An Evaluation

Analyzing the Cost-Effectiveness of Interventions to Benefit Orphans and Vulnerable Children: Evidence from Kenya and Tanzania

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Acknowledgements

Acronyms

AIDS	acquired immune deficiency syndrome
CRS	Catholic Relief Services
HIV	human immunodeficiency virus
IAP	Integrated AIDS Program-Thika
OVC	orphans and vulnerable children
PLWHA	people living with HIV and AIDS
SILC	savings and internal lending communities
TSA	The Salvation Army
USAID	U.S. Agency for International Development

Summary

In an attempt to improve the lives of orphans and vulnerable children (OVC) in sub-Saharan Africa, the U.S. President's Emergency Plan for AIDS Relief provides funding to programs that supply wide-ranging services to OVC and their families. While the programs have a similar objective – the improvement of OVC well-being – they may differ substantially in the types of services they provide: educational support, vocational training, or other income generating skills; food aid; support groups for guardians; home visiting that includes basic psychosocial support or assistance with anti-retroviral therapy; HIV education, recreational opportunities, and individual counseling for children. Their approaches may involve – individually or jointly – direct support to OVC, indirect support to OVC guardians, or more widespread support to communities as a whole. In order to provide some further insight on the success of these programs, this paper attempts a rudimentary cost-effectiveness analysis by linking measures of intervention costs for four OVC programs in Kenya and Tanzania to measures of program outcomes. These results provide some evidence that investments in OVC programs – particularly school-based HIV education and counseling for children and savings and internal lending committees (SILC) for guardians – can achieve improvements in their well-being at a fairly low cost per beneficiary.

Introduction

In sub-Saharan Africa, an estimated 12 million children 17 years of age or younger have lost one or both parents to AIDS, and many more live with a chronically ill parent or guardian.[1] Children affected by HIV and AIDS often face intensified poverty; inadequate food, shelter, and medical care; stigma and discrimination; mental distress; and other challenges. Current programs for orphans and vulnerable children (OVC) focus on these multiple hardships by working towards multiple disparate goals for children and their guardians – improving mental health; increasing future income-earning prospects through improved educational and income-generation opportunities; providing in-kind assistance to their households; and ensuring good health through antiretroviral therapy and other medical care. Despite the widespread recognition of the scale of the problems confronting these children and the numerous programs to address them, there is a dearth of evidence as to what types of programs best improve the well-being of OVC and at what cost.

To address this evidence gap, MEASURE Evaluation received funding from the U.S. President's Emergency Plan for AIDS Relief to conduct evaluations of four multifaceted programs for OVC in East Africa: the Integrated AIDS Program (IAP) in Kenya; the Catholic Relief Services (CRS) Kilifi OVC Project in Kenya; Allamano Home-Based Care in Tanzania; and The Salvation Army (TSA) Mama Mkubwa Program in Tanzania. For each of these programs, the outcome evaluation results and further details of the studies can be found elsewhere;[2-5] this paper examines the cost-effectiveness of these initiatives.

Each of the programs included in this study focus on improving the well-being of OVC and therefore have many common elements, such as home visiting, counseling, educational support, and support groups for guardians. But they differ in the nature and intensity of support that they provide to OVC and their guardians. Because of this variation, these programs may also differ in their success in improving OVC well-being, as well as differ in the costs of program implementation.

Information on variations in outcomes and costs for the different types of OVC programs can be used to identify best practices and "best buys." The purpose of this study is, therefore, to analyze the performance of each of these purposively-chosen programs in improving the well-being – directly or indirectly – of OVC at given levels of program expenditures. Program effectiveness is assessed using multivariate regression analysis to compare outcomes among children participating in programs and those who are not covered by programs (though likely will be in the future) – noting that the evaluation designs are not such that conclusive measures of impact or effectiveness can be definitively ascertained. Similar analyses for the guardians of children in these different categories are also conducted. Having determined which program interventions have the largest associations with better outcomes, measures of effectiveness are linked with data on the costs of implementing the OVC program interventions in the manner of a cost-effectiveness analysis.

Methods and Key Findings

Purpose and Components of Cost-Effectiveness Analysis

Program evaluators often analyze interventions and programs to determine which ones produce the largest improvements in behaviors and outcomes. Not surprisingly, they find that more intensive programs – programs with more training, more resources, more support – often lead to better outcomes than less intensive programs. Such results should be far from surprising. In everyday life, if we buy an organic tomato instead of a regular tomato, we expect it to taste better. If we buy a luxury car instead of an economy model, we expect it to offer more comforts. In short, if we spend more, we expect to get more. This leads to a very important question: How does one decide whether spending more on something – different components of an OVC program in this case – is worth it? Specifically, what is the incremental gain in OVC well-being from spending on one program or program component relative to another? Answering such questions is extremely important.

If our goal is to maximize the well-being of OVC, we need to have some way of knowing that we are getting the most out of our money.

One way to do so is to use economic evaluation tools, such as cost-effectiveness analysis. Cost-effectiveness analysis can help to prioritize activities or interventions intended to improve health or well-being by ranking interventions based on the ratio of the costs to measures of intervention effectiveness. Abstracting from other objectives such as equity, interventions with lower costs per unit of effectiveness are generally preferred to those with higher costs per unit of effectiveness. This may seem fairly straightforward, but rigorous analyses of cost-effectiveness must follow common methodologies and adhere to well-defined standards. Some of the key components of a rigorous analysis are summarized in Figure 1. These criteria are used to describe and evaluate the cost-effectiveness of the interventions conducted by the four OVC programs in Kenya and Tanzania.

