAT score was calculated as the average of category level scores. To calculate category level scores, the item scores were summed up and divided by the number of items in each category. For each item, a score of 1 was given for strongly disagree, 2 for disagree, 3 for neither agree nor disagree, 4 for agree, and 5 for strongly agree.

Data analysis

Validity

To assess construct validity (i.e. the extent to which the tool measures what it is intended to measure),[90] I observed the association between PSAT scores and self-

report of whether program activities and outcomes continued/sustained one-year (or more) post-funding phase-out. The outcome variables (whether program activities were current and whether program goals were current) are binary. However, given a small sample size, logistic regressions generated oversized odds ratios. Therefore, I used a modified Poisson regression approach—a generalized linear model with a Poisson family, log link, and robust standard error, to generate relative risks as suggested by the literature.[91]

The sample was also under powered for confirmatory factor analysis to assess the factorial validity (empirical structure of the tool).

Reliability

To assess the tool's internal consistency reliability, I calculated the Cronbach's alpha for the tool overall and for each category. The literature suggests ranges of Cronbach alpha values for excellent to low levels of tool reliability. Specifically, it suggests the following ranges: excellent (0.93–0.94), strong (0.91–0.93), reliable (0.84–0.90), adequate (0.64–0.85), moderate (0.61–0.65), not satisfactory (0.4–0.55) and low (0.11).[90, 92] I used these ranges to determine the level at which the modified PSAT is reliable. All analyses were conducted in Stata.

Results

Summary statistics

The survey had a 47% response rate, with 21 out of 43 approached individuals completing the survey. Of those, program duration ranged from .17 to 8.8 years. Years that have passed since program completion ranged from 1.3 to 9 years. 24% of respondents indicated their programs were implemented in Ethiopia, whereas 19% were in Uganda. The remainder were in Kenya, Malawi, Zambia, Mozambique, Nigeria, Rwanda, South Africa, Swaziland, and Tanzania. Areas of program intervention included HIV, cancer, maternal and child health, health information systems, reproductive health, mental health, and primary care.

About half of the participants indicated that program outcomes had been sustained to date whereas just 38% indicated that program activities had been sustained (Table 7). 76% of participants indicated that they would have found the tool helpful for their program. Of those who indicated it would not be helpful, one expressed that their program was a short-term program not intended to continue upon completion of implementation, and three suggested modifications of some questions would have made it helpful. The average PSAT score across the 21 programs was 3.8 and scores in the data ranged from 3.2 to 4.5. A higher score indicates higher likelihood of sustainability and the highest possible score is a 5. Looking at category scores on average, participants assigned the lowest score for funding stability and the highest for environmental support.

Table 7: Survey Background Characteristics

	Mean (SD) or N(%)
Program duration (months)	42.7 (26.0)
Years since program completion	3.2 (1.9)
Program sustained activities to current date	8 (38 %)
Program sustained outcomes to current date	11 (52 %)
PSAT score	3.7 (0.4)
Environmental support score	4.4 (0.5)
Funding stability score	2.7 (0.8)
Partnership score	3.8 (0.6)
Organizational capacity score	4.0 (0.4)
Program evaluation score	4.1 (0.5)
Program adaptation score	3.9 (0.7)
Communication score	3.8 (0.7)
Strategic planning score	3.2 (0.7)
PSAT helpful for my role	16 (76.2%)

Validity

Construct Validity

The analysis suggests that higher PSAT scores were associated with significantly higher likelihood of sustained activities and goals to current date (Table 8). Specifically, a 1 unit increase in the PSAT score is associated with a 7-fold likelihood of sustainment of program activities (p = 0.001) and a 3-fold likelihood of sustainment of program goals 1 or more years after program implementation completion (p = 0.009). When controlling for program duration and years since program completion, a 1 unit increase in the PSAT score is associated with a 5-fold likelihood of sustainment of program activities (p = 0.008) and a 2.6-fold likelihood of sustainment of program goals 1 or more years after program implementation completion (p = 0.022). This implies that the PSAT likely predicts program sustainment. However, these results need to be considered with caution as the sample size used is small and underpowered.

Table 8: Relative Risk of Sustained Program Activities and Goals to Current Date

	Relative Risk (Sustained activities to current date)		**Relative Risk (Sustained goals to current date)**	
	Unadjusted	**Adjusted**	**Unadjusted**	**Adjusted**
PSAT score	7.096*** (2.237 - 22.510)	5.403*** (1.568 - 18.617)	3.113*** (1.320 - 7.342)	2.648** (1.147 - 6.109)
Program duration (months)		1.024*** (1.011 - 1.038)		1.003 (0.990 - 1.017)
Years since program completion		0.877 (0.700 - 1.097)		0.765* (0.577 - 1.015)
Constant	0.000*** (0.000 - 0.028)	0.000*** (0.000 - 0.265)	0.007*** (0.000 - 0.040)	0.022* (0.000 – 1.003)

*** p<0.01, ** p<0.05, * p<0.1 ; Confidence Intervals in parentheses

Reliability

As discussed earlier, the literature suggests the following ranges for Cronbach's alpha: excellent (0.93–0.94), strong (0.91–0.93), reliable (0.84–0.90), adequate (0.64–0.85), moderate (0.61–0.65), not satisfactory (0.4–0.55) and low (0.11).[90, 92] The overall Cronbach's alpha of 0.93 indicates that the reliability of the tool is strong. Considering each category within the tool, all but the environmental support and program evaluation categories had Cronbach's alpha levels above 0.7 (Table 9). This suggests that these categories had fairly high levels of reliability. On the other hand, the environmental support and program evaluation categories had adequate and moderate levels of reliability respectively.

Table 9: Overall and Category Cronbach's Alpha Levels

	Cronbach's alpha
Overall	0.93
Environmental support	0.67
Funding	0.80
Partnerships	0.79
Organizational capacity	0.71
Program evaluation	0.63
Program adaptation	0.82
Communication	0.83
Strategic planning	0.82

Discussion

In this analysis, I found that the PSAT is a valid, reliable tool to measure sustainment of programs implemented in SSA. This aligns with previous evidence from the literature in a broader context. Luke et al (2014) found that the original version of the tool had category level Cronbach's alpha levels ranging from 0.79 to 0.92 when used to assess

sustainability of 252 public health programs in the US.[79] Other studies that used the PSAT also found similar results. A study of a public health intervention for physical activities in elementary schools in the US modified the PSAT to a 26-item tool and found similar results with category Cronbach's alpha levels ranging from 0.77 to 0.92.[93] Similar results were also observed for construct validity of the tool. Luke et al assessed construct validity by surveying 205 participants on whether their programs sustained to find a positive correlation between the PSAT and perceived sustainment.[79]

However, this analysis is limited in that the sample size was very small and it was a convenience sample. Thus, validity calculations were underpowered. Analyses with a larger sample size are needed in the future. Specifically, confirmatory factor analysis is needed to provide evidence on the empirical structure of the tool. Furthermore, the data is limited in that it does not include stakeholders with experience in all countries in SSA. Thus, results are not generalizable to all parts of SSA because participants did not have experience from all countries in the region. Finally, sustainment was assessed based on self-reported perceptions. Future research with an objective measure of sustainment could be helpful to address this limitation.

Conclusions and Implications

Overall, the modified PSAT is seen to be a reliable, valid tool based on the web-based survey. In other words, it measures what it is supposed to measure and repeat measurements using the tool are expected to yield the same result. However, these psychometric assessments are limited by the sample size.

Overall Conclusion

In conclusion, this dissertation study found that funding is one of the key determinants for sustainability in SSA as seen in the challenges for sustainment of an intervention in Lesotho as shown in chapter 1. In chapter 2, I further demonstrated that reduction of PEPFAR funding did not impact ART service coverage negatively. Yet this seemed to be a result of other development assistance funding that covered the gap created by reduction of PEPFAR funding. In chapter 3, I identified additional determinants of sustainability and a sustainability framework for the SSA setting. However, the literature had no sustainability assessment tools developed for/ used in the SSA setting. Thus, I identified the PSAT as an appropriate fit based on its overlap with the SSA framework for sustainability. Finally, I adapted the tool to the SSA setting and calculated its reliability and validity in chapters 4 and 5.

The dissertation project adds value to the area of research focused on sustainability in implementation science. It provides a broad set of analyses to understand the policy challenge in the SSA context—the lack of a validated tool to assess and plan for sustainability, and then suggests a solution to the problem. Given that a program's sustainability is crucial to its real utility, and that programs in SSA are implemented with time-limited development assistance funding from external donors, a sustainability assessment tool like the PSAT will likely be useful.

Findings from this dissertation project will be of interest to researchers, local implementors, government-level policymakers, and the external funders of programs in low-resource settings like SSA. Researchers may be interested in identifying gaps in sustainability enabling criteria to help transition from research that establishes the efficacy and cost-effectiveness of a program to successful translation of the program into routine service provision by community-based organizations and providers. Local implementors and government-level policy makers may be interested in identifying criteria such that they can shape programs to fit local contexts and available resources. External funders may be interested in knowing gaps for enabling sustainability to make funding allocation decisions.

