The effect of Abstinence, Being faithful to one partner, and Condom use (ABC) messages on HIV infection among youth in Uganda

By

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A dissertation submitted in partial satisfaction of the Requirements for the degree of Doctor of Philosophy in Epidemiology in the Graduate Division of the University of California, Berkeley

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The effect of Abstinence, Being faithful to one partner, and Condom use (ABC) messages on HIV infection among youth in Uganda

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ABSTRACT

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By

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Uganda has suffered a devastating epidemic of HIV/AIDS for the last two and a half decades, with an estimated 2.6 million people becoming infected by 2005, half of whom had died by the end of that year. In 2009 an estimated 1.2 million people were living with HIV/AIDS in Uganda, including 120,000 who became infected in 2009. A campaign for abstinence from sex, being faithful to one sexual partner and condom use (ABC) became a pillar of HIV/AIDS prevention efforts in Uganda. Though there are indications that this intervention played a role in reducing the prevalence of HIV in Uganda, there are no data with which to estimate the impact of this intervention. It is important to determine the effect of this intervention, particularly among youth, who are thought to be a window of hope for changing the course of the HIV pandemic. There is also a need to explore the relationship between stigma and risky sexual behavior. While it has been shown that stigma affects uptake of voluntary counseling and testing (VCT), it is possible that stigma may also have effects on sexual behavior. While reluctance to take up VCT may be due to fear of being stigmatized when found to be HIV positive, it is also possible that fear of being stigmatized may lead to safer sexual behavior. Exploring the
relationship between HIV/AIDS-related stigma and sexual behavior requires a valid measure of HIV/AIDS related stigma, but there is currently no such instrument that has been validated for use among youth in Uganda.

The aims of this dissertation were to estimate the effects of the abstinence, being faithful, and condom use messages (ABC) on risky sexual behavior and HIV infection among youth in Uganda and to develop an instrument for measuring HIV/AIDS-related stigma among youth in Uganda.

Chapter 1 presents an overview of HIV/AIDS and prevention efforts in Uganda.


Chapter 3 also utilizes data from the Uganda National HIV zero and behavioral Survey of 2004/2005 to estimate the effect of the ABC messages on risky sexual behavior among youth in Uganda.

Chapter 4 presents a report on the development process for and psychometric properties of an instrument that was developed to measure HIV/AIDS-related stigma among youth in Uganda.

Chapter 5 presents a summary of study findings, conclusions and implications for public health and future research.
DEDICATION

I dedicate this dissertation to my wonderful family: My patient and understanding wife, Helen Lilian Auren, who had to go an extra mile to care for me and the children while I was busy with studies and to our lovely children Isaac Gregory Ekwaru and Gabriella Acelo who were a tremendous source of joy and inspiration despite enduring many days of my unavailability to play with them.

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CHAPTER 1

HIV/AIDS overview and prevention efforts in Uganda
BACKGROUND

HIV/AIDS

The human immunodeficiency virus (HIV) is a member of a group of viruses called retroviruses. HIV destroys a type of defense cell in the body called the CD4 helper lymphocyte. These lymphocytes are part of the body's immune system, the defense system that fights infectious diseases. As HIV destroys CD4 and other cells, the immune system of the infected individual is weakened, leaving the person vulnerable to various infections, known as "opportunistic infections" as well as various malignancies. When this occurs, the infected individual is said have a condition called acquired immunodeficiency syndrome (AIDS). The U.S. Centers for Disease Control and Prevention (CDC) defines someone as meeting the clinical diagnosis of AIDS if he or she has tested positive for HIV and meets one or both of these conditions: (1) has experienced one or more HIV/AIDS-related infections or illnesses; (2) the number of CD4 cells has reached or fallen below 200 per cubic millimeter of blood.

HIV is present in the blood and other body fluids of an infected person and is mainly transmitted through the exchange of such fluids. The most common ways in which HIV is transmitted include unprotected anal or vaginal sex, sharing needles or other injection equipment, and from mother to child during pregnancy, delivery, or breast-feeding.

According to the 2010 UNAIDS report on the global AIDS Epidemic, around 33.3 million people were living with HIV worldwide at the end of 2009, including approximately 2.6 million who became infected in 2009(1). It was also estimated that 2 million deaths due to AIDS-related illness occurred worldwide in 2009(1).

HIV/AIDS in Uganda

Uganda has suffered a devastating epidemic of HIV/AIDS for the last two and a half decades. The Uganda AIDS Commission estimates that, since 1982 when the country's first cases of HIV infections were detected on the shores of Lake Victoria in Rakai district, cumulatively an estimated 2.6 million Ugandans had been infected by the end of 2005, of whom about half had died due to HIV/AIDS-related illnesses, including 76,000 in 2005 alone (2, 3).
According to the 2010 UNAIDS report on the global AIDS Epidemic, around 1.2 million people were living with HIV in Uganda at the end of 2009, including approximately 120,000 people who became infected in 2009(1). In the same year, an estimated 64,000 people died in Uganda due to HIV/AIDS-related illnesses (1). Though with varying magnitude, the HIV/AIDS epidemic has affected all regions and occupational groups in Uganda, affecting both rural and urban areas. Life expectancy in Uganda is currently 48.9 years (50 years for women and 48 years for men), but it has been projected that it would have been 56.9 years without AIDS (4). Most of the AIDS deaths occur among men and women of childbearing age, resulting in an increase in orphans and vulnerable children. It is estimated that, in 2009, Uganda had about 1.2 million orphans who had lost one or both parents to AIDS (1).

In Uganda, young people aged 15–24 years, referred to as youth, account for about 20% of the total population (5). Many of these youth are at risk of or already struggling with the consequences of unplanned pregnancies or sexually transmitted infections (STI), including HIV/AIDS. Though the majority of new HIV infections in Uganda now appear to have shifted to older age groups, the burden of HIV infection among youth is still very high (2). The Uganda National HIV Sero and Behavioral Survey (UHSBS) of 2004/5 estimated the prevalence of HIV infection among youth at 3%, and it was higher among young women(4%) compared to young men(1%) (6).

Youth in Uganda are highly vulnerable to HIV because of social, economic, behavioral, and biological factors(4). Youth are at an age of rapid physical and psychological development that compels them to experimentation and risk taking (4). Though there has been some reduction in the frequency of high risk sexual behavior, youth in Uganda still start sex early, especially young men. In 2005, about 17% of Ugandan girls and 23% of boys aged 15 years reported having already had sex (6). Early sexual debut has been found to be associated with a higher risk of HIV infection, at least in part because those who start sexual activity at an early age are more likely not to use condoms at first sex and to subsequently have multiple sexual partners, even after controlling for duration of sexual activity (7).

Because of poverty, many youth in Uganda lack basic needs, leading some youth, especially girls, to engage in survival sex, commercial sex work, and early, sometimes forced marriages (4). The 2004/5 national sero-survey also
found that 14% of the sexually active female youth had their last sex when they or their partner had been drinking alcohol, which increases the risk of unprotected sex (6).

Vulnerability of youth to HIV/AIDS is not unique to Uganda. According to the 2011 UNAIDS publication on the synthesis of strategic information on HIV and young people, young people aged 15-24 accounted for 41% of all new adult infections in 2009 (8). It was also estimated that 5 million young people were living with HIV worldwide at the end of 2009 (8). It is estimated that globally, 2,500 youth become infected with HIV every day, most of them in developing countries (9).

In recognition of youth’s vulnerability to HIV/AIDS, the United Nations General Assembly Special Session on HIV/AIDS (UNGASS on HIV/AIDS) outlined a number of goals and targets focusing on youth. Acknowledging that prevention of HIV infection must be the mainstay of the national, regional and international response to the epidemic, one of the goals was to ensure that, by 2010, at least 95% of youth would have access to the information they need to reduce their vulnerability to HIV infection (10).

**HIV/AIDS prevention and control efforts in Uganda**

From the onset of the epidemic, the government of Uganda recognized the gravity of the problem HIV posed and initiated public health strategies for its prevention and control. In 1987, the government of Uganda established a National AIDS Control program (NACP), which piloted and implemented several interventions to contain further spread of HIV. The NACP was initially established under the Ministry of Health, but on recognizing the need for a multisectoral strategy the Uganda AIDS Commission (UAC) was subsequently established to coordinate HIV/AIDS control activities of various sectors and partners.

Because the majority of HIV infections in Uganda are transmitted through heterosexual contact, the prevention strategy of the NACP sought to address risky sexual behavior. The prevention strategy was to promote sexual abstinence, mutual faithfulness among married or cohabiting partners, and condom use. This approach to prevention, commonly known as ABC (Abstinence, Being faithful, Condom use), has continued to be the pillar of the HIV prevention strategy in Uganda (3). It has since been expanded to include
voluntary counseling and HIV testing (VCT), prevention of mother-to-child transmission (PMTCT), antiretroviral treatment (ART), and HIV/AIDS care and support services. There is a widespread belief that scaling up HIV voluntary counseling and testing (VCT) programs will have large prevention benefits through reductions in risky sexual behaviors (11).

**Existing evidence on the effectiveness of the ABC campaign in Uganda**

Uganda has experienced positive changes in sexual behavior and a decline in the prevalence of HIV since the establishment of the NACP. The national prevalence of HIV infection declined from 18.3% at the end of 1992 to about 6.4% in 2005 (2). The survey of 2004/5 estimated national prevalence of HIV among 15-49 year olds at 6.4%, 0.7% among under 5 year olds, and 5.8% among 50-59 year olds (6). The survey also found large variations in both HIV knowledge and HIV prevalence within the country. HIV prevalence ranged from 8.5 percent in the central region to 2.3 percent in the West Nile region. Among youth, HIV knowledge, which was assessed in relation to the ABC messages, was found to vary by gender, education, residence (urban/rural) and geographic location. Urban youth had greater knowledge than rural youth. While more than half of youth in Kampala (52 percent of women and 53 percent of men) had comprehensive HIV knowledge, fewer than 20 percent of young men and women in the Southwest region had comprehensive HIV knowledge.

The decline in HIV prevalence in Uganda has been attributed to the ABC campaign because corresponding changes were also observed in the reported frequency of abstinence, reduction in number of sexual partners and increased condom use (12-18). The observed decline in HIV prevalence in Uganda led to an intense debate about its determinants. Some have argued that delayed sexual debut (i.e. abstinence) was the pivotal factor in the decline of HIV infections, while others have argued that increased use of condoms was responsible for the decline, and still others have argued that reductions in the number of sexual partners was the main factor (12-18).

According to the Uganda AIDS Commission, the debate on the determinants of the decline threatened to derail the country’s gains in fighting HIV. However, through an open dialogue, stakeholders acknowledged the benefits of each component and agreed to continue promoting them together as a package. The position taken by the stakeholders is in line with calls to
emphasize all of the components of ABC rather than single components (19). Though there is interest in knowing the relative importance of each individual component of ABC, it is difficult if not impossible to disaggregate the contributions of these factors, because all of the components of ABC were promoted in the campaign (19, 20). Promotion of single components of the ABC strategy may be ineffective. For example, though condoms provide approximately 87% protection when correctly and consistently used, a randomized trial that assessed the effect of increasing condom use alone found no effect on HIV incidence and the authors concluded that the observed increase in condom use was offset by an increased number of sexual partners (21, 22).

Though there are indications that the ABC strategy played a role in reducing the prevalence of HIV in Uganda, the magnitude of the effect is unknown. Furthermore given the large variations in HIV prevalence and risky sexual behavior observed in the national survey, the effect may not have been uniform across gender groups, rural/urban areas, and geographical locations. Some studies have found behavioral interventions to be more effective among girls than boys. A behavioral intervention trial that was done in Uganda also found a significant individual effect only among females, though the authors concluded that the intervention had no effect at the community level (23).

Uptake of voluntary counseling and testing (VCT) added as a component of HIV prevention is also affected by the barrier created by HIV/AIDS-related stigma VCT (24). In a study done in South Africa, people who had not taken up VCT were more likely to hold negative attitudes toward people with HIV. They were more likely to believe that people with AIDS must have done something wrong to have AIDS and were more likely to say that they would rather not be friends with someone who has AIDS (24). Stigma not only affects willingness to undergo voluntary HIV counseling and testing, it may also have effects on sexual behavior. While those who hold negative attitudes towards people living with HIV/AIDS may be reluctant to take an HIV test for fear of becoming one of the stigmatized, it is possible that the same fear may also lead them to exercise more caution in their sexual behaviors, such as delay their sexual debut, limit their number of sexual partners and use condoms regularly once they do begin to have sex. If this is the case, then stigma reduction interventions that are meant to improve VCT uptake may
perversely have negative effects on sexual behavior. It is, therefore, also important to explore the relationship between stigma and risky sexual behavior. Understanding this relationship will be useful in modifying stigma reduction interventions to improve VCT uptake without negatively affecting sexual behavior.

