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Cost-effectiveness analysis: Educational interventions that reduce the incidence of HIV/AIDS infection in Kenyan teenagers

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ABSTRACT

This paper demonstrates a comprehensive and thorough application of an education cost-effectiveness analysis. Two interventions implemented in Western Kenya aimed to reduce the incidence of HIV/AIDs contraction in middle school girls. The cost-effectiveness of each intervention is assessed, ex post facto, by combining the results of the two programs' evaluations with their costs. As few education evaluations consider cost, this article highlights a sound and disciplined method to use when detailed cost information is both readily available and unavailable. An analysis such as this has policy implications for a more efficient use of educational resources, reduction in the costs of achieving specific objectives, and expansion on what can be accomplished for a budget or another type of constraint, especially in a low-income to lower-middle income economy context.

1. Introduction

Thirty-seven million people around the world are living with HIV today (UNAIDS, 2015). Seventy percent of all people with HIV in 2014 were living in Sub-Saharan Africa (UNAIDS, 2015). The region has the highest rate of HIV infection in the world where about one quarter of infections occur in people under the age of 25, nearly all as a result of unprotected sex (UNAIDS, 2015). Many believe that adopting safer sexual patterns among youth is crucial in preventing the spread of this incurable disease.

Kenya has the 13th highest HIV infected population in the world (CIA, 2015). In an effort to educate youth and prevent the spread of HIV, in the late 1990s, UNICEF and Kenya's Ministry Of Education (MOE) developed an AIDS education curriculum mainly aimed at abstinence. But by 2003, this curriculum had not been fully implemented in Kenya, which is likely a result of teacher unfamiliarity and discomfort in teaching a sensitive subject (Dupas, 2011).

In this paper I analyzed two programs, a Relative Risk (RR) Program and Uniform Subsidy (US) Program. While the programs were found to be significantly effective, it is important to take into consideration the cost of these interventions. By combining the result of each program's evaluation with its costs, we can assess the cost-effectiveness (CE) of the interventions and compare them to one another. This leads to a more efficient use of educational resources, reduction in the costs of achieving specific objectives, and expansion on what can be accomplished for a budget or another type of constraint (Levin and McEwan, 2001).

The purpose of this paper is to demonstrate an education CE analysis as applied to the RR and US Programs, ex post facto. Cost analysis is a critical component of evaluations especially in low-income or lower-middle income economies. Because evaluations of educational alternatives rarely include cost or keep track of ingredients, this report can serve as a guide to education policy makers who encounter similar deficiencies in quality and quantity of information. In cases where detailed cost data is limited such as with the US and RR Programs, it is imperative that a disciplined and valid approach be used to determine costs. In an effort to present such a method, this paper emphasizes the process in which ingredients' qualities and quantities are identified when they are unknown, incomplete, or inappropriate. This served as a foundation on which to build the CE analysis, yet caution is drawn around stating concrete conclusions in the absence of solid data on ingredients. Education policy makers will be able use this analysis as a source of information and application.

2. description of interventions

2.1. RR program

2.1.1. Description

The RR Program provided 8th grade students with detailed HIV risk information on the distribution of HIV infections by age and gender. Eighth graders averaged 15 years of age due to high repetition. During the period of July 2004–October 2004, a trained project officer visited each of the 71 schools in the treatment group and spoke with students

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for a 40-min session. At the beginning of the period, students were administered an anonymous survey to gauge how much they knew about the distribution of HIV in Kenya. After the survey, the project officer showed the children a 10-min video[1] on "sugar daddies".[2] The video was followed by an open discussion about intergenerational sex.

2.1.2. Theory of action

The rate of HIV infection among girls is three times higher than that of boys in sub-Saharan Africa (Fustos, 2011). This is due to the prevalence of unsafe intergenerational sex (Dupas, 2011). Because wealth is more of an observable trait than HIV infection, sugar daddies may be better able to negotiate having unprotected sex than a teenager. Additionally, older men have been sexually active longer and are more likely to carry HIV. Therefore, teenage girls are at a greater risk of contracting HIV in an intergenerational relationship. Most HIV campaigns emphasize the high prevalence of HIV and attribute this to unprotected sex with anyone, regardless of age, yet this approach omits key information such as data that 25-year-old men are much more likely to have HIV than teenage boys. Consequently, if girls are provided evidence on HIV disaggregated by gender and age, unprotected sex in intergenerational relationships may be reduced along with the rate of infection.

The national HIV/AIDS education curriculum in Kenya, as in many sub-Saharan African countries, is limited to *risk avoidance* information; meaning they promote abstinence until marriage and omit *risk reduction* information such as teaching students how condoms can reduce the chance of HIV transmission (Dupas, 2011). The RR Program sought to explore behavioral choices in response to information on the relative riskiness of partners and choice of protection level, as opposed to deciding whether to engage in sex or not. As such, risk reduction information might be more effective than risk avoidance messages in preventing unprotected sex and in turn HIV infection.