While the dissertation project adds value overall, there is a key limitation considering the PSAT/ modified PSAT itself. It appears to be user-friendly and perceived to be helpful across different stakeholder types as seen from interviews and surveys in this study. It can also be adapted to different contexts. However, the tool offers a simplistic approach to identifying gaps. This simplicity is a limitation in that ratings across categories could fail to capture context-specific nuances and details that are qualitative and not necessarily quantifiable. Thus, when used, it is essential to review the tool with relevant stakeholders at design phase to assess if there is any qualitative information that can be used to supplement PSAT scoring.

References

1. World Health Organization, *State of Health Financing in the African Region*. 2013, World Health Organization, : Brazzaville.
2. Dieleman, J.L., et al., *Spending on health and HIV/AIDS: domestic health spending and development assistance in 188 countries, 1995-2015.* Lancet, 2018. **391**(10132): p. 1799-1829.
3. Management Sciences for Health, *Managing Access to Medicines and Health Technologies*. 2012, Management Sciences for Health,: Arlington, VA.
4. Mccoy, D., S. Chand, and D. Sridhar, *Global health funding: how much, where it comes from and where it goes.* Health Policy and Planning, 2009. **24**(6): p. 407-417.
5. Grepin, K.A., et al., *Donor funding health policy and systems research in low- and middle-income countries: how much, from where and to whom.* Health Res Policy Syst, 2017. **15**(1): p. 68.
6. Le Gargasson, J.B., et al., *Sustainability of National Immunization Programme (NIP) performance and financing following Global Alliance for Vaccines and Immunization (GAVI) support to the Democratic Republic of the Congo (DRC).* Vaccine, 2013. **31**(15): p. 1886-91.
7. Rashed, S., et al., *Sustaining malaria prevention in Benin: local production of bednets.* Health Policy Plan, 1997. **12**(1): p. 67-76.
8. Wagner, G.J., et al., *INtegration of DEPression Treatment into HIV Care in Uganda (INDEPTH-Uganda): study protocol for a randomized controlled trial.* Trials, 2014. **15**(1): p. 1-12.
9. Grand Challenges Canada. *Saving Brains*. 2022 March 13 2022]; Available from: https://www.grandchallenges.ca/programs/saving-brains/.
10. Ndayizigiye, M., et al., *Integrating an early child development intervention into an existing primary healthcare platform in rural Lesotho: a prospective case-control study.* BMJ Open, 2022. **12**(2): p. e051781.
11. Giordano, F.B., et al. *The stakeholder map: A conversation tool for designing people-led public services*. in *Service Design and Innovation Conference: Proof of Concept*. 2018. Linköping University Electronic Press.
12. Wagner, G., et al., *A cluster randomized controlled trial of two task-shifting depression care models on depression alleviation and antidepressant response among HIV clients in Uganda.* Res Adv Psychiatry, 2016. **3**(1): p. 12-21.
13. Blanchet, K., et al., *Advancing the application of systems thinking in health: analysing the contextual and social network factors influencing the use of sustainability indicators in a health system - a comparative study in Nepal and Somaliland.* Health Research Policy and Systems, 2014. **12**.
14. Mutale, W., et al., *Application of systems thinking: 12-month postintervention evaluation of a complex health system intervention in Zambia: the case of the BHOMA.* J Eval Clin Pract, 2017. **23**(2): p. 439-452.
15. Sarriot, E., et al., *A causal loop analysis of the sustainability of integrated community case management in Rwanda.* Soc Sci Med, 2015. **131**: p. 147-155.
16. PEPFAR. *What is PEPFAR*. 2020 [cited 2020 12/1/2020]; Available from: https://www.hiv.gov/federal-response/pepfar-global-aids/pepfar.
17. The Global Fund, *The Global Fund Data Explorer*. 2020.
18. amfAR, *PEPFAR Country/Regional Operational Plans (COPs/ROPs) Database*. 2020.
19. Sessions, M., *Overview of the President's Emergency Plan for AIDS Relief (PEPFAR)*. Center for Global Development. p. https://www.cgdev.org/page/overview-president%E2%80%99s-emergency-plan-aids-relief-pepfar
20. Banigbe, B., et al., *Effect of PEPFAR funding policy change on HIV service delivery in a large HIV care and treatment network in Nigeria.* PLoS One, 2019. **14**(9): p. e0221809.

21. Kavanaugh, M. and M. Thorp, *PEPFAR's Declining Investment In HIV/AIDS Treatment*, in *Health Affairs Blog*. 2011.
22. El-Sadr, W.M., et al., *Scale-up of HIV treatment through PEPFAR: a historic public health achievement.* Journal of acquired immune deficiency syndromes (1999), 2012. **60 Suppl 3**(Suppl 3): p. S96-S104.
23. Global Burden of Disease Collaborative Network, *Global HIV/AIDS Spending 2000-2015*, G.H.A.S. 2000-2015, Editor. 2018.
24. UNAIDS, *AIDSinfo*. 2020.
25. World Bank, *World Development Indicators*. 2022.
26. Medicins Sans Frontieres, *Accessing ARVs: untangling the web of price reductions for developing countries*. 2001, Medicins Sans Frontieres, : Geneva, Switzerland.
27. Medicins Sans Frontieres, *Untangling the web of price reductions: a pricing guide for the purchase of ARVs for developing countries*. 2002, Medicins Sans Frontieres,: Geneva, Switzerland.
28. Medicins Sans Frontieres, *Untangling the web of price reductions: a pricing guide for the purchase of ARVs for developing countries*. 2003: Geneva, Switzerland.
29. Medicins Sans Frontieres, *Untangling the web of price reductions: a pricing guide for the purchase of ARVs for developing countries*. 2005, Medicins Sans Frontieres,: Geneva, Switzerland.
30. Medicins Sans Frontieres, *Untangling the web of price reductions: a pricing guide for the purchase of ARVs for developing countries*. 2006, Medicins Sans Frontieres,: Geneva, Switzerland.
31. Medicins Sans Frontieres, *Untangling the web of price reductions: a pricing guide for the purchase of ARVs for developing countries*. 2007, Medicins Sans Frontieres, : Geneva, Switzerland.
32. Medicins Sans Frontieres, *Untangling the web of antiretroviral price reductions*. 2008, Medicins sans frontieres: Geneva, Switzerland.
33. Medicins Sans Frontieres, *Untangling the web of price reductions: a pricing guide for the purchase of ARVs for developing countries*. 2009, Medicins Sans Frontieres: Geneva, Switzerland.
34. Medicins Sans Frontieres, *Untangling the web of antiretroviral price reductions*. 2010, Medicins Sans Frontieres, : Geneva, Switzerland.
35. Medicins Sans Frontieres, *Untangling the web of antiretroviral price reductions*. 2011, Medicins Sans Frontieres: Geneva, Switzerland.
36. Medicins Sans Frontieres, *Untangling the web of antiretroviral price reductions*. 2012, Medicins Sans Frontieres: Geneva, Switzerland.
37. Clinton Health Access Initiative, *ARV Market Report: The State of the Antiretroviral Drug Market in Low- and Middle- Income Countries*. 2014.
38. Clinton Health Access Initiative, *ARV Market Report: The State of the Antiretroviral Drug Market in Low- and Middle- Income Countries, 2015-2020*. 2016.
39. Clinton Health Access Initiative, *HIV Market Report: The State of HIV treatment, testing, and prevention markets in Low- and Middle- Income Countries, 2017-2022*. 2018.
40. Clinton Health Access Initiative, *HIV Market Report: The State of HIV treatment, testing, and prevention markets in Low- and Middle- Income Countries*. 2019.
41. Clinton Health Access Initiative, *HIV Market Report: The State of HIV treatment, testing, and prevention markets in Low- and Middle- Income Countries*. 2020.
42. Bendavid, E., et al., *The relation of price of antiretroviral drugs and foreign assistance with coverage of HIV treatment in Africa: retrospective study.* Bmj, 2010. **341**.
43. World Bank, *Government Effectiveness*. 2021.
44. Boah, M., et al., *The scale-up of antiretroviral therapy coverage was strongly associated with the declining tuberculosis morbidity in Africa during 2000–2018.* Public Health, 2021. **191**: p. 48-54.

