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Cost-Effectiveness of a Savings-led Economic Empowerment Intervention for AIDS-Affected Adolescents in Uganda: Implications for Scale-up in Low Resource Communities

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Abstract

Purpose—Nearly 12 million children and adolescents in Sub-Saharan Africa (SSA) have lost one or both parents to AIDS. Within SSA, Uganda has been greatly impacted, with an estimated 1.2 million orphaned children, nearly half of which have experienced parental loss due to the epidemic. Cost-effective and scalable interventions are needed to improve developmental outcomes for these children, most of whom are growing up in poverty. This paper examines the direct impacts and cost-effectiveness of a savings-led family economic empowerment intervention, *Bridges to the Future*, that employed varying matched savings incentives to encourage investment in Ugandan children orphaned by AIDS.

Methods—Using data from 48 primary schools in southwestern Uganda, we calculate per-person costs in each of the two treatment arms - *Bridges (1:1 match savings)* vs *Bridges PLUS (1:2 match savings)*; estimate program effectiveness across outcomes of interest; and provide the ratios of per-person costs to their corresponding effectiveness.

Results—At the 24-month post-intervention initiation, children in the two treatment arms showed better results in health, mental health and education when compared to the *Usual Care* condition, however, no statistically significant differences were found between treatment arms

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with the exception of school attendance rates which were higher for those in *Bridges PLUS*. Due to the minimal cost difference between the *Bridges* and *Bridges PLUS* arms, we did not find substantial cost-effectiveness differences across the two treatment arms.

Conclusion—After 24 months, an economic intervention that incorporated matched savings yielded positive results on critical development outcomes for adolescents orphaned by AIDS in Uganda. The 1:1 and 1:2 match rates did not demonstrate variable levels of cost-effectiveness at 24-month follow-up, suggesting that governments intending to incorporate savings-led interventions within their social protection frameworks may not need to select a higher match rate to see positive developmental outcomes in the short-term. Further research is required to understand intervention impacts and cost-effectiveness after a longer follow-up period.

Introduction

Adolescence is a period of development characterized by rapid physical, social and emotional maturation. It requires sufficient family and community support to successfully navigate these transitions. Financial stress experienced by economically insecure families compromises the family and community support available to adolescents as they transition to adulthood, putting them at increased risk of experimenting with unhealthy behaviors (1-3). Adolescents facing adversity, particularly poverty, exhibit high rates of early and risky sexual behavior, poor health and mental health functioning (1-4) along with poor educational outcomes (5). The rates are even more pronounced for adolescents affected by AIDS (6-8).

Sub-Saharan Africa (SSA) remains the world's most affected region in the HIV epidemic, home to 71% of people living with HIV worldwide (9). Nearly 12 million children in the region have lost one or both parents to HIV/AIDS (10) – hence categorized as AIDS-orphans (also known as *orphans made vulnerable by AIDS*). Within SSA, Uganda is one of the hardest hit countries, with an estimated 1.2 million orphans, 45% of whom are AIDS-orphans (11).

Parental death due to AIDS affects children in multiple ways. Financially, AIDS-orphans are vulnerable due to long episodes of parental illness which often precede the death of parents. Financial instability can, in turn, negatively affect family cohesion and psychosocial wellbeing (12-14). In addition, there are negative effects of parental death on children's overall health functioning and psychosocial development (13-16).

Growing up as an orphan poses psychosocial and economic challenges to children and the households in which they live. As orphans enter early adolescence, they are beginning to be exposed to sexual and other risk behaviors (17), making this period in their lives very precarious. Moreover, the high prevalence of poverty, compounded by a lack of government safety nets (as in most SSA countries) and a lack of hope for the future can influence adolescents' decisions on sexual risk taking resulting in increased HIV risk, and negatively impacting adolescents' prospects to succeed in life. Yet most interventions for children and families in AIDS-impacted communities in SSA have primarily focused psychosocial services for children (6, 7, 18), giving less attention to the economic needs of adolescents and their families.

Effective interventions are needed to improve the developmental outcomes of adolescents. Given scarce economic resources, the SSA region needs interventions that are cost-effective, and scalable, with multidimensional benefits. Emerging evidence, from a series of randomized controlled trials (RCTs) in Uganda, indicates that an innovative saving-led economic empowerment intervention using incentivized financial savings focused on adolescents (hereafter, children matched savings accounts – CSAs), and directed towards specific purposes such as education and family micro-enterprise development, may be a viable approach to improving multidimensional wellbeing among orphaned and vulnerable adolescents (6, 7, 18-20).

Results from these matched CSA programs demonstrate a reduction in levels of depression and hopelessness (18); improved HIV preventive attitudes and behaviors (19, 21); improved self-concept and educational achievement (22); and increased financial resources (23, 24). These findings are in line with prior research of transfers (CCT) which have shown positive effects on adolescents (25). It is important, however, to note that although akin to CCT interventions—which primarily focus on enabling families to meet basic needs while incentivizing pro-social behaviors (25-27), CSA interventions go beyond incentivizing behavior. They emphasize long-term investment and promote life-long financial inclusion by forming savings habits and establishing partnerships between the participating family and local financial institutions—hence laying the groundwork for potential long-term sustainable interactions and scale-up.

In order to advocate for policy that promotes savings-led economic empowerment interventions as a potential for impacting adolescents' health and overall developmental outcomes, economic analysis needs to be employed to compare and assess intervention alternatives for an approach that is less costly to achieve similar effects. Indeed, if economic empowerment interventions are to be taken to scale, and if governments are to include them among possible policy priorities, they would need to be cost-effective.