2.2. US program

2.2.1. Description

In the US Program, students were provided two free school uniforms over the last three years of primary school (grades 6–8). In doing this, the opportunity cost, which is a value in terms of the resources that were used or lost by applying them in the best alternative, of pregnancy (and hence unprotected sex) increases. Between February 2003 and July 2003, uniforms were given to all treatment schools' 6th graders, whose ages ranged from 13.5 to 20.5 years. The second distribution occurred 18 months later in the fall of 2004. The same students received uniforms in the 1st and 2nd distributions, regardless of their grade.

2.2.2. Theory of action

As late school entry and grade repetition are common in Kenya, many students are around 15 or 16 years old by the end of 8th grade, and many are sexually active in the upper primary grades (grades 6–8). In addition, although enrollment is almost universal in lower primary grades (grades 1–5), dropout rates are high in upper grades, especially for girls. In the control group of this intervention, about 30% of sixth grade girls dropped out of school before finishing the 8th grade. Girls who are sexually active and become pregnant in primary school usually leave, although they are legally entitled to attend. Because girls who become pregnant usually face strong social pressure to drop out of school, reducing the cost of school raises the opportunity cost of pregnancy and hence, unprotected sex (Duflo et al., 2015). Once a girl leaves school, sex and marriage are expected. For a teenage girl out of school, there is little stigma towards premarital sex and pregnancy that leads to a marriage, which is usually considered an attractive option. Providing a free uniform can reduce absenteeism in younger grades (Evans et al., 2009). Therefore, providing a uniform subsidy was a way to potentially keep girls in school longer, which in the long run can lead to many additional positive benefits for the girls and their families.

2.3. Evaluations and their validity

Results of a CE analysis are most reliable and valid when the underlying interventions are part of high-quality research. Both interventions were randomized control trials. The well-defined population consisted of all 328 public rural schools in 7 divisions of the Butere-Mumias and Bungoma districts in Western Kenya. About 70,000 students were involved in the study (Duflo et al., 2006). The treatment schools were randomly selected by the generation of a random number, after stratifying the 328 schools by location, test scores, and student sex ratio. 82 schools were in the control group, 71 schools were randomly assigned to the RR Program, 83 schools to the US Program and the remaining schools received teacher training in the national HIV prevention curriculum program. Simple OLS regressions which controlled for year of birth, school size, and randomization strata were used for the experiments (Duflo et al., 2015).

2.4. Comparability of the outcomes

Additionally, CE analysis results are most reliable when the underlying interventions produce a significant effect size. Both interventions used childbearing rate as a proxy measure of effectiveness for unprotected sex, which is the main cause of HIV/AIDS infection in the region. The RR Program reduced the incidence of childbearing by 1.5%, significant at the 10% level, within a year of the intervention (Dupas, 2011). The US Program reduced the childbearing rate by 2.7%, significant at the 5% level (Duflo et al., 2015). Comparability issues might arise in the differing ages and grade levels of the two programs. The RR Program involved 8th graders on average at the age of 15, due to high repetition (Dupas, 2011). The US Program started with 6th graders whose ages averaged 13.5 years at baseline (Duflo et al., 2015). Both programs were evaluated within a year of ending, in July 2005.

3. Cost analysis

CE analysis is a form of cost analysis in which alternatives are evaluated according to their relative costs and effects (Levin and McEwan, 2001). In order to compare the CE of two or more interventions, programs must have similar or identical goals and a common measure of effectiveness (Levin and McEwan, 2001). Because both the RR Program and the Uniforms Subsidy Program have the same goal of reducing the incidence of HIV infection by unprotected sex in Kenyan teenagers and the same outcome measurement obtained from a rigorous evaluation, CE analysis was deemed the most fitting cost analysis.

3.1. Ingredients method, identification, and sources

In this analysis, the cost of each intervention was valued in terms of the resources that were used or lost by applying them in the best alternative, which is also known as the opportunity cost. This was performed using the ingredients method. I specified all the "ingredients" required to create or replicate each of the programs. All resources needed to produce the effect observed in the evaluation were identified,

[1] The video "Sara: The Trap" was distributed by ACE Communications, who provided this synopsis: *"This episode addresses the issue of sexual exploitation of young girls by older men popularly known as "sugar daddies". Sara is approached by Mbutu, a local shopkeeper, who tries to trap her into a sexual liaison. Mbutu offers to pay for Sara's schooling and to give her other gifts. At school, Sara tells her friends what has happened, and the girls in the school yard show off gifts that they have received from "sugar daddies". Later Sara goes to the market to run errands. Mbutu gives her money for her Uncle and a necklace. He bribes Sara to meet him that night. With the help of her friends and pet monkey, Sara is able to sabotage Mbutu's plan to rape her and expose him to their fellow villagers."*

[2] Sugar daddies are men often decade(s) older than teenage girls with whom they have intergenerational unprotected sexual relationships.