General

- **definition of intervention (and alternatives including absence of any intervention)**
- **country and time period**
- **perspective (provider/societal/patient/client)**
- **discount rate for cost/consequences incurred in different time periods**

Costs

- **types of costs (capital/recurrent)**
- **units and unit costs (including adjustments for non-market items)**
- **costing methods (allocation of shared costs, amortization)**

Effectiveness

- **outcomes (e.g., disability-adjusted life years, quality-adjusted life years, other)**
- **type of study (e.g., randomized control trial, meta-analysis, behavioral/observational, decision-analytic modeling)**
- **sensitivity analysis (using ranges of values, bootstrap methods)**
- **clear description of assumptions**
- **generalizability and replicability**

Figure 1. **Key components considered in conducting cost-effectiveness analysis.[6-8]**

Defining an Intervention

As a first step, appropriate use of cost-effectiveness analysis requires a clear definition of an intervention and its intended outcomes. The different components of the four OVC programs explored in this analysis are described in Figure 2. Each program aims to improve OVC and guardian well-being in several key domains — physical health, psychosocial well-being, educational attainment, HIV education and prevention, and income supplementation and food security. The different program interventions can also generally be classified as those that improve OVC well-being directly (e.g., counseling and support, health care, education) and those that improve OVC well-being indirectly (e.g., home-based care or support groups for guardians, household income supplementation).

Kenya

Community Based HIV/AIDS Prevention, Care and Support Program implemented by Pathfinder and Integrated AIDS Program (Thika District)

- home visiting and home-based care by trained volunteers
- educational support for OVC
- income generation for PLWHA ("merry-go-round" loans)
- household food support
- school-based HIV education

Kilifi OVC Project Implemented by Catholic Relief Services (Kilifi District)

- home visiting and support from trained volunteers
- support for OVC guardians
- educational support for OVC
- income generation for PLWHA guardians ("merry-go-round" loans)
- household food support
- school-based HIV education
- individual counseling for OVC

Tanzania

Tumaini Project Implemented by Allamano, CARE Tumaini, and Family Health International (Iringa Region)

- home visiting and home-based care by trained volunteers
- kids' clubs for OVC
- educational support for OVC
- income generation for OVC guardians (gardening and livestock training)
- household food support
- individual counseling for OVC

Mama Mkubwa and Kids' Clubs Implemented by The Salvation Army (Mbeya Region)

- home visiting and support from trained volunteers
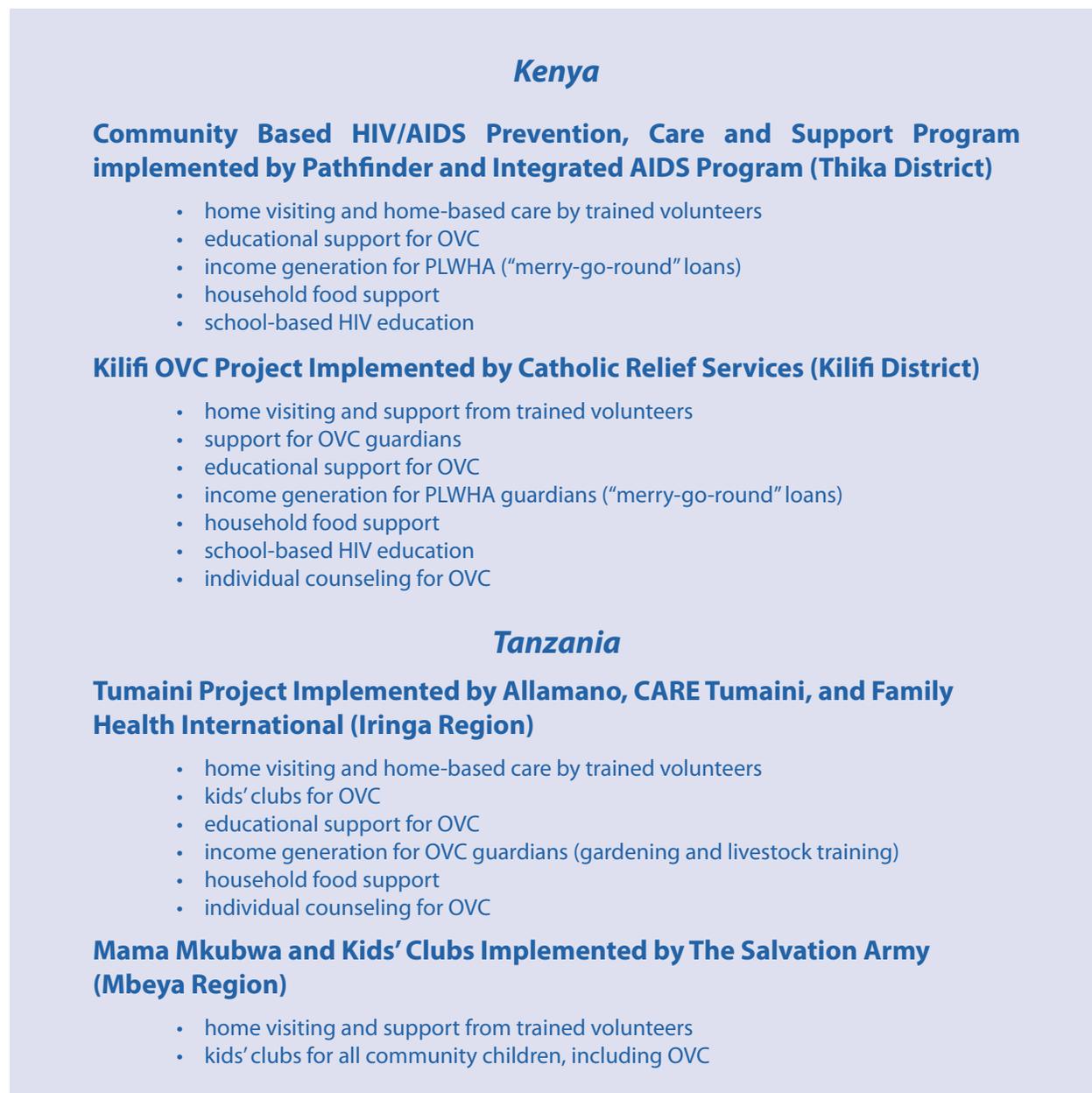- kids' clubs for all community children, including OVC

