Application of the information, motivation and behavioural skills model for targeting HIV risk behaviour amongst adolescent learners in South Africa

Misheck Ndebele, Mambwe Kasese-Hara, Michael Greyling

Abstract

This paper discusses the application of an information, motivation and behavioural skills (IMB) model in a school-based programme for the reduction of HIV risk behaviour among 259 Grade 11 learners in two high schools in Alexandra township, Johannesburg. School 1 was the Experimental group, while School 2 was the Control group. After a baseline study (Time 1) at both schools, a 3-week intervention programme was conducted at School 1. A post-test (Time 2) was conducted at both schools. The intervention was repeated at School 2, followed by another post-test (Time 3) at both schools. A final test (Time 4) was conducted at both schools. While there were positive changes in the levels of HIV&AIDS IMB in learner participants, these changes may not be entirely attributed to the intervention. If an IMB model-based intervention is to be maximally effective in reducing HIV-risk behaviour among adolescents, it must focus on the behavioural, structural and socio-cultural contexts in which adolescents live.

Keywords: *IMB model, vulnerability, adolescents, risk behaviour, structural, socio-cultural*

Résumé

Cet article traite de l'application du model : Information, Motivation et Comportement (IMC) dans un programme en milieu scolaire pour la réduction des comportements à risque relatif au VIH parmi 259 élèves de l'avant dernière année du secondaire dans deux écoles secondaires du canton d'Alexandra, à Johannesburg. L'école 1 était le groupe expérimental, tandis que l'école 2 était le groupe de contrôle. Après une étude de base (Temps 1) dans les deux écoles, un programme d'intervention de 3 semaines a été mené à l'école 1. Un post-test (Temps 2) a été mené dans ces deux écoles. L'intervention a été répétée à l'école 2, suivi par un autre post test (temps 3) dans les deux écoles. Un test final (temps 4) a été mené dans ces deux écoles. Bien qu'il y ait eu des changements positifs dans les taux d'information, de motivation et des compétences comportementales relatifs au VIH / SIDA chez les élèves participants, ces changements peuvent ne pas être entièrement attribué à l'intervention. Si une intervention du type IMC doit atteindre une efficacité maximale dans la réduction des comportements à risque chez les adolescents, elle doit se concentrer sur les contextes comportementaux, structurels et socioculturels dans lequel vivent les adolescents.

Mots-clés*: Modèle IMC, vulnérabilité, adolescents, comportements à risque, structurel, socioculturel*

Introduction

An estimated 33.3 million people worldwide were living with HIV at the end of 2009. During the same year an estimated 2.6 million became newly infected with HIV, while another estimated 2.8 million lost their lives to AIDS (UNAIDS 2010). South Africa has the biggest HIV positive population in a single country in the world with an estimated 5.6 million people living with HIV in 2009 (UNAIDS 2010). In fact, South Africa has about 1500 new infections each day (Rehle, Shisana, Pillay, Zuma, Puren & Parker 2007), with an estimated 1000 people dying of HIV and AIDS every day in South Africa (UNAIDS 2008).

Globally, about 5.4 million youth were living with HIV in 2006, with 61% (3.28 million) of these living in sub-Saharan Africa (UNAIDS 2007). About 10 years ago, adolescents were the fastest growing population group at risk for HIV (United

Misheck Ndebele is a Lecturer in the School of Education at the University of the Witwatersrand, Johannesburg, South Africa. His teaching falls broadly within the areas of Studies in Education, with special focus on Educational Psychology and School/Family Partnerships. His research interests are in HIV and AIDS Education and Orphaned and Vulnerable Children. He is a PhD candidate at the University of the Witwatersrand, awaiting graduation in June 2012.

Mambwe Kasese-Hara is a Senior Lecturer in the School of Human and Community Development at the University of the Witwatersrand, Johannesburg, South Africa. Her teaching falls broadly within the areas of Developmental and Health Psychology, and her research interests are in Psychosocial aspects of HIV and AIDS, including psychosocial wellbeing and adjustment of orphans and vulnerable children, parenting and fostering within the context of HIV and AIDS; and HIV risk in heterosexual relationships in Southern Africa – socio-cultural factors.

Michael Greyling is a Lecturer in the School of Human and Community Development at the University of the Witwatersrand, Johannesburg, South Africa. His teaching falls broadly within the fields of Research Methods and Analysis and Multi-disciplinary approaches to theorizing about the mind. His research interests include post-traumatic stress and wellness in organizations.

Correspondence to: misheck.ndebele@wits.ac.za

Nations Children's Fund, Joint United Nations Programme on HIV/AIDS & World Health Organization 2002). More recent studies suggest that young people under the age of 19 years continue to be at the centre of South Africa's fastest growing HIV pandemic (Desmond Tutu Foundation 2008). In 2008, out of an estimated 6800 new infections a day, 45% of all new infections occurred in young people between 15 and 24 years of age (UNAIDS 2008). In fact, adolescents are currently considered being at the highest risk of infection (UNAIDS 2010).

Many young people at risk of HIV infection, or already living with HIV are found in the world's poorest regions (UNAIDS 2009). Their vulnerability to HIV operates within a broader context of poverty, which may include lack of access to education, economic opportunities, and health services. Hallman (2004) states that poor populations, unskilled workers and people with low educational levels, have become increasingly vulnerable to HIV and are also disproportionately affected by the epidemic. Hallman (2004) further argues that poverty and lack of power may compel populations into sexual behaviour and practices that may put them at risk of HIV infection.

The role of poverty in risky adolescent sexual behaviour is further highlighted by Hartell (2005) who notes that poor young people start their sexual experience at an even younger age than their wealthier counterparts, and often lack the knowledge and skills they need to protect themselves. Similarly, Homans (2008) observes that vulnerable young people live in extreme poverty with adults who are generally unemployed. As a result of their poverty, they have limited access to health and social services. Associated with these poor living conditions is the high rate of HIV infection in areas where vulnerable young people live.

Many adolescents are unaware of what constitutes risky sexual behaviour (Barden-O'Fallon, deGraft-Johnson, Bisika, Sulzbach, Benson & Tsui 2004; Macintyre, Rutenberg & Brown 2004; Pettifor, Rees, Steffenson, Hlongwa-Madikizela, MacPhail, Vermaak, *et al.* 2004; Sarker, Milkowski, Slanger, Gondos, Sanou, Kouyate, *et al.* 2005). Furthermore, most of the adolescents living with HIV do not know they are infected (UNAIDS 2004). Because adolescents are not aware of their vulnerable situation, they do not perceive themselves to be at risk. In fact, for most of them, being infected is neither real nor possible.

Various authors acknowledge the vast amount of knowledge South African youth have about HIV&AIDS (Pettifor *et al.* 2004; Shisana, Rehle, Simbayi, Parker, Zuma, Bhana, *et al.* 2005). Schools are expected to communicate knowledge, instil values and promote behaviours that will enable learners to protect themselves against HIV infection. However, many approaches in schools do not seem to be effective in changing the sexual behaviour of adolescents (James, Reddy, Ruiter, McCauley & Van den Borne 2006). In fact, Zisser and Francis (2005) doubt the effectiveness of knowledge in HIV&AIDS reduction when they observe the high incidence of HIV&AIDS in South African youth aged 15–24. From their analysis, it is evident that knowledge clearly does not translate into action. Similarly, James *et al.* (2006) argue that even when adolescents' HIV knowledge is high, it has not generally translated into safer sexual practices.

Although adolescent infection rates in South Africa have begun to show a downward trend (UNAIDS 2009), the need for strategies and interventions aimed at young people is still critical as young people are particularly vulnerable to HIV infection due to their risky sexual behaviour (Kelly 2001; Van Dyk & Van Dyk 2003). According to Fisher and Fisher (1992), adolescent learners are likely to be empowered through intervention programmes that provide them with appropriate knowledge, motivate them to change risky sexual behaviour and equip them with relevant behavioural skills to act upon the knowledge they possess.

The information, motivation and behavioural skills model

The information, motivation and behavioural skills (IMB) model (Fisher & Fisher 1992) is based on an early health behaviour theory that implicates cognitive determinants of HIV risk and prevention, such as AIDS knowledge, personal attitudes, and behavioural intentions to practice prevention (Ajzen & Fishbein 1980). According to this model, AIDS prevention behaviour is determined by information, or knowing about transmission and prevention, motivation to reduce risk, and behavioural skills to practice prevention. Fig. 1 illustrates the main elements of an IMB model:

The IMB model has been used worldwide. For instance, in the USA, the use of this model has confirmed the relationship among HIV&AIDS prevention, IMB in research studies focused on gay men and heterosexual university students (Fisher, Fisher, Williams & Malloy 1994) and ethnically diverse heterosexual high school students (Fisher, Bryan, Fisher & Misovich 2002).

The model has also been used in South Africa. For example, in their study of sexually transmitted infections (STIs), with 131 men and 60 women in Cape Town, Kalichman, Simbayi, Cain, Jooste, Skinner and Cherry (2006) concluded that the IMB model is generalizable to South Africa and is therefore useful in guiding HIV-risk reduction interventions. Similarly, Simbayi, Kalichman and Bok (2004) confirm that research has supported the IMB model in South Africa, with IMB interventions based on predicting sexual risk-reduction behaviours in

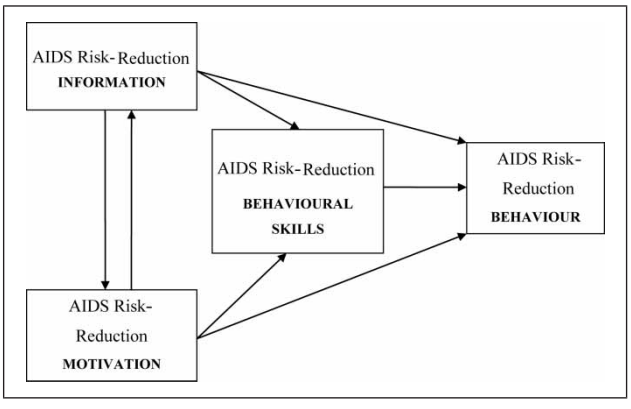

Fig. 1. The IMB model (adapted from Fisher & Fisher 1992).

STI clinic patients. Further literature shows that IMB interventions have been associated with risk-reduction behaviours in South Africa (Pettifor *et al.* 2004).

This article therefore presents research which examines the effectiveness of the IMB model in promoting appropriate sexual behaviour and practices that reduce the likelihood of HIV-risk behaviour amongst adolescent learners in public high schools in South African townships.

Research design and methodology

Participants

Two high schools in Alexandra township, Johannesburg, South Africa, were purposively sampled (Trochim 2002). The two high schools were chosen because they are centrally located in the township, servicing the largely impoverished community of Alexandra. Although there are minor differences between the two participating schools due to their proximity to each other (about a kilometre apart), the two schools have much in common.

The participants were 259 black Grade 11 learners (boys and girls aged between 14 and 18), drawn from the two schools. Of these participants, 136 learners from one school formed the experimental group while 123 from another school formed the control group. The experimental school was coded 1 (ES), and the control school was coded 2 (CS). The sample size was big enough to detect a treatment effect as well as to make inferences on HIV-risk behaviour among adolescents in South Africa at large. Grade 11 learners were chosen as a research sample for this study because they constitute an age group that is largely in the late adolescence stage. In addition, Grade 11 learners were chosen because they would be less affected by interruptions to their curriculum, and hence more easily available, compared with Grade 12 learners who would be preparing for their Matriculation examinations, and were therefore less available.

Demographic information shown in Table 1 reveals that learners participating in this study were drawn from an impoverished environment in Alexandra Township. Most of the learners were born and have grown up in single-parent families. With little or no education, most of their parents are unemployed or have little or no household income, compounding the plight of the learners. More importantly, such a poor environment has exposed learners to various forms of anti-social behaviours, including HIV-risky behaviour.

While the initial arrangement with the principals at both schools was that Grade 11 learners would attend treatment sessions during their normal Life Orientation periods, some learners did not attend all the sessions. For instance, at School 1 (ES) of the 220 who agreed to attend, only 123 continued to the end of the sessions. At School 2 (CS), 250 learners first agreed to attend, but only 136 learners attended till the end. In informal discussions with learners about why other learners did not attend the sessions, it was revealed that some learners felt it unnecessary to attend because what was learned during the sessions would not be part of their Grade 11 assessment at the end of the year. However, after further explanation of its relevance to their personal lives more than half the learners were convinced and continued attending the sessions to the end.

Research design

This study is an example of a quasi-experimental and pre-test-post-test research design (Rosenthal & Rosnow 1991). In particular, a quasi-experimental form of the cross-lagged panel design was used (Rosenthal & Rosnow 1991). Table 2 presents a summary of this design.

Procedures

Ethical clearance for the research was obtained from the University of the Witwatersrand's Ethics Committee.

Data were collected using a modified version of the 'Teen Health Survey', a 13-page questionnaire designed for the IMB model of HIV-risk behaviour change (Fisher & Fisher 1992). After a baseline study (Time 1) at the two participating schools, an HIV&AIDS intervention programme was conducted at the experimental school (ES). In both schools, learners attended three 45-minute sessions a week for 3 weeks during their usual Life Orientation classes. The corresponding author led the intervention sessions.

The first week provided learners with HIV&AIDS *information* which aimed to enhance sexual health and to enable them to avoid HIV-risky sexual behaviours. For example, content focused on HIV transmission, the use of condoms, and HIV testing. During the second week, learners were *motivated* to avoid activities that would make them vulnerable to HIV infection. Topics such as risky activities and saying no to sexual intercourse were introduced. Sessions during the third week aimed to equip learners with *behavioural skills* that would enable them to deal with situations of risky sexual behaviour.

A month later a post-test (Time 2) was conducted at both schools. The intervention was repeated at the control school (CS) after another month, followed by another post-test a month later (Time 3) at both schools. After a further month, a final post-test (Time 4) was conducted.

Instruments

HIV&AIDS information

A 'Teen Health Survey' instrument was used to assess the learners' levels of AIDS prevention information. Specifically, learners were tested on facts about HIV&AIDS that are relevant to the practice of preventive behaviour. Learners were expected to respond to a 23-item questionnaire on Facts about HIV&AIDS using a five-point scale as follows: Definitely True; Probably True; Don't Know; Probably False; Definitely False. The questionnaire focused on general facts about HIV&AIDS, including issues such as HIV transmission and signs and symptoms of HIV&AIDS. For items where the assertion was correct the question was scored as correct if the respondent selected 'definitely true' or 'probably true'. If the assertion was incorrect the response was scored incorrect if the respondent selected 'probably false' or 'definitely false'.

The Cronbach alpha for the scale was 0.71.

Table 1. Demographic characteristics of learner participants.

School 1 = ES (*n* = 130)					School 2 = CS (*n* = 121)				
Variable	**Freq.**	**%**	**Cum. Freq.**	**Cum. %**	**Variable**	**Freq.**	**%**	**Cum. Freq.**	**Cum. %**
Gender, age, language, family									
Gender					*Gender*				
Male	61	47	61	47	Male	64	53	64	53
Female	69	53	130	100	Female	57	47	121	100
Age					*Age*				
14	1	0.78	1	0.78	14	–	–	–	–
15	1	0.78	2	1.55	15	2	1.65	2	1.65
16	18	13.95	20	15.50	16	29	23.97	31	25.62
17	45	34.88	65	50.39	17	33	27.27	64	52.89
18	42	32.56	107	82.95	18	39	32.23	103	85.12
19	22	17.05	129	100.00	19	18	14.88	121	100.00
Language					*Language*				
Sepedi	29	21.32	29	21.32	Sepedi	45	36.59	45	36.59
Sesotho	3	2.21	32	23.53	Sesotho	11	8.94	56	45.53
SiSwati	1	0.74	33	24.53	SiSwati	2	1.63	58	47.15
Xitsonga	24	17.65	57	41.91	Xitsonga	4	3.25	62	50.41
Setswana	3	2.21	60	44.12	Setswana	16	13.01	78	63.41
Tshivenda	47	34.56	107	78.68	Tshivenda	4	3.25	82	66.67
IsiXhosa	29	21.32	136	100.00	IsiXhosa	40	32.52	122	99.19
IsiZulu	–	–	–	–	IsiZulu	1	0.81	123	100.00
Live with					*Live with*				
Mother and father	50	37.59	50	37.59	Mother and father	44	37.29	44	37.29
Mother	43	32.33	93	69.92	Mother	46	38.98	90	76.27
Father	14	10.53	107	80.45	Father	7	5.93	97	82.20
Guardian	19	14.29	126	94.74	Guardian	16	13.56	113	95.76
Other	7	5.26	133	100.00	Other	5	4.24	118	100.00
Parental education, household income									
Parental education					*Parental education*				
Primary	4	3.23	4	3.23	Primary	1	0.95	1	0.95
Secondary	51	41.13	55	44.35	Secondary	37	35.24	38	36.19
Tertiary	15	12.10	50	56.45	Tertiary	20	19.05	58	55.24
Don't know	54	43.55	124	100.00	Don't know	47	44.76	105	100.00
Household income					*Household income*				
Under R2000	22	16.18	22	16.18	Under R2000	11	9.09	11	9.09
R2000–R4000	27	19.85	49	36.03	R2000–R4000	10	8.26	21	17.36
R4100–R6000	8	5.88	57	41.91	R4100–R6000	8	6.61	29	23.97
R6100–R8000	1	0.74	58	42.65	R6100–R8000	4	3.31	33	27.27
R8100–R10,000	2	1.47	60	44.12	R8100–R10,000	4	3.31	37	30.58
Over R10,000	2	1.47	62	45.59	Over R10,000	12	9.92	49	40.50
Don't know	74	54.41	136	100.00	Don't know	72	59.50	121	100.00

Motivation

According to Fisher and Fisher (1992) the IMB model identifies 'motivation' as an important determinant of risk behaviour change. In this study, motivation to engage in AIDS preventive behaviour was assessed in accordance with the theory of Reasoned Action (Ajzen & Fishbein 1980; Fishbein & Ajzen 1975). Consistent with this theory, participating learners were tested on their attitudes towards preventive behaviours, subjective norms associated with the preventive behaviour, behavioural intentions towards preventive behaviours, and perceived vulnerability to HIV infection.

Table 2. Research design: Time 1, Time 2, Time 3, Time 4.

		Time 1		Time 2		Time 3	Time 4
School 1	Learner sampling	Pre-test/baseline assessment	Intervention (1)	Post-test repeated measure	–	Post-test repeated measure	Post-test repeated measure
School 2	Learner sampling	Pre-test/baseline assessment	–	Post-test repeated measure	Intervention (2)	Post-test repeated measure	Post-test repeated measure

The Attitudes Towards AIDS Preventive Acts sub-scale measured learners' attitudes towards performing specified behaviours on a five-point scale ranging from 'very bad' to 'very good'. For example, learners were tested on their attitudes towards *delaying sex; discussing sex with partners; acquiring condoms; carrying condoms; using condoms;* and *discussing the use of condoms with partners.* Their responses to these items established the personal motivation of the adolescents to engage in safer sexual practices.

The Subjective Norms Regarding HIV Preventive Acts sub-scale measured the learners' perceived norms (or social support) for engaging in HIV preventive behaviours on a five-point scale ranging from 'very true' to 'very untrue'. Questionnaire items in this section established the *social motivation* in terms of general opinion and views of people around learners regarding sexual behaviour. Such opinions could have a large influence on the adolescent's behavioural intentions. For instance, the respondents were asked the opinion of friends regarding delaying sex, use of condoms, and so on.

The Behavioural Intentions to Engage in AIDS Preventive Acts sub-scale measured each learner's intention (or plans) to perform each of the preventive behaviours in the near future. Learners were required to rate their responses according to a five-point scale ranging from 'very true' to 'very untrue' in regard to the likelihood that they would perform each of the HIV preventive behaviours in the near future. For example, learners were tested on behavioural intentions to *delay sex, discuss whether or not to have sex with partners, acquire condoms, carry condoms, use condoms; and tell sex partners to use condoms.*

The perceived vulnerability sub-scale measured the learners' perceptions of their own and their peers' likelihood of being infected with HIV, and their personal fear associated with being infected with HIV. Learners were expected to rate their perceptions on a five-point scale ranging from 'no chance' to 'very strong chance', and 'not at all afraid' to 'very afraid'. Responses to questions such as 'What do you think are your friends' and your own chances of getting HIV&AIDS?' and 'How afraid are you of getting HIV&AIDS?' would reveal the adolescents' perceptions of their personal susceptibility to HIV infection and their motivation to adopt safe sexual behaviours.

The Cronbach alphas for the four sub-scales were 0.58 for attitudes, 0.80 for subjective norms, 0.61 for behavioural intentions and 0.41 for the vulnerability scale. The reliability for the vulnerability scale was considered too low to be meaningful and was excluded from further analyses.

Behavioural skills

AIDS preventive behavioural skills were assessed with an HIV prevention behavioural skills sub-scale, which tapped into the perceived difficulty or ease with which one could engage in a range of AIDS preventive behaviours. The scale required respondents to rate, on a five-point scale, how hard or easy it would be for them to perform the series of HIV-preventive behaviours, ranging from 'very hard to do' to 'very easy to do'. In other words, respondents were asked to show, among other things, how assertive they were when confronted with HIV-risk situations. For instance, they would reveal how easy or difficult it was for them to be persuaded to do things they did not want to do, such as, the ability to *delay sexual intercourse until older, refuse sex with a boyfriend or girlfriend, acquire condoms; use condoms always, and use condoms even when under the influence of alcohol.*

The Cronbach alpha for the behavioural skills scale was 0.61.

Data analysis

All outcome variables were first inspected for distribution properties using histogram plots. The design allowed for a number of specific questions to be addressed. The primary objective was to establish whether or not there was evidence in the variables of interest associated in time with the intervention. To address this concern a Repeated Measures ANOVA was added to the model. The four time periods outlined in the design constituted the Repeated Measures component, while the use of two schools enabled a Between Subjects comparison.

Within the framework of this procedure a series of planned comparisons allowed the testing of specific questions related to the primary question. Planned comparisons (linear contrasts) allowed for the testing of specific linear functions of the estimated model parameters related to particular research questions. The model used was SAS PROC MIXED (Littell, Milliken, Stroup, Wolfinger & Schadenfreude 2006).

These specific questions are described below along with their appropriate contrasts.

1. *Pre-test equivalence:* This examined whether the two schools had the same average scores prior to the intervention (i.e. at Time 1.) If the schools did not have the same baseline scores this difference might impact on subsequent changes. The contrast was equivalent to a traditional *post hoc test* for comparing the scores at Time 1 for the two groups.

2. *Increase over the intervention period.* If the intervention was successful the variables would change at the time of the intervention, that is, between Times 1 and 2 for the experimental school 1 (ES) and between Times 2 and 3 for the control school 2 (CS). The contrast would thus be equal to the sum of these two comparisons, viz. the difference between Time 1 and 2 for School 1 (ES) and Times 2 and 3 for School 2 (CS).
3. *Increase over the whole period.* Similarly, if the intervention was successful it was anticipated that the scores would still be improved relative to the baseline at the final measurement. This contrast compared the scores at Time 4 with the baseline scores for both groups and was equivalent to the main effect *post hoc* comparison.
4. *Differential Impacts over intervention periods.* The final set of contrasts examined whether the increases occurred specifically at the time of the intervention for each school. In particular it was anticipated that school 1 (ES) would show an increase from Time 1 to Time 2 while school 2 (CS) would not. The contrast thus examined whether the difference between Time 1 and Time 2 was greater for school 1 (ES) than school 2 (CS). This was equivalent to the interaction hypothesis if only Time 1 and 2 were included in the model. Similarly, the same comparison could be made in reverse for Times 2 and 3, where it was anticipated that the difference in means would be greater for school 2 (CS) than for school 1 (ES). Finally, these two effects could be combined to provide a global test of whether the schools showed greater change during the period that they received the intervention.

The same set of analyses was performed for the individual HIV&AIDS information questions. However, in this instance the scores were binary and the model was adjusted to account for this. A mixed generalized linear model was fitted using the SAS GLIMMIX procedure. The binary nature of the dependent variables was accommodated using a Logit link function. For clarity, estimates from the model were presented as percentages.

Results

Hypothesis

It was hypothesized that levels of HIV&AIDS IMB among the learner participants would be likely to increase as a result of the intervention based on the IMB model. According to the hypothesis, the mean score at school 1 (ES) was expected to rise at Time 2, as a result of the intervention between Times 1 and 2. However, the score at school 2 (CS) was expected to remain unchanged at Time 2, changing only after the intervention at that school between Times 2 and 3. Ultimately, the results were expected to be maintained at a high level in both schools at Time 4.

HIV&AIDS information

As indicated earlier, after the baseline (pre-test) assessment, Grade 11 learners at both schools participated in a 1-week long intervention on HIV&AIDS information.

Table 3 shows the results at both schools in percentage form, comparing the results across the four time periods. Specifically, the table demonstrates the percentages of the learners who had a correct response on each of the HIV&AIDS information items listed. The results were estimated using the generalized linear mixed model (Littell *et al.* 2006). The numbers in brackets are the standard errors for the estimates. In general, the respondents show significant improvement in their knowledge across the period of the research with the time effect being statistically significant for all except one of the items. By contrast only two of the items show a significant interaction indicating a differential pattern of change across the two schools. This is problematic as it suggests that the changes do not necessarily coincide with the specific period of the intervention. This is explored in more detail below.

Tables 4 and 5 identify the tests of statistical significance for each of the contrasts described in the analysis above. The general trends are as follows:

There is little difference in knowledge at the baseline with only one item showing statistical significance. In particular the control school respondents were more aware that HIV cannot be contracted by sharing knives and forks with infected persons. The results show a significant improvement over the period of the intervention for 16 of the 23 items. All except one of the knowledge items show significant improvement over the period of the research.

Finally, only one of the items showed a significant pattern of differential improvement consistent with the timing of the interventions. The item regarding the contracting of HIV as a consequence of oral sex showed a clear improvement from Time 1 to Time 2 for school 1 (ES) with no change in the scores at school 2 (CS). By contrast from Time 2 to Time 3 school 2 (CS) increased while school 1 (ES) decreased slightly. Both schools remained constant from Time 3 to Time 4. This was precisely the pattern anticipated if the intervention was to be considered successful. However, as noted above, the general trend for all except one of the items was a consistent trend for both schools across the time periods.

Results for information, motivation and behavioural skills

The pattern of results for the scales shows a similar pattern to that seen for the individual items of the HIV&AIDS information questionnaire. Both schools showed a statistically significant increase in their IMB. However, the pattern of increase did not differ significantly for the two schools if the changes were directly attributed to the intervention.

This is clearly evident in Tables 6 and 7 where a significant improvement is seen over the period of the intervention for each of the variables (with the exception of behavioural skills), while a significant improvement is seen for all of the variables over the period of the study. However, there is no evidence of a differential effect of the timing of the intervention for either of the two schools.

It is important to note that while the improvement in HIV&AIDS information was substantial (*Cohen's* $D = 1.58$) the

Table 3. Mean changes across time.

Question		Time 1	Time 2	Time 3	Time 4	Time	School * time
Infection by someone you love	ES	65% (4.6)	80% (3.7)	91% (2.7)	95% (2.0)	31.08 (764)	0.64 (764)
	CS	58% (4.6)	83% (3.3)	89% (2.8)	96% (1.7)	<0.0001	0.5918
Symptoms of HIV infection	ES	61% (4.8)	83% (3.6)	88% (3.0)	92% (2.5)	25.24 (762)	0.39 (762)
	CS	66% (4.5)	80% (3.6)	90% (2.6)	93% (2.2)	<0.0001	0.7628
HIV infection for homosexuals and drug addicts only	ES	39% (4.9)	67% (4.7)	83% (3.6)	84% (3.5)	38.11 (760)	1.85 (760)
	CS	52% (4.9)	68% (4.5)	80% (3.7)	93% (2.2)	<0.0001	0.1361
No need for a condom if you know someone very well	ES	84% (3.6)	89% (3.0)	96% (1.7)	97% (1.5)	13.71 (763)	0.97 (763)
	CS	76% (4.0)	85% (3.3)	91% (2.5)	99% (0.9)	<0.0001	0.404
Condoms in single relationships	ES	86% (3.4)	94% (2.2)	99% (1.0)	97% (1.6)	9.14 (766)	2.16 (766)
	CS	89% (2.9)	90% (2.7)	96% (1.7)	99% (0.6)	<0.0001	0.0914
HIV and a drug abusing lover	ES	80% (3.9)	87% (3.1)	94% (2.1)	93% (2.4)	13.48 (762)	0.84 (762)
	CS	75% (4.1)	89% (2.8)	94% (2.1)	96% (1.7)	<0.0001	0.4719
Telling possible HIV infection from someones actions	ES	51% (