45. Lebelonyane, R., et al., *To achieve 95-95-95 targets we must reach men and youth: High level of knowledge of HIV status, ART coverage, and viral suppression in the Botswana Combination Prevention Project through universal test and treat approach.* PLoS One, 2021. **16**(8): p. e0255227.
46. *Global, regional, and national incidence, prevalence, and mortality of HIV, 1980-2017, and forecasts to 2030, for 195 countries and territories: a systematic analysis for the Global Burden of Diseases, Injuries, and Risk Factors Study 2017.* Lancet HIV, 2019. **6**(12): p. e831-e859.
47. Haakenstad, A., et al., *Potential for additional government spending on HIV/AIDS in 137 low-income and middle-income countries: an economic modelling study.* Lancet HIV, 2019. **6**(6): p. e382-e395.
48. Global Burden of Disease Health Financing Collaborator, N., *Health sector spending and spending on HIV/AIDS, tuberculosis, and malaria, and development assistance for health: progress towards Sustainable Development Goal 3.* Lancet (London, England), 2020. **396**(10252): p. 693-724.
49. Chambers, D.A., R.E. Glasgow, and K.C. Stange, *The dynamic sustainability framework: addressing the paradox of sustainment amid ongoing change.* Implement Sci, 2013. **8**: p. 117.
50. Rabin, B.A., et al., *A glossary for dissemination and implementation research in health.* Journal of Public Health Management and Practice, 2008. **14**(2): p. 117-123.
51. Aarons, G.A., M. Hurlburt, and S.M. Horwitz, *Advancing a Conceptual Model of Evidence-Based Practice Implementation in Public Service Sectors.* Administration and Policy in Mental Health and Mental Health Services Research, 2011. **38**(1): p. 4-23.
52. Iwelunmor, J., et al., *Toward the sustainability of health interventions implemented in sub-Saharan Africa: a systematic review and conceptual framework.* Implement Sci, 2016. **11**: p. 43.
53. Ajayi, I., A. Jegede, and C. Falade, *Sustainability of Intervention for Home Management of Malaria: The Nigerian Experience.* J Community Med Health Educ, 2012. **2**(175).
54. Blanchet, K. and P. James, *Can international health programmes be sustained after the end of international funding: the case of eye care interventions in Ghana.* BMC Health Serv Res, 2014. **14**: p. 77.
55. Eliason, R.N., *Towards sustainability in village health care in rural Cameroon.* Health Promotion International, 1999. **14**(4): p. 301-306.
56. Somasse, Y.E., et al., *Sustainability and scaling-up analysis of community-based management of acute malnutrition: lessons learned from Burkina Faso.* Food Nutr Bull, 2013. **34**(3): p. 338-48.
57. Amazigo, U., et al., *Performance of predictors: evaluating sustainability in community-directed treatment projects of the African programme for onchocerciasis control.* Soc Sci Med, 2007. **64**(10): p. 2070-82.
58. Abbey, M., et al., *Factors related to retention of community health workers in a trial on community-based management of fever in children under 5 years in the Dangme West District of Ghana.* Int Health, 2014. **6**(2): p. 99-105.
59. Ahluwalia, I.B., et al., *Sustainability of community-capacity to promote safer motherhood in northwestern Tanzania: what remains?* Glob Health Promot, 2010. **17**(1): p. 39-49.
60. Vamos, S., et al., *Translation and sustainability of an HIV prevention intervention in Lusaka, Zambia.* Transl Behav Med, 2014. **4**(2): p. 141-8.
61. Mbanefo, E.C., et al., *Onchocerciasis in Anambra State, Southeast Nigeria: clinical and psychological aspects and sustainability of community directed treatment with ivermectin (CDTI).* Postgrad Med J, 2010. **86**(1020): p. 573-7.
62. Teguete, I., et al., *Can visual cervical screening be sustained in routine health services? Experience from Mali, Africa.* BJOG, 2012. **119**(2): p. 220-6.
63. Lutge, E., S. Lewin, and J. Volmink, *Economic support to improve tuberculosis treatment outcomes in South Africa: a qualitative process evaluation of a cluster randomized controlled trial.* Trials, 2014. **15**: p. 236.

64. Ghiron, L., et al., *Beginning with sustainable scale up in mind: initial results from a population, health and environment project in East Africa.* Reprod Health Matters, 2014. **22**(43): p. 84-92.
65. Osawa, E., T. Kodama, and E. Kundishora, *Motivation and sustainability of care facilitators engaged in a community home-based HIV/AIDS program in Masvingo Province, Zimbabwe.* AIDS Care, 2010. **22**(7): p. 895-902.
66. Roura, M., et al., *Barriers to sustaining antiretroviral treatment in Kisesa, Tanzania: a follow-up study to understand attrition from the antiretroviral program.* AIDS Patient Care STDS, 2009. **23**(3): p. 203-10.
67. Rasschaert, F., et al., *Sustainability of a community-based anti-retroviral care delivery model - a qualitative research study in Tete, Mozambique.* J Int AIDS Soc, 2014. **17**: p. 18910.
68. Sharma, A., et al., *Building sustainable organizational capacity to deliver HIV programs in resource-constrained settings: stakeholder perspectives.* Glob Health Action, 2013. **6**: p. 22571.
69. Walsh, A., et al., *"The problem is ours, it is not CRAIDS' ". Evaluating sustainability of Community Based Organisations for HIV/AIDS in a rural district in Zambia.* Global Health, 2012. **8**: p. 40.
70. Zullig, L.L., et al., *Sustainability of cancer registration in the Kilimanjaro Region of Tanzania--a qualitative assessment.* World Health Popul, 2014. **15**(1): p. 21-30.
71. Aubel, J. and K. Samba-Ndure, *Lessons on sustainability for community health projects.* World Health Forum, 1996. **17**(1): p. 52-7.
72. Sebotsa, M.L., et al., *Assessment of the sustainability of the iodine-deficiency disorders control program in Lesotho.* Food Nutr Bull, 2007. **28**(3): p. 337-47.
73. Humphries, D., L. Gomez, and K. Hartwig, *Sustainability of NGO capacity building in southern Africa: successes and opportunities.* Int J Health Plann Manage, 2011. **26**(2): p. e85-101.
74. Harpham, T. and R. Few, *The Dar Es Salaam Urban Health Project, Tanzania: a multi-dimensional evaluation.* J Public Health Med, 2002. **24**(2): p. 112-9.
75. Torpey, K., et al., *From project aid to sustainable HIV services: a case study from Zambia.* J Int AIDS Soc, 2010. **13**: p. 19.
76. Wandeler, G., et al., *Outcomes of antiretroviral treatment programs in rural Southern Africa.* J Acquir Immune Defic Syndr, 2012. **59**(2): p. e9-16.
77. Fernandez, M.E., et al., *Implementation Mapping: Using Intervention Mapping to Develop Implementation Strategies.* Front Public Health, 2019. **7**: p. 158.
78. Powell, B.J., et al., *Improving the implementation and sustainment of evidence-based practices in community mental health organizations: a study protocol for a matched-pair cluster randomized pilot study of the Collaborative Organizational Approach to Selecting and Tailoring Implementation Strategies (COAST-IS).* Implementation science communications, 2020. **1**: p. 9.
79. Luke, D.A., et al., *The Program Sustainability Assessment Tool: a new instrument for public health programs.* Prev Chronic Dis, 2014. **11**: p. 130184.
80. Schell, S.F., et al., *Public health program capacity for sustainability: a new framework.* Implement Sci, 2013. **8**: p. 15.
81. Calhoun, A., et al., *Using the Program Sustainability Assessment Tool to assess and plan for sustainability.* Prev Chronic Dis, 2014. **11**: p. 130185.
82. Stoll, S., et al., *A Mixed-Method Application of the Program Sustainability Assessment Tool to Evaluate the Sustainability of 4 Pediatric Asthma Care Coordination Programs.* Prev Chronic Dis, 2015. **12**: p. E214.
83. Lieber, E., T. Weisner, and J. Taylor, *Dedoose*. 2022.
84. National Institutes for Health, *Research Portfolio Online Reporting Tools*. 2020.
85. Bujang, M.A., E.D. Omar, and N.A. Baharum, *A Review on Sample Size Determination for Cronbach's Alpha Test: A Simple Guide for Researchers.* Malays J Med Sci, 2018. **25**(6): p. 85-99.

86. Bonett, D.G., *Sample Size Requirements for Testing and Estimating Coefficient Alpha.* Journal of Educational and Behavioral Statistics, 2002. **27**(4): p. 335-340.
87. Mundfrom, D.J., D.G. Shaw, and T.L. Ke, *Minimum Sample Size Recommendations for Conducting Factor Analyses.* International Journal of Testing, 2005. **5**(2): p. 159-168.
88. Myers, N.D., S. Ahn, and Y. Jin, *Sample Size and Power Estimates for a Confirmatory Factor Analytic Model in Exercise and Sport.* Research Quarterly for Exercise and Sport, 2011. **82**(3): p. 412-423.
89. Bujang, M.A., et al., *Sample Size Guidelines for Logistic Regression from Observational Studies with Large Population: Emphasis on the Accuracy Between Statistics and Parameters Based on Real Life Clinical Data.* Malays J Med Sci, 2018. **25**(4): p. 122-130.
90. DeVellis, R.F., *Scale development: Theory and applications*. Vol. 26. 2016: Sage publications.
91. Zou, G., *A Modified Poisson Regression Approach to Prospective Studies with Binary Data.* American Journal of Epidemiology, 2004. **159**(7): p. 702-706.
92. Taber, K.S., *The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education.* Research in Science Education, 2018. **48**(6): p. 1273-1296.
93. Hall, A., et al., *Adaptation and Validation of the Program Sustainability Assessment Tool (PSAT) for Use in the Elementary School Setting.* International Journal of Environmental Research and Public Health, 2021. **18**(21): p. 11414.

