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IMPLEMENTATION OF A SCHOOL-BASED HIV PREVENTION CURRICULUM FOLLOWING NATIONAL DISSEMINATION IN NYANZA PROVINCE, KENYA

E. J. MATTHEWS, E. S. PUFFER, C. S. MEADE and S. A. BROVERMAN

ABSTRACT

***Background*: Primary School Action for Better Health (PSABH) became the national HIV prevention curriculum of Kenya in 2005.**
***Objective*: To examined implementation of PSABH and student risk behaviour s.**
***Setting*: Muhuru, a rural division of Nyanza Province.**
***Subjects*: One thousand one hundred and forty six students aged 9-21 years from six primary schools in Muhuru.**
***Outcome measures*: Anonymous surveys were administered to assess students' exposure to PSABH curriculum components, sexual activity, condom use, and self-efficacy related to engaging in lower risk behaviours.**
***Results*: The six schools implementing PSABH were not implementing the full curriculum. Fifty-five percent of males and 44% of females reported a history of sexual activity. For females, condom self-efficacy was related to lower risk behaviour , while HIV education during pastoral instruction was associated with higher risk. Boys who reported higher self-efficacy and learning about abstinence strategies engaged in lower risk behaviour , while exposure to HIV education in assemblies and communication with relatives about HIV was associated with higher risk.**
***Conclusion*: Previous studies documented benefits of PSABH. However, it is unclear how effective the curriculum is after national scale-up. In this community, PSABH was implemented at a low level, with some curriculum components associated with higher risk behaviour , calling into question how PSABH is being delivered. Future studies should examine effective strategies for ongoing support, monitoring, and evaluation. Successfully disseminating evidence-based prevention strategies could reduce HIV incidence and the burden on healthcare providers struggling to care for people living with HIV/AIDS.**

INTRODUCTION

The HIV pandemic is a growing concern for youths. Young people, ages 15 to 24, account for almost half of all new HIV infections (1, 2), and AIDS is now the leading cause of death in sub-Saharan Africa among this age group (3). Prevention among youth is essential in order to slow the spread of HIV and minimise the impact of AIDS on societies. Utilising schools as a venue for HIV prevention is a promising approach for reaching large numbers of youth (4).

Despite the development of dozens of efficacious school-based interventions (5, 6), dissemination has proven to be difficult (7). The lack of consistent, long-term results from prevention efforts to date is due in part to incomplete implementation when interventions "go to scale" (8). For school interventions, the numerous barriers faced by teachers and the lack of training in novel pedagogies may help explain the low levels of implementation (9). Given these barriers, follow-up studies are needed to understand how school-based programmes are implemented in "real world" conditions over the long term and to identify the factors associated with the largest benefits (10).

In Kenya, 7.8% of adults ages 14 to 59 are infected with HIV. Nyanza province, on the shores of Lake Victoria, has the highest prevalence in the country at 15.3%. Young women aged 15 to 24 are at particularly high risk, with an HIV infection rate four times as high as men in the same age group (11). In 2000, the Ministry of Education responded to the

HIV epidemic among youth by distributing books on HIV prevention to schools for use during regular lessons. Later, questions on HIV were also added to the primary school exit exam, and information on HIV was integrated into multiple subjects in the national curriculum. In these initial efforts, however, teachers did not receive training and many were not made aware of the above changes; thus, implementation was weak (12).

During 2001 and 2002, researchers and non-profit organisations collaborated to develop Primary School Action for Better Health (PSABH), a curriculum based largely on Social Learning Theory (13). The PSABH curriculum was developed through extensive consultation with teachers and community members with the goal of overcoming barriers to dissemination in Kenya. PSABH targets students in standards (grade levels) six to eight and includes integrating HIV lessons into all classes and co-curricular activities, teaching specific abstinence skills, starting a school health club, and utilising a question box to address sensitive issues through anonymous questions (14). The curriculum was implemented through a cascading training model. One to four teachers per school were trained for two weeks and were then responsible for training other teachers in their school.

A large-scale evaluation of PSABH was conducted between 2002 and 2006 in almost 1500 schools in Nyanza and Rift Valley provinces. Zonal inspectors in all schools monitored implementation at least once per year during this time. Changes in reported behaviour were measured through successive cross-sectional surveys. Results documented improvements on indicators of HIV risk (14). Male students reported increased condom use and females reported higher abstinence self-efficacy. Students who had not engaged in sex before beginning the curriculum benefitted more than those who were already sexually experienced; girls with a history of sexual activity benefitted the least.