Within this frame, the Bridges intervention study (hereafter, *Bridges*), a National Institute of Child Health and Development (NICHD) funded randomized control trial (Grant # 1 R01 HD070727-01), on which this paper is based, aimed to evaluate the efficacy and cost-effectiveness of an innovative savings-led family-based economic empowerment intervention for AIDS-orphaned children. Specifically for this paper, we use data from the *Bridges* study to investigate how the varying matched savings incentives applied in the *Bridges* study, and the intervention costs, translate into measurable effects. We specifically examine the direct impacts of the Bridges intervention on key health and educational outcomes for AIDS-orphaned adolescents—including: sexual-risk taking behaviors; and physical and mental health functioning. This is done by comparing: a) *Bridges* intervention condition receiving a 1:1 savings match rate (each equivalent of US\$1 deposited into a participant's savings account was matched by US\$1) to the *Usual Care* Control group; b) A *Bridges Plus* intervention condition receiving a 1:2 savings match rate (each equivalent of US\$1 deposited into a participant's savings account was matched by US\$2) to the *Usual Care* Control Group; and c) The *Bridges* intervention condition to the *Bridges Plus* intervention. Additionally, we evaluate the cost-effectiveness of the alternative savings match rates: the 1:1 (*Bridges*) vs. 1:2 (*Bridges PLUS*).

Design and Samples

The Bridges study recruited AIDS-orphans from 48 primary schools in southwest districts of Uganda. Specifically, to be included into the study, the adolescent had to meet the following criteria: (1) be an AIDS-orphaned adolescent—defined as an adolescent who lost one or both biological parent(s) to AIDS; (2) in the last two years of primary school; (3) living within a family (broadly defined and not an orphanage, as those in institutions have different familial needs).

As detailed in the CONSORT flow chart (Figure 1), a total of 1,410 participants were recruited for baseline assessment. The study primarily relied on schools and the Masaka Diocese parish to identify potential participants and to help with recruitment. Following several announcements via parents-teachers' associations (PTA) meetings, church services, village-level meetings, and visitations to the schools by the research team, caregivers with adolescents in primary grades 5 and 6 who indicated interest were invited, together with their adolescents, for an information meeting with the research team. During the meetings, potential participants were given study details. Informed consent of the primary caregiver and assent of the adolescent were obtained before enrolling any adolescent into the study (24). During the first year of study implementation, 27 participants were found to have been included in error through the schools' administration records. For that reason, they were excluded from subsequent interviews, and our final sample interviewed in subsequent waves was 1,383 adolescents from 48 primary schools.

Using a three-group cluster randomization control trial (RCT) method, the 48 schools were randomly assigned to three study arms. All selected adolescents from a particular school received the same intervention (in order to avoid contamination). In sum, of the 48 schools, 16 were randomly assigned the control condition; 16 to the *Bridges* condition; and the final 16 to the *Bridges PLUS* condition. A flow diagram following the Consolidated Standards of Reporting Trials (CONSORT) guidelines is presented in Figure 1.

All participants in the *Usual Care* control condition (and in the two experimental arms: *Bridges* and *Bridges Plus*—described more fully below) received usual care services for AIDS-orphans in the study area. These included: counseling, food (school lunches), and scholastic materials (textbooks and notebooks). Counseling was provided by priests in the community. In addition to the usual care condition, students in the intervention conditions, *Bridges* and *Bridges Plus*, received the following intervention components: 1) Financial Literacy (FL) workshops focused on asset building, future planning, family microenterprise development, and protection from risks; 2) mentors to reinforce learning and build optimism; 3) a Child Savings Account (CSA), from which matched savings could be used for secondary education, and microenterprise development. These components are described in earlier publications (7, 29, 30). The only difference between the two treatment arms, *Bridges* and *Bridges Plus*, was the rate of the financial incentive for saving (match rate) described earlier. Varying match rates were provided to address whether offering higher savings incentives would be an effective strategy to promote savings and other observable developmental outcomes; and what the cost would be for each match rate. The intervention

was provided for 24 months. This study uses data from baseline and 24-month post intervention initiation.

Methods

Data Collection

Cost—We measure program costs on a per person basis (31). We draw costs data from the management information system for savings and project administrative records. Cost categories include recruitment, CSA operations (account opening and savings match), mentorship and FL workshops (including microenterprise development training), equipment, personnel, and other costs. We provide details on how each component of cost is calculated in Appendix Table 1 (31). Our costs include both direct costs (e.g., savings match costs, logistics for workshops, and transport) and indirect costs (e.g., time spent by implementing partners and volunteers on participant recruitment, intervention implementation, and mentorship, including opportunity costs for implementation partners and study participants) (31).

Effectiveness—We assess program effectiveness in the following areas: self-related health, mental health functioning, sexual health, and educational outcomes. Data are derived from in-person interviews with adolescents and school administrative records. The in-person interviews were conducted annually by trained research assistants (21, 24, 29, 30). School attendance and examination performance data come from school records and unannounced roll-calls conducted by the program staff post-baseline assessment.

Measures

Self-rated health is measured by the question, “at the present time, would you say that your physical health is excellent, good, fair, poor, or very poor?”, with response categories ranging from excellent to very poor. Higher values indicate better health (32). Mental health is captured by depression and hopelessness. It is measured through the 27-item Child Depression Inventory (CDI) and the 20-item Beck Hopelessness Scale (BHS) (33). Higher CDI and BHS values indicate worse mental health. In addition, self-concept is measured by the 20-item Tennessee Self-Concept Scale (TSCS) (34), and self-efficacy by the 29-item Youth Self-Efficacy Survey (YSES) (35). Higher values on TSCS and YSES indicate more positive self-concept and self-efficacy respectively. Sexual health is captured through three indicators: sexual risk-taking intentions, HIV prevention intention, and HIV knowledge (20, 30, 36). Examples of questions from each scale are provided in Appendix Table 4. The self-concept, self-efficacy, and sexual health measures have acceptable internal consistency levels (Cronbach’s $\alpha = 0.7$), while the two mental health measures, CDI ($\alpha=0.68$) and Beck’s Hopelessness Scale ($\alpha=0.65$) show modest internal consistency levels. All of the above outcomes are standardized and comparable across outcomes.