Appendix A: Interrupted time series sensitivity analysis results

Figure 10: HIV Spending in PEPFAR Focus Countries in SSA Before and After Second Decrease in PEPFAR Funding

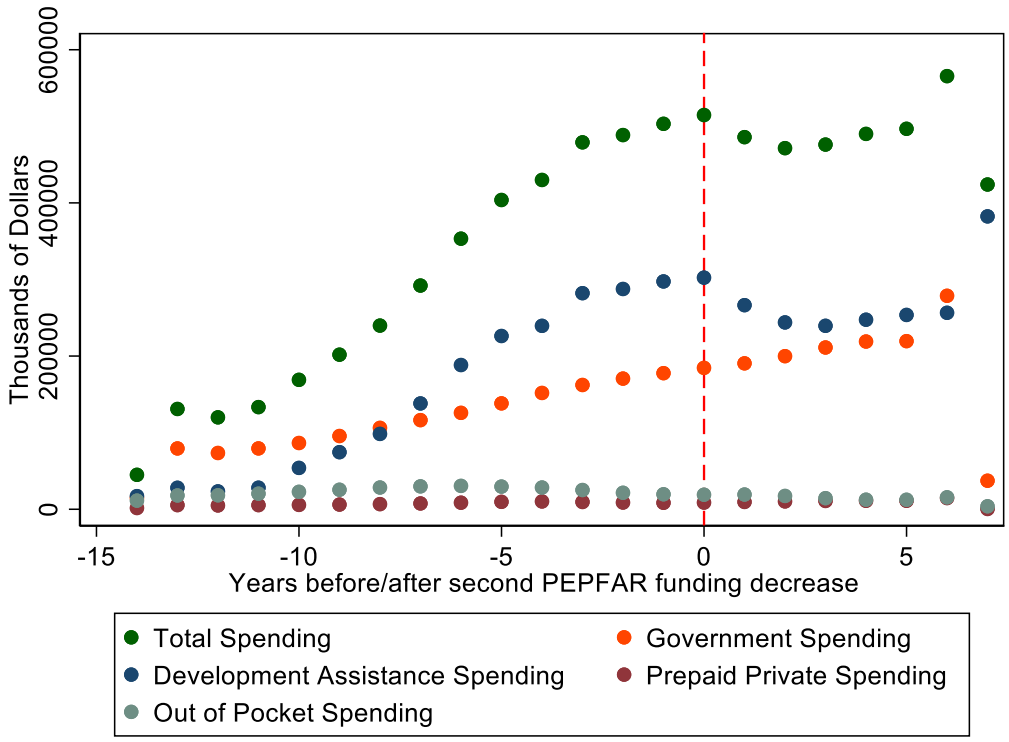


Figure 11: Observed Trends in ART coverage before and after second PEPFAR allocation decrease among PEPFAR Focus countries in SSA

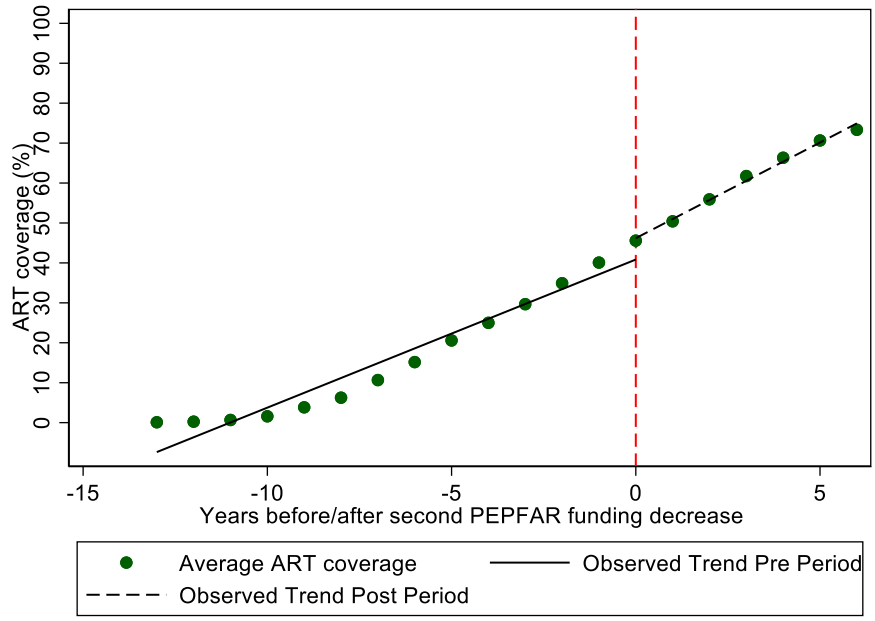


Table 10: Change in ART service coverage before and after second decrease in PEPFAR funding—nonparametric regression output

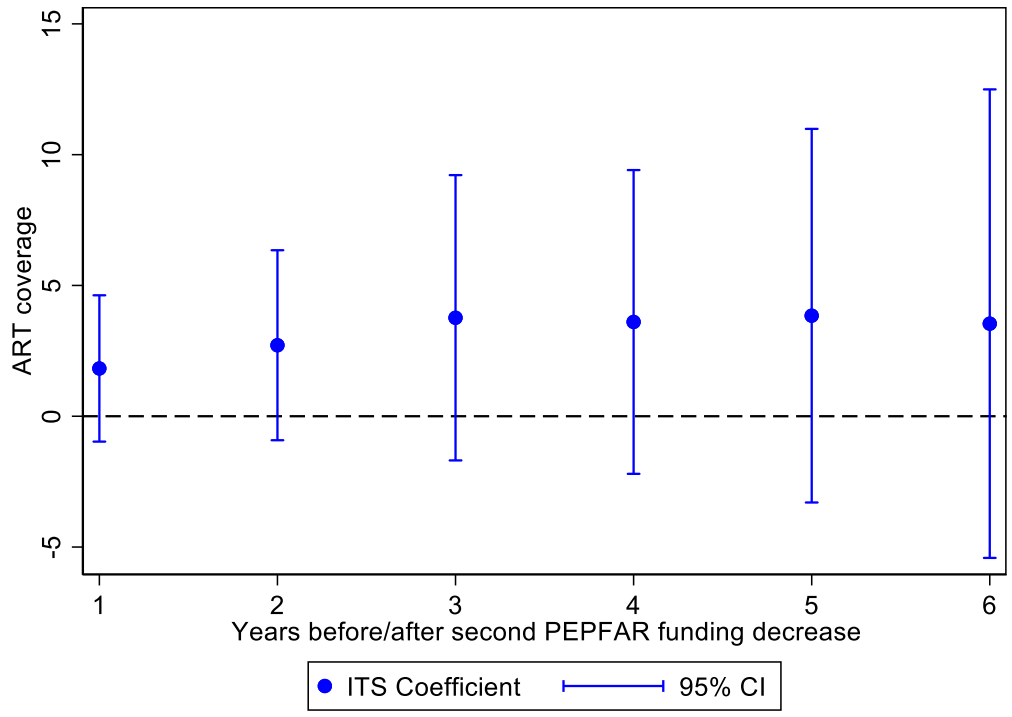
VARIABLES	Model 1
Pre-trend	4.873***
	(0.525)
Year 1 post	1.827
	(1.426)
Year 2 post	2.715
	(1.853)
Year 3 post	3.764
	(2.782)
Year 4 post	3.605
	(2.962)
Year 5 post	3.844
	(3.643)
Year 6 post	3.539
	(4.569)
ART price	0.0339***
	(0.00763)
GDP per capita	0.00475*
	(0.00246)
HIV prevalence	-0.464
	(0.844)
Proportion urban	-0.556*
	(0.336)
Government spending on HIV (2019 USD)	-2.76e-06

	(8.91e-06)
Government effectiveness index	7.903*
	(4.312)
Out of pocket spending on HIV (2019 USD)	-0.000143***
	(4.09e-05)
Private prepaid spending on HIV (2019 USD)	0.000268
	(0.000199)
Observations	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 12: Coefficients of non-parametric regressions for each year after second decrease of PEPFAR funding



Appendix B: PSAT tool and scoring instructions

Program Sustainability Assessment Tool v2

What is program sustainability capacity?

We define program sustainability capacity as *the ability to maintain programming and its benefits over time.*

Why is program sustainability capacity important?