Encouraged by these results, the Ministry of Education adopted PSABH as the national curriculum in 2005. PSABH was disseminated to schools throughout Kenya using the cascading training structure, but the length of the training was cut in half, to one week. No monitoring or evaluation efforts have been funded since the initial effectiveness trial. Without any tracking, it is unclear whether PSABH has been implemented throughout Kenya and whether the curriculum continues to be effective since dissemination. Examining how PSABH has been implemented is important for informing other efforts to bring similar programmes to scale, as PSABH is the only example to our knowledge of a theory-based curriculum supported by effectiveness research that has been disseminated nationally in sub-Saharan Africa.

The purpose of this study was to examine the ongoing implementation of PSABH in Muhuru, a rural division of Nyanza Province. Study aims were to:

(a) determine the number of schools implementing PSABH since the national dissemination, which took place between 2005 and 2008, 14 and mid-2009, when the data was collected,
(b) assess the degree of implementation of the curriculum in schools that had adopted PSABH, and
(c) identify PSABH components and other individual-level characteristics associated with sexual risk behaviours.

This study contributes to the literature informing the dissemination of HIV prevention interventions. The scale up of effective prevention strategies is a key approach to reducing HIV incidence. Thus, successful scale up could greatly reduce the burden on medical providers in Kenya to provide high-quality medical treatment for people living with HIV / AIDS.

MATERIALS AND METHODS

Participants and Procedures: All nine public schools in Muhuru were contacted and asked whether they were implementing PSABH. Within schools who reported that they were implementing the curriculum, a cross-sectional survey was conducted among students in Standards six to eight. All students present the day of the survey participated. The schools' headmasters gave consent for their students to participate after meetings with the headmasters and community meetings in which investigators presented information about the research project. Surveys were translated into Dholuo, the local language, by native speakers and then back translated. Research assistants administered the measures in single-gender classrooms, reading the questions aloud while the students filled out their answers on their own copies. Institutional Review Boards at Duke University and the Kenya Medical Research Institute approved all study procedures.

Measures: Table 1 shows the variables measured in the survey and how each variable was assessed. The following categories of constructs were measured:

1. implementation of PSABH components,
2. individual-level risk-factors, and
3. sexual risk behaviour s.

Some of these were measured with single items, while others were assessed using scales or composites. Measures were adapted from those used in the previous evaluation of PSABH in Nyanza province (14) and other studies of HIV risk (15) All survey items were pilot-tested and adapted when needed for the current study.

Table 1
Measures and Descriptive Results

Variable	Measure Description	Results		Difference Statistic (p value)
		% Yes (n) or Mean (SD)		
		Girls (n = 488)	*Boys* (n = 658)	
Implementation Factors				
School health club participant	Y/N	41.7% (161)	68.6% (352)	$\chi2$=65.1 (.202)
HIV lesson frequency	1 item	2.79 (1.38)	2.29 (1.52)	T= 5.06 (.000)
Number subjects learned about HIV1	6 items	2.39 (1.45)	1.49 (.97)	T= 10.7 (.000)
HIV education at assembly[2]	Y/N	34.8% (138)	21.9% (117)	$\chi2$=18.9 (.000)
HIV education in Pastoral Program[2]	Y/N	44.4% (176)	34.5% (184)	$\chi2$=9.56 (.002)
HIV education through debate[2]	Y/N	21.7% (86)	13.7% (73)	$\chi2$=10.3 (.001)
Learned about how to resist sex	Y/N	65.2% (259)	38.2% (204)	$\chi2$=66.6 (.000)
Learned to control natural urges	Y/N	48.9% (194)	28.1% (150)	$\chi2$=42.2 (.000)
Learned to abstain despite pressure	Y/N	50.4% (200)	30.3% (162)	$\chi2$=31.3 (.000)
Individual Level Factors				
HIV knowledge3	18-item scale	66.4% (16.5)	66.4% (16.7)	T= 0.01 (.992)
Know someone who died of AIDS	Y/N	54.7% (216)	56.1% (290)	$\chi2$=0.18 (.671)
Comfort asking teacher about HIV/sex	2-item scale	1.70 (.52)	1.60 (.61)	T= 2.72 (.007)
Communication: relatives about HIV/sex	2-item scale	1.49 (.70)	1.52 (.72)	T= -0.53 (.596)
Abstinence self-efficacy[4]	3 item scale	2.04 (.91)	1.94 (.89)	T= 1.57 (.118)
Condom self-efficacy[5]	3-item scale	2.47 (.89)	2.47 (.77)	T= -0.07 (.943)
Sexual Risk Behaviour s				
Sexual activity (ever)	Y/N	43.7% (173)	54.7% (287)	$\chi2$=10.9 (.001)
Sex in last 3 months	Y/N	33.3% (57)	37.8% (107)	$\chi2$=0.93 (.336)
Condom use at last sex	Y/N/DK	47.0% (77)	20.8% (54)	$\chi2$=32.0 (.000)