With respect to education, this study includes four outcomes: whether the child was present at school during unannounced roll call for more than 90% of the time, whether the child dropped out of school, whether the child had taken the government-administered Primary Leaving Examinations (PLE), and the PLE score aggregated from the four subjects ranging

from 4 to 36, with lower scores indicating better performance (30). These educational outcomes are only available post-intervention—not at baseline. Thus, our analysis only include one observation per child for the four educational related outcomes. The study received IRB approval from Columbia University, and local in-country IRB approval from Uganda National Council of Science and Technology.

Data Analysis Strategy

A cost-effectiveness analysis of the Bridges intervention involves examining how much *Bridges* or *Bridges PLUS* costs to achieve a unit of effect (31). We calculate cost-effectiveness in three steps. First, we calculate the per-person costs in each treatment arm. Second, we estimate program effectiveness across our outcomes of interest. Third, we provide the ratios of per-person costs of *Bridges* and *Bridges PLUS* groups to their corresponding effectiveness as the cost-effectiveness. For outcomes other than educational outcomes, we chose a benchmark of 0.2 standard deviation as the unit of change because it reflects a small effect size, and the effects for these outcomes generally are in the range of 0.2-0.4. A high benchmark (e.g., 1 standard deviation) would not be practically meaningful.

To examine effectiveness of the intervention on health, mental health, self-concept, self-efficacy, and sexual health outcomes, we use three-level multilevel models to account for school and individual effects by including school ID and child ID as random intercept terms. Further, we allow the slopes over time to differ for each child. In each model, we include study group dummies (*Bridges* and *Bridges PLUS*; *Usual Care* as the reference group), a wave dummy (24-month follow-up; baseline as the reference group), and their interactions. After each multilevel regression, we use a Wald test to examine whether the coefficients between the two interaction terms are statistically the same. For educational outcomes (since we have no baseline information) we use a two-level multilevel model to account for school-level clustering. Each model includes study group dummies. Wald tests are conducted to compare whether coefficients from the *Bridges* and *Bridges PLUS* dummies are statistically the same. The following commands are used in Stata 14: `–mixed–` for continuous outcomes and `–melogit–` for dichotomous outcomes.

Results

To frame the results of this analyses, we first briefly summarize savings performance outcomes across study arms. As outlined in detail in another manuscript (24), *Bridges PLUS* children showed a higher likelihood to save and made more deposits as compared to *Bridges* children, in both the first and second intervention years. However, the actual amount of savings was near equal between intervention arms in the first year and *Bridges* children showed a higher monthly amount of savings, on average, as compared to those in *Bridges PLUS*. This data is reflected in the presentation of cost differences.

Costs

The average per-person costs over the course of the two intervention years were 118 USD (in real US dollars in 2012) for *Usual Care*, 418 USD for *Bridges*, and 426 USD for *Bridges PLUS*. Per-person costs for *Bridges* and *Bridges PLUS* adolescents were the same except for

the program expenditure on matched savings where *Bridges PLUS* offers a higher saving match rate. In Appendix Table 2, we further detail the costs breakdown by program activities and functions, and in Appendix Table 3, we present per-person costs by different sample definitions and exchange rates. Our preferred cost calculation uses treatment on the treated (TOT) samples to calculate per-person costs because it allows us to capture the cost if a respondent participated in all program activities. This cost is higher and reflects a more conservative estimation of cost-effectiveness.

It is important to note that 82% of children in the *Bridges* (1:1) opened a bank account compared to 90% of children in the *Bridges PLUS* (1:2) arm; 61.5% of children in the *Bridges* arm attended mentorship and workshops compared to 67.7% of their counterparts in the *Bridges PLUS* arm; and 58% of the *Bridges* arm children attended microenterprise development workshops compared to 63.1% of their counterparts in the *Bridges PLUS* arm. Thus, part of the cost difference being reported between *Bridges* and *Bridges PLUS* could be resulting from a slightly higher take-up rate of services by adolescents in the *Bridges PLUS* arm as a result of the higher incentive.

Effectiveness

Table 1 shows the descriptive statistics of adolescent characteristics. The average participant's age at baseline was 12 years, and the average household size was 6 individuals. There were slightly more girls than boys, and around 80% of them were single orphans. Table 1 also provides the means of each outcome at baseline, with the exception of the educational outcomes – specifically school attendance and PLE performance – only captured at post-baseline assessment.

Tables 2-4 present results on intervention effectiveness from multilevel regressions analyses. In Tables 2-3, the key coefficients of interest are interactions between 24-month post intervention initiation indicator and intervention arms (*Bridges* and *Bridges PLUS*). These coefficients demonstrate effects of the intervention controlling for baseline differences across groups and trends in outcomes shared across groups. Results in Table 2 indicate the intervention increased adolescents' self-rated physical health by 0.34-0.36 standard deviation and decreased their levels of depression by 0.25-0.29 standard deviation and levels of hopelessness by 0.18-0.23 standard deviation. Also, the intervention improved adolescents' self-concept by 0.23-0.37 standard deviation and self-efficacy by 0.31-0.35 standard deviation. These effects are statistically significant when compared to outcomes of adolescents receiving *Usual Care*, but the differences in coefficients between *Bridges* and *Bridges PLUS* tested through Wald-tests are not statistically significant – implying that having a higher savings match rate does not seem to lead to differential treatment effects.