Programs at all levels and settings struggle with their sustainability capacity. Unfortunately, when programs are forced to shut down, hard won improvements in public health, clinical care, or social service outcomes can dissolve. To maintain these benefits to society, stakeholders must understand all of the factors that contribute to program sustainability. With knowledge of these critical factors, stakeholders can build program *capacity* for sustainability and position their efforts for long term success.

What is the purpose of this tool?

This tool will enable you to assess your program's current capacity for sustainability across a range of specific organizational and contextual factors. Your responses will identify sustainability strengths and challenges. You can then use results to guide sustainability action planning for your program.

Helpful definitions

This tool has been designed for use with a wide variety of programs, both large and small, across different settings. Given this flexibility, it is important for you to think through how you are defining your program, organization, and community before starting the assessment.

Below are a few definitions of terms that are frequently used throughout the tool.

- Program refers to the set of formal organized activities that you want to sustain over time. Such activities could occur at the local, state, national, or international level and in a variety of settings.
- Organization encompasses all the parent organizations or agencies in which the program is housed. Depending on your program, the organization may refer to a national, state, or local department, a nonprofit organization, a hospital, etc.
- Community refers to the stakeholders who may benefit from or who may guide the program. This could include local residents, organizational leaders, decision-makers, etc. Community does not refer to a specific town or neighborhood.

Copyright 2013. The Program Sustainability Assessment Tool v2 is a copyrighted instrument of Washington University, St Louis, MO. All rights reserved. If you would like more information about the framework or our sustainability assessment tool, visit http://www.sustaintool.org.

Center for Public Health Systems Science
GEORGE WARREN BROWN SCHOOL OF SOCIAL WORK

The name of the program or set of activities I am assessing is:

_____

In the following questions, you will rate your program across a range of specific factors that affect sustainability. Please respond to as many items as possible. If you truly feel you are not able to answer an item, you may select "NA." **For each statement, circle the number that best indicates the extent to which your program has or does the following things.**

Environmental Support: Having a supportive internal and external climate for your program

	To little or no extent						To a very great extent	Not able to answer
1. Champions exist who strongly support the program.	1	2	3	4	5	6	7	NA
2. The program has strong champions with the ability to garner resources.	1	2	3	4	5	6	7	NA
3. The program has leadership support from within the larger organization.	1	2	3	4	5	6	7	NA
4. The program has leadership support from outside of the organization.	1	2	3	4	5	6	7	NA
5. The program has strong public support.	1	2	3	4	5	6	7	NA

Funding Stability: Establishing a consistent financial base for your program

	To little or no extent						To a very great extent	Not able to answer
1. The program exists in a supportive state economic climate.	1	2	3	4	5	6	7	NA
2. The program implements policies to help ensure sustained funding.	1	2	3	4	5	6	7	NA
3. The program is funded through a variety of sources.	1	2	3	4	5	6	7	NA
4. The program has a combination of stable and flexible funding.	1	2	3	4	5	6	7	NA
5. The program has sustained funding.	1	2	3	4	5	6	7	NA

For each statement, circle the number that best indicates the extent to which your program has or does the following things.

Partnerships: Cultivating connections between your program and its stakeholders

	To little or no extent					To a very great extent		Not able to answer
1. Diverse community organizations are invested in the success of the program.	1	2	3	4	5	6	7	NA
2. The program communicates with community leaders.	1	2	3	4	5	6	7	NA
3. Community leaders are involved with the program.	1	2	3	4	5	6	7	NA
4. Community members are passionately committed to the program.	1	2	3	4	5	6	7	NA
5. The community is engaged in the development of program goals.	1	2	3	4	5	6	7	NA

Organizational Capacity: Having the internal support and resources needed to effectively manage your program and its activities

	To little or no extent					To a very great extent		Not able to answer
1. The program is well integrated into the operations of the organization.	1	2	3	4	5	6	7	NA
2. Organizational systems are in place to support the various program needs.	1	2	3	4	5	6	7	NA
3. Leadership effectively articulates the vision of the program to external partners.	1	2	3	4	5	6	7	NA
4. Leadership efficiently manages staff and other resources.	1	2	3	4	5	6	7	NA
5. The program has adequate staff to complete the program's goals.	1	2	3	4	5	6	7	NA

For each statement, circle the number that best indicates the extent to which your program has or does the following things.

Program Evaluation: Assessing your program to inform planning and document results

	To little or no extent						To a very great extent	Not able to answer
1. The program has the capacity for quality program evaluation.	1	2	3	4	5	6	7	NA
2. The program reports short term and intermediate outcomes.	1	2	3	4	5	6	7	NA
3. Evaluation results inform program planning and implementation.	1	2	3	4	5	6	7	NA
4. Program evaluation results are used to demonstrate successes to funders and other key stakeholders.	1	2	3	4	5	6	7	NA
5. The program provides strong evidence to the public that the program works.	1	2	3	4	5	6	7	NA

Program Adaptation: Taking actions that adapt your program to ensure its ongoing effectiveness

	To little or no extent						To a very great extent	Not able to answer
1. The program periodically reviews the evidence base.	1	2	3	4	5	6	7	NA
2. The program adapts strategies as needed.	1	2	3	4	5	6	7	NA
3. The program adapts to new science.	1	2	3	4	5	6	7	NA
4. The program proactively adapts to changes in the environment.	1	2	3	4	5	6	7	NA
5. The program makes decisions about which components are ineffective and should not continue.	1	2	3	4	5	6	7	NA

For each statement, circle the number that best indicates the extent to which your program has or does the following things.

Communications: Strategic communication with stakeholders and the public about your program

	To little or no extent						To a very great extent	Not able to answer
1. The program has communication strategies to secure and maintain public support.	1	2	3	4	5	6	7	NA
2. Program staff communicate the need for the program to the public.	1	2	3	4	5	6	7	NA
3. The program is marketed in a way that generates interest.	1	2	3	4	5	6	7	NA
4. The program increases community awareness of the issue.	1	2	3	4	5	6	7	NA
5. The program demonstrates its value to the public.	1	2	3	4	5	6	7	NA

Strategic Planning: Using processes that guide your program's direction, goals, and strategies

	To little or no extent						To a very great extent	Not able to answer
1. The program plans for future resource needs.	1	2	3	4	5	6	7	NA
2. The program has a long-term financial plan.	1	2	3	4	5	6	7	NA
3. The program has a sustainability plan.	1	2	3	4	5	6	7	NA
4. The program's goals are understood by all stakeholders.	1	2	3	4	5	6	7	NA
5. The program clearly outlines roles and responsibilities for all stakeholders.	1	2	3	4	5	6	7	NA

The *Program Sustainability Assessment Tool* is a copyrighted instrument of Washington University, St Louis MO. All rights reserved. This work is licensed under a Creative Commons Attribution-NonCommercial- ShareAlike License. If you modify this tool, please notify the Center for Public Health Systems Science. By using the *Program Sustainability Assessment Tool* you understand and agree to these terms of use and agree that Washington University bears no responsibility to you or any third party for the consequences of your use of the tool. If you would like more information about how to use this tool with your program or would like to learn about our sustainability workshops and webinars, visit http://www.sustaintool.org. August 2013

Rating Instructions

Once you have completed the Program Sustainability Assessment Tool, transfer your responses to this rating sheet to calculate your average scores. Please record the score for each item (1-7), or write "NA" if you were not able to answer.

		DOMAIN							
		Envirmntl. Support	Funding Stability	Partnerships	Organizational Capacity	Program Evaluation	Program Adaptation	Communications	Strategic Planning
	ITEM 1.								
	ITEM 2.								
	ITEM 3.								
	ITEM 4.								
	ITEM 5.								
Add up your scores in each column. Exclude 'NA'	Domain Total:								
Divide the domain total by the total number of items with a score. Exclude 'NA'	Average Score for Domain:								
Average together all the domain scores	Overall Score:								

Use these results to guide sustainability action planning for your program. The domains with lower average scores indicate areas where your program's capacity for sustainability could be improved.

Copyright 2013. The *Program Sustainability Assessment Tool v2* is a copyrighted instrument of Washington University, St Louis, MO. All rights reserved. If you would like more information about the sustainability framework or the tool, visit http://www.sustaintool.org.

Center for Public Health Systems Science
GEORGE WARREN BROWN SCHOOL OF SOCIAL WORK

Appendix C: Key informant cognitive interview consent and interview protocol

Participant Informed Consent

Study Title and Version: Assessing Sustainability of Public Health Programs in Low Resource Settings (Version 1)

Introduction

What you should know about this study

Thank you for taking the time to speak with me today. You are being asked to join this research study on sustainability of public health programs in low resource settings, which is funded by the RAND Corporation and has been approved by the Mildmay Uganda Research Ethics Committee (MUREC).This consent form explains the research study and your role in it. Please read this form carefully and take as much time as you need. Please also keep in mind that your participation is voluntary. You can choose not to take part in the study, and if you join, you may decide to quit at any time. There will be no penalty if you decide to change your mind or quit the study.