Figure 2. Overview of the integration strategies investigated across the four programs (all rural environments).

Home visiting is the most predominant intervention across all programs and generally includes monitoring the health status of OVC and guardians, including people living with HIV and AIDS (PLWHA), and sometimes treatment of health ailments. Programs may also provide some form of counseling or health education during these visits. Three of the programs in this study also provide some sort of educational support (e.g., school fees, uniforms, books, supplies), though they range in the extent and frequency of such support. Two programs offer school-based HIV prevention initiatives. Psychosocial interventions can include kids' clubs, guardian support groups, counseling from trained professionals, or home visits by volunteers. To promote poverty alleviation, several programs provide vocational training, often in gardening or micro-finance. To address immediate economic hardships, several programs also provide direct food support.

It is recognized that a single intervention can affect outcomes in multiple domains, such as physical health or psychosocial well-being. For example, when Allamano staff in Tanzania visit homes of OVC and PLWHA, they carry home-based care kits that allow them to address basic health needs and treatment of PLWHA. They may also provide counseling and support, which is intended to improve or maintain psychosocial well-being. Or they may use these visits as an opportunity to provide education or even distribute resources, such as food. These visits therefore have multiple outcomes — better physical and mental health, increased knowledge, and better short- and long-term economic well-being.

This has important implications for the cost-effectiveness analysis. First, when programs have multiple goals and therefore multiple outcomes (e.g., reductions in illness, improved mental health, better economic well-being) evaluators must decide whether to aggregate outcomes into a common metric or disaggregate costs across multiple outcomes. For example, home visitors may provide psychosocial support, basic medical care, and advice on income generating activities, each of which affects very different aspects of well-being. A researcher could attempt to calculate the share of resources supporting each of these outcomes and assign an appropriate unit cost. Alternatively, the researcher could attempt to link each outcome to a common metric — such as the monetary value of improvements in health due to a specific component of the intervention. In this analysis, a simplifying assumption is made; i.e., the benefits of an intervention accrue to multiple specifically identified outcomes. In the case of home visiting, for example, the benefits of home visiting are examined in terms of how it improves guardians' physical or psychosocial well-being and children's psychosocial well-being. Further, in some instances, one domain can include multiple indicators or just one (i.e., psychosocial includes multiple indicators at the child and guardian level, and food security is assessed with only one guardian-reported measure).

Cost Analysis

Quantifying Inputs and Assigning Resource Values — The costing of interventions for OVC and their guardians, in general, is not methodologically distinct from the costing of any other medical or public health intervention and necessarily involves assigning appropriate values to the resources used in an intervention and its relevant alternatives. The cost analyses of these OVC programs involves the following: the quantification of inputs and assignment of appropriate resource values; the apportionment of costs that are shared across outcomes (e.g. overhead); discounting future costs and assigning appropriate annualized costs to capital inputs; valuing resources when market prices deviate from the actual value of resources; and valuing non-program costs to individuals and society.

Data on program resources were collected from multiple sources, including workplans, budgets, and expenditure summaries. Program documents and interviews with program personnel also helped

to identify the expected number of beneficiaries for each intervention.

In this analysis, we utilize an ingredients approach,[6] quantifying the current value of recurrent inputs and assigning appropriate annual values for capital inputs. The key cost components of these programs vary across the nature of the intervention, but generally consist of the costs of start-up and program development and the recurrent inputs associated with intervention delivery – salaries, materials, transportation. In all cases, capital inputs, inputs whose useful lives extend over multiple periods (e.g. vehicles, buildings, equipment), were valued using an annual cost, generally the purchase price divided by the expected years of life or the average annual market rental rate for comparable inputs.