With regard to sexual health, the intervention increased adolescents' HIV knowledge score by 0.37-0.38 standard deviation but had no effect on HIV prevention attitudes. The *Bridges* intervention decreased participants' sexual risk taking intention score by 0.23 standard deviation when compared to *Usual Care*, however, *Bridges PLUS* does not demonstrate this effect.

Table 4 presents the effects of the intervention on educational outcomes. Results show that participants in the two intervention arms exhibit higher odds of attending school at least 90% of the time over a 2-year period. However, the intervention effect is only statistically significant for adolescents receiving *Bridges PLUS*. In regard to other educational outcomes, on average, adolescents receiving both interventions showed lower drop-out rates, a higher likelihood to take the Primary Leaving National Examinations (PLE) and score higher on these PLEs – although the intervention effects are not statistically significant.

Cost Effectiveness

Table 5 presents the cost-effectiveness of the intervention arms when compared to *Usual Care*. Cost-effectiveness reveals the required costs to attain one unit of an effect. Here we take self-rated health as an example to explain the cost-effectiveness calculation process. The costs of *Bridges* and *Bridges PLUS* interventions relative to the *Usual Care* group were 300 USD (418-118=300) and 308 USD (426-118=308), respectively. The corresponding effects of *Bridges* and *Bridges PLUS* relative to the *Usual Care* group were 0.336 and 0.357 standard deviation. Therefore, the cost-effectiveness ratios were 178.57 USD for *Bridges* (300 USD/0.336 * 0.2=178.57 USD) and 172.55 USD (308 USD/0.357 * 0.2=172.55 USD) for *Bridges PLUS*.

In terms of health, mental health, self-concept and self-efficacy, findings show that *Bridges PLUS* on average is more cost-effective to attain improved outcomes. Since the per-person costs of *Bridges PLUS* is very similar/slightly higher than the *Bridges* intervention, this result is a reflection of the higher average effects of the *Bridges PLUS* intervention on these outcomes compared with *Bridges*. Further analyses show that the differences in cost-effectiveness between *Bridges* and *Bridges PLUS* are not statistically significantly different. When it comes to sexual health and educational outcomes, on average, *Bridges* is more cost effective than *Bridges PLUS*. However, it is important to note that these differences in cost-effectiveness are not statistically significant. We also pooled the two intervention arms and conducted effectiveness and cost-effectiveness analyses, and we reported results in Appendix Tables 5 and 6.

Discussion and Conclusion

This study is the first, to our knowledge, to examine cost-effectiveness of a family economic empowering intervention based on matched savings accounts in sub-Saharan Africa. We found that, at the 24-month post intervention initiation, adolescents in both intervention groups showed better health, mental health, self-concept, self-efficacy, and HIV knowledge when compared to their counterparts in the *Usual Care* condition. Specific to the two intervention groups, adolescents in the *Bridges PLUS* group showed a higher likelihood of school attendance.

In terms of costs, the per adolescent program costs for *Bridges PLUS* adolescents were slightly higher than *Bridges* adolescents due to the higher match rates received by *Bridges PLUS*. For a comparison of whether a higher match rate (1:2) is more cost-effective than a lower one (1:1), because the cost difference is low, the relative cost-effectiveness largely

depends on the effect difference. Most cost-effective differences between *Bridges PLUS* and *Bridges* are not statistically significant.

Although there is little evidence on the cost-effectiveness of different match rates (*Bridges* and *Bridges PLUS* approaches), we have to note that this result is only based on a 24-month follow-up post-intervention initiation. A longer term follow-up may yield different outcomes since adolescents in the *Bridges PLUS* group do accumulate more matched savings than *Bridges* children (24). We do not know how different the outcomes would be – in the long-run—once adolescents in the two intervention groups start to use their matched savings for educational or microenterprise development. Given the lack of cost-effectiveness differences between intervention arms, further research to disentangle the effectiveness of the individual program components, such as mentorship or financial education, would be warranted.

One key limitation for this study worthy noting is our inability—at this stage—to perform a benefit-cost analysis. Benefit-cost analysis of program interventions is generally the best guide to policy, however, when critical benefits cannot be valued in dollar terms, cost effectiveness is a good guide to policy (37). In this case, because a 2-year year post-intervention initiation follow-up of young AIDS-orphaned adolescents is too short to detect long-run changes in economic, health and education benefits of the intervention being assessed, a benefit-cost analysis would be premature. Thus, we conducted a cost-effectiveness analysis which allows one to measure the cost of achieving an agreed upon benefit—as detailed in our analysis. Despite this limitation, our study makes a contribution to policy and programming. Specifically, given that economic resources in SSA are scarce, this study provides evidence that a matching incentive of 1:1 does not lead to less positive outcomes when compared to a costlier matching incentive of 1:2 by the relatively short-term 2-year follow-up. However, future studies on a longer-term follow-up will be particularly informative for policymakers to know the necessity of employing a higher matching incentive.

Appendix

Appendix Table 1

Costs calculation

Activities	Cost items	Per-person costs calculation methods
Recruitment	Fuel to travel to schools, communication costs to contact school (airtime), and printing flyers.	Divide the total costs by the number of recruited participants.
Account Opening	[Account Opening Meetings] Fuel to travel to school, printing of documents, snacks, transport refund for participants, facilitation for contact teachers in each school, and lunch for staff. [Initial Deposits] 20,000 UGX	Divide the total costs by the number of recruited <i>Bridges</i> and <i>Bridges PLUS</i> participants.
IDA-Match Savings	The maximum matchable deposit is 20,000 UGX monthly. The match rate for <i>Bridges</i> is 1:1, and the match rate for <i>Bridges PLUS</i> is 1:2	Multiply annual matchable deposit by 1(2) and divide by number of <i>Bridges</i> (<i>Bridges Plus</i>) participants.