**DISSERTATION AIMS AND RATIONALE**

The aims of this dissertation are to determine the effect of the ABC messages on the risk of HIV infection and on risky sexual behavior among youth in Uganda, and to develop an instrument for measuring HIV/AIDS related stigma among youth in Uganda.

**SPECIFIC AIMS**

**Aim 1:** Determine the effect of the ABC messages on prevalent HIV infection among youth in Uganda.

**Hypothesis:** The prevalence of HIV infection is lower among youth who know the ABC prevention messages compared to those who do not know the ABC messages.

**Aim 2:** Determine the effect of the ABC messages on risky sexual behavior.

**Hypothesis:** Risky sexual behavior is less frequent among youth who know the ABC messages compared to youth who do not know the ABC messages.

**Rationale for specific aims 1 and 2**

Because ABC has become a pillar of HIV/AIDS prevention efforts in Uganda, determining its effects among youth is particularly important, as youth are the ‘window of hope’ in changing the course of the HIV/AIDS pandemic (25). Youth are considered a ‘window of hope’ because many behavioral habits are formed during the early adolescent years, and as acquisition of HIV in youth is predominantly through sexual activities, this period in life provides the opportune time to influence positive behaviors, choices and lifestyles that will last into adulthood (25).

**Aim 3:** Develop an instrument for measuring HIV/AIDS-related stigma among youth in Uganda.
Rationale for specific aim 3

The development of an instrument to measure HIV/AIDS-related stigma among youth will be a first step in studying the effect of HIV/AIDS-related stigma on risky sexual behavior. Though there exist several scales that measure HIV/AIDS-related stigma among HIV/AIDS patients and scales that measure HIV/AIDS-related stigma among HIV-uninfected individuals, most of these previously described scales have not been developed or validated for use in an African setting, and most of these scales may be relevant only among the people for whom they were developed (26). In addition to its use in studying the effects of and factors that affect HIV/AIDS-related stigma, an instrument to measure HIV/AIDS-related stigma will also be useful in evaluating the effectiveness of programs intended to reduce HIV/AIDS-related stigma.
REFERENCES


CHAPTER 2

The effect of Abstinence, Being faithful to one partner, and Condom use (ABC) messages on HIV infection among youth in Uganda.
ABSTRACT

Background: HIV infection among adolescents and young adults is a significant and growing problem worldwide. According to the 2011 UNAIDS publication on the synthesis of strategic information on HIV and young people, young people 15-24 years of age accounted for 41% of all new adult infections in 2009 and an estimated 5 million young people were living with HIV globally at the end of 2009(1). In Uganda youth aged 15–24 account for about 20% of the total population. Many of these youth are at risk of or already struggling with the consequences of unplanned pregnancies or sexually transmitted infections (STI), including HIV/AIDS. Because the majority of HIV infections in Uganda are transmitted through heterosexual contact, the Government of Uganda used educational messages to promote sexual abstinence, mutual faithfulness among married or cohabiting partners, and condom use. Though there are indications that this intervention played a role in the decline of the prevalence of HIV that has been observed in Uganda, there are no data on the estimated effect of this intervention. The aim of this study was to obtain an estimate of the effect of the abstinence, being faithful to one partner, and condom use messages (ABC) on the prevalence of HIV infection among youth in Uganda.

Methods: The study was based on an analysis of data from the 15-24 year old youth who participated in the Uganda national HIV Sero and Behavioural Survey (UHSBS) of 2004/5. A targeted maximum likelihood estimator (TMLE) was used to estimate the average effect of the ABC messages on HIV prevalence.

Results: Knowledge of the ABC messages is associated with a reduction in the prevalence of HIV by 1.5 (95% CI: 0.2 to 2.9) percentage points among 18-24 year old Ugandan youth. The effect of the ABC messages on the prevalence of HIV was greater among female youth compared to male youth.

Conclusion: Knowledge of the ABC messages was associated with a reduction in the prevalence of HIV of 1.5 percentage points among Ugandan youth who are legally of age to make their own decisions (18-24 years). However, the effect of the ABC messages is lower among male youth compared to female youth.
BACKGROUND

HIV infection among adolescents and young adults is a significant and growing problem worldwide. According to the 2011 UNAIDS publication on the synthesis of strategic information on HIV and young people, young people aged 15-24 accounted for 41% of all new adult infections in 2009 (1). It was also estimated that 5 million young people were living with HIV worldwide at the end of 2009(1).

In recognition of youth’s vulnerability to HIV/AIDS, the United Nations General Assembly Special Session on HIV/AIDS (UNGASS on HIV/AIDS) outlined a number of goals and targets focusing on youth. Acknowledging that prevention of HIV infection must be the mainstay of the national, regional and international response to the epidemic, one of the goals was to ensure that, by 2010 at least 95% of youth would have access to the information they need to reduce their vulnerability to HIV (2).

In Uganda, youth aged 15–24 years, account for about 20% of the total population (3). Many of these youth are at risk of or already struggling with the consequences of unplanned pregnancies or sexually transmitted infections (STI), including HIV/AIDS (4).

Though the majority of new HIV infections in Uganda appear to have shifted to older age groups, the burden of HIV among youth is still very high (5). The Uganda National HIV Sero and Behavioral Survey (UHSBS) of 2004/5 estimated the prevalence of HIV infection among youth at 3%, and it was higher among females (4%) compared to males(1%) (6).

Because the majority of HIV infections in Uganda are transmitted through heterosexual contact, the prevention strategy that the Government of Uganda adopted to contain further spread of HIV was a campaign to promote sexual abstinence, mutual faithfulness among married or cohabiting partners, and condom use. This approach to prevention, commonly known as ABC (Abstinence, Being faithful, Condom use), has continued to be the pillar of the HIV prevention efforts in Uganda (7). Since the start of the campaign to reduce risky sexual behavior in 1987, Uganda has experienced a decline in HIV prevalence from 18.3% at the end of 1992 to about 6.4% in 2005(5). Results from population-based cohorts in the districts of Masaka (8) and Rakai (9) showed declines in the incidence of HIV infection as well.
The decline in HIV prevalence has been attributed to the ABC campaign because corresponding changes were also observed in self-reported abstinence, number of sexual partners and condom use (10-16).

Though there are indications that this intervention played a role in reducing HIV prevalence in Uganda, there are no data on the estimated effect of this intervention. Obtaining an estimate of the effect of this intervention is important, particularly among youth, who are thought to be a window of hope for changing the course of the HIV pandemic(17).

The main objective of this study was to obtain an estimate of the effect of the abstinence, mutual faithfulness among married or cohabiting partners, and condom use messages (ABC) on the prevalence of HIV infection among youth in Uganda.

**METHODS**

**Study design**

This study was based on analysis of data from youth aged 15-24 years who participated in the Uganda National HIV Sero and Behavioural Survey (UHSBS) of 2004/2005 (6). The UHSBS was a nationally representative, population-based survey that collected data on socio-demographic characteristics, sexual behavior in the past 12 months and blood samples that were tested for HIV.

The survey utilized a two-stage sample design. The first stage involved selecting 417 clusters from a list of enumeration areas covered in the 2002 Uganda national census. The second stage involved systematic sampling of households from the list for each cluster. The survey team provided weights that were used to take into account sampling and non-response probabilities.

**Exposure**

The exposure of interest was knowledge of the ABC prevention messages. Participants in the survey were asked to name the most important HIV message that they got from all the HIV information sources to which they were exposed. Those who mentioned one or more of the three key ABC messages (i.e. Abstinence, Being faithful and use of Condoms) were considered exposed.

**Outcome**

The outcome of interest was prevalent HIV infection at the time of the survey.
Potential confounders that were considered in the analysis were: Age, gender, region, place of residence (rural/urban), male circumcision, education and household wealth.

**Statistical analyses**

Data analysis was carried out using SAS (SAS Institute, Cary, NC, USA) and R – programming language. A targeted maximum likelihood estimator (TMLE)(18), was used to estimate the average effect of the ABC messages on HIV prevalence while adjusting for potential confounders. The variables that we adjusted for in this model were determined based on the assumed relationships encoded in the Directed Acyclic Graph (DAG) in Figure 2-1. Our parameter of interest in this analysis was the difference \( \psi_0 \) in HIV prevalence, comparing the prevalence, \( P(Y_1 = 1) \) of HIV infection when youth know the ABC messages to the prevalence \( P(Y_0 = 1) \) when they do not know the ABC messages.

\[ \psi_0 = P(Y_1 = 1) - P(Y_0 = 1) \]

Assuming the causal relationships encoded in the directed acyclic graph (Figure 2-1) and no unmeasured confounders, the parameter of interest is identifiable from the observed data as

\[ \hat{\psi}_0 = E_W[P(Y = 1|A = 1, W) - P(Y = 1|A = 0, W)] \]

The targeted maximum likelihood estimator is based on the factorization of the likelihood of the observed data into three parts.

\[ \mathcal{L}(O) = P(Y|A, W)P(A|W)P(W) \]

Where,

- \( P(W) \) - Marginal distribution of the covariates \( W \)
- \( P(A|W) \) - Conditional distribution of the exposure, \( A \) (Knowledge of the ABC messages) given the covariates \( W \).
- \( P(Y|A, W) \) - Conditional distribution of the expectation of the outcome \( Y \) (HIV infection) given the exposure \( A \) and covariates \( W \).

TMLE estimator involves estimation of both \( P(A|W) \) and \( P(Y|A, W) \), and is double robust to model misspecification, in that it guarantees asymptotically unbiased estimates whenever at least one of the models is estimated consistently. In this
study, the targeted maximum likelihood estimator was implemented using a package called tmleLite(19). The tmleLite package is available for academic use at http://www.stat.berkeley.edu/~laan/Software/. tmleLite implements a simplified TMLE approach to estimating the additive treatment effect using the Deletion/Substitution/Addition(DSA) algorithm as a default algorithm for data-adaptive estimation of both $P(A|W)$ and $P(Y|A,W)$, but also allows user supplied functions.

The DSA is a data-adaptive algorithm which searches over a space of polynomial generalized linear models (20). A software package for implementing DSA is also available from http://www.stat.berkeley.edu/~laan/Software/.

In this analysis, the tmleLite package was left to use its default algorithm for estimation of both $P(A|W)$ and $P(Y|A,W)$. To identify the parameter of interest, we relied on two major assumptions; first, the randomization assumption (RA), which requires that, conditional on the measured covariates ($W$), exposure assignment is independent of the counterfactual outcome; and secondly, the experimental assignment assumption (ETA), which requires that, conditional on the covariates ($W$) each study subject has a probability greater than 0 and less than 1 of being exposed.

Implementation of the targeted maximum likelihood estimator for the average treatment effect involves the following steps.

1. Estimate the conditional expectation of the outcome $Y$ given $A$ and $W$, $\hat{Q}_n^0(A,W)$ from the observed data as the initial estimates of the true $P(Y=1|A,W)$.

2. Estimate the conditional distribution of the exposure $A$ given the covariates $W$, $\hat{g}_n^0(A,W)$, as the initial estimate of the true $P(A|W)$. This portion can further be factorized to include missigness and censoring mechanisms. The tmleLite incorporates missingness of the outcome in the TMLE estimation.

3. For each study subject, calculate a special covariate $h(A,W)$, based on the subjects observed values for $A$, $W$ and the estimate of $\hat{g}_n^0(A,W)$. The function used to calculate this covariate depends on the parameter of interest. For risk difference (difference in prevalence in our case), this covariate is calculated using the expression.
\[ h(A, W) = \left( \frac{I(A=1)}{g_n^0(1,W)} - \frac{I(A=0)}{g_n^0(0,W)} \right) = \left( \frac{A}{g_n^0(1,W)} - \frac{(1-A)}{1-g_n^0(1,W)} \right) \]

where \( A \) takes on the values 1 and 0 if a study subject is exposed and unexposed respectively.