Notes: Included main subjects in Kenya curriculum. 2. List of activities simplified from PSABH documents. 3. Adapted from Kalichman & Simbayi (2003); Carey & Schroder (2002). 4. Items included "I can say no to sex", "I can have a boyfriend or girlfriend and abstain from sex", and whether " a girl means 'no' when she says 'no'". 5. Questions included "I can talk to their girlfriend or boyfriend about using a condom", I can make sure they use a condom if they play sex" and "I should use a condom if they play sex".

Data Analysis: Descriptive statistics for predictor variables and sexual risk behaviours were calculated using means and proportions. We examined male and female students separately because chi-square and t-tests showed significant differences between males and females in the majority of predictor variables (see Table 1). Further, previous studies have found that girls and boys often respond differently to HIV education (4 ,16). Two logistic regression models were run for each gender to determine correlates of the two sexual risk behaviours:

(a) whether or not students had ever had vaginal sex and
(b) whether or not they used a condom at their most recent sexual intercourse.

Age and standard were entered as control variables in all bivariate and multivariate regressions. Variables significant in the bivariate analysis at an alpha level of $p < 20$ were entered in the multivariate model. Multivariate analyses were conducted using the backwards selection procedure, and a critical value of $p < .05$ was used to determine significance. Analyses were performed in SPSS, Version 15.0.

RESULTS

Of the nine public primary schools in Muhuru, six reported that they were trained in PSABH and were currently implementing components of the curriculum. All subsequent analyses were restricted to these six schools. Two components of PSABH that could be evaluated without student-level data were the presence of a health club and of a question box. All six schools with PSABH had an active school health club, but none were using a question box to collect anonymous questions about HIV/AIDS.

Participants were 1146 students (488 female) in standards six to eight. Participants were between 9 and 21 years old (M = 14 years). Table 1 describes students' reports of their exposure to education and communication about HIV/AIDS. Twenty percent of girls and 33 percent of boys reported that they learned about HIV "less than once a month" or "never," while half of girls and one-third of boys reported learning about HIV more than once a week in class. Approximately half of all students reported talking with both male and female relatives about HIV/AIDS and sex. On a test of HIV knowledge, less than half of students knew whether HIV can be spread by kissing, whether there are physical signs of HIV infection, whether a mother can give HIV to her child, and whether it is more risky to have sex with older partners.

Correlates of Sexual Activity: Table 2 presents correlates of sexual activity for boys and girls in bivariate and multivariate models. In multivariate analyses, girls who were older, had higher condom use self-efficacy, and had learned about HIV during the Pastoral Instruction Program, were more likely to have been sexually active. For boys, those who were older, reported more communication with relatives, and had higher condom self-efficacy were more likely to have been sexually active.

Correlates of Unprotected Sex: Table 3 presents the bivariate and multivariate logistic regression models examining condom use at the most recent sexual act for students who reported a history of sexual activity. Multivariate analyses showed that girls who reported knowing someone who died of AIDS and who had lower condom use self-efficacy were more likely not to have used a condom at most recent sex. Boys who reported learning about HIV in an assembly, not learning about how to resist sex, and having lower condom self-efficacy were more likely not to have used a condom at most recent sex.