Activities	Cost items	Per-person costs calculation methods
Workshop & Mentorship	Stationery, printing of materials, fuel to travel to each school, snack for participant, transport refund for participants, lunch allowance for mentors, allowance for mentors, and allowance for contact teachers.	Divide the total costs across 8 sessions by the number of participants in <i>Bridges</i> and <i>Bridges PLUS</i> groups.
Income Generating Activity Training (IGA)	Stationery, printing of handouts, refreshments, fuel for transportation, hired car, fuel for generator, facilitation of extension workers, refund for model farmers, transport refund for participants, facilitation for contact teachers, and lunch for staff.	Divide the total costs in each year by the number of participants in <i>Bridges</i> and <i>Bridges PLUS</i> groups.
Assets and Equipment	Rent expenses, utilities, vehicle purchase and repair, sub-contracts with security and other service providers, and office asset or equipment like laptop, printers, photocopier, modems, scanners, and routers.	Estimate the fraction of time that each equipment was devoted to program (as opposed to research), and then multiply this proportion by the price of this item. After factoring in depreciation of each asset/equipment in Uganda, take a total across all assets and equipment and divide it by the total number of participants.
Personnel	The Bridges Study had 8 staff in year 1 and 7 staff in year 2. One of the staff members is a project coordinator while other staff are both research assistants and program staff. Each staff member has different salary rates based on his/her experience and skills, and they all receive health insurance and housing benefits.	Estimate the fraction of time each staff member devoted to the program (as opposed to research), and then multiply this proportion by his/her salary. Afterwards, take a total of the salary devoted to program activities across all staff and divide it by the total number of participants.
Leveraged resources (monetized)	(1) Foregone salaries from mentors and community partners (contact teachers, bank officials, and community leaders) for implementing the program. (2) Space provided by schools to implement program activities (e.g., mentorship, income-generating training).	(1) Calculate the hours mentors and community partners devoted to implement the program, and then multiply these hours by their converted hourly rate. (2) Calculate the hours schools donated their space to implement program activities, and then multiply these hours by the fees for renting each hour of space. Add (1) and (2) and then divide it by the total number of participants.

Appendix Table 2

Program per-person cost by program activity and year (in nominal UGX)

	Year 1/2012-2013			Year 2/2013-2014		
	Usual Care	Bridges	Bridges PLUS	Usual Care	Bridges	Bridges PLUS
Usual Care						
Porridge	20,840	20,840	20,840	20,840	20,840	20,840
School uniform	12,209	12,209	12,209	11,987	11,987	11,987
Exercise books	11,109	11,109	11,109	11,109	11,109	11,109
Text books	17,193	17,193	17,193	17,193	17,193	17,193
Recruitment	5,847	5,847	5,847	–	–	–
CDA Account						

	Year 1/2012-2013			Year 2/2013-2014		
	Usual Care	Bridges	Bridges PLUS	Usual Care	Bridges	Bridges PLUS
Account opening	–	27,414	27,414	–	–	–
Initial account deposit	–	20,000	20,000	–	–	–
Annual matched savings	–	16,330	38,613	–	4,447	4,492
Mentorship	–	55,490	55,490	–	–	–
IGA Training	–	15,512	15,512	–	23,934	23,934
Equipment	42,396	84,793	84,793	26,692	53,384	53,384
Personnel	64,837	129,674	129,674	39,407	78,814	78,814
Leveraged Resources	3,178	20,620	20,620	3,180	16,551	16,470
Total per child costs	<u>109,595</u>	<u>286,736</u>	<u>309,020</u>	<u>87,822</u>	<u>142,895</u>	<u>142,940</u>

Note: All prices are in nominal Uganda Shillings (UGX); denominator is the treated sample size when calculating the per-person cost.

Appendix Table 3

Per person program costs over two intervention years (in 2012 real US dollars)

Samples	Exchange Rate	Usual Care (\$)	Bridges (\$)	Bridges PLUS (\$)
Intent-to-treat	Nominal	104	364	373
	Purchasing Power Parity (PPP)	255	890	912
Treatment-on-the-treated	Nominal	118	418	426
	PPP	289	1022	1044

Note: The costs over two intervention years are summed after adjusting the program costs in Table 2 in the second year by inflation (to real dollars in 2012) and discounting (at 3% discount rate). A 3% discount rate is standard in cost-effectiveness studies [44]. When exchanging the Ugandan Shillings (UGX) to US dollars (USD), two types of exchange rates are used: nominal exchange rate and purchasing power parity exchange rate. When dividing the total program costs by the number of participants, two types of denominators are used: intent-to-treat sample and treatment-on-the-treated sample. The bolded numbers indicate our preferred specification.

Appendix Table 4

Description of outcome measures

Outcomes	Description	Response options
Child depression (Range: 0-54) 27 items; $\alpha=0.68$	"I am sad once in a while/many times/all the time;" "I do most things okay/I do many things wrong/I do everything wrong;"	0 being the least depressed; 2 being the most depressed
Hopelessness (Range: 0-20) 20 items; $\alpha=0.65$	"I don't expect to get what I really want;" "I might as well give up because there is nothing I can do about making things better for myself;" "My future seems dark."	True/False
Self-concept (Range: 20-100) 20 items; $\alpha=0.74$	"I like the way I look;" "I'm happy with who I am;" "I feel good most of the time."	Always true (5) to always false (1)
Self-efficacy (Range: 32-116) 29 items; $\alpha=0.82$	"Some kids feel they can understand math if they work at it BUT other kids feel that no matter how hard they work at it, it is still very hard to learn math;" "Some kids feel that they can NOT figure out the answers in school even when they try, BUT other kids feel that they can usually figure out the answers in school if they try;" "Some kids find that even when they try, it is hard to get people their age to like them, BUT other kids think that if they try, they can get people their age to like them."	Pick one statement that fits better and score very true or sort of true (range: 1 to 4, with 4 indicating the highest self-efficacy)