Purpose of research project: The purpose of the project is to identify factors that enable sustainability of public health programs in low resource settings after initial stream of funding has expired. I will be interviewing about 20 professionals such as yourself who work at different levels of public health interventions. Information from this project will help us modify a sustainability assessment tool that can be used to develop strategies that enable sustainability of programs after funding has expired. This interview will be about 60 minutes.

Dissemination: Findings from this study will be put into a monograph dissertation report and may be presented in an academic conference and an academic journal.

Why you are being asked to participate: You are being asked to take part in a research project because of your role in implementing public health programs. You will receive a copy of this consent form.

Procedures: I would like to spend the next hour discussing your experience with the implementation of public health programs like the Maternal Depression Treatment in HIV program **where initial funding came from an external grant or a foreign funder** at your clinic. I would like to ask you some questions about your personal experience with implementing such programs that have sustained after donor / study funding has expired and those that have not sustained. I would also like to audio- record the interview to make sure that I am able to accurately understand your views and experiences. Later this interview will be typed up but we will make sure that your name or any information that could be used to identify you will be removed. The audio recording will be destroyed after we have transcribed the interview.

Risks / discomforts:

There are no direct risks for you in participating in the study.

Benefits: Indirectly, findings of the study may help you to identify gaps and plan for sustainability of programs you implement in the future.

Compensation: Recognizing this is not enough value for your time, we have prepared a $20 USD (74,000 Ugandan Shilling) compensation for your participation.

Protecting data confidentiality: Whatever you tell me here will be used only for the purposes of our research and will not be shared with others at the clinic (including your superiors). I will ensure that what you tell me remains confidential. Later this interview will be typed up, but we will make sure that your name or any information that could be used to identify you will be removed. The audio recording will be destroyed after we have transcribed the interview.

Protecting subject privacy during data collection: No identifying / private information about you will be collected during this interview.

Right to refuse/ withdraw: Please know that your participation is voluntary. If at any time you do not want to answer a question or stop participating in the study, we can stop the interview.

What happens if you leave the study: You may choose to discontinue participation at any time without penalty or loss of benefits.

Who do I ask/call if I have questions or a problem?

For queries related to the study:

Principal Investigator in the US
Ms Mahlet Tebeka
RAND Corporation
mtebeka@rand.org or +001 310 393 0411 (x7200)

Local Uganda Contact
Ms. Ms Harriet Chemusto
Mildmay Uganda
+256 782405487

For queries related to participant rights and welfare:

Research ethics committee office
Ms Mary Odiit
Mildmay Uganda Research Ethics Committee Vice Chairperson
+256 392174236

What does your signature (or thumbprint/mark) on this consent form mean?

Your signature or thumbprint/mark on this form means that you have been informed about this study's purpose, procedures, possible benefits, and risks. You have been given the chance to ask questions before you sign and you have voluntarily agreed to be in this study.

| --- | --- | --- |
| Print name of adult participant | Signature of adult participant/legally Authorized representative | Date |

_____	_____	
Print name of person obtaining Consent	Signature	Date

Questions

1. What is your current role? Can you elaborate on your responsibilities?
   1.1. How involved are you in program implementation?

2. What do you think about sustainability of programs you have been involved with after external funding has expired?

3. Have you ever used strategies to try to sustain a program after funding expires?
   3.1. If so, can you tell me about the strategies you used? *What else?*
   3.2. Were there any challenges in the process of planning and implementing the strategies? *Can you tell me more?*

4. Think of programs that were first funded by an external donor or a grant and ***WERE*** successfully continued by the clinic after the funding expired, if there have been any. What aspects of the program do you think enabled continuation of the program after the funding expired? *Can you tell me more?*
   4.1. Were there particular stakeholders that helped drive sustainability of the program? *Any others?*

5. Now think of programs that were first funded by an external donor or a grant and ***WERE NOT*** successfully continued by the clinic after the funding expired, if there have been any. What aspects of the program do you think made it hard to continue the program after the funding expired?

PSAT Review*[tool attached as separate file]*

Thank you. Now I would like to show you a tool that was designed to assess a program's

ability to sustain. For this part of the interview, I would like us to go through each of the items on the tool and get your feedback on the content.

6. First, do you think a tool like this may be useful for someone with your roles and responsibilities when you implement a program?
   6.1. If so, can you describe in what ways? If not, can you describe why the tool wouldn't be useful?

7. Do you think that the first main category/scale on the tool, environmental support, and the provided definition make sense for the context you work in?
   7.1. Would you change the sub-scales in this category in any way? May be the wording of items? Or the items included? If so, why?
   7.2. Are there any sub-scales you would remove for the context you work in? If so, why?
   7.3. Can you think of any items that are relevant for your work and would fit in this category but not addressed in the tool? (Tell me about this.)

8. Do you think the next main category/scale on the tool, funding stability, and the provided definition make sense for the context you work in?
   8.1. Would you change the sub-scales in this category in any way? May be the wording of items? Or the items included? If so, why?
   8.2. Are there any sub-scales you would remove for the context you work in? If so, why?
   8.3. Can you think of any items that are relevant for your work and would fit in this category but not addressed in the tool? (Tell me about this.)

9. Do you think the next main category/scale on the tool, partnerships, and the provided definition make sense for the context you work in?
   9.1. Would you change the sub-scales in this category in any way? May be the wording of items? Or the items included? If so, why?
   9.2. Are there any sub-scales you would remove for the context you work in? If so,

why?

9.3. Can you think of any items that are relevant for your work and would fit in this category but not addressed in the tool? (Tell me about this.)

10. Do you think the next main category/scale on the tool, organizational capacity, and the provided definition make sense for the context you work in?
    10.1. Would you change the sub-scales in this category in any way? May be the wording of items? Or the items included? If so, why?
    10.2. Are there any sub-scales you would remove for the context you work in? If so, why?
    10.3. Can you think of any items that are relevant for your work and would fit in this category but not addressed in the tool? (Tell me about this.)

11. Do you think the next main category/scale on the tool, program evaluation, and the provided definition make sense for the context you work in?
    11.1. Would you change the sub-scales in this category in any way? May be the wording of items? Or the items included? If so, why?
    11.2. Are there any sub-scales you would remove for the context you work in? If so, why?
    11.3. Can you think of any items that are relevant for your work and would fit in this category but not addressed in the tool? (Tell me about this.)

12. Do you think the next main category/scale on the tool, program adaptation, and the provided definition make sense for the context you work in?
    12.1. Would you change the sub-scales in this category in any way? May be the wording of items? Or the items included? If so, why?
    12.2. Are there any sub-scales you would remove for the context you work in? If so, why?
    12.3. Can you think of any items that are relevant for your work and would fit in this category but not addressed in the tool? (Tell me about this.)

13. Do you think the next main category/scale on the tool, communications, and the provided definition make sense for the context you work in?
    13.1. Would you change the sub-scales in this category in any way? May be the wording of items? Or the items included? If so, why?
    13.2. Are there any sub-scales you would remove for the context you work in? If so, why?
    13.3. Can you think of any items that are relevant for your work and would fit in this category but not addressed in the tool? (Tell me about this.)

14. Do you think the next main category/scale on the tool, strategic planning, and the provided definition make sense for the context you work in?
    14.1. Would you change the sub-scales in this category in any way? May be the wording of items? Or the items included? If so, why?
    14.2. Are there any sub-scales you would remove for the context you work in? If so, why?
    14.3. Can you think of any items that are relevant for your work and would fit in this category but not addressed in the tool? (Tell me about this.)

15. Now think about the entirety of the tool. Can you think of a category that is missing on the tool? Or something else that comes to mind that might be relevant?(Tell me about this).
    15.1. What kind of items would be appropriate for the category you mentioned?

16. We have come to the end of this interview. Before we wrap up, is there anything I did not ask you about you

Appendix D: Survey consent and survey questions

Participant Informed Consent

Study Title: Assessing Sustainability of Public Health Programs in Low Resource Settings

Researcher: Mahlet Gizaw, MS, MPhil, PhD Candidate

We're inviting you to take a survey for research. This survey is completely voluntary. There are no negative consequences if you don't want to take it. If you start the survey, you can always change your mind and stop at any time.

Purpose of study: The purpose of this study is to understand determinants of program sustainability for public health in sub-Saharan Africa and to adopt a sustainability assessment tool for the sub-Saharan African setting.

Contents of the survey: This survey will ask questions about a public health intervention program you participated in implementing. It includes questions about current status of the program, the context when the program was implemented, key stakeholders during implementation, and key strategies program leadership used to sustain the program. The survey will take about 30 minutes.

Risks: There are no direct risks for you in participating in the study.

Possible benefits: **:** Indirectly, findings of the study may help you to identify gaps and plan for sustainability of programs you implement in the future.

Study participants: Public health intervention funders and implementers who worked on interventions in sub-Saharan Africa will be asked to participate in this survey.

How long will it take? The survey will take 30 minutes to complete.

Costs: None

Compensation: You will receive a compensation of $100 amazon gift card upon completion of the survey.