Most of the programs considered here involve administrative and overhead costs supporting multiple outcomes. Overhead includes such items as rented inputs (e.g. office space or equipment); supplies, salaries and other personnel remuneration; and purchases of capital inputs such as vehicles, office equipment or buildings. These costs are apportioned using step-down costing methods procedures.[6]

Costs per Beneficiary — The costs per beneficiary for a selected set of interventions for which cost data were available are summarized in Table 1. Identifying these per beneficiary costs is important; but in the later sections of this paper, when cost-effectiveness ratios are calculated, it is not the cost per beneficiary that matters but rather the cost per incremental increase in an outcome. An intervention with a high cost per beneficiary can be deemed a better use of program funds if it is proportionally more effective than a cheaper intervention. Alternatively, inexpensive interventions that produce no improvement in an outcome are not cost-effective and are a poor use of scarce programmatic funds.

A wide range of costs for similar interventions can be seen across the programs, as for instance, kids' clubs were only $1.96 per beneficiary in one program (Allamano), but $14.08 per beneficiary in another (TSA), with the latter estimate including the value of kids' club registration books and kits, and time of multiple volunteers. Home visiting also varied from $3.55 per beneficiary (CRS) to $89.68 per beneficiary (Allamano). The principal difference in the costs was the addition of drugs for the Tanzania home visiting programs.

The costs of income generating activities also varied considerably. Training in gardening under the Allamano program cost approximately $89 per beneficiary, while support in income generating activities for IAP cost approximately $24 per beneficiary with the principal difference being Allamano's provision of capital inputs, such as wheelbarrows, spades, and other equipment. Training in savings and internal lending committees (SILC) under the CRS OVC project was fairly inexpensive, only $2.29 per beneficiary. Food supplementation also ranged from less than two dollars for two programs, IAP and CRS, $1.36 to $32.36 for Allamano. This variation was principally due to the fact that food was provided sporadically by the less expensive programs and consistently distributed by Allamano.

Educational support could also be quite expensive per beneficiary, depending upon whether or not programs paid school fees and which other supplies (e.g. uniforms, books, etc.) were included. Educational support ranged from $17.23 per beneficiary for the CRS OVC project to $141.32 for secondary school students supported by Allamano, which generally paid student fees for these students.

Other interventions were fairly inexpensive. Individual counseling for children came at a cost of only $0.21 per beneficiary under the CRS OVC project. School-based HIV education was very inexpensive for the two programs under which it was offered – $1.51 per beneficiary for IAP and $0.14 per beneficiary for CRS. Guardian support groups were $5.65 per beneficiary for IAP and $0.44 per beneficiary under the CRS OVC project.

Table 1.   **Costs Per Beneficiary of OVC Interventions in Kenya and Tanzania**

	Kenya		Tanzania	
	Integrated AIDS Program-Thika	**Catholic Relief Services**	**Allamano**	**The Salvation Army**
Kids' clubs	*NA*	*NA*	$1.96	$14.08
Individual counseling	*NA*	$0.21	*NA*	*NA*
Educational support	$68.18	$17.23	nursery $31.04 primary $18.44 secondary $141.32	*NA*
School-based HIV education	$1.51	$0.14	*NA*	*NA*
Home visiting	$21.54	$3.55	$89.68	21.54
Guardian support groups	$5.65	$0.44	*NA*	*NA*
Food support	$1.36	$1.53	$32.36	*NA*
Income generation	$23.52	$2.29	gardening $88.97 chickens/rabbits $8.33	*NA*

Note
   NA Not assessed because either the program does not provide this service or costing data were not available.

Effectiveness Analysis

This section describes the study designs, data, and analytical methods used to estimate the magnitude of the effects of each of the program interventions identified in Table 1. Figure 3 provides an overview of the evaluation questions explored.

Study Designs —These studies applied a quasi-experimental design with program participants compared to similar but non-equivalent non-participants. Table 2 summarizes the research designs for each of the programs. In each case, the evaluation relies on post-intervention

- *What is the impact of kids' clubs, individual counseling, and home visiting on children's psychosocial outcomes?*

- *What is the impact of educational support on children's educational outcomes?*

- *What is the impact of school-based HIV interventions on children's HIV knowledge levels?*

- *What is the impact of home visiting and guardian support groups on guardians' physical health and psychosocial outcomes?*

- *What is the impact of food support and income-generating activities on household food security?*

Figure 3.   **Key questions explored in effectiveness analysis.**

measurement with non-experimental program and comparison groups. For three of the evaluations – CRS, Allamano, and TSA – comparison groups were drawn from OVC households that were expected to receive services in the future. For the IAP evaluation, program and comparison households were determined by self-reported exposure to program interventions (e.g., participation in school-based HIV prevention activities and receipt of other IAP services).

Study Sample —The evaluations concentrated on program impact among children aged 8-14 at the time of data collection and their guardians. Three studies (CRS in Kenya and the two in Tanzania) relied on beneficiary lists, including children who had received services for one year or more, as well as children slated to receive services following data collection. Beneficiary lists were obtained from program staff, and children on these lists had been identified by community committee processes. These lists were narrowed to include only households with a child aged 8-14 and systematic sampling procedures were applied to select participants. The research team attempted to locate all selected households and conduct face-to-face interviews with the child and his or her guardian. The last study (IAP) was a broader community survey including OVC and non-OVC, as the evaluation was interested in impacts beyond OVC. All households in six geographical areas were approached and those with a child aged 8-14 were invited to participate.