Outcomes	Description	Response options
Sexual risk-taking intentions (Range: 5-25) 5 items; $\alpha=0.76$	"I believe it's OK for people my age to have sex with someone they've just met;" "I agree that it's OK to force a girlfriend/boyfriend to have sex even when they don't want to;" "I believe it's OK to have sex without protection with someone you know."	Always (5) to never (1)
HIV prevention attitudes (Range: 5-25) 5 items; $\alpha=0.70$	"I think it is very important to use condoms every time one has sex;" "As a teenager I think AIDS is a threat to my health;" "I think all people my age who have sex should use condoms."	Agree a great deal (5) to not at all agree (1)
HIV knowledge (Range: 0-16) 16 items; $\alpha=0.83$	"You can look at a person and tell if they are infected with HIV/AIDS;" "If a woman is using birth control pills, she is protected from HIV infection;" "You can get HIV from using the same washing basin with an HIV infected person."	1 when the response is correct and 0 when wrong.

Appendix Table 5

Multilevel regressions for outcomes pooling two intervention arms

Panel 1:	Self-rated health	Depression	Hopelessness	Self-concept
Group (Ref: Usual Care)				
Intervention	-0.18 ** [-0.312, -0.048]	0.049 [-0.109, 0.207]	-0.012 [-0.138, 0.115]	-0.121 + [-0.243, 0.001]
Time (Ref: Baseline)				
24 Month	-0.068 [-0.196, 0.060]	-0.212 *** [-0.307, -0.118]	-0.451 *** [-0.542, -0.361]	0.304 *** [0.215, 0.392]
Group $\times$ Time				
Intervention $\times$ 24 Month	0.348 *** [0.195, 0.501]	-0.275 *** [-0.395, -0.154]	-0.209 *** [-0.333, -0.085]	0.308 *** [0.184, 0.431]
Constant	0.039 [-0.064, 0.141]	0.133 * [0.005, 0.261]	0.375 *** [0.278, 0.472]	-0.198 *** [-0.284, -0.112]
Observations	2604	2589	2601	2601
N	1383	1383	1383	1383
Panel 2:	Self-efficacy	Sexual risk-taking intention	HIV prevention attitudes	HIV knowledge
Group (Ref: Usual Care)				
Intervention	-0.168 * [-0.327, -0.009]	0.006 [-0.117, 0.128]	0.04 [-0.139, 0.219]	-0.012 [-0.206, 0.182]
Time (Ref: Baseline)				
24 Month	0.157 [-0.046, 0.360]	0.03 [-0.129, 0.188]	0.584 *** [0.393, 0.775]	0.516 *** [0.362, 0.671]
Group $\times$ Time				
Intervention $\times$ 24 Month	0.331 ** [0.1, 0.562]	-0.15 [-0.345, 0.044]	-0.009 [-0.216, 0.197]	0.374 *** [0.195, 0.553]
Constant	-0.109 + [-0.226, 0.007]	-0.013 [-0.111, 0.084]	-0.401 *** [-0.565, -0.237]	-0.477 *** [-0.629, -0.325]
Observations	2585	2551	2604	2603
N	1383	1383	1383	1383

Panel 1:	Self-rated health	Depression	Hopelessness	Self-concept
Panel 3:	Attendance 90% [Odds Ratio]	Drop out [Odds Ratio]	Take PLE [Odds Ratio]	PLE score
Group (Ref: Usual Care)				
Intervention	1.715 [*] [1.051, 2.799]	0.697 [0.443, 1.098]	1.339 [0.810, 2.214]	-2.277 ⁺ [-4.893, 0.339]
Constant	0.333 ^{***} [0.224, 0.497]	0.392 [0.275, 0.554]	1.291 [0.853, 1.952]	26.937 ^{***} [24.852, 29.023]
N	1383	1383	1383	1383

Note:

⁺ p<0.10,

^{*} p<0.05,

^{**} p<0.01,

^{***} p<0.001.

Appendix Table 6

Cost-effectiveness (CE) ratios relative to Usual Care (in 2012 real US dollars)

	Intervention groups (Bridges + Bridges PLUS)		Unit
	CE	(95% CI)	
Self-rated health	174.7	(121.4 – 311.8)	0.2 Standard deviation increase
Depression	221.1	(153.9 – 394.8)	0.2 Standard deviation decrease
Hopelessness	290.9	(182.6 – 715.3)	0.2 Standard deviation decrease
Self-concept	197.4	(141.1 – 330.4)	0.2 Standard deviation increase
Self-efficacy	183.7	(108.2 – 608.0)	0.2 Standard deviation increase
Sexual risk taking intention	405.33	(n.s.)	0.2 Standard deviation decrease
HIV prevention attitudes	6755.6	(n.s.)	0.2 Standard deviation increase
HIV knowledge	162.6	(109.9 – 311.8)	0.2 Standard deviation increase
Attendance 90%	5.9	(2.4 – 82.7)	1 percent
Drop out	13.9	(n.s.)	1 percent
Take PLE	12.4	(n.s.)	1 percent
PLE score	185.3	(n.s.)	One point

Note: The shaded areas indicate that the intervention effect is not statistically significant

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Figure 1. CONSORT Flow Diagram: Bridges Study

Note: The study uses an intent to treat. Therefore, children who did not respond to 12-month interview were traced and followed-up at 24-month. The lost to follow up numbers at 12-month and 24-month therefore are relative to the baseline number.