4. Update the initial estimate, \( \hat{Q}_n^0(A, W) \) by adding the covariate \( h(A, W) \) then estimate its corresponding coefficient by maximum likelihood, holding the coefficients of the initial model fixed.

\[
\text{logit} \left( \hat{Q}_n^1(A, W) \right) = \text{logit} \left( \hat{Q}_n^0(A, W) \right) + \epsilon h(A, W)
\]

5. Evaluate the updated regression at \( A=1 \) and \( A=0 \) to get the two predicted outcomes for each subject. The targeted parameter is then obtained by taking the mean of the difference across all subjects.

\[
\psi_n^{TMLE} = \frac{1}{n} \sum_{i=1}^{n} \left( \hat{Q}_n^1(1, W) - \hat{Q}_n^1(0, W) \right)
\]

6. Inference for the parameter is then obtained through bootstrapping or based on the variance of the influence curve of the parameter of interest (IC). i.e the 95\% confidence interval for the estimated parameter is calculated as

\[
\psi_n^{TMLE} \pm 1.96 \hat{\sigma} / \sqrt{n}
\]

Where

\[
\hat{\sigma}^2 = \frac{1}{n} \sum_{i=1}^{n} \bar{IC}^2
\]

\[
\bar{IC} = h(A, W)(Y - Q_n^1(A, W)) + Q_n^1(1, W) - Q_n^1(0, W) - \psi_n^{TMLE}
\]

\[
h(A, W) = \left( \frac{I(A=1)}{g_n^0(1,W)} - \frac{I(A=0)}{g_n^0(0,W)} \right), \text{ in the case of additive effect.}
\]

A test statistic \( T = \frac{\psi_n^{TMLE}}{\sqrt{\hat{\sigma}^2 / n}} \), can be calculated for testing the null hypothesis that \( H_0: \psi_0 = 0 \)

Participants who had missing data on exposure were excluded from the analysis. However, participants who had missing data on the outcome variable but had exposure response were included in the analysis. A binary variable indicating
whether the outcome was observed or missing was created and supplied to the tmleLite package.

A variable identifying clusters to which survey participants belonged and participants’ survey weights were also supplied to the tmleLite package to take into account the cluster sampling design and the sampling/non-response probabilities.

**Ethical considerations**

Permission to use the data was obtained from the Uganda Ministry of Health (owner of the data) and the University of California, Berkeley Committee for the Protection of Human Subjects. Respondents who took part in the survey had provided informed consent for interviews and blood collection. The survey protocols had been approved by the Uganda National Council for Science and Technology, the Centers for Disease Control and Prevention (CDC), the Institutional Review Boards of the Uganda Virus Research Institute and ORC Macro.

**RESULTS**

Of the 8242 youth who took part in the Uganda national HIV Sero and Behavioral Survey (UHSBS) of 2004/2005 7289(88%) had non-missing responses on knowledge of the ABC messages, the exposure of interest in this study. Of the 7289 who had valid responses on the exposure of interest, 494(7%) had missing HIV results due to technical problems, refused testing or were absent at the time of blood draw. All analyses were based on the 7289 youth who had non-missing responses on the exposure of interest, regardless of whether their HIV results were missing. There were no missing data on confounders except for circumcision which was missing for 7 male participants. These 7 were retained in the analysis by adding a category for missing circumcision status.

Of the 7289 youth who were included in the analysis, 56% were female, and the majority 79% lived in rural areas. The observed prevalence of HIV by demographic characteristics is presented in Table 2-1. The overall prevalence of HIV among 15-24 year old youth was 2.9% and it was much higher among female youth (4.4%) than male youth (1.1%). The prevalence was higher in urban areas compared to rural areas (4.8% and 2.5%, respectively) and higher levels of education were associated with a lower prevalence of HIV infection (Table 2-1).
Figure 2-2 shows the distribution of HIV prevalence by age and knowledge of the ABC messages. The observed prevalence of HIV among youth who knew the ABC messages was 2.7% compared to 3.8% among those who did not know any of them.

Results from the TMLE estimator are presented in Table 2-2. Overall, the estimated marginal difference in HIV prevalence between when youth know the ABC messages and when they do not know was 0.9 percentage points (difference = -0.88, 95% confidence interval: -1.80 to 0.05). The effect was higher and statistically significant among youth who are legally of age to make own decisions (18-24 years) and was not statistically significant among 15-17 year old youth. While the estimated difference in HIV prevalence between when youth know and when they do not know the ABC messages was -1.52 percentage points (95% confidence interval: -2.86 to -0.18) among 18-24 year old youth, it was 0.16 percentage points (95% confidence interval: -1.82 to 2.13) among 15-17 year old youth.

We also found gender differences in the effect of the ABC messages in this population. The effect of the ABC messages was estimated to be higher among female youth compared to male youth. Among 18-24 year old youth, the estimated difference in HIV prevalence between when youth know and when they do not know the ABC messages was -2.48 percentage points (95% confidence interval: -4.95 to -0.0002) among females and -0.44 percentage points (95% confidence interval: -2.20 to 1.33) among males.

DISCUSSION

In addition to providing additional evidence supporting earlier observations that interventions advocating abstinence, mutual faithfulness among married or cohabiting partners, and condom use (ABC) have an effect on HIV prevalence (10-16), this study has also provided estimates of the effect of the ABC messages on HIV prevalence among youth in Uganda. Our results show that knowledge of the ABC messages reduces the prevalence of HIV among Ugandan youth aged 15-24 years by about 1 percentage point and by close to 2 percentage points among youth who are legally of age to make their own decisions (18-24 years).

The effect of the ABC messages on HIV prevalence was statistically significant only among the 18-24 year old youth; the effect was smaller and not statistically significant among those who were under 18 years of age. In addition to possible residual confounding that might not have been accounted for in the analysis and low power due to the small number of HIV infections, other possible reasons for the lack
of a significant effect of the ABC messages among youth who are under 18 years of age may include the following two explanations. First, their sexual behavior may not depend only on their knowledge and the choices that they make, but also on the knowledge of their parents/guardians and the level of control they are allowed by their parents. Second, of all the HIV infected youth who were under 18 years of age, 44% said they had never had sex. Though this may mean that they were under reporting sex, it could also be that a number of infections among youth in this age group may not have resulted from their sexual behavior, but from other sources of infections that are not affected by the ABC messages, such as infections that occurred during delivery, breast feeding, blood transfusion, and medical injections.

We also found the estimated benefit of the ABC messages to be lower and not statistically significant among male youth compared to female youth. While knowledge of the ABC messages was estimated to be associated with a reduction in the prevalence of HIV by 2.5 percentage points among 18-24 year old female youth, the estimated reduction in prevalence was only 0.4 percentage points and not statistically significant among 18-24 year old male youth.

This finding is consistent with findings from a community randomized behavioral intervention trial carried out in Masaka district in Uganda (21). Though the authors concluded that the intervention had no effect overall, their study found a significant reduction of HIV acquisition among females but not among males, even after they had adjusted for a number of possible confounders (21). Finding a greater effect among females in both of these two studies may not be a coincidence. Gender differences in the effects of some sexual behavior interventions have also been observed in studies elsewhere(22). While the ABC messages continue to be a pillar of HIV prevention efforts in Uganda, it will be necessary to determine why the ABC intervention appears to be having less effect among males compared to females. Understanding the factors determining the apparent lack of an effect of the ABC messages among males will help in modifying the intervention so as to improve its effect among male youth.

Because of the cross-sectional nature of our study design, the temporality assumption for the relationship between knowledge of the ABC messages and HIV infections may not be fully met. However, because most youth were not aware of their HIV status at the time of the survey (86%), it is unlikely that HIV status could have influenced their knowledge of the ABC prevention messages. Our measurement of exposure was based on recall, which could have led to
misclassification of the exposure, but it is unlikely that exposure misclassification would have been differential, as most youth were not aware of their HIV status. Possible non-differential misclassification of the exposure could have biased our estimated effect towards the null. Also, because we used knowledge of the ABC messages at the time of the survey as our measure of exposure, some of the youth who became infected with HIV before getting to know the ABC messages could have gotten to know the ABC messages by the time of the survey, which would bias the effect towards the null. Because of these possible biases towards the null, we would expect our estimated effect to be an underestimate of the true effect. However, unmeasured confounding could have biased our estimates away from the null if the youth who got to know ABC messages were better off in some way that we did not measure but that reduced their risk of becoming HIV infected.

In conclusion, our study has estimated that knowledge of the ABC messages is associated with a reduction in the prevalence of HIV of 1 percentage point among 15-24 year old Ugandan youth, and 2 percentage points among Ugandan youth who are legally of age to make own decisions (18-24 years); the effect was higher among female youth compared to male youth.
REFERENCES


Table 2-1. Observed HIV prevalence by demographic characteristics

<table>
<thead>
<tr>
<th>Demographic characteristic</th>
<th>Number of respondents</th>
<th>HIV prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-17</td>
<td>2388</td>
<td>1.14</td>
</tr>
<tr>
<td>18-24</td>
<td>4407</td>
<td>3.89</td>
</tr>
<tr>
<td><strong>Sex of respondent</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3016</td>
<td>1.09</td>
</tr>
<tr>
<td>Female</td>
<td>3779</td>
<td>4.37</td>
</tr>
<tr>
<td><strong>Type of residence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>1391</td>
<td>4.78</td>
</tr>
<tr>
<td>Rural</td>
<td>5404</td>
<td>2.51</td>
</tr>
<tr>
<td><strong>Region</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central, East Central and Kampala</td>
<td>2383</td>
<td>3.43</td>
</tr>
<tr>
<td>North Central</td>
<td>590</td>
<td>3.73</td>
</tr>
<tr>
<td>Eastern and North East</td>
<td>1314</td>
<td>1.92</td>
</tr>
<tr>
<td>Western and South West</td>
<td>1456</td>
<td>3.16</td>
</tr>
<tr>
<td>West Nile</td>
<td>1052</td>
<td>0.91</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>531</td>
<td>4.58</td>
</tr>
<tr>
<td>Primary incomplete</td>
<td>3300</td>
<td>3.15</td>
</tr>
<tr>
<td>Primary complete</td>
<td>832</td>
<td>2.56</td>
</tr>
<tr>
<td>Secondary or higher</td>
<td>2132</td>
<td>2.32</td>
</tr>
<tr>
<td><strong>Wealth Index</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lowest</td>
<td>1092</td>
<td>2.83</td>
</tr>
<tr>
<td>Lower</td>
<td>1352</td>
<td>1.80</td>
</tr>
<tr>
<td>Middle</td>
<td>1139</td>
<td>3.01</td>
</tr>
<tr>
<td>Higher</td>
<td>1295</td>
<td>2.79</td>
</tr>
<tr>
<td>Highest</td>
<td>1917</td>
<td>3.74</td>
</tr>
</tbody>
</table>
Table 2-2. Estimated effect of ABC messages on HIV prevalence

<table>
<thead>
<tr>
<th>Sub-group</th>
<th>Observed HIV prevalence by knowledge of ABC messages (%)</th>
<th>TMLE estimated marginal difference in prevalence [95% CI]</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Didn't know</td>
<td>Knew</td>
<td></td>
</tr>
<tr>
<td><strong>15-17 year olds</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.9</td>
<td>1.2</td>
<td>0.16[-1.82 to 2.13]</td>
</tr>
<tr>
<td><strong>18-24 year olds</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>6.6</td>
<td>5.2</td>
<td>-2.48[-4.95 to -0.0002]</td>
</tr>
<tr>
<td>Male</td>
<td>1.9</td>
<td>1.5</td>
<td>-0.44[-2.20 to 1.33]</td>
</tr>
<tr>
<td>Combined (male &amp; female)</td>
<td>5.1</td>
<td>3.6</td>
<td>-1.52[-2.86 to -0.18]</td>
</tr>
<tr>
<td><strong>Overall, 15-24 year olds</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>5.2</td>
<td>4.1</td>
<td>-1.73[-4.85 to 1.40]</td>
</tr>
<tr>
<td>Male</td>
<td>1.2</td>
<td>1.1</td>
<td>-0.18[-1.25 to 0.89]</td>
</tr>
<tr>
<td>Combined (male &amp; female)</td>
<td>3.8</td>
<td>2.7</td>
<td>-0.88[-1.80 to 0.05]</td>
</tr>
</tbody>
</table>
Demographic covariates: Age, gender, region, type of residence rural/urban, education, wealth

Knowledge of ABC prevention messages

Marital status

Male circumcision status

HIV infection

Figure 2-1. Directed Acyclic Graph
Figure 2-2. Observed HIV prevalence by Age and knowledge of the ABC messages
CHAPTER 3

The effect of Abstinence, Being faithful to one partner, and Condom use (ABC) messages on risky sexual behavior among youth in Uganda.
ABSTRACT

Background: Uganda has suffered a devastating epidemic of HIV/AIDS for the last two and a half decades. The Uganda AIDS Commission estimates that, since 1982, when the country's first cases of HIV infection were detected on the shores of Lake Victoria in Rakai district, cumulatively an estimated 2.6 million Ugandans had been infected by the end of 2005, of whom about 1.6 million had died of HIV/AIDS-related illnesses. In 2009 there were an estimated 1.2 million people living with HIV/AIDS in Uganda including 100,000 who got infected in 2009 alone. To reduce further spread of HIV, a campaign promoting abstinence from sex, being faithful to one sexual partner and condom use (ABC) became a pillar of HIV/AIDS prevention efforts in Uganda. In recent years, Uganda has experienced declines in both risky sexual behaviors and HIV prevalence. These declines in risky sexual behaviors and HIV prevalence have been attributed to the ABC campaign. Though there are indications that this intervention did play a role in reducing risky sexual behaviors and HIV prevalence in Uganda, there are no data on the estimated effect of this intervention. The objective of this study was to estimate the effect of the ABC message on risky sexual behavior among youth in Uganda.