Table 2

Bivariate and multivariate logistic regression models predicting sexual activity among school-going youth

	Girls (N = 357)				Boys (N = 388)			
Predictor	Bivariate OR	Analyses 95% CI	Multivariate Adjusted OR	Analyses 95% CI	Bivariate OR	Analyses 95% CI	Multivariate Adjusted OR	Analyses 95% CI
Demographic Control Variables								
Age	1.69***	1.42, 2.00	1.56***	1.30, 1.88	1.23***	1.12, 1.36	1.22**	1.08, 1.37
Standard	1.46***	1.12, 1.91	Deleted		1.03	.83, 1.28	Deleted	
Implementation Factors								
School health club participant	.78	.50, 1.22	NI		1.02	.69, 1.51	NI	
HIV lesson frequency	1.19*	1.01, 1.40	Deleted		1.08	.96, 1.23	NI	
Sum of subjects where learned HIV	1.01	.87, 1.17	NI		.93	.76, 1.14	NI	
Learned about HIV at an assembly	1.10	.70, 1.71	NI		.99	.65, 1.52	NI	
Learned about HIV in Pastoral Programme	1.51	.98, 2.33	1.68*	1.05, 2.66	1.10	.75, 1.61	NI	

Learned about HIV through debate	1.35	.81, 2.26	NI		.81	.48, 1.36	NI	
Learned how to resist sex	1.20	.75, 1.91	NI		.85	.59, 1.23	NI	
Learned how to control natural urges	1.05	.68, 1.62	NI		.66*	.44, .98	0.63	.40, 1.00
Learned how to abstain despite pressure	1.49	.97, 2.28	Deleted		1.22	.83, 1.80	NI	
Individual Level Factors								
HIV knowledge	1.72	.41, 7.21	NI		1.34	.44, 4.04	NI	
Knows someone who died of AIDS	1.86**	1.20, 2.89	Deleted			1.62**	1.12, 2.33	Deleted
Comfort asking teacher about HIV/sex	1.73*	1.11, 2.71	1.50	0.93, 2.43		1.29	.95, 1.74	Deleted
Communication with relatives about HIV/sex	1.07	.76, 1.51	NI			1.31	.99, 1.73	1.49**
Abstinence self-efficacy	1.28	1.00, 1.65	Deleted			.81*	.66, .99	0.78
Condom self-efficacy	2.11***	1.52, 2.94	2.11***	1.50, 2.96		1.38**	1.09, 1.75	1.33*

p < .20; *p < .05; **p < .01, ***p < .001
Notes. Girls: Nagelkerke R2= 0.233, Model $\chi 2 = 68.271$, p < 0.0001; Boys: Nagelkerke R2= 0.097, Model $\chi 2 = 29.079$, p < 0.000. NI = not included because p < .20 in bivariate analysis. Deleted = variable eliminated in backwards step process in multivariate analyses.

Table 3

Bivariate and multivariate logistic regression models predicting condom use at last sexa among sexually active school-going youth

Predictor	Bivariate OR	Analyses 95% CI	Multivariate Adjusted OR	Analyses 95% CI	Bivariate OR	Analyses 95% CI	Multivariate Adjusted OR	Analyses 95% CI
		Girls (N = 357)				Boys (N = 388)		
Demographic Control Variables								
Age	.96	.76, 1.22	Deleted		1.21*	1.02, 1.43	Deleted	
Standard	1.22	.79, 1.90	Deleted		1.85**	1.23, 2.76	Deleted	
Implementation Factors								
School health club participant	.86	.44, 1.67	NI		1.28	.64, 2.56	NI	
HIV lesson frequency	1.13	.88, 1.46	NI		1.15	.92, 1.44	NI	
Sum of subjects where learned HIV	.94	.75, 1.17	NI		1.17	.85, 1.60	NI	
Learned about HIV at an assembly	.87	.45, 1.66	NI		.41*	.17, .98	0.31*	.13, .77

Learned about HIV in Pastoral Programme	.76	.41, 1.43	NI		1.20	.63, 2.27	NI	
Learned about HIV through debate	1.75	.85, 3.62	2.12	0.97, 4.65	1.71	.75, 3.89	Deleted	
Learned how to resist sex	1.02	.52, 2.02	NI		1.84	.96, 3.50	2.84**	1.46, 5.52
Learned how to control urges	1.26	.67, 2.37	NI		1.17	.58, 2.33	NI	
Learned how to abstain despite pressure	1.03	.55, 1.94	NI		1.02	.52, 1.97	NI	
Individual Level Factors								
HIV knowledge	.77	.10, 6.09	NI		3.44	.33, 35.95	NI	
Knows someone who died of AIDS	.32***	.16, .64	0.30***	.15, .61	2.00	1.00, 4.02	2.04	.98, 4.26
Comfort asking teacher about HIV/sex	.67	.32, 1.39	NI		.98	.54, 1.77	NI	
Communication with relatives about HIV/sex	1.12	.68, 1.85	NI		1.27	.75, 2.15	NI	
Abstinence self-efficacy	1.11	.75, 1.64	NI		.97	.70, 1.36	NI	
Condom self -efficacy	2.17*	1.07, 4.40	2.32*	1.11, 4.86	1.91*	1.02, 3.60	2.10*	1.11, 3.98