Table 1

Descriptive statistics of adolescent characteristics at baseline

Baseline Characteristics	Usual Care	Bridges	Bridges PLUS
<u>Socio-demographics</u>			
Age	12.75 (1.23)	12.56 (1.31)	12.71 (1.25)
Female	55%	57%	56%
Household size	6.43 (2.97)	6.29 (2.62)	6.32 (2.74)
Number of children in household	3.18 (2.32)	3.14 (2.08)	3.23 (2.18)
Double orphan	25%	18%	20%
Years since living in the household	7.12 (4.41)	7.19 (4.44)	7.44 (4.54)
Primary caregiver			
Parents	37%	41%	44%
Grandparents	40%	35%	36%
Other relatives	23%	24%	21%
<u>Outcomes</u>			
Self-rated health (Range: 1-5) 1 item	4.28 (0.90)	4.11 (1.00)	4.13 (0.97)
Child depression (Range: 0-54) 27 items; $\alpha=0.68$	9.72 (5.13)	9.67 (4.97)	9.98 (4.97)
Hopelessness (Range: 0-20) 20 items; $\alpha=0.65$	5.42 (3.17)	5.13 (3.20)	5.51 (2.95)
Self-concept (Range: 20-100) 20 items; $\alpha=0.74$	67.49 (9.31)	67.54 (9.65)	65.60 (9.15)
Self-efficacy (Range: 29-116) 29 items; $\alpha=0.82$	99.34 (11.16)	98.22 (12.22)	96.67 (12.58)
Sexual risk-taking intentions (Range: 5-25) 5 items; $\alpha=0.76$	9.02 (5.00)	9.06 (4.76)	9.02 (4.60)
HIV prevention attitudes (Range: 5-25) 5 items; $\alpha=0.70$	17.54 (6.74)	18.08 (6.35)	17.56 (6.53)
HIV knowledge (Range: 0-16) 16 items; $\alpha=0.83$	7.75 (2.85)	7.91 (2.81)	7.66 (2.82)
Attendance rates > 90% ^I	26%	33%	44%
Dropout rate ^I	30%	22%	23%
Whether taking PLE ^I	54%	64%	62%
PLE score ^I (Range: 4-36) 1 item	26.85 (6.28)	22.42 (7.81)	24.46 (6.23)
<u>Sample Sizes</u>			
Baseline	487	396	500
24-Month Follow-Up	427	345	449

Note: Percentages or means are provided for each indicator, and standard deviations are provided for continuous outcomes in parenthesis.

^I Summary statistics from educational outcomes are from 24-month post intervention initiation because baseline information is not available.

Table 2

Multilevel regressions for health, mental health, self-concept, and self-efficacy

Outcomes	Self-rated health	Depression	Hopelessness	Self-concept	Self-efficacy
Group (Ref: Usual Care)					
Bridges	-0.194 [*] [-0.345, -0.043]	0.011 [-0.162, 0.184]	-0.086 [-0.214, 0.043]	-0.017 [-0.154, 0.12]	-0.099 [-0.257, 0.06]
Bridges PLUS	-0.168 [*] [-0.326, -0.01]	0.082 [-0.109, 0.273]	0.050 [-0.11, 0.211]	-0.206 ^{**} [-0.349, -0.064]	-0.228 [*] [-0.436, -0.021]
Time (Ref: Baseline)					
24 Month	-0.068 [-0.196, 0.06]	-0.212 ^{***} [-0.307, -0.118]	-0.452 ^{***} [-0.542, -0.361]	0.304 ^{***} [0.215, 0.392]	0.157 [-0.046, 0.36]
Group × Time					
Bridges × 24 Month	0.336 ^{***} [0.166, 0.506]	-0.253 ^{**} [-0.409, -0.098]	-0.178 [*] [-0.353, -0.003]	0.227 ^{**} [0.078, 0.376]	0.306 [*] [0.057, 0.554]
Bridges PLUS × 24 Month	0.357 ^{***} [0.181, 0.533]	-0.291 ^{***} [-0.425, -0.158]	-0.234 ^{***} [-0.364, -0.104]	0.371 ^{***} [0.231, 0.511]	0.351 ^{**} [0.093, 0.609]
Constant	0.039 [-0.064, 0.141]	0.133 [*] [0.005, 0.261]	0.375 ^{***} [0.278, 0.472]	-0.199 ^{***} [-0.285, -0.114]	-0.109 ⁺ [-0.226, 0.007]
Variance of School Random Intercepts	0.008 ^{***} [0.002, 0.035]	0.026 ^{***} [0.013, 0.053]	0.015 ^{***} [0.004, 0.058]	0.020 ^{***} [0.010, 0.044]	0.025 ^{***} [0.012, 0.049]
Variance of Child Random Slopes (time)	0.031 ^{***} [0.287, 0.336]	0.227 ^{***} [0.200, 0.256]	0.254 ^{***} [0.226, 0.285]	0.237 ^{***} [0.224, 0.251]	0.317 ^{***} [0.286, 0.351]
Variance of Child Random Intercepts	0.852 [*] [0.753, 0.945]	0.853 ^{**} [0.757, 0.962]	0.847 ^{**} [0.762, 0.942]	0.767 ^{***} [0.694, 0.848]	0.838 ^{**} [0.744, 0.945]
Covariance of Child Slopes & Intercepts	-0.348 ^{***} [-0.393, -0.303]	-0.287 ^{***} [-0.328, -0.246]	-0.295 ^{***} [-0.340, -0.249]	-0.229 ^{***} [-0.251, -0.206]	-0.306 ^{***} [-0.356, -0.257]
Variance of Residual	0.237 ^{***} [0.189, 0.298]	0.146	0.159 ^{***} [0.138, 0.182]	0.142 ^{***} [0.118, 0.172]	0.177 ^{***} [0.143, 0.219]
Wald-test: Bridges × 24 Month= Bridges PLUS × 24 Month (χ^2)	0.06	0.23	0.39	3.05 ⁺	0.17
Observations	2604	2589	2601	2601	2585
N	1383	1383	1383	1383	1383