For each study, up to two children per household could be included in the study. In cases where there were three or more children within this age range, the interviewers selected two children randomly (either on-site in the case of the community IAP study in Kenya or prior to fieldwork in the studies utilizing beneficiary lists). With the possibility of up to two children per household, the total sample of children is larger than the sample of guardians. The final sample size for each study is presented in Table 2.

The sample sizes differed for each of the program evaluations. The largest sample was for IAP, where 2,487 guardians and 3,423 children were

Table 2.   Study Design and Comparison Groups for OVC Programs in Kenya and Tanzania

	Kenya		Tanzania	
	Integrated AIDS Program-Thika	**Catholic Relief Services**	**Allamano**	**The Salvation Army**
Study design	Post-test	Post-test	Post-test	Post-test
Intervention group	Self-reported exposure to program interventions among community members	Guardians and their children receiving services	PLWHA and their children receiving services	List of beneficiary children participating in kids' clubs
Comparison group	Community members in same areas that did not report exposure to program interventions	Guardians and their children in same areas but not yet receiving services	Newly identified PLWHA and their children in neighboring communities to receive future support	Children in same communities who were not exposed to TSA interventions
Sample				
Children aged 8-14	3,423	1,036	1,104	564
Guardians	2,487	771	845	488

Note
  Sample sizes for intervention and comparison groups varied by program strategy, as it was based on self-reported exposure to the strategy under investigation.

interviewed. The smallest sample was for the TSA evaluation, for which interviews were completed with 488 guardians and 564 children aged 8-14 years. The CRS project sample included 1,036 children and 771 guardians, while the Allamano sample involved 1,104 children and 845 guardians.

Study Design Limitations — Measuring intervention effectiveness is determined largely by the choice of research design. Randomized control trials, in which individuals are randomly assigned to treatment and control groups, are often considered to be the "gold standard" because they minimize the risk of selection bias – the bias resulting when differences in outcomes reflect who was in treatment and control groups, rather than the effects of the treatment itself. With randomized contol trials, researchers can more confidently assert that samples of exposed and unexposed individuals are statistically equivalent in all aspects related to the outcome under study, or, at worst, that any differences that exist are due to random chance. However, the use of randomized control trials in the evaluation of OVC programs is often not feasible, not ethical, or not even appropriate. Interventions that provide broad support to communities – through school-based HIV prevention initiatives, for example – are difficult to restrict to only a subset of community members. Other interventions, such as provision of antiretroviral therapy and food, have proven efficacy or are provided based on dire need and cannot ethically be withheld from potential beneficiaries.

The alternative – which was applied in these studies – is to rely upon a quasi-experimental design with program participants compared to similar but not necessarily equivalent non-participants. Further, the studies applied a post-test-only design, meaning that an assessment of changes from a baseline was impossible. In an attempt to demonstrate the effectiveness of the interventions, outcomes for beneficiary OVC and their guardians were compared with OVC and their guardians who were not currently receiving services but were slated to receive such interventions in the future. Several limitations exist with this design:

Non-random program targeting: Rationally, program interventions are likely to be targeted to those households and OVC most in need. This means that, viewed at a point in time, households and OVC that receive program services may appear worse than just about any feasible comparison group – either non-OVC households or OVC households that have not yet received services. Naïve analysts might even conclude that OVC programs cause worse OVC outcomes.

Self-selection: Another form of non-random exposure to program interventions is that some households may choose to participate in interventions, such as attending a support group meeting or income generating activities training. Even among OVC households, those that choose to participate may be very different than those who do not participate, perhaps being more knowledgeable about caring practices, being more motivated to seek help, or possessing some other enabling characteristic that will confound estimates of program effectiveness.

Measurement error in exposure to interventions: For many of the interventions, the only measures of whether or not households received services were self-reported affirmative responses to survey questions. This may lead to recall bias, as households that recall exposure may also be different from those that do not recall such exposure.

Post-intervention measurement: For all of the programs, no baseline data collection was undertaken. Much of the sample had therefore been exposed to interventions for some time prior to being surveyed. As

a result, the full measure of the program's effect – the change in an outcome from a pre-intervention baseline to a post-intervention follow-up – cannot be ascertained. Further, the available comparison groups – both non-OVC households and OVC households that were delayed in receiving interventions – were unlikely to have equivalent outcomes at the baseline, tending perhaps to be already better or worse off than participating OVC households.

Outcomes — A wide assortment of potential outcomes were examined to determine the magnitude of effect, if any, of the OVC programs. These outcomes reflect child, guardian, and overall household well-being (summarized in Figure 4). Child-level outcomes include psychosocial well-being (e.g., self-esteem, social isolation, behavior), educational attainment (i.e., appropriate age-for-grade, current enrollment, absenteeism), and a measure of HIV knowledge. Guardian-level outcomes include areas of physical health (i.e., self-rated health) and psychosocial well-being (e.g., positive and negative feelings, feelings of stigma and marginalization, assessments of family functioning). The household level outcome of food security is also assessed in this study. Further details on these outcomes for each of the four study populations can be found in the respective individual evaluation reports.[2-5]

Analytical Methods — In examining program effectiveness, the analyses aims to answer the questions presented in Figure 3. In an attempt to address the study design limitations, we utilize a regression framework that examines the relationship between an outcome of interest (e.g. marginalization), a measure of program exposure (e.g. participation in support group meetings) and a set of variables to control for potential differences among participants and non-participants. Estimations were undertaken separately for outcomes of children age 8-14 and for outcomes of guardians. For continuous

outcomes, ordinary least squares regression was used, while for dichotomous outcomes (yes/no) probit models were estimated. The control variables in the multivariate regression models are summarized as follows:

Guardians: Control variables were guardian's age, gender, marital status, level of education, and illness status; and household socioeconomic status and number of children in the household.