Future research: Your data won't be used or shared for any future research studies.

Funding source: Pardee RAND Graduate School

Confidentiality and Data Security: No identifying information will be kept in this survey.

Questions about research, complaints, or problems? Contact the principal investigator, Mahlet Gizaw at (310) 393-0411 Ext: 7200 or mtebeka@rand.org

Questions about you rights as a research participant, complaints, or problems: Contact RAND IRB at

Please print or save this screen if you want to be able to access the information later.
IRB #: 2019-0960
IRB Approval Date: [insert once received]

Agreement to participate: Your participation is completely voluntary, and you can withdraw at any time.
To take this survey, you must be:

- A principal investigator or program lead for a public health intervention in sub-Saharan Africa
- The program you lead completed implementation in the sub–Saharan African setting ≥ 1 year ago

If you meet these criteria and would like to take the survey, click the button below to start.

Background information

In this section, we will ask you about background information on the program indicated in the recruitment email you received. **Think of a program you were involved in that completed implementation is sub–Saharan Africa ≥ 1 year ago when answering ALL the following questions.**

1. What area of public health did the intervention program address?
   _____
2. What country (countries) was the intervention program implemented in?
   _____
3. When did the intervention program start implementation?
   __MM /YYYY___
4. When did the intervention program complete implementation?
   __MM/ YYYY___
5. What was your role during program implementation? (Check all that apply)
   a. Securing funding
   b. Making decisions about implementation activities
   c. Making decisions about funding allocation
   d. Other: _____
6. Are any program activities still going on currently?
   a. Yes
   b. No

If yes on 6 go to 7. Otherwise skip to 8

7. What proportion of program activities have continued since completion of

implementation?

a. < 50 %
b. 50% - 90%
c. >90%

8. Did the program meet its any outcome goals?
    a. Yes
    b. No

If yes on 8 go to 9. Otherwise skip to next section

9. Have the outcome goals reached at the end of the program continued too today?
    a. Yes
    b. No
    c. Don’t know

Sustainability Assessment

In the following part of the survey, we will ask you questions about your program's capacity for sustainability at time of implementation. We define program sustainability as the ability to maintain programming and its benefits over time. There will be a total of 8 sections with questions about factors relevant to your program.

In the first section we will ask about **environmental support**. This refers to a supportive internal and external setting for your program.

During implementation of your program to what extent would you agree with the following statements being true?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. There were advocates who support the program.	1	2	3	4	5
2. The program had advocates with the ability to garner resources.	1	2	3	4	5
3. The program had leadership support from within the organization.	1	2	3	4	5
4. The program had leadership support from outside of the organization.	1	2	3	4	5
5. The program had support from local stakeholders.	1	2	3	4	5

In the next section we will ask about **funding stability.** This refers to a consistent financial base for your program.

During implementation of your program to what extent would you agree with the following statements being true?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. The program existed in a supportive **economic** setting.	**1**	**2**	**3**	**4**	**5**
2. The program existed in a supportive **socio-political** setting.	**1**	**2**	**3**	**4**	**5**
3. The program implemented strategies to help ensure sustained funding beyond initial funding cycle.	**1**	**2**	**3**	**4**	**5**
4. The program was funded through **balanced** contribution from a **variety** of sources.	**1**	**2**	**3**	**4**	**5**
5. The program had **stable** funding beyond initial funding cycle.	**1**	**2**	**3**	**4**	**5**
6. The program had **flexible, unrestricted** funding beyond initial funding cycle.	**1**	**2**	**3**	**4**	**5**

In the next section we will ask about **partnerships.** This refers to connections between your program and its stakeholders.

During implementation of your program to what extent would you agree with the following statements being true?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. Diverse organizations (government, private, non-profit and community organizations) were **invested in the success** of the program.	**1**	**2**	**3**	**4**	**5**
2. The program **communicated** with local leaders from diverse organizations (government, private, non-profit and community organizations).	**1**	**2**	**3**	**4**	**5**
3. Diverse organizations (government, private, non-profit and community organizations) were engaged in the **development of program goals**.	**1**	**2**	**3**	**4**	**5**
4. Local leaders from diverse organizations (government, private, non-profit and community organizations) were engaged in the **development of program activities**.	**1**	**2**	**3**	**4**	**5**
5. Diverse organizations (government, private, non-profit and community organizations) were **engaged in implementation of program activities.**	**1**	**2**	**3**	**4**	**5**

In the next section we will ask about **organizational capacity.** This refers to the internal support and resources needed to effectively manage your program and its activities.

During implementation of your program to what extent would you agree with the following statements being true?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. The program was integrated into the operations of the organization.	1	2	3	4	5
2. Organizational systems were in place to support the various program needs.	1	2	3	4	5
3. Leadership effectively articulated the vision ofthe program to **external partners.**	1	2	3	4	5
4. Leadership effectively articulated the vision of the program to **internal staff**.	1	2	3	4	5
5. Leadership effectively managed staff and other available resources.	1	2	3	4	5
6. Leadership had appropriate succession plans in place.	1	2	3	4	5
7. The program had **adequately trained staff** to complete program activities.	1	2	3	4	5
8. The program had **motivated staff** to complete the program's goals.	1	2	3	4	5

In the next section we will ask about **program evaluation.** This refers to assessment of the program to inform planning and document results.

During implementation of your program to what extent would you agree with the following statements being true?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. The program had the capacity for quality program evaluation.	1	2	3	4	5
2. The program reported short-term, intermediate, and long-term change in outcomes compared to baseline.	1	2	3	4	5
3. The program evaluated implementation processes.	1	2	3	4	5
4. Evaluation results informed program planning and implementation.	1	2	3	4	5
5. Program evaluation results were used to demonstrate successes to funders and other key stakeholders.	1	2	3	4	5
6. The program provided evidence to the public that the program worked.	1	2	3	4	5

In the next section we will ask about **program adaptation.** This refers to taking actions that adjust your program to ensure its ongoing effectiveness.

During implementation of your program to what extent would you agree with the following statements being true?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. The program periodically reviewed the evidence base.	1	2	3	4	5
2. The program **adapted to new evidence**.	1	2	3	4	5
3. The program adapted **strategies** as needed.	1	2	3	4	5
4. The program proactively **adapted to changes in the environment**.	1	2	3	4	5
5. The program made decisions about which components are ineffective and should not continue.	1	2	3	4	5

In the next section we will ask about **communication.** This refers to strategic exchange of information with stakeholders and the public about your program.

During implementation of your program to what extent would you agree with the following statements being true?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. The program had communication strategies to secure and maintain support from local stakeholders (government, private, non-profit and community organizations).	1	2	3	4	5
2 Program communicated the need for the program to the public.	1	2	3	4	5
3. The program was marketed in a way that generates interest.	1	2	3	4	5
4. The program increased community awareness of the issue.	1	2	3	4	5
5. The program demonstrated its value to local stakeholders (government, private, non-profit and community organizations).	1	2	3	4	5
6. The program had a mechanism in place to communicate findings/lessons learned regularly	1	2	3	4	5

In the next section we will ask about **strategic planning.** This refers to using processes that guide your program's direction, goals, and approaches.

During implementation of your program to what extent would you agree with the following statements being true?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. The program had a long-term **financial plan**.	1	2	3	4	5
2. The program planned for **other long-term resource needs**.	1	2	3	4	5
3. The program had a sustainability plan.	1	2	3	4	5
4. The program's goals were understood by stakeholders (government, private, non-profit and community organizations).	1	2	3	4	5
5. The program clearly outlined roles andresponsibilities for all stakeholders (government, private, non-profit and community organizations).	1	2	3	4	5
6. The program involved key stakeholders (government, private, non-profit and community organizations) in strategic planning.	1	2	3	4	5
7. The program conducted risk assessments to account for changing settings.	1	2	3	4	5

Tool feedback

In the final part of the survey, we will ask you questions about your thoughts on the sustainability section presented above.

1. Do you think a tool with questions asked in this survey would have been helpful to have to help with implementation of the program?
    a. Yes
    b. No

2. If yes, how do you think it would have been helpful?

    _____

Thank you for your time!

Appendix E: Exploratory factor analysis

Exploratory factor analysis

Exploratory factor analysis suggests that there are between 6 and 13 key categories (themes) in the modified PSAT. The Scree plot demonstrates the presence of 6 possible factors (Figure 13). On the other hand, bootstrapping and eigen value approaches yielded 13 factors. With the current version, the tool has 8 main categories (factors), which falls within the range of factors observed using exploratory factor analysis. In addition, the way each factor loaded in the 6, 8 and 13 factor solutions showed that items in the funding category, program adaptation category, communication category and strategic planning category loaded onto separate factors, as expected (Appendix E). However, the items in the environmental support, organizational capacity and partnership categories did not load onto separate factors. In addition, the first item in the environmental support category did not load into any of the factors in the 6-factor solution and loaded negatively in the other two solutions. This suggests that the first item in the environmental support category may not add information to the tool and could be removed.