Note:

⁺ p<0.10,

p<0.001.

p<0.01
**
p<0.05
*

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Table 3

Multilevel regressions for sexual risk taking intention, HIV prevention attitudes and HIV knowledge

Outcomes	Sexual risk taking intention	HIV prevention attitudes	HIV knowledge
Group (Ref: Usual Care)			
Bridges	0.011 [−0.138, 0.16]	0.091 [−0.117, 0.299]	0.007 [−0.209, 0.223]
Bridges PLUS	0.000 [−0.136, 0.137]	−0.002 [−0.181, 0.178]	−0.030 [−0.266, 0.206]
Time (Ref: Baseline)			
24 Month	0.029 [−0.13, 0.188]	0.584 *** [0.392, 0.775]	0.516 *** [0.362, 0.671]
Group × Time			
Bridges × 24 Month	−0.234 * [−0.454, −0.014]	−0.049 [−0.273, 0.176]	0.379 *** [0.183, 0.575]
Bridges PLUS × 24 Month	−0.085 [−0.305, 0.135]	0.021 [−0.195, 0.238]	0.370 *** [0.167, 0.573]
Constant	−0.014 [−0.11, 0.083]	−0.401 *** [−0.565, −0.237]	−0.477 *** [−0.629, −0.325]
Variance of School Random Intercepts	0.002 ** [0.000, 0.138]	0.011 *** [0.003, 0.048]	0.046 *** [0.029, 0.073]
Variance of Child Random Slopes (time)	0.335 *** [0.313, 0.358]	0.288 *** [0.267, 0.310]	0.218 *** [0.201, 0.237]
Variance of Child Random Intercepts	0.850 ** [0.756, 0.956]	1.106 ** [1.028, 1.189]	0.633 *** [0.579, 0.691]
Covariance of Child Slopes & Intercepts	−0.374 *** [−0.416, −0.332]	−0.416 *** [−0.454, −0.377]	−0.192 *** [−0.219, −0.165]
Variance of Residual	0.167 *** [0.134, 0.209]	0.193 *** [0.170, 0.220]	−0.135 *** [0.113, 0.160]
Wald-test: Bridges × 24 Month= Bridges PLUS × 24 Month (χ^2)	1.85	0.78	0.01
Observations	2551	2604	2603
N	1383	1383	1383

Note:

+ p<0.10,

* p<0.05,

** p<0.01,

*** p<0.001.

Table 4

Multilevel regressions for educational outcomes

	Attendance 90% [Odds Ratio]	Drop out [Odds Ratio]	Take PLE [Odds Ratio]	PLE score
Group (Ref: Usual Care)				
Bridges	1.266 [0.679, 2.359]	0.698 [0.429, 1.136]	1.409 [0.793, 2.506]	-2.687 [-6.05, 0.676]
Bridges PLUS	2.242 *** [1.393, 3.609]	0.697 [0.386, 1.259]	1.278 [0.712, 2.292]	-1.877 [-4.589, 0.834]
Constant	0.335 *** [0.225, 0.499]	0.420 *** [1.180, 0.979]	1.290 [0.853, 1.951]	26.937 *** [24.852, 29.022]
Variance of School Random Intercepts	0.380 ** [0.207, 0.699]	0.420 * [0.180, 0.979]	0.504 *** [0.290, 0.877]	17.200 *** [10.796, 27.405]
Variance of Residual				29.303 *** [26.818, 32.018]
Wald-test: Bridges = Bridges PLUS (χ^2)	4.35 *	0.00	0.11	0.25
N	1383	1383	1383	826

Note:

+
p<0.10,*
p<0.05,**
p<0.01,***
p<0.001.

Table 5

Cost-effectiveness (CE) ratios relative to Usual Care (in 2012 real US dollars)

	Bridges		Bridges PLUS		Unit
	CE	(95% CI)	CE	(95% CI)	
Self-rated health	178.6	(118.6 – 361.4)	172.5	(144.9 – 340.3)	0.2 Standard deviation increase
Depression	237.2	(146.7 – 612.2)	211.7	(144.9 – 389.9)	0.2 Standard deviation decrease
Hopelessness	337.1	(170.0 – 20000.0)	263.2	(169.2 – 592.3)	0.2 Standard deviation decrease
Self-concept	264.3	(159.6 – 769.2)	166.0	(120.5 – 266.7)	0.2 Standard deviation increase
Self-efficacy	196.1	(108.3 – 1052.6)	175.5	(101.1 – 662.4)	0.2 Standard deviation increase
Sexual risk taking intention	256.4	(132.2 – 4285.7)	724.7	(n.s.)	0.2 Standard deviation decrease
HIV prevention attitudes	-1224.5	(n.s.)	2933.3	(n.s.)	0.2 Standard deviation increase
HIV knowledge	158.3	(104.3 – 327.9)	166.5	(107.5 – 368.9)	0.2 Standard deviation increase
Attendance 90%	11.3	(n.s.)	2.5	(1.2 – 7.8)	1 percent
Drop out	9.9	(n.s.)	10.2	(n.s.)	1 percent
Take PLE	7.3	(n.s.)	11.1	(n.s.)	1 percent
PLE score	111.6	(n.s.)	164.1	(n.s.)	One point

Note: The shaded areas indicate that the intervention effect is not statistically significant, and the bolded numbers indicate the more cost-effective intervention arm for a given outcome.