Children aged 8-14: Control variables were all the guardian and household characteristics above, as well as child characteristics of age, gender, orphan status, and relationship to guardian.

These methods are unlikely to overcome all of the limitations in the study design described above, in particular the non-random exposure of OVC and guardians to program interventions. However, as the calculations of the cost-effectiveness of interventions depend upon accurate measurements of program effects, this analysis takes additional analytical steps to address the possible confounding of program effects with other measured and unmeasured characteristics of participants. For example, guardians who chose to participate in workshops may have better health outcomes not just because of the beneficial health information gleaned from those workshops, but also because such guardians may be motivated to seek information and health services from numerous sources. Such an unmeasured phenomenon would tend to over-state the beneficial effects of one set of workshops because it would be a proxy for all sources of health information gathering. In the evaluation literature, this confounding is known as endogenous program participation or targeting.[20,21] To address this potential confounding, two types of endogeneity-correcting estimation strategies were employed:

- For outcomes in which both exposure to the intervention and the outcome were measured as binary variables,

Child Outcomes

Psychosocial

Self-esteem	Global self-esteem subscale from the Self-Esteem Questionnaire[9]
Family self-esteem	Family subscale of the Self-Esteem Questionnaire[9]
Social isolation	KIDSCREEN Social Acceptance Scale[10]
Prosocial behavior	Subscale of the Strengths and Difficulties Questionnaire[11,12]
Total difficulties	Subscale of the Strengths and Difficulties Questionnaire[11,12]
Community stigma	Scale generated for this study reflecting perceived negative perceptions concerning OVC and PLWHA of community members

Educational Attainment

Appropriate age-for-grade	Binary outcome if child is less than two years above the appropriate age for grade
School enrollment	Binary outcome, enrolled in school at the time of the survey
Absenteeism	Continuous outcome, number of days of school missed in week preceding survey

HIV Knowledge

HIV prevention methods	Responses to an open-ended question concerning how HIV is transmitted, with possible accurate responses from a Demographic and Health Survey HIV module[13]

Guardian Outcomes

Physical Health

Self-rated health	Self-rated health ("In general, how is your health?" very good/good/neither good nor poor/poor/very poor)

Psychosocial

Positive feelings	Subscale derived from WHO Quality of Life[14,15]
Negative feelings	Subscale derived from WHO Quality of Life Instrument[14,15]
Family functioning	Subscale of the McMaster's Family Assessment Device[16]
Feelings towards child	Scale derived from U.S. Census Bureau Survey of Income and Program Participation[17]
Community stigma	Scale generated for this study reflecting perceived negative perceptions concerning OVC and PLWHA of community members
Marginalization	Scale of perceived stigma and isolation (e.g., "people speak badly about you or your family")[18]

Household Outcomes

Food security	Household Food Insecurity Access Scale developed by the Food and Nutrition Technical Assistance Project; respondents were classified in this analysis as being food secure or not[19]

Figure 4. Outcome variables in multivariate regression models.

bivariate probit models were estimated. These allowed for the correlation in unobservable factors across both the exposure and outcome equations. Rejecting the null hypothesis that $\rho = 0$ (i.e., absence of correlation in unobservables) indicates the presence of endogenous program exposure and potential confounding of program effects.

- For outcomes in which the outcome was measured as a continuous variable but the measure of program exposure was not, instrumental variables estimation strategies were employed. A Hausman type test was then conducted to determine the presence of an endogenous relationship.

It is notable that testing and controlling for endogeneity was performed only in this impact analysis that is linked to exploring cost-effectiveness analysis. As such, results within the individual evaluation reports may vary.

Program Effectiveness — Because of the large number of regression models that were estimated, only a summary of results for the marginal effects for the intervention coefficients are presented here. Marginal effects, which represent the incremental change in an outcome from a unit change in an independent variable (e.g., program exposure), provide an estimate of the magnitude of the effect of exposure to an intervention on an outcome. For ordinary least squares regressions, these marginal effects were simply the coefficient on the program exposure variable; for probit regressions with dichotomous outcomes, the mfx command in Stata 10.1 was used.