$p < .20$; *$p < .05$; **$p < .01$, ***$p < .001$

Notes: Girls: Nagelkerke R2= 0.160, Model $\chi 2 = 20.032$, $p < 0.0001$; Boys: Nagelkerke R2= 0.160, Model $\chi 2 = 28.874$, $p < 0.0001$. NI = Not included because $p < .20$ in bivariate analyses. Deleted = Variable eliminated in backwards step process in multivariate analyses. a. Condom use coded 1=Yes, 0= No or not sure. b. NS= not significant $p < .20$ for unadjusted OR and for adjusted OR $p < .05$ or the variables that were not included in the final model.

DISCUSSION

Kenya's adoption of PSABH, an empirically supported HIV curriculum, is a move in the right direction for school-based HIV education. Not surprisingly, rolling out such a curriculum on a national scale comes with challenges. One purpose of this study was to assess the level of implementation of PSABH, and by doing so examine barriers to dissemination. A second purpose was to evaluate which components of the PSABH curriculum, as it is being implemented currently in one setting, are associated with students' sexual risk behaviours

In Muhuru division, six of the nine public schools were implementing PSABH to some extent four years after the national dissemination of the curriculum began. Of the three schools without PSABH, two schools reported that they had not heard about the curriculum. At the third school, the headmaster had been trained by PSABH, though the other teachers were not trained themselves, and the curriculum was not being implemented. One administrator for the public schools in the area also reported that he was trained, but had not been able to communicate with the schools about HIV education during his short time at his post. Teachers in Muhuru had been trained sometime between 2006 and 2008.

These observations reflect several difficulties in the dissemination and implementation of the national curriculum. In this area, there seems to be inconsistency in the provision of training across schools. Further, in schools with teachers who had received training, we observed a training-implementation gap suggesting that the training, as provided for teachers or administrators, does not seem to be sufficient. At the school level, this also indicates that the cascading training structure may not be effective if only one person at the school is trained. Related to this, the rate of staff turnover in schools was high (i.e., teachers were transferred to different areas, or to different schools in the same area). When teachers or headmasters leave, they may not have trained the other teachers, leaving

that school without the curriculum. Lastly, teachers in this study reported that they often do not seek out additional training in curricula such as PSABH due to their heavy workload and a general lack of material and financial resources to implement the basic school curricula (9). If true, this could be one reason that even trained staffs do not put forth the time and effort it would take to train others in their schools.

In schools implementing PSABH, the overall degree of implementation was low. For example, not even one school made use of a question box – a key interactive component of the curriculum that allows students to ask anonymous questions. Most schools reported that they previously used old chalk boxes for this purpose, but no school bought or constructed a permanent box; thus the practice fell out of use. Examples such as this suggest that even small expenses or tasks can prevent schools from implementing novel strategies, even when the teachers may understand the benefit. Further, while these schools did have a health club, many did not associate this club with PSABH per se; another HIV prevention initiative was actively supporting the clubs because it fit within their mission; thus it is not clear whether the clubs would have been in place if only PSABH had been present.

Other key components of PSABH, lessons about HIV and abstinence strategies and teaching about HIV / AIDS within other school subjects, also seemed difficult for some teachers to adopt. Less than half of students reported learning about any of the abstinence strategies, and the HIV lesson frequencies suggest that while some teachers are teaching about HIV in class regularly, others do not seem to address the subject at all. One effect of this overall low level of implementation seems to be that students have gaps in essential knowledge about HIV / AIDS.

Across many of the student-reported variables, girls and boys reported significantly different levels of learning. This is consistent with other studies documenting that different types of HIV prevention affect boys and girls differently, in part due to culturally constructed gender roles (6, 17, 18). Previous research has documented that education about HIV and condoms benefits females more than males. This is consistent with findings of this study that girls consistently reported more learning than boys in the classroom (16). The only component whereby boys reported significantly more participation was in the school health club. One potential reason for this is that these clubs are one of the only places to have an open dialogue about HIV; speaking and discussing in mixed-gender situations may be more comfortable for boys than girls. As it is important that this component be equally accessible across genders, future studies should examine whether there is a gender disparity in access to more interactive, discussion-based HIV prevention activities.