Methods: The study was based on an analysis of data from 15-24 year old youth who participated in the Uganda national HIV Sero and Behavioural Survey (UHSBS) of 2004/5. A targeted maximum likelihood estimator (TMLE) was used to estimate the effect of the ABC messages on risky sexual behavior, which was assessed using four measures; number of sexual partners in the past 12 months; sexual activity among unmarried youth in the past 12 months; sex with a non-marital sexual partner in the past 12 months; and condom use in the last sexual act with a non-marital/non-cohabiting partner.

Results: Knowledge of the ABC messages was estimated to reduce sexual activity among unmarried youth by 5 (95% CI: 0.8 to 9.5) percentage points, the mean number of sexual partners in the past 12 months by 0.2 (95% CI: 0.1 to 0.3), and the proportion of unprotected sex when youth have sex with non-marital sexual partners by 8 (95% CI: 0.9 to 16.0) percentage points. However, the effect of the ABC messages on sexual activity among unmarried youth and number of sexual partners was smaller among male youth than female youth.
Conclusion: Knowledge of the ABC messages reduces sexual activity among unmarried youth by 5 percentage points, the mean number of sexual partners in the past 12 months by 0.2 and the proportion of unprotected sex when youth have sex with non-marital sexual partners by 8 percentage points. However, the effect of the ABC messages on sexual activity among unmarried youth and number of sexual partners was smaller among male youth than among female youth.
BACKGROUND

Uganda has suffered a devastating epidemic of HIV/AIDS since 1982, when the country's first HIV infections were detected on the shores of Lake Victoria in Rakai district (1, 2). According to the 2010 UNAIDS Report on the Global AIDS Epidemic, by the end of 2009, there were an estimated 1.2 million people living with HIV in Uganda, including 100,000 people who became infected in 2009(3). In the same year, an estimated 64,000 people died of HIV/AIDS-related illnesses in Uganda. It is estimated that HIV/AIDS has reduced adult life expectancy in Uganda from the projected 56.9 years without HIV/AIDS to the current 48.9 years (50 years for females and 48 years for males) (4).

Because the majority of HIV infections in Uganda are transmitted through heterosexual contact, the government of Uganda has relied on a campaign that promotes sexual abstinence, mutual faithfulness among married or cohabiting partners, and condom use to reduce further spread of HIV. This approach to prevention, which later came to be known as ABC (Abstinence, Being faithful, Condom use), has continued to be the pillar of HIV prevention efforts in Uganda (2).

Over the years, Uganda has experienced declines in both risky sexual behavior and HIV prevalence. The proportion of youth aged 15-19 who had never had sex increased from 31% in 1989 to 56% in 1995 among males, and from 26% to 46% among females. Reported sex with a non-regular partner declined from 22.6% in 1989 to 18.1% in 1995 among men and increased slightly from 6% to 8%, among women. Ever use of condoms among sexually active 15 – 49 year olds increased from 15.4% in 1989 to 55.2% in 1995 for men, and from 5.8% to 38.7% for women (5-11). The prevalence of HIV infection declined from 18.3% at the end of 1992 to about 6.4% in 2005 (1). These declines in risky sexual behaviors and HIV prevalence have been attributed to the ABC campaign (5-11).

Though there is evidence that the ABC campaign played a role in reducing risky sexual behavior and in the observed decline in HIV prevalence in Uganda, there are no data on the estimated effect size of this intervention (5-11). Because the ABC approach remains a pillar of HIV/AIDS prevention efforts in Uganda, determining its effects among youth is particularly important, as they are the ‘window of hope’ in changing the course of the HIV/AIDS pandemic (12). Youth are considered a ‘window of hope’ because many behavioral lifestyles are formed during the early adolescent years, and as acquisition of HIV in youth is predominantly through sexual
activities, this period in life provides the opportune time to positively influence behaviors, choices and lifestyles that will last into adulthood (12).

The objective of this study was to estimate the effect of the ABC message on risky sexual behavior among youth in Uganda. We hypothesized that risky sexual behaviors would be less frequent when youth know the ABC messages compared to when they do not know the ABC messages.

METHODS

Study design
This study was based on an analysis of data from youth aged 15-24 years who participated in the Uganda National HIV Sero and Behavioural Survey (UHSBS) of 2004/2005. The data collected in the UHSBS, which was a nationally representative, population-based survey, included data on socio-demographic characteristics and sexual behavior in the past 12 months (13). A two-stage sample design was used to select participants for the UHSBS survey. In the first stage, 417 clusters were selected from a list of enumeration areas covered in the 2002 Uganda national census. The second stage involved systematic sampling of households from the list for each cluster. The survey team provided weights that were then used to take into account sampling and non-response probabilities.

Exposure
The exposure of interest in this study was knowledge of the ABC messages. Participants in the survey were asked to name the most important HIV message that they got from all the HIV information sources, to which they were exposed. Those who mentioned any of the three key ABC messages (i.e. Abstinence, Being faithful and use of Condoms) were considered exposed.

Outcome
The outcome of interest was risky sexual behavior, which was assessed using four measures:

1. Number of sexual partners in the past 12 months
2. Sexual activity among unmarried youth in the past 12 months
3. Sex with a non-marital sexual partner in the past 12 months
4. Condom use in the last sex with a non-marital sexual partner among those who had sex with a non-marital partner
Potential confounders that were considered in the analysis were; Age, gender, region, place of residence (rural/urban), male circumcision, education and household wealth.

**Statistical analyses**

Data analysis was carried out using SAS (SAS Institute, Cary, NC, USA) and R – programming language. A targeted maximum likelihood estimator (TMLE) (14) was used to estimate the marginal effect of the ABC messages on the four risky sexual behavior measures, while adjusting for potential confounders. The variables that we adjusted for in this model were determined based on the assumed relationships encoded in the Directed Acyclic Graphs (Figure 3-1). The parameter of interest in this study was the marginal difference \( \psi_0 \) in the risky sexual behavior measure, comparing the expectation, \( E(Y_1) \) of the risky sexual behavior measure when youth know the ABC messages to the expectation, \( E(Y_0) \) when they do not know the ABC messages.

\[
\psi_0 = E(Y_1) - E(Y_0)
\]

The targeted maximum likelihood estimator is based on the factorization of the likelihood of the observed data \( O = (W, A, Y) \) into three parts.

i.e \( \mathcal{L}(O) = P(Y|A, W)P(A|W)P(W) \)

Where,

\( P(W) \) - is the marginal distribution of the covariates \( W \)

\( P(A|W) \) - is the conditional distribution of the exposure \( A \) (Knowledge of the ABC messages) given the covariates \( W \).

\( P(Y|A, W) \) - is conditional distribution of the outcome given the exposure \( A \) and covariates \( W \).

The TMLE estimator involves estimation of both \( P(A|W) \) and \( P(Y|A, W) \), and is therefore double robust to model misspecification, in that it guarantees...
asymptotically unbiased estimates whenever at least one of the models is estimated consistently.

In this study, the targeted maximum likelihood estimator was implemented using a package called tmleLite(15). The tmleLite package is available for academic use at http://www.stat.berkeley.edu/~laan/Software/. tmleLite implements a simplified TMLE approach to estimating the additive treatment effect using as a default, the Deletion/Substitution/Addition(DSA) algorithm for data-adaptive estimation of both $P(A|W)$ and $P(Y|A,W)$, but also allows user supplied functions. The DSA is a data-adaptive algorithm which searches over a space of polynomial generalized linear models (16). A software package for implementing DSA is also available from http://www.stat.berkeley.edu/~laan/Software/.

In this analysis, the tmleLite package was left to use its default algorithm for estimation of both $P(A|W)$ and $P(Y|A,W)$ in the analysis of all the risky sexual behavior measures, except for the number of sexual partners in the past 12 months. For the number of sexual partners in the past 12 months, the tmleLite default algorithm was used in the estimation of only $P(A|W)$. $P(Y|A,W)$ was estimated using a Poisson model that was not data-adaptively selected because there was no readily available data adaptive algorithm for selecting Poisson models. To select a Poisson model for $P(Y|A,W)$ which was supplied to tmleLite, a stepwise process using a step function in R-programming language was used. A backward elimination approach was used, starting with a model that included up to two-way interaction terms between all independent variables and up to three order polynomials for age.

Survey participants who had missing data on the exposure of interest (Knowledge of ABC messages) were excluded from the analysis. However, participants who had missing data on the outcome but had data on the exposure of interest were included in the analysis. A variable indicating whether or not the outcome was missing was created and was also supplied to the tmleLite package.

A variable identifying clusters to which survey participants belonged and participants’ survey weights were also supplied to the tmleLite package to take into account the cluster sampling design and the non-response/sampling probabilities.
Ethical considerations
Permission to use the data was obtained from the Uganda Ministry of Health (owner of the data) and the University of California, Berkeley Committee for the Protection of Human Subjects. Respondents who took part in the survey had provided informed consent for interviews and blood collection. The survey protocols had been approved by the Uganda National Council for Science and Technology, the U.S. Centers for Disease Control and Prevention (CDC), the Institutional Review Boards of the Uganda Virus Research Institute and ORC Macro.

RESULTS

Participant characteristics
Demographic characteristics of youth who took part in the Uganda national HIV Sero and Behavioral Survey (UHSBS) of 2004/2005 are presented in Table 3-1. Of the 8242 youth who took part, 7289 (88%) responded to questions on knowledge of the ABC messages and were included in this analysis. Of the 7289 youth who were included in this analysis, 56% were female and the majority, 79%, lived in rural areas. About 65% had never married, 30% were married or cohabiting and 5% were widowed, divorced or separated. More than 92% had had some form of education, but only 32% had reached secondary or higher level of education.

Effect of the ABC messages on risky sexual behavior.
The distribution of the four risky sexual behavior measures by age and knowledge of the ABC messages is presented in Figure 3-2 and the TMLE estimated effects of the ABC messages on the four risky sexual behavior measures are presented in Table 3-2.

Number of sexual partners in the past 12 months
Overall, 51% of the youth reported having had at least one sexual partner in the past 12 months, including 59% of those who did not know the ABC messages and 49% of those who knew the ABC messages. The distribution of the mean number of sexual partners in the past 12 months by knowledge of the ABC messages is presented in Figure 3-2(a). The mean number of sexual partners in the past 12 months was 0.72 among those who did not know the ABC messages compared to 0.62 among those who knew the ABC messages (Table 3-2). Knowledge of the ABC messages was estimated to reduce the mean number of sexual partners in the past 12 months by 0.2 (Difference= -0.17, 95% Confidence Interval (CI): -0.30 to -0.05). The estimated effect of the ABC messages on the number of sexual partners in the past 12 months...
was smaller and not statistically significant among male youth (Difference=-0.09, CI: -0.34 to 0.16) compared to the effect among female youth (Difference = -0.14, CI: -0.29 to 0.00) which was of borderline significance.

**Abstinence among unmarried/non-cohabiting youth**

Overall, 50% of the unmarried youth reported sexual activity in the past 12 months. Figure 3-2(b) presents the observed proportions of unmarried youth who reported sexual activity in the past 12 months. Reported sexual activity among unmarried youth was lower among those who knew the ABC messages (48%) compared to unmarried youth who did not know them (58%) (Table 3-2). Knowledge of the ABC messages was estimated to reduce sexual activity among unmarried youth by 5 percentage points (Difference = -5.15, CI: -9.49 to -0.80). The estimated reduction in sexual activity among unmarried youth was lower and not statistically significant among male youth (Difference = -0.28, CI: -5.62 to 6.19) compared to female youth (Difference = -8.44, CI: -16.23 to -0.64).

**Sex and condom use with non-marital/non-cohabiting sexual partners**

About 22% of all the youth reported having had sex with a non-marital/non-cohabiting sexual partner in the past 12 months. There was no statistically significant effect of the ABC messages on having had sex with a non-marital sexual partner in the past 12 months (Difference = 0.10, CI: -2.61 to 2.81). However, the ABC messages were estimated to reduce the proportion of unprotected sex with non-marital sexual partners among those who had sex with non-marital partners (Table 3-2).

Among youth who reported having had sex with a non-marital sexual partner in the past 12 months, 47% reported having not used a condom the last time they had sex. The proportion reporting unprotected last sex with a non-marital/non-cohabiting sexual partner was lower among youth who knew the ABC messages (45%) compared to those who did not know the ABC messages (54%) (Table 3-2). Knowledge of the ABC messages was estimated to reduce the proportion of unprotected sex when youth have sex with non-marital sexual partners by 8 percentage points (Difference= -8.43, CI: -15.97 to -0.90).

**DISCUSSION**

The aim of this study was to estimate the effect of the ABC messages on risky sexual behavior among youth in Uganda. This study estimated that, knowledge of the ABC
messages reduces sexual activity among unmarried youth, reduces the proportion of youth reporting unprotected sexual contacts with a non-marital sexual partner and reduces the mean reported number of sexual partners in the past 12 months.

Knowledge of the ABC messages was estimated to reduce the mean number of sexual partners in the past 12 months by 0.2. This effect on the number of sexual partners is close to the effect size (0.11) estimated in a meta-analysis of sexual risk reduction trials carried out largely among youth in the United States (17).

Sexual activity among unmarried youth in this population was generally high. About half of the unmarried youth reported having had sex in the past 12 months. Our study estimates that knowledge of the ABC messages reduces sexual activity among unmarried youth by 5 percentage points. However, the effect was smaller among male (0.3 percentage points) compared to female youth (8.4 percentage points).

Though there was no statistically significant effect of the ABC messages on the proportion of youth reporting having had sex with non-marital sexual partners, the ABC messages were found to reduce the proportion of unprotected sex when youth have sex with non-marital sexual partners. Knowledge of the ABC messages was estimated to reduce the proportion of unprotected sex with non-marital sexual partners by 8 percentage points.

We found gender differences in the estimated effect of the ABC messages on sexual activity among unmarried youth and on the mean number of sexual partners in a year. Because our study relied on self-reported sexual behaviors, differences in the estimated effects may partly be due to the known gender differences in reporting sexual behaviors (18, 19). However, similar differences in the effects of sexual behavior interventions have been observed in studies that used biological outcomes. A community randomized trial that used HIV acquisition as an outcome to assess the effect of a behavior change intervention in Uganda also found a significant reduction of HIV acquisition only among females and none among males, even after they had adjusted for a number of possible confounders(20).

Because the ABC messages continue to be a pillar of HIV prevention efforts in Uganda(2), there is a need to determine why the ABC intervention appears to benefit male youth less than female youth. Determining reasons for the apparent low effect of the ABC messages among male youth could help in modifying the intervention to improve its effect among male youth.
Because our study relied on self-report to measure risky sexual behavior, potential misreporting of sexual behavior may have resulted in misclassification of the outcome. It is possible that the misclassification could be differential, if youth who knew the ABC messages were more likely to under report their risky sexual behavior because they know how they are expected to behave. In addition to any unmeasured confounding, potential differential misclassification of the outcome may have resulted in overestimation of the effects of the ABC messages in our study. Because our estimation of the effect of the ABC messages on sexual activity among unmarried youth was conditional on being unmarried, our estimate may be underestimated if there is an effect of the ABC messages that goes through marital status. Similarly, the effect of the ABC messages on condom use with non-marital sexual partners which was also conditional on having had sex with a non-marital partner may also be underestimated if there is an effect through having sex with a non-marital partner.

In conclusion, our study has estimated that knowledge of the ABC messages reduces sexual activity among unmarried youth by 5 percentage points, reduces the proportion of youth reporting unprotected sexual contacts when they have sex with a non-marital sexual partner by 8 percentage points, and reduces the mean number of sexual partners in the past 12 months by 0.2. However, the effects of the ABC messages on sexual activity among unmarried youth are non-desirable among male youth.
REFERENCES


Table 3-1. Demographic characteristics of the 15-24 youth who took part in the 2004/2005 UHSBS survey.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number of respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age group (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 - 16</td>
<td>1764</td>
<td>24.2</td>
</tr>
<tr>
<td>17 - 18</td>
<td>1662</td>
<td>22.8</td>
</tr>
<tr>
<td>19 - 20</td>
<td>1562</td>
<td>21.4</td>
</tr>
<tr>
<td>21 - 22</td>
<td>1206</td>
<td>16.5</td>
</tr>
<tr>
<td>23 - 25</td>
<td>1095</td>
<td>15.0</td>
</tr>
<tr>
<td><strong>Sex of respondent</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3245</td>
<td>44.5</td>
</tr>
<tr>
<td>Female</td>
<td>4044</td>
<td>55.5</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never married</td>
<td>4705</td>
<td>64.5</td>
</tr>
<tr>
<td>Married/Cohabiting</td>
<td>2211</td>
<td>30.3</td>
</tr>
<tr>
<td>Widowed/divorced/separate</td>
<td>373</td>
<td>5.1</td>
</tr>
<tr>
<td><strong>Type of residence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>1531</td>
<td>21.0</td>
</tr>
<tr>
<td>Rural</td>
<td>5758</td>
<td>79.0</td>
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<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>568</td>
<td>7.8</td>
</tr>
<tr>
<td>Primary incomplete</td>
<td>3514</td>
<td>48.2</td>
</tr>
<tr>
<td>Primary complete</td>
<td>893</td>
<td>12.3</td>
</tr>
<tr>
<td>Secondary or higher</td>
<td>2314</td>
<td>31.7</td>
</tr>
</tbody>
</table>
Table 3-2. Effect of the ABC messages on risky sexual behavior

<table>
<thead>
<tr>
<th></th>
<th>Observed estimate by knowledge of the ABC messages</th>
<th>TMLE estimated effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Did not know</td>
<td>Knew</td>
</tr>
</tbody>
</table>

Mean number of sexual partners in last 12 months

<table>
<thead>
<tr>
<th></th>
<th>Did not know</th>
<th>Knew</th>
<th>Difference (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>0.76</td>
<td>0.63</td>
<td>-0.09 (-0.34 to 0.16)</td>
<td>0.480</td>
</tr>
<tr>
<td>Female</td>
<td>0.69</td>
<td>0.60</td>
<td>-0.14 (-0.29 to 0.00)</td>
<td>0.053</td>
</tr>
<tr>
<td>All</td>
<td>0.72</td>
<td>0.61</td>
<td>-0.17 (-0.30 to -0.05)</td>
<td>0.008</td>
</tr>
</tbody>
</table>

Percentage reporting sexual activity in the last 12 months among unmarried

<table>
<thead>
<tr>
<th></th>
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<th>Knew</th>
<th>Difference (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>42.5</td>
<td>39.7</td>
<td>-0.28 (-5.62 to 6.19)</td>
<td>0.925</td>
</tr>
<tr>
<td>Female</td>
<td>67.6</td>
<td>55.9</td>
<td>-8.44 (-16.23 to -0.64)</td>
<td>0.034</td>
</tr>
<tr>
<td>All</td>
<td>58.2</td>
<td>48.2</td>
<td>-5.15 (-9.49 to -0.80)</td>
<td>0.020</td>
</tr>
</tbody>
</table>

Percentage had sex with a non-marital partner in last 12 months

<table>
<thead>
<tr>
<th></th>
<th>Did not know</th>
<th>Knew</th>
<th>Difference (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>29.0</td>
<td>31.2</td>
<td>-2.22 (-6.20 to 1.77)</td>
<td>0.276</td>
</tr>
<tr>
<td>Female</td>
<td>16.5</td>
<td>15.2</td>
<td>2.48 (-2.54 to 7.51)</td>
<td>0.333</td>
</tr>
<tr>
<td>All</td>
<td>21.1</td>
<td>22.7</td>
<td>0.10 (-2.61 to 2.81)</td>
<td>0.941</td>
</tr>
</tbody>
</table>

Percentage had last sex with a non-marital partner without a condom

<table>
<thead>
<tr>
<th></th>
<th>Did not know</th>
<th>Knew</th>
<th>Difference (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>53.5</td>
<td>45.4</td>
<td>-9.40 (-20.04 to 1.24)</td>
<td>0.083</td>
</tr>
<tr>
<td>Female</td>
<td>55.0</td>
<td>44.7</td>
<td>-8.21 (-17.95 to 1.54)</td>
<td>0.099</td>
</tr>
<tr>
<td>All</td>
<td>54.2</td>
<td>45.2</td>
<td>-8.43 (-15.97 to -0.90)</td>
<td>0.028</td>
</tr>
</tbody>
</table>
**Figure 3-1. Directed Acyclic Graph**

**W** - Demographic covariates: Age, gender, region, type of residence rural/urban, education, and household wealth

**A** - Exposure to ABC prevention messages

**M** - Marital status

**Y** - Risky sexual behavior outcome: Number of sexual partners, Sexual activity among unmarried, sex with non-marital sexual partners, condom use with no-marital sexual partners.
Figure 3-2. Distribution of risky sexual behavior measures by age and knowledge of the ABC message.
CHAPTER 4

Development of an instrument to measure HIV/AIDS-related stigma among youth in Uganda.
ABSTRACT

Background: The HIV/AIDS epidemic has been accompanied by HIV/AIDS-related stigma, which has continued to burden HIV/AIDS sufferers worldwide and has been shown to interfere with attempts to fight the AIDS epidemic. Studies have suggested that stigmatizing attitudes towards people living with HIV/AIDS have an impact on the quality and timing of HIV testing, treatment, care and social support that infected individuals receive.

In Uganda, HIV prevention efforts have been expanded to include HIV voluntary counseling and testing (VCT), but studies have shown that, HIV/AIDS-related stigma creates a barrier to uptake of VCT. However, while those who hold negative attitudes towards people living with HIV/AIDS may be reluctant to take an HIV test for fear of becoming one of the stigmatized, it is possible that the same fear may lead them to exercise more caution, such as to delay their sexual debut, limit their number of sexual partners and use condoms regularly once they do begin to have sex. If this is the case, then stigma reduction interventions that are meant to improve VCT uptake may, perversely, result in undesirable effects on sexual behavior. It is, therefore important to explore the relationship between stigma and risky sexual behavior. Exploring the relationship between HIV/AIDS-related stigma and sexual behavior requires a valid measure of HIV/AIDS-related stigma, but no such instrument has been developed and validated for use among youth in Uganda.

The objective of this study was to design an instrument to measure HIV/AIDS-related stigma among youth in Uganda.

Methods: A total of 30 items were adopted from published instruments and assembled into an instrument that was administered to 438 secondary school students in Uganda. A partial credit Rasch model was used to calibrate the instrument in a generalized item response modeling software called ConQuest.

Results:

The person separation reliability was 0.82. The split-halves reliability coefficient was 0.68, and after adjustment with the Spearman-Brown formula, the reliability coefficient becomes 0.81, if items are doubled.

All the 30 items had weighted mean square values within the 0.75 to 1.33 interval, indicating a good fit for all the items to the partial credit model that was chosen for calibration. None of the item exhibited more than negligible differential item
functioning by gender or having known a relative with HIV/AIDS. Measurements from the instrument indicated lower HIV/AIDS-related stigma among females compared to males, consistent with observed patterns of HIV/AIDS-related stigma in previous studies.

**Conclusion:** The instrument has shown reasonable reliability and validity, and all items appear to be performing in the same way across sub-groups of students. It is, therefore, going to be a useful tool in evaluation of programs aimed at reducing HIV/AIDS-related stigma and in studies aimed at determining the effects of or factors affecting HIV/AIDS-related stigma in Uganda and possibly in other countries in the same region of Africa.
BACKGROUND

The HIV/AIDS epidemic has been accompanied by HIV/AIDS-related stigma, which has continued to burden HIV/AIDS sufferers worldwide (1). People living with HIV/AIDS not only face difficulties related to treatment and management of the disease, but they also have to deal with HIV/AIDS-related stigma, especially in countries where it is widespread (1). The Joint United Nations Programme on HIV/AIDS, describes HIV/AIDS-related stigma as a ‘process of devaluation’ of people either living with or associated with HIV/AIDS (2).

Stigma directed at people living with HIV/AIDS not only makes it more difficult for people trying to come to terms with their illness on a personal level, but it also interferes with attempts to fight the AIDS epidemic as a whole. Studies have suggested that stigmatizing attitudes towards people living with HIV/AIDS have an impact on the quality and timing of HIV testing, treatment, care and social support that infected individuals received (1, 3, 4).

In Uganda, voluntary counseling and HIV testing (VCT) has been included as a key component in HIV prevention efforts. There is a widespread belief that scaling up VCT programs will have large prevention benefits through reductions in risky sexual behaviors (5). However, studies have shown that HIV/AIDS-related stigma creates a barrier to uptake of voluntary counseling and testing (6). In a study done in South Africa, people who had not taken up VCT held negative attitudes toward people with HIV/AIDS(6). They were found to be more likely to believe that people with HIV/AIDS must have done something wrong to have HIV/AIDS and were more likely to say that they would rather not be friends with someone who has HIV/AIDS(6). In addition to being a barrier to voluntary counseling and testing, HIV/AIDS-related stigma may also have effects on sexual behavior. While those who hold negative attitudes towards people living with HIV/AIDS may be reluctant to take an HIV test for fear of becoming one of the stigmatized, it is possible that the same fear may lead them to exercise more caution, such as delaying their sexual debut, limiting the number of their sexual partners and using condoms regularly once they do begin to have sex. If this is the case, then stigma reduction interventions that are meant to improve VCT uptake may, perversely, result in undesirable effects on sexual behavior. It is, therefore, important to explore the relationship between stigma and risky sexual behavior, particularly among youth who are thought to be a window of hope for changing the course of the HIV pandemic(7). Understanding this
relationship will be useful in streamlining stigma reduction interventions to improve VCT uptake without negatively affecting sexual behavior.

Studying the effects of HIV/AIDS-related stigma or factors affecting it requires a valid measure of HIV/AIDS-related stigma, but currently no such instrument has been developed and validated for use among youth in Uganda. Though there exist several scales that measure HIV/AIDS-related stigma among HIV/AIDS patients and some that have been developed to measure HIV/AIDS-related stigma in the general public or among uninfected individuals, most of these scales have not been developed and validated for use in an African setting.

The objective of this study is to design an instrument to measure HIV/AIDS-related stigma among youth in Uganda. In addition to its use in studies on effects and factors that affect HIV/AIDS-related stigma, an instrument to measure HIV/AIDS-related stigma will also be useful in evaluating the effectiveness of programs intended to reduce HIV/AIDS-related stigma.

**METHODS**

**Design of the instrument**

The definition of the construct to be measured (HIV/AIDS-related stigma) and development of the construct map (8) were based on a review of the existing literature on HIV/AIDS-related stigma and consultations with researchers involved in HIV/AIDS research and those involved in development of measurements. The draft construct map was presented to instructors and students taking a measurement course at the University of California at Berkeley and was refined based on their comments and suggestions. The construct map that was developed is presented in Figure 4-1.

**Theory**

Studies have found HIV/AIDS-related stigma to be a multi-dimensional construct (3, 9). The sub-dimensions of HIV/AIDS-related stigma generally relate to the factors that are thought to explain it (3, 9). Fear of contracting HIV/AIDS because it is an incurable disease with a high mortality rate and its being associated with behaviors that are already stigmatized by society (e.g. homosexual behavior, drug use and promiscuity) have been explored in several studies as the two possible explanations for HIV/AIDS-related stigma (10). Initially, these explanations were seen as competing hypotheses, and earlier studies found evidence to support each of them
Later, it was shown that focusing on just one of these explanations was not sufficient because both were important (11, 12). A study to determine the structure of HIV/AIDS-related stigma found it to be structured around three main sub-dimensions: Social distance, blame/victimization, and sympathy/care(9).

The *social distance dimension* relates to unwillingness to be in contact with those who have or are perceived to have HIV/AIDS. People may be unwilling to be in contact with, hug or touch those who have HIV/AIDS because of the fear of becoming infected and dying from HIV/AIDS.

The *blame/victimization dimension* relates to negative attitude towards those who have HIV/AIDS because they are considered to be responsible for getting themselves infected by behaving immorally.

The *sympathy and care dimension* relates to willingness to give support to those who have HIV/AIDS and opinions on whether those who have HIV/AIDS deserve sympathy and care. Some people may feel those who have HIV/AIDS do not deserve any sympathy or care because they got what they deserve. However, though people may blame those who acquire HIV through sex, they may be sympathetic to those who acquire HIV through blood transfusion and children whose infection came from their mothers at the time of or following birth.

The Construct Map (8) that is presented in Figure 4-1 was developed with the assumption that all these sub-dimensions constitute one underlying dimension of HIV/AIDS-related stigma. This assumption was evaluated as described in the methods section.

**Item design**

One of the design requirements of this instrument was for it to cover all three of the sub-dimensions of HIV/AIDS-related stigma and yet remain easy to administer. To be able to meet this requirement, a fixed response format was adopted and items were scored on four levels; strongly disagree (SD), disagree (D), agree (A) and strongly agree (SA). Items that are included in the draft instrument have been adopted from existing instruments that had been developed for different settings and groups of respondents. The selection of existing instruments from which to adopt items was based on whether:-

1. The instrument publication indicated that the generation of items involved consultations with the intended respondents or experts.
2. The items underwent review by some panel of experts/stake holders
3. The items were relevant to youth in Uganda.

Based on these criteria, a total of 30 items were adopted from four published scales (13-16) and were assembled into a draft instrument (Appendix A).

**Outcome space**

As shown in the construct map (Figure 4-1), HIV/AIDS-related stigma increases with increasing negativity towards people with HIV/AIDS. Therefore, items that are phrased negatively toward persons with HIV/AIDS were scored as (0, 1, 2, 3) for SD, D, A, and SA, respectively. Items that are phrased positively towards people with HIV/AIDS were scored as (3, 2, 1, 0) for SD, D, A, and SA, respectively (Appendix A).

**Study participants**

The development version of the instrument is in English and was administered to secondary school students who can read and write in English. A total of 437 secondary school students in Uganda responded to the instrument. In addition to the administration of the instrument items, data were also collected on age, gender and whether the respondents had known of a relative who had HIV/AIDS. The additional variables were collected for assessing validity of the instrument and assessing differential item functioning, which is described in detail in the analysis section.

**Data analysis.**

Instrument calibration was carried out using generalized item response modeling software called ConQuest (17) and ConstructMap (18). However, some graphics were produced in STATA(19) software using outputs exported from Conquest.

**Item calibration**

Item calibration was carried out using the Rasch model that focuses on modeling the probability of the observed responses. In the Rasch model, the probability of a given response to an item is modeled as a function of the location of the respondent and the location of the item on the continuum of the trait being measured. For HIV/AIDS-related stigma, this model will estimate the probability of a respondent giving a particular response to an item as a function of both that person’s location (level of stigma) and the location of the item being responded to on the HIV/AIDS-related stigma continuum. The Rasch model was chosen because it provides
estimates of item locations (parameters) that are independent of the study sample from which they are derived.

In the general polytomous Rasch model, the probability of a response score \( x \) to item \( i \) by a person \( n \) is given by

\[
Pr(X_{ni} = x) = \frac{\exp \sum_{k=0}^{x}(\theta_n - \delta_{ik})}{\sum_{j=0}^{m_i} \exp \sum_{k=0}^{j}(\theta_n - \delta_{ik})}
\]

Where,

\( \delta_{i0} = 0 \) and \( \sum_{k=0}^{0}(\theta_n - \delta_{ik}) = 0 \)

\( m_i \) - is the maximum response score for item \( i \).

\( \theta_n \) - is the location of person \( n \) on the continuum of the trait being measured

\( \delta_{ik} \ (k=1,2, m_i) \) are parameters known as “step parameters” that govern the probability of a respondent giving a response \( k \) instead of \( k-1 \) or in other words, making a step from a response score \( k-1 \) to a response score \( k \).

The first step in this evaluation was to select a particular Rasch model for calibrating the instrument. Because all items were Likert-scale type with the same number of response categories, there was a need to choose between two potential models from Rasch’s family of models i.e. the rating scale model that assumes the same step parameters across all the items and a partial credit model that allows step parameters to vary across items.

To evaluate whether it is reasonable to treat HIV/AIDS-related stigma as a unidimensional construct, despite the existence of its subcomponents, a principal components analysis was conducted using SAS version 9.1 (SAS Institute, Cary, NC, USA). Based on Reckase’s criterion (20), a unidimensionality assumption was considered reasonable if the first extracted principal component accounted for at least 20% of the total variance. The fit of the selected model was further assessed using item fit statistics.

**Item fit**

The fit of the items to the selected model was assessed using the *mean-square fit statistics*. The *mean-square fit statistics* indicate the level of randomness of
responses to an item and are calculated as a ratio of the average expected squared residuals to average observed squared residuals (8).

There are several ways to create fit indexes (8), but one called the *weighted mean square* (or sometimes the *infit* mean square) is computed as

$$MS_i = \frac{\sum_{n=1}^{N} Y_{in}^2}{\sum_{n=1}^{N} W_{in}}$$

Where,

- $Y_{in}^2 = (X_{in} - E_{in})^2$, is the observed squared residual
- $W_{in} = \sum_{k=0}^{K_i} (k - E_{in})^2 Pr(X_{in} = k|\theta, \delta)$, is the expected residual
- $N$, is the number of respondents
- $X_{in}$, is the observed response score to item $i$ by respondent $n$
- $Pr(X_{in} = k|\theta, \delta)$, is the probability of a response score $k$
- $E_{in} = \sum_{k=0}^{K_i} kPr(X_{in} = k|\theta, \delta)$, is the expected response score

A *weighted mean-square* value of less than 1.0 indicates that the responses are too predictable (redundancy or data overfit the model) and a value greater than 1.0 indicates that the responses are unpredictable (unmodeled noise or data underfit the model). Though there is no absolute limit for what is a good mean square value, previous researchers have indicated that 0.75 and 1.33 are reasonable lower and upper bounds, respectively (8).

**Reliability**
Reliability of the instrument was evaluated using person separation reliability and split-halves reliability coefficients. Person separation reliability indicates how well the instrument is able to separate respondents on the construct being measured. Split-halves is a measure of consistency in which a test is split in two and the scores for each half of the test are compared with one another. To obtain the split-halves reliability coefficient, items were split into two sets, one containing odd numbered items and the other containing even numbered items. This split was expected to
obtain balanced sets of items. The split-halves reliability coefficient was adjusted using the Spearman-Brown formula (8) to determine the reliability if items were doubled (from half in each split-half to the full number of items in the instrument).

**Differential item functioning**

Differential item functioning is said to occur when subgroups of respondents with the same level of the construct being measured respond differently to items in the instrument. Because the instrument is intended for use in measuring HIV/AIDS-related stigma across all subgroups of adolescents in Uganda, it is important that the instrument perform in the same way across all subgroups of youth.

Assessment for differential item functioning was carried out using multifaceted models in Conquest (17). The testing involved comparing a model that assumed invariance in item parameters across subgroups of students to a model that allowed item parameters to vary across subgroups by including an interaction term with the grouping variable. Two grouping variables were used in the evaluation of differential item functioning: Gender and having known of a relative who had HIV/AIDS. Because some students had missing responses on the two grouping variables, the models that were compared in the assessment of differential item functioning were all based only on students who had non-missing responses for the grouping variables.

Identification of specific items that exhibited differential item functioning was carried out using two approaches. The first approach involved comparing item parameters obtained when the instrument was calibrated separately among subgroups of students. The second approach involved estimating the magnitude of differential item functioning using multifaceted models that included an interaction term with a grouping variable. The magnitude of differential item functioning estimated from these models was categorized using a classification provided by Paek (8). Differential item functioning was classified as negligible if the magnitude was less than 0.426 logits, moderate if it was between 0.426 to 0.638 logits, and large if it was greater than 0.638 logits.

**Validity**

Evidence based on internal structure of the instrument was evaluated by comparing the expected locations of the items in the Construct Map and results in the Wright map obtained from the observed data, and assessing whether groups of respondents who are located high on the construct map on average score high on each item.
Evidence based on the relationship between the instrument scores and other variables was assessed using gender and having known of a relative who had HIV/AIDS. Gender was used because studies have shown women to have less negative attitudes toward people HIV/AIDS than men (9, 21). Therefore, observing lower instrument measurements among female students compared to male students would be an indication that the instrument is measuring what it is intended to measure. Students who had known of a relative with HIV/AIDS were also expected to measure lower on the instrument compared to those who had not. It was expected that students who have known of a relative with HIV/AIDS may have been sensitized or may have been influenced by how other family members interact with the sick person.

Ethical considerations
Ethical approval for the study was obtained from the Institutional Review Board of Uganda Virus Research Institute, and the University of California, Berkeley Committee for the Protection of Human Subjects. Written informed consent (or assent for those less than 18 years of age) was obtained from all students. For students who were less than 18 years of age, consent from a parent/guardian was also obtained.

RESULTS

Demographic characteristics of the study respondents
Demographic characteristics of the 437 students who participated in the study are presented in Table 4-1. The median age of the students was 17 years and ranged between 11 and 34 years. Some students did not indicate their gender, but of the 424 who indicated their gender, 50.5% were male and more than 42% of the students reported having known of a relative who had HIV/AIDS.

Selecting a model for instrument calibration.
Results from the principal components analysis indicated that the first extracted component accounted for 20.4% of the total variance. Therefore based on Reckase's criterion(20), the instrument was sufficiently unidimensional and it was reasonable to proceed with a unidimensional Rasch model.

Model fit statistics for the rating scale model that assumes the same step parameters for all the items and a partial credit model that allows for step parameters to vary across items are presented in Table 4-2. Because the rating scale is a sub-model to
the partial credit model, the difference in their deviance follows a chi-square distribution with the number of degrees of freedom equal to the difference in the number of parameters estimated. Based on a chi-square distribution with 58 degrees of freedom, the difference (583.4) in the deviance between these two models is highly significant (p-value<0.0001), indicating that the partial credit model fits significantly better than the rating scale model.

All the *weighted mean-square statistics* for the step parameters estimated in the rating scale model were greater than 1.33, indicating that all the step parameters estimated from the rating scale model were poorly fitting(8). Because a rating scale model fitted poorly, a partial credit model was chosen and used for all the subsequent evaluations.

**Instrument calibration using a partial credit model.**

The distributions of both the students’ locations and item Thurstonian thresholds along a logit-scale continuum of HIV/AIDS-related stigma are shown side by side in Figure 4-2, referred to as the Wright map(8). Thurstonian thresholds give locations on the continuum of the trait being measured at which the probability of giving a particular ordinal response or higher is 0.5(8). Because all of the items had four ordinal categories (scored 0,1,2,3) each item had three thurstonian thresholds indexed as 1,2, and 3 corresponding to the locations at which there is a 0.5 probability for a response 1 or higher, 2 or higher, and 3 or higher, respectively. In the location labels presented in Figure 4-2, the digits to the left of the decimal point denote the item number and the digits to the right of the decimal point denotes the respective thresholds. As an example, a location labeled 19.2 indicates the level of stigma (on a logit scale) at which the probability of giving a response score 2 or higher to item 19, is 0.5.

Inspection of the Wright map shows that the majority of the students are located below 0 logit, indicating generally low HIV/AIDS-related stigma among the students who participated in this study. However, despite the low level of HIV/AIDS-related stigma among these students, the instrument had items covering all the extreme levels of the students (Figure 4-1).

**Item fit from a partial credit model**

The weighted mean squares for the 30 items are displayed in Figure 4-3. All of the items had weighted mean square values between 0.75 and 1.33, indicating a good fit for all the items in the instrument(8).
Reliability of the instrument
The person separation reliability was 0.82. The split-halves reliability coefficient was 0.68, and after adjustment with the Spearman-Brown formula (8), the reliability coefficient becomes 0.81, if items are doubled.

Differential Item Functioning
Results on the assessment of differential item functioning by gender and having known of a relative with HIV/AIDS are presented in Table 4-3. There was no significant difference in the fit between model 2, which allowed for item locations to vary by gender, and model 1, which assumed the item locations to be the same across gender groups (p-value = 0.42), indicating no significant differential item functioning by gender. Figure 4-4(a) shows item location estimates that were obtained when items were calibrated separately among female and male students. The thick lines marked UCL and LCL are the upper and lower bounds of the 95% confidence band that were computed using a formula provided by Wright and Masters (22). Items that would exhibit differential item functioning would fall outside the 95% confidence band. As was indicated by the non significant test for differential item functioning by gender, none of the items fell outside the 95% confidence band, indicating that all the items functioned in the same way across gender groups.

There was a statistically significant differential item functioning by having known of a relative who had HIV/AIDS. Model 4, which included an interaction term with having known of a relative with HIV/AIDS, fitted significantly better than model 3, which assumed no interaction (p<0.001), indicating that some items in the instrument performed differently, depending on whether or not a student had known of a relative with HIV/AIDS. To identify specific items that exhibited differential item functioning, item locations that were estimated when items were calibrated separately among students who had known of a relative with HIV/AIDS and those who had not are plotted in Figure 4-4(b). Five items fell outside the 95% confidence band, indicating that they exhibited differential item functioning. However, based on the classification provided by Paek (8), all the items that fell outside the 95% confidence band exhibited negligible differential item functioning. The estimated magnitude of differential item functioning for the five items that fell outside the 95% confidence interval were, <0.001, 0.022, 0.092, 0.108 and 0.03 for items 5, 6, 13, 18 and 28, respectively, all of which were less than 0.426.
Validity of the instrument

Evidence based on Instrument Content

Both the assembled items and the construct map that was developed after a review of the HIV/AIDS literature and consultations with researchers in HIV/AIDS were presented to a panel consisting of instructors and students taking a measurement course at the University of California at Berkeley. The same panel convened twice, first to review the draft construct map and second, to review the assembled items together with the refined construct map. Comments and suggestions from the panel were used to refine both the construct map and the items.

Evidence based on response process.

Though there were plans to carry out exit interviews with the students regarding what they thought as they were responding to the items, time constraints on the part of the respondents made this difficult. Instead, respondents were asked to write down what they thought while responding to the items on a blank page at the back of the instrument. A majority of the written statements indicated that students responded to the items based on their feelings toward people with HIV/AIDS and their opinions on how they should be treated or interact with other people. The majority of the statements related to students’ feeling sympathy toward people with HIV/AIDS, whether or not people with HIV/AIDS should be treated with kindness, given support like any other patients, given the same rights as everybody else, or be isolated. A number of students wrote that while responding to the items they were thinking of their relatives/friends or were putting themselves in the position of those having HIV/AIDS. Two students wrote that they were thinking of their responses to the items as suggestions on how people with HIV/AIDS should be treated, and another two wrote that they thought the instrument was testing their knowledge on the best ways to treat people with HIV/AIDS.

Evidence based on Internal Structure

Figure 4-5 shows the relationship between the expected location of the “Strongly Agree” (or “Strongly Disagree” if positively phrased) response to each item in the Construct map and the rank of its average location in the Wright map obtained from the observed data. The Spearman’s rank correlation coefficient was low for this comparison (Spearman’s r = 0.452). This was not surprising because the estimation
of the expected locations was not informed by interviews with students or consultations with experts.

To assess whether groups of students who, on average, measured high on the instrument also measured high on each item, mean locations of students who gave particular responses to each of the items were plotted against item response categories (Figure 4-6). Except for a few slight deviations, the mean locations of the students generally increased as their responses to most of the negatively phrased items changed from strongly disagree to strongly agree, indicating validity in the items’ design. However, only three of the six positively phrased items had declining mean locations of the students as their responses changed from strongly disagree to strongly agree. The three positively phrased items that did not follow the expected declining trends were:

“Item 9. A student who has HIV/AIDS should be allowed to attend school with other students”

“Item 17. Students with HIV have the same right to be at school like all the others”

“Item 30. I am sympathetic towards the misery people with HIV/AIDS experience”

For each of these three items, the mean location of the students declined (as expected) as their responses changed from Disagree to Strongly Agree, but the mean locations of the students was instead lower for those who gave the response “Strongly Disagree” compared to those who gave the response “Disagree”. This means that while students with high levels of stigma were responding Disagree to these statements, students who had lower levels of stigma than them were responding “Strongly Disagree”. Though these items had good overall fit statistics, they will need reviewing after discussion with potential respondents to make sure they conform to the expected response patterns.

Evidence based on relationship to other variables.

Previous studies have shown lower stigma levels among women compared to men. The same patterns of measurements were observed with this instrument as well. The mean location for girls was -1.46 compared to -1.27 for boys. The difference was however not statistically significant (p-value = 0.494).

Students who had known of a relative who had HIV/AIDS were expected to score lower on the instrument because of the sensitization or influence they may have experienced from other family members interacting with and taking care of the sick
person. As expected, the mean location for students who had known of a relative who had HIV/AIDS was lower (-1.54) compared to those who had not known of a relative with HIV (-1.29), but the difference was not statistically significant (p-value = 0.312).

**DISCUSSION**

The instrument has demonstrated reasonable reliability and validity. The instrument had adequate reliability; both the split-halves and the person separation reliability were more than 0.80.

Though none of the relationships between the instrument scores and other variables was statistically significant, probably because of the small sample size, measurements from the instrument correlated well with known and expected HIV/AIDS-related stigma patterns, indicating that the instrument is measuring what it is intended to measure. Measurements from the instrument indicated lower levels of HIV/AIDS-related stigma among female students compared to male students. These findings are consistent with what other investigators found among Australian adults(9) and undergraduate students in the United States(21). In both populations, men were found to have more negative attitudes toward HIV/AIDS patients, which was also consistent with findings of earlier research that suggested that men are less tolerant than women of different social groups, such as homosexuals(9).

The overall finding of low stigma among students who took part in this evaluation was also consistent with what was expected in Uganda. Uganda has experiencing the HIV epidemic for a long time, and the majority of people have had at least one relative, friend or neighbor who has suffered from HIV/AIDS and have learned to live with them. In addition, efforts to improve the care of people with HIV/AIDS in Uganda have included stigma reduction education programs. One such program is a collaboration by the Agency for Cooperation and Research in Development (ACORD), in which both print and electronic media agencies have been involved in addressing HIV/AIDS-related stigma through mobilization, education and advocacy(23).

Overall, all of the items in the instrument performed in the same way across subgroups of students that were explored in this evaluation, except for a few items that exhibited negligible differential item functioning. Among the few items that exhibited negligible differential item functioning, item 18 ("People with HIV do not deserve any support") had the largest magnitude of differential item functioning.
(0.054), by knowledge of a relative who had HIV/AIDS. This item was slightly harder to endorse among students who had known of a relative who had HIV/AIDS, compared to students with the same level of HIV/AIDS-related stigma but who had not known of a relative with HIV/AIDS.

Though the differential item functioning was negligible, all items that exhibited some level of differential item functioning will need to be reviewed and discussed with youth, people involved in HIV/AIDS care, and individuals conducting HIV/AIDS research. The review should explore potential reasons for the apparent differential item functioning and, if necessary, the items will need to be revised or replaced with new items. Because the instrument has shown promising qualities, the next steps will be to validate versions translated into local languages and interviewer (instead of self)-administered versions for use by those who cannot read and write.

In conclusion, the instrument has shown reasonable reliability and validity, and all items appear to be performing in the same way across sub-groups of student. It is, therefore, going to be a useful tool in evaluation of programs aimed at reducing HIV/AIDS-related stigma and in studies aimed at determining the effects of or factors affecting HIV/AIDS-related stigma.
REFERENCES


22. Wright BD, Masters G. Rating Scale Analysis. Chicago: MESA Press, 1982,

Table 4-1. Demographic characteristics of study respondents

<table>
<thead>
<tr>
<th>Factor</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>214</td>
<td>50.5</td>
</tr>
<tr>
<td>Female</td>
<td>210</td>
<td>49.5</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 – 14</td>
<td>86</td>
<td>20.0</td>
</tr>
<tr>
<td>15 – 18</td>
<td>234</td>
<td>54.4</td>
</tr>
<tr>
<td>19 - 22</td>
<td>98</td>
<td>22.8</td>
</tr>
<tr>
<td>23+</td>
<td>12</td>
<td>2.8</td>
</tr>
<tr>
<td><strong>Known a relative who had HIV</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>178</td>
<td>42.4</td>
</tr>
<tr>
<td>No</td>
<td>242</td>
<td>57.6</td>
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</table>
Table 4-2. Fit statistics for a partial credit and a rating scale models.

<table>
<thead>
<tr>
<th>Model</th>
<th>Deviance</th>
<th>Number of Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial credit</td>
<td>26088.2</td>
<td>91</td>
</tr>
<tr>
<td>Rating Scale</td>
<td>26671.6</td>
<td>33</td>
</tr>
<tr>
<td>Difference ($p$-value $&lt; 0.001$)</td>
<td>583.4</td>
<td>58</td>
</tr>
</tbody>
</table>
Table 4-3. Tests for existence of differential item functioning.

<table>
<thead>
<tr>
<th>Model</th>
<th>Deviance</th>
<th>Parameters</th>
<th>Difference compared to the preceding model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Deviance</td>
</tr>
<tr>
<td><strong>By gender †</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Item + item×step</td>
<td>25279.75</td>
<td>91</td>
<td>-</td>
</tr>
<tr>
<td>2. Item + gender + item×gender + item×step</td>
<td>25248.77</td>
<td>121</td>
<td>30.98</td>
</tr>
<tr>
<td><strong>By knowledge of a relative who had HIV/AIDS †</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Item + item×step</td>
<td>24978.53</td>
<td>91</td>
<td>-</td>
</tr>
<tr>
<td>4. Item + known + item×known + item×step</td>
<td>24396.58</td>
<td>121</td>
<td>581.95</td>
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</tbody>
</table>

† **Note:** All models that were compared were based on only students with non-missing values for the grouping variables.
### Direction of increasing level of HIV/AIDS-related Stigma

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Hypothetical Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>People with HIV/AIDS should be Isolated</strong></td>
<td><strong>People with HIV/AIDS are to blame for what they got</strong></td>
</tr>
<tr>
<td><strong>SA</strong></td>
<td><strong>A</strong></td>
</tr>
</tbody>
</table>

**High Stigma (3)**
- Those who strongly feel that people with HIV/AIDS
  - Should not have physical contact (e.g. touch, hug) with other people and should be isolated.
  - Are to blame for what they got
  - Deserve no sympathy from any one
  - Don’t deserve care and support

**Moderate Stigma (2)**
- Those who feel that people with HIV/AIDS
  - Should NOT be isolated but should have no physical contact (e.g. touch, hug) with other people.
  - Are to blame for what they got and deserve no sympathy
  - Deserve care and support, only if they got HIV through blood transfusion of needles in hospital

**Low Stigma (1)**
- Those who feel that people with HIV/AIDS
  - Should NOT be isolated but should have no physical contact (e.g. touch, hug) with other people.
  - Are NOT to blame for what they got
  - Deserve care and support

**No Stigma (0)**
- Those who feel that people with HIV/AIDS
  - Should NOT be isolated and it is ok to be in physical contact with them (e.g. touch, hug).
  - Are NOT to blame for what they got
  - Deserve care and support

### Direction of decreasing level of HIV/AIDS-related Stigma

---

**Figure 4-1 Construct Map**
### Generalised-Item Thresholds

<table>
<thead>
<tr>
<th>logit</th>
<th>proficiency</th>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>3.3</td>
<td>2.3 5.3</td>
<td>1.3 25.3</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>4.3 6.3 24.3 26.3</td>
<td>10.3 21.3 28.3</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>14.3 23.3</td>
<td>7.3 8.3 19.3</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>11.3 18.3 20.3</td>
<td>14.1 24.2 27.3</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>13.3 16.3 17.3</td>
<td>6.2 8.2 9.2 22.2 26.2 30.2</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>18.2 23.2</td>
<td>22.3</td>
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<tr>
<td>7</td>
<td></td>
<td></td>
<td>2.2 11.2 16.2 25.2</td>
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<td>8</td>
<td></td>
<td></td>
<td>10.3 21.3 28.3</td>
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<td>9</td>
<td></td>
<td></td>
<td>3.2 13.3 16.3 17.3</td>
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<td>10</td>
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<td>1.2 14.2 17.2</td>
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<td>11</td>
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<td></td>
<td>30.3</td>
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<td></td>
<td></td>
<td>18.2 23.2</td>
<td></td>
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<td>13</td>
<td></td>
<td></td>
<td>22.3</td>
<td></td>
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<td></td>
<td>7.3 8.3 19.3</td>
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<td></td>
<td></td>
<td>14.1 24.2 27.3</td>
<td></td>
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<td>17</td>
<td></td>
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<td>6.2 8.2 9.2 22.2 26.2 30.2</td>
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<td>12.3 15.3</td>
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<tr>
<td>36</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Each 'X' represents 2.9 cases
The labels for thresholds show the levels of item, and step, respectively

Figure 4-2. Wright Map
Figure 4-3. Item fit graph
Figure 4-4. Comparison of item locations from separate calibrations among subgroups of students
Figure 4-5. Rank of average locations in the Wright Map vs Expected locations in the construct map.
Figure 4-6. Mean students’ locations on HIV/AIDS-related stigma continuum by responses given to each item.
### APPENDICES


<table>
<thead>
<tr>
<th>Response key: SD – Strongly Disagree</th>
<th>D – Disagree</th>
<th>A – Agree</th>
<th>SA – Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. People with HIV/AIDS should be Isolated from others</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Students with HIV should not be allowed to play with other students</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I fear I could be exposed to HIV if I hugged someone who has HIV/AIDS</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. If I shake hands with some who has HIV/AIDS I might get infected</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. If you kiss someone who has HIV/AIDS on the cheek, you might get infected</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I fear I could be infected if I was exposed to sweat of someone who has HIV/AIDS</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I fear I could be infected if I was exposed to saliva of someone who has HIV/AIDS</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I fear I could become infected if I play with someone who has HIV</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. A student who has HIV/AIDS should be allowed to attend school with other students</td>
<td>3-SA 2-D 1-A 0-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. If a teacher has HIV, they should be allowed to continue teaching in the school</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. If a friend of mine got AIDS I would continue being friend with him/her</td>
<td>3-SA 2-D 1-A 0-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. It does not bother me if my classmate had HIV/AIDS</td>
<td>3-SA 2-D 1-A 0-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Young children should be removed from the home if one of the parents has HIV</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. People with HIV/AIDS do not deserve to receive treatment</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. People who get AIDS from blood transfusions are more deserving of treatment than those who get it through sex</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. People who have AIDS deserve kindness</td>
<td>3-SA 2-D 1-A 0-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Students with HIV have the same right to be at school like all the others</td>
<td>3-SA 2-D 1-A 0-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. People with HIV do not deserve any support</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
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<tr>
<td>19. Only those who were infected with HIV by medical needles or blood in a hospital deserve to receive care and treatment</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
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</tr>
<tr>
<td>20. If young people in the community associate or interact with a person who has HIV/AIDS, they may be influenced to participate in immoral activities</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. People with HIV/AIDS are promiscuous</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
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<tr>
<td>22. HIV is a punishment for bad behavior</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. People with HIV/AIDS should be ashamed of them selves</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
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<tr>
<td>24. It is shameful to have a relative who has HIV/AIDS</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. It is shameful to be friends with someone who has HIV/AIDS</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26. Having a friend who has HIV/AIDS makes you lose respect</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
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<tr>
<td>27. I have little sympathy for people who get HIV from sexual promiscuity</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. If I get infected with HIV I will lose respect.</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29. I feel more sympathetic toward people who get AIDS from blood transfusions</td>
<td>0-SD 1-D 2-A 3-SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30. I am sympathetic towards the misery people with HIV/AIDS experience.</td>
<td>3-SA 2-D 1-A 0-SA</td>
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</table>
CHAPTER 5

Summary of study findings, conclusion and implication for public health and future research
SUMMARY

Since 1997, Uganda has relied on promotion of sexual abstinence, mutual faithfulness among married or cohabiting partners, and condom use (ABC) as a pillar of its HIV prevention strategy(1). Over the years, Uganda has experienced declines in HIV prevalence. The declines in HIV prevalence have been attributed to the ABC campaign because corresponding changes were also observed in reported levels of abstinence, number of sexual partners and condom use (2-8). Though there are indications that the ABC intervention played a role in reducing HIV prevalence in Uganda, there are no data on the estimated effects of these messages. It is important to determine the effect of this intervention, particularly among youth, who are thought to be a window of hope for changing the course of the HIV pandemic(9).

HIV prevention efforts in Uganda have been expanded to include voluntary counseling and testing (VCT), but HIV/AIDS-related stigma has been shown to affect uptake of VCT. While reluctance to take up VCT may be due to fear of being stigmatized when found positive, it is also possible that fear of being stigmatized may lead to safer sexual behavior. If this is the case, then stigma reduction interventions that are meant to improve VCT uptake may result in risky sexual behavior. It is, therefore, important to explore the relationship between stigma and risky sexual behavior. However, exploring the relationship between HIV/AIDS-related stigma and sexual behavior requires a valid measure of HIV/AIDS-related stigma, but currently no instrument for measuring HIV/AIDS-related stigma has been validated among youth in Uganda.

This dissertation aimed at providing estimates of the effect of the ABC prevention messages on risky sexual behavior and prevalent HIV infection among youth in Uganda and to develop an instrument that can be used to measure HIV/AIDS-related stigma in future studies.

STUDY SUMMARIES

The studies in this dissertation addressed the following objectives

1. Determine the effect of knowing ABC prevention messages on HIV infection among youth in Uganda.
A study addressing this objective utilized data from 15-24 year old youth who participated in the Uganda national HIV Sero and Behavioural Survey (UHSBS) of 2004/5. A Targeted maximum likelihood estimator (TMLE) was used to estimate the effect of the ABC messages on HIV prevalence. Knowledge of the ABC messages was estimated to reduce the prevalence of HIV by 1 percentage point among 15-24 year old Ugandan youth, and by 2 percentage points among Ugandan youth who are legally of age to make their own decisions (18-24 years). However, the effect of the ABC messages on HIV infection was found to be lower among male youth compared to female youth.

2. **Determine the effect of knowing ABC prevention messages on risky sexual behavior among youth in Uganda.**

A study to address this objective also used data from youth who participated in the Uganda national HIV Sero and Behavioural Survey (UHSBS) of 2004/5. Risky sexual behavior was measured using four variables: Sexual activity in the past 12 months among unmarried youth; number of sexual partners in the past 12 months; having had sex with a non-marital sexual partner in the past 12 months; and condom use in the last sex with a non-marital partner among those who reported having had sex with a non-marital partner.

Knowledge of the ABC messages was estimated to reduce the average number of sexual partners in the past 12 months by 0.2, sexual activity among unmarried youth by 4 percentage points, and the proportion of youth who have unprotected sex when they have sex with non-marital sexual partners by 2 percentage points. However, the effect of the ABC messages on sexual activity among unmarried youth and unprotected sex with non-marital sexual partners was found to be lower among male youth compared to female youth.

3. **Develop an instrument for measuring HIV/AIDS-related stigma among youth in Uganda.**

Following review of existing literature and consultations with researchers in HIV/AIDS and instruments development, a draft instrument of 30 items was assembled from items adopted from different published instruments. Evaluation of the psychometric properties of the instrument that was developed was based on the administration of the instrument to a sample of 437 secondary students in Uganda. The instrument was found to have
reasonable reliability (person separation reliability = 0.82). All the items from the instrument were found to perform in the same way among male and female students. Measurements from the instrument indicated lower HIV/AIDS-related stigma among female youth compared to male youth, which was consistent with observed patterns of HIV/AIDS-related stigma in previous studies.

PUBLIC HEALTH IMPLICATIONS

In addition to providing additional evidence in support of earlier observations on the benefits of advocating for abstinence, mutual faithfulness among married or cohabiting partners, and condom use (ABC), the findings from these studies suggest that the benefit among male youth in less than the benefit among female youth. This finding is consistent with findings from a community randomized behavioral intervention trial carried out in Masaka district in Uganda, which also found a reduction in HIV infection among females but none among males(10).

There is therefore, a need to determine the reasons for the disparities by gender so as to modify the ABC intervention to increase benefits among male youth.

The 30 item instrument that was developed for measuring HIV/AIDS-related stigma has shown reasonable reliability and validity, and all items appear to be performing in the same way across sub-groups of youth. It is, therefore, going to be a useful tool in the evaluation of programs aimed at reducing HIV/AIDS-related stigma and in studies aimed at determining the effects of or factors affecting HIV/AIDS-related stigma.

IMPLICATIONS FOR RESEARCH

This dissertation identified differences in the benefits of the ABC messages between male and female youth; further research is needed to determine why the ABC messages are not benefiting male youth as much as they benefit female youth.

The instrument that was developed for measuring HIV/AIDS-related stigma was developed in English and evaluated among secondary students who could read and write; further evaluations are needed to validate translated
versions of the instrument and interviewer-administered versions for use among youth who cannot read and write.
REFERENCES