Table 3 summarizes the marginal effectiveness of OVC interventions from the four study areas. For many of the outcomes under study, there was no measurable effect of the program. For some interventions, a measurable effect was found only for one or two outcomes. For example, among the

many possible psychosocial outcomes for guardians and children (see Figure 4 for specific outcomes by domain), home visiting was associated with only one psychosocial indicator for each program. Interestingly, the outcomes associated with home visiting also differed by program. Among guardians, TSA was associated with a reduction in the index of perceived community stigma of 0.82 points (p=0.095) whereas the home-based care of Allamano was associated with a reduction in the index of negative feelings of 0.147 (p=0.047), and home visiting from the CRS project was associated with lower feelings of marginalization of 0.139 points (p=0.055). For OVC, home visiting was associated with an increase in family self-esteem of 0.092 (p=0.078) for CRS, a reduction in social isolation of 0.132 (p=0.094) for Allamano, and an increase in self-esteem of 0.161 (p=0.001) for TSA. None of the home visiting programs had a measurable effect on guardian's health.

There was also a dearth of statistically significant psychosocial results for kids' clubs. For Allamano, the only measured effect was with the outcome family self-esteem; participation in kids' clubs was positively associated with a 0.305 increase in the family self-esteem index (p=0.005). There was no effect of participation in kids' clubs for any of the TSA outcomes. There were also no effects of educational support on any of the educational outcomes for any of the projects.

Individual counseling was associated with an increase in children's prosocial behavior of 0.584 (p=0.001), but had no significant relationship with other psychosocial indicators. Further, school-based HIV education showed a small effect on HIV knowledge for IAP of .579 (p=0.000), but a sizable increase of 1.56 for CRS (p=0.000).

Participation in guardian support groups was associated with a reduction in negative feelings among guardians of 0.075 points for IAP (p=0.000), but had no effect on any guardian psychosocial outcomes for the CRS OVC project. Neither program showed an effect of support group participation on guardian health status.

Table 3.   Marginal Effectiveness of OVC Interventions in Kenya and Tanzania

	Kenya		Tanzania	
	Integrated AIDS Program-Thika	**Catholic Relief Services**	**Allamano**	**The Salvation Army**
Kids' clubs *(child psychosocial outcomes)*	NA	NA	Family self esteem 0.305 (p=0.005)[a]	No effect
Individual counseling *(child psychosocial outcomes)*	NA	Prosocial behavior 0.584 (p=0.001)	NA	NA
Educational support *(child educational outcomes)*	NA (No variation in outcomes)	No effect	No effect	NA
School-based HIV education *(child HIV knowledge)*	HIV knowledge 0.579 (p=0.000)	HIV knowledge 1.556 (p=0.000)	NA	NA
Home visiting *(child psychosocial outcomes)*	NA (Only n = 35 exposed)	Family self-esteem 0.092 (p=0.078)	Social isolation 0.132 (p=0.094)	Self-esteem 0.161 (p=0.001)
Home visiting *(guardian health and psychosocial outcomes)*	NA (Only n = 35 exposed)	Marginalization 0.139 (p=0.055)	Negative feelings -0.147 (p=0.047)	Community stigma -0.82 (p=0.095)[a]
Guardian support groups *(guardian health and psychosocial outcomes)*	Negative feelings -0.75 (p=0.000)	No effect	NA	NA
Food support *(household food security)*	No effect	No effect	Food security 0.437 (p=0.000)[b]	NA
Income generation *(household food security)*	No effect	Food security 0.142 (p=0.003)	Food security 0.097 (p=0.042)	NA

Notes

    Details on the specific outcomes for each domain are described in Figure 4; only outcomes where an effect was found are listed.

    NA Not assessed because either the program does not provide this service or costing data were not available.

    a Marginal effect was estimated using instrumental variables estimation with ivregress command in Stata 10.0.

    b Marginal effect was estimated using bivariate probit model with biprobit command in Stata 10.0.

Food support was not associated with lower food insecurity for IAP or CRS, but was associated with a sizable reduction in food insecurity of 43.7% for Allamano. SILC training by the CRS OVC project was positively associated with greater food security, increasing the odds of food security by 14.2 percentage points (p=0.003). Training in bio-intensive gardening under the Allamano program was also associated with a 9.7 percentage point increase in food security (p=0.042).

Cost-Effectiveness — The cost-effectiveness of each of the interventions is determined by dividing the per beneficiary cost of an intervention (Table 1) by a measure of the magnitude of the intervention's effect, i.e. the marginal effect shown in Table 3. If an intervention was not found to be effective in the regression analysis, then it could not be cost-effective either, and no cost-effectiveness ratio was calculated. Table 4 displays the cost-effectiveness calculations for interventions with both cost information and measures of effectiveness.

Several points should be made about the numbers in Table 4. First, because the interventions tended to affect different outcomes, each measured in different, often abstract units, it is not strictly possible to determine which interventions are most cost-effective relative to each other. For example, home visiting for children improves family self-esteem in CRS, social isolation in Allamano, and self-esteem in the TSA program (but showed no measurable effect for other indicators of psychosocial well-being). The costs per one unit improvement in each of these psychosocial indices was $38.59, $679.40, and $398.63, respectively. The large costs per incremental change in the indices for Allamano and TSA do not indicate

that these interventions were not cost-effective – in fact, they were effective as shown in regression analysis – but rather that a one unit decrease in the social isolation index cost $679 while a one unit increase in self-esteem cost $399.