Of all participants, over half of boys and almost half of girls reported that they have had vaginal sex. Almost half of the girls, but only one-fifth of the boys, reported using a condom at their most recent sexual intercourse. Overall these rates were consistent with another study on sexual risk behaviour in this area of Nyanza that documented generally low condom use among adolescents (19). However, the higher rate of use among girls was unexpected and inconsistent with previous studies (11, 18). Reasons for this are unclear. A potential explanation is that girls in this community may engage in transactional sex with boys who are not in school, particularly boys who make money from fishing. These boys, who were not included in this study, may be older or for some other reason more likely to initiate or agree to the use of condoms. If future studies replicate this finding, it will be important to examine the reasons that female students might use condoms more often than their male peers.

Only one PSABH curriculum component was significantly associated with reduced risk behaviour —learning about how to resist sex—and this was associated only with condom use among boys. Several components, however, were associated with higher risk behaviour . Boys who reported learning about HIV in an assembly were less likely to have used a condom than those who did not. Girls who reported learning about HIV in the Pastoral Instructional Program, an assembly focused on religious messages, were more likely to have ever engaged in sexual activity than those who did not. One possible explanation is that teachers may be expressing opinions in large group settings that discourage using condoms, and / or they may not leave room for discussion. This is consistent with a qualitative study in Kenya that documented negative teacher attitudes towards condoms.20 While there may be other explanations, results clearly point to the need to recognise and evaluate how HIV education can be harmful and to minimise the use of any educational strategies that lead to increased risk behaviour . Additionally, these negative effects could be due to incomplete or incorrect implementation, pointing to the potential benefits of closer monitoring throughout dissemination.

Examining the relationships between individual-level characteristics and risk behaviour s yielded some unexpected findings. For boys, a higher level of communication with relatives was associated with increased likelihood of sexual activity. This could reflect that sexually active students seek out more opportunities to talk about HIV and sex. Another explanation may be that relatives could encourage, or even pressure, male youth to engage in sex, as suggested in previous studies conducted in Kenya (17, 18). Sexual activity is sometimes seen as rite of passage to manhood in this community. Secondly,

female students who knew someone who died of AIDS were less likely to use condoms. This was unexpected, as exposure to AIDS-related deaths could plausibly lead to safer behaviour s to reduce one's own risk. This finding is difficult to interpret in this community, as over half of the sample reported knowing someone who died of AIDS. Because of the very high prevalence of HIV in this community, the effects of AIDS-related deaths may not carry the same meaning for adolescents that we would expect in settings with lower prevalence. For instance, if AIDS-related deaths are so common, adolescents could develop a sense of hopelessness or fatalism, leading to apathy and lower motivation to engage in risk reduction behaviours.

This study is among the first to examine implementation of an HIV prevention curriculum after national dissemination. The combination of school- and student-level data is a strength of this study and provides a unique contribution to the literature on school-based HIV education. With these data, we provide a case study that points to reasons that HIV prevention programmes may be less effective when they go to scale. However, our study is limited in that data were collected in one division of Nyanza; therefore results may not be widely applicable. In particular, Muhuru is located on Lake Victoria and is subject to the migrations, poverty, and transactional sex that are prevalent in fishing communities and associated with high rates of HIV transmission (2). It is a strength of our study, however, that we identified some effective curriculum components in such an environment. Further, the cross-sectional design does not allow us to examine causality; that is, we cannot attribute the findings directly to the presence or absence of PSABH in the schools. We also relied on student self-report measures, which leaves data open to several biases; the anonymity of responses, however, was emphasized during data collection to reduce these sources of bias as much as possible.

Our findings support the need for more research on how school-based HIV education programmes can be scaled up effectively so that all students in Kenya, and other countries, benefit from curricula shown to be effective in smaller-scale research studies. Larger-scale and longitudinal studies after scale-up of these programmes could help identify components that are effective versus those that are ineffective (or even harmful) when taken to scale. For example, it is possible that the less intensive training that was provided when the programme was scaled up is inadequate for some teachers; thus these teachers may make serious errors in how they relay information about HIV that do more harm than good.