Figure 13: Scree plot

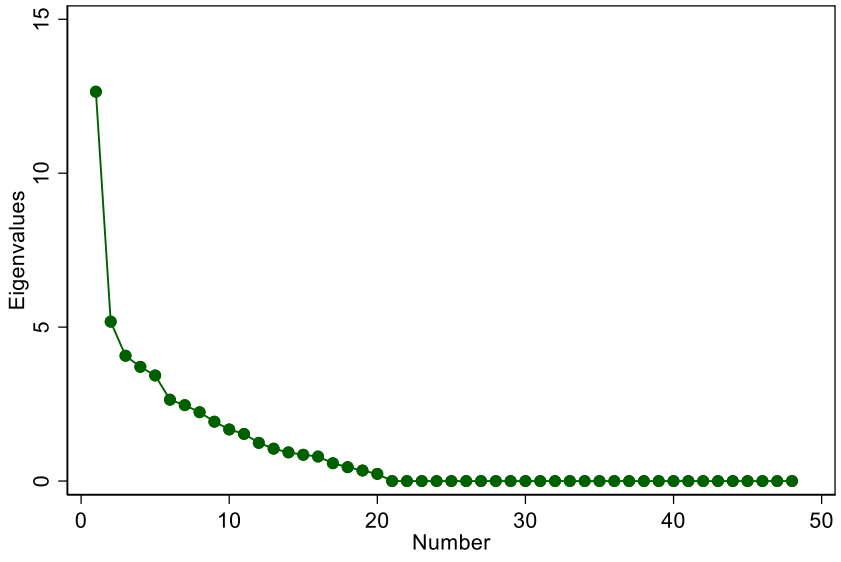


Table 11: Exploratory Factor Analysis Loadings for 6 Factor Solution

Variable	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Uniqueness
env_supp_1							0.7945
env_supp_2					0.5402		0.5640
env_supp_3	0.7221						0.2039
env_supp_4	0.8876						0.1615
env_supp_5	0.8214						0.1998
funding_1					0.6086	0.5041	0.3554
funding_2				0.4565		0.5781	0.2630
funding_3	0.5715			0.4896			0.2625
funding_4				0.5876			0.4302
funding_5				0.7654			0.2206
funding_6				0.7295			0.3305
partner_1		0.5709		0.7068			0.1487
partner_2	0.5621					-0.5366	0.2257
partner_3	0.6181		0.4502				0.3093
partner_4	0.4908		0.4937				0.4338
partner_5			0.4687	0.4488			0.3860
org_cap_1					0.8484		0.2326
org_cap_2			0.5385		0.4214		0.2997
org_cap_3	0.6067						0.3466
org_cap_4	0.4839						0.4578
org_cap_5			0.4905		0.4724		0.4303
org_cap_6						-0.4226	0.4399
org_cap_7						0.6509	0.4081
org_cap_8						0.5406	0.3826
prog_eval_1							0.5749
prog_eval_2	0.5301					0.4811	0.3940
prog_eval_3			-0.5235	0.4987			0.3737
prog_eval_4		0.7405					0.2580
prog_eval_5				0.5518			0.5846
prog_eval_6		0.6062	0.4096				0.1822
prog_adapt_1		0.8955					0.1569
prog_adapt_2		0.7162					0.2966
prog_adapt_3	0.5332	0.4361					0.4935
prog_adapt_4		0.7846					0.1963
prog_adapt_5		0.4129			-0.4745	0.4772	0.2592
comm_1		0.6467	0.4900				0.1927
comm_2		0.4381	0.6885				0.2993
comm_3			0.9061				0.1136
comm_4			0.7039		-0.4473		0.2228
comm_5			0.6442				0.4742
comm_6	0.7254						0.2171
strateg_1					0.5548		0.4075
strateg_2	0.4629				0.5747		0.2014
strateg_3	0.7160			0.4328			0.1365
strateg_4	0.4209	0.4379					0.6006
strateg_5	0.4138				0.4478		0.5420
strateg_6	0.4306	0.5135					0.5080
strateg_7	0.5590				0.5155		0.3483

(blanks represent abs(loading)<.4)

Table 12: Exploratory Factor Analysis Loadings for 8 Factor Solution

Variable	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Uniqueness
env_supp_1								-0.4787	0.5206
env_supp_2					0.5537				0.5474
env_supp_3	0.7135								0.1213
env_supp_4	0.8544								0.1292
env_supp_5	0.8742								0.1036
funding_1							-0.6945		0.2607
funding_2		0.5805							0.1646
funding_3	0.5480	0.6256							0.2526
funding_4		0.8098							0.2601
funding_5		0.6394							0.2030
funding_6		0.8498							0.2183
partner_1		0.4232				0.6196			0.1335
partner_2	0.5442						0.4400		0.2234
partner_3	0.6320		0.4607						0.2238
partner_4	0.4737		0.4669						0.4328
partner_5		0.5246							0.2419
org_cap_1					0.7861				0.1928
org_cap_2		0.4047	0.5110						0.2604
org_cap_3	0.7001								0.1713
org_cap_4	0.5763								0.3595
org_cap_5			0.5698						0.3164
org_cap_6		0.5143					0.6087		0.1513
org_cap_7								0.8488	0.2429
org_cap_8			0.4038					0.6788	0.3105
prog_eval_1						0.8500			0.2100
prog_eval_2	0.4229							0.5759	0.2887
prog_eval_3			-0.4450			0.5397			0.3590
prog_eval_4				0.6196		0.4818			0.2262
prog_eval_5						0.5057			0.4702
prog_eval_6			0.5033	0.4004			0.4275		0.1736
prog_adapt_1				0.8392					0.1226
prog_adapt_2				0.8951					0.0729
prog_adapt_3	0.5318			0.6037					0.2682
prog_adapt_4				0.6875					0.1776
prog_adapt_5				0.4115	-0.6630				0.2243
comm_1			0.5508	0.5397					0.1642
comm_2			0.6598	0.5250					0.1475
comm_3			0.8691						0.0922
comm_4			0.6323		-0.5270				0.1779
comm_5			0.7377						0.2198
comm_6	0.6634								0.1823
strateg_1	0.4099	0.4798		0.4003					0.2565
strateg_2	0.4265	0.5196			0.4174				0.1807
strateg_3	0.7269								0.1007
strateg_4	0.5100								0.4513
strateg_5									0.5187
strateg_6							0.7499		0.1655
strateg_7	0.5442				0.4187				0.3256

(blanks represent abs(loading)<.4)

Table 13: Exploratory Factor Analysis Loadings for 13 Factor Solution

Variable	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9	Factor10	Factor11	Factor12	Factor13	Uniqueness
env_supp_1											-0.8602			0.1431
env_supp_2							0.7148							0.0850
env_supp_3	0.7721													0.0276
env_supp_4	0.4287		0.7921											0.0610
env_supp_5	0.4335		0.7142											0.0462
funding_1							0.8735							0.0277
funding_2										0.7156				0.0382
funding_3	0.6450			0.4670										0.0471
funding_4				0.8862										0.1250
funding_5	0.4466			0.5397										0.1115
funding_6				0.9261										0.0296
partner_1		0.4413		0.5302					0.5139					0.0606
partner_2								0.4973		-0.4305				0.1009
partner_3			0.7426											0.1010
partner_4			0.4134					0.6177						0.0578
partner_5				0.4818	0.4395									0.1413
org_cap_1							0.4699						0.4800	0.0644
org_cap_2												0.4596		0.1344
org_cap_3	0.8453													0.0171
org_cap_4	0.4776		0.4686											0.1269
org_cap_5												0.6133		0.2577
org_cap_6				0.4976							0.4880			0.0687
org_cap_7						0.9658								0.0196
org_cap_8						0.7981								0.1097
prog_eval_1									0.9389					0.0663
prog_eval_2						0.4592						-0.4777		0.0459
prog_eval_3					-0.4192									0.2554
prog_eval_4		0.5956							0.5254					0.0808
prog_eval_5								0.8922						0.0512
prog_eval_6		0.5318			0.4702									0.1104
prog_adapt_1		0.8780												0.0349
prog_adapt_2		0.7775												0.0367
prog_adapt_3	0.5416	0.5561												0.1646
prog_adapt_4		0.7436												0.1020
prog_adapt_5										0.7968				0.0812
comm_1		0.6561			0.5332									0.0683
comm_2		0.4921			0.7330									0.0643
comm_3					0.8665									0.0531
comm_4					0.6889									0.1062
comm_5					0.7691				0.4392					0.0166
comm_6			0.7773											0.1106
strateg_1	0.6058			0.4612										0.0537
strateg_2	0.5794													0.1075
strateg_3	0.6752		0.4362											0.0508
strateg_4	0.4824	0.4649												0.0858
strateg_5													0.7257	0.2127
strateg_6		0.4937	0.5890											0.0506
strateg_7	0.5835													0.1776