In a similar vein, home visiting for guardians produced differential effects for different outcomes and programs. For example, $25.54 spent on home visiting by the CRS project is associated with a one unit decrease in the index of marginalization. Alternatively, to achieve a one unit reduction in negative feelings among guardians, Allamano would have to spend $610 per beneficiary on home-based care. Similarly, $78 spent on home visiting by TSA would achieve a one unit reduction in guardian perceptions of community stigma. Guardian support groups – offered by IAP – can achieve a one unit reduction in negative feelings at a rate of $75 per beneficiary.

For both IAP and CRS, school-based HIV education had substantial impacts on HIV knowledge at very low cost, $2.61 and $0.09, respectively, for a one unit improvement in HIV knowledge among those exposed to the intervention. Further, a one unit increase in children's prosocial behaviors can be achieved through individual counseling at a cost of $0.36 per beneficiary.

Income generating activities also appeared relatively cheap for achievable outcomes. For example, SILC training by the CRS program can achieve a 10% reduction in food insecurity at a cost of $1.61 per beneficiary. At a slightly higher cost, $9.17 per beneficiary, a similar sized reduction in food insecurity could be achieved by training in bio-intensive gardening with the Allamano program.

Table 4.   Cost-Effectiveness of OVC Interventions in Kenya and Tanzania

	Kenya		Tanzania	
	Integrated AIDS Program-Thika	**Catholic Relief Services**	**Allamano**	**The Salvation Army**
Kids' clubs *(child psychosocial outcomes)*	NA	NA	$6.43 Family self-esteem	No effect
Individual counseling *(child psychosocial outcomes)*	NA	$0.36 Prosocial behavior	NA	NA
Educational support *(child educational outcomes)*	NA	No effect	No effect	NA
School-based HIV education *(child HIV knowledge)*	$2.61 HIV knowledge	$0.09 HIV knowledge	NA	NA
Home visiting *(child psychosocial outcomes)*	NA	$38.59 Family self-esteem	$679.40 Social isolation	$398. 63 Self-esteem
Home visiting *(guardian health and psychosocial outcomes)*	NA	$25.54 Marginalization	$610.07 Negative feelings	$78.27 Community Stigma
Guardian support groups *(guardian health and psychosocial outcomes)*	$75 Negative feelings	No effect	NA	NA
Food support *(household food security)*	No effect	No effect	$0.74 10% reduction in probability of food insecurity	NA
Income generation *(household food security)*	No effect	$1.61 10% reduction in probability of food insecurity	$9.17 10% reduction in probability of food insecurity	NA

Notes
   Details on the specific outcomes for each domain are described in Figure 4; only outcomes where an effect was found are listed.
   NA   Not assessed because either the program does not provide this service or costing data were not available.

Conclusions

This study demonstrates that OVC interventions in some cases can be effective in improving OVC and guardian outcomes and that these improvements can be achieved at very low cost. This appears to be particularly the case for SILC training, which can lead to reductions in food insecurity at a cost of only $1.61 per beneficiary, and OVC individual counseling, which can achieve incremental increases in children's prosocial behaviors at a cost of only $0.36 per beneficiary. Further, school-based HIV prevention activities increase HIV knowledge at less than 10 cents per beneficiary. Overall, we find that the application of cost-effectiveness tools to the evaluation of interventions for OVC and their guardians is indeed practical. Results offer some initial insight as to the incremental gain in OVC and guardian well-being from spending on specific program components.

However, this analysis was very strongly limited by the research design and the absence of suitable control/comparison groups that would allow for more appropriate assessments of program effectiveness. This likely impacts upon the dearth of statistically significant effectiveness results, and therefore on the dearth of cost-effectiveness calculations. The key limitations include the following:

Comparability: The different interventions influence many different types of outcomes. Even within similar types of outcomes (e.g., psychosocial), it is difficult to compare the costs of marginal changes in outcomes since they lack a common unit of analysis. For equal costs, would a 10% change in the index of self-esteem be less important, as important, or more important than a similar sized change in the index of perceived stigma? Answering such questions requires that outcomes be measured in a common metric. The most likely candidate would be to monetize the value of outcomes and conduct a more standard cost-benefit analysis. That was beyond the scope of this analysis.

Research design: The research design was plagued by two principal limitations (post-only data collection and non-random assignment to program groups). Neither limitation could be adequately overcome. Absence of pre-intervention measures of outcomes meant that the full effect of the interventions could not be measured. Coupling this limitation with the non-random assignment of program participants and non-participants meant that it was not possible to conclude that differences in outcomes between the two groups reflected the effects of the interventions or were due to innate and existing differences between the two groups.

Another key consideration when interpreting the results of this cost-effectiveness analysis relates to the costs and outcomes that were included. The analyses undertaken here followed a strictly programmatic perspective. That is, we focused solely on the costs and effects related to the programs themselves. For example, home visiting involves the value of counselors' time, transport costs, supplies and equipment, and some amount of overhead for administration. Effects examined were specific expected outcomes for program participants. However, other costs and effects could also have been considered. Such visits might influence individuals' risk behaviors and therefore reduce the likelihood that HIV is transmitted to non-program participants, who might otherwise have required medical care and antiretroviral therapy. The avoidance of such costs would not be a consideration for the program, but from a societal perspective, these broader implications could make some programs much more cost-effective. With such a perspective, in fact, interventions may actually be found to be cost-saving; not implementing them is more expensive than undertaking them. Extensions to this analysis may eventually consider these larger costs and potential cost savings.

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