Future research should also examine barriers and facilitators to implementation across different geographical areas of the country. Related to this, studies could empirically test the effects of increased monitoring and evaluation efforts to determine if putting resources into these follow-up activities could lead to more complete and effective implementation. Increased monitoring, training refreshers, and regular support of PSABH activities could be especially important in low-resource or rural settings where teachers and schools have fewer resources with which to educate the children in their communities. Further, increased monitoring and support also may be particularly important in high HIV prevalence areas in which the task of HIV prevention can seem daunting and unattainable.

In conclusion, one of the best strategies for stopping the spread of HIV in Kenya is to identify successful prevention interventions and to take those interventions to scale to reach large numbers of youths. School-based prevention interventions are particularly promising for having widespread impact, and Kenya has taken a remarkable first step in adopting PSABH, a programme backed by empirical evidence. However, results of this study suggest that even more efforts are needed to achieve full and effective implementation over the long-term. Investing resources to understand how to disseminate and sustain PSABH and other evidence-based programmes well could have significant and positive implications for the healthcare systems across the country. At present, the medical community is overburdened and struggling to provide care for the growing number of people living with HIV / AIDS, perhaps even sacrificing quality to reach the large numbers of patients. Successful prevention could reduce this burden and thereby even improve the quality of care that healthcare professionals are able to provide.

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REFERENCES

1. UNAIDS. Report on the global AIDS epidemic. 2008.
2. Allison EH, Seeley JA. HIV and AIDS among fisherfolk: a threat to 'responsible fisheries'? *Fish and Fisheries* 2004;**5**:215-34.

3. Blum RW. Youth in sub-Saharan Africa. *J Adolesc* Health 2007;**41**:230-238.
4. Gallant M, Maticka-Tyndale E. School-based HIV prevention programmes for African youth. *Soc Sci Med* 2004;**58**:1337-51.
5. Visser MJ. Life skills training as HIV / AIDS preventive strategy in secondary schools: evaluation of a large-scale implementation process. *SAHARA J* 2005;**2**:203-216.
6. Duflo E, Dupas P, Kremer M, Sinei S. Education and HIV / AIDS Prevention: Evidence from a randomized evaluation in Western Kenya. World Bank Policy Research Working Paper 4024, 2006.
7. Kirby D, Obasi A, Laris BA. The effectiveness of sex education and HIV education interventions in schools in developing countries. *World Health Organ Tech Rep Ser* 2006;**938**:103-50; discussion 317-341.
8. Solomon J, Card JJ, Malow RM. Adapting efficacious interventions: advancing translational research in HIV prevention. *Eval Health Prof* 2006;**29**:162-194.
9. Clark DJ. Heroes and Villians: teachers in the education response to HIV. Paris: International Institute for Educational Planning, UNESCO, 2008.
10. Greenberg MT. Current and future challenges in school-based prevention: The researcher perspective. *Prev. Sci*. 2004;**5**:5-13.
11. National AIDS and STI Control Programme MoH, Kenya. Kenya AIDS Indicator Survey 2007: Preliminary Report. Nairobi, Kenya, 2007.
12. Ndambuki JK, McCretton E, Rider N, Gichuru M, Wildish J. An Analysis of HIV / AIDS Policy Formulation and Implementation Structures, Mechanisms and Processes in the Education Sector. Nairobi, Kenya: Center for British Teaching (CfBT).
13. Bandura A. Social learning theory. New York: General Learning Press, 1977.
14. Maticka-Tyndale E, Wildish J, Gichuru M. Quasi-experimental evaluation of a national primary school HIV intervention in Kenya. *Eval Programme Plann* 2007;**30**:172-186.
15. Carey MP, Schroder KE. Development and psychometric evaluation of the brief HIV Knowledge Questionnaire. *AIDS Educ Prev* 2002;**14**:172-182.
16. Albarracin D, Gillette JC, Earl AN, Glasman LR, Durantini MR, Ho MH. A test of major assumptions about behaviour change. *Psychol Bull* 2005;**131**:856-897.
17. Tenkorang EY, Maticka-Tyndale E. Factors influencing the timing of first sexual intercourse among young people in Nyanza, Kenya. *Int Fam Plan Perspect* 2008;**34**:177-188.
18. Kabiru CW, Orpinas P. Factors associated with sexual activity among high-school students in Nairobi, Kenya. *J Adolesc* 2009;**32**:1023-1039.
19. Author. In Press.
20. Njue C, Nzioka C, Ahlberg BM, Pertet AM, Voeten HA. "If you don't abstain, you will die of AIDS": AIDS education in Kenyan public schools. *AIDS Educ Prev* 2009;**21**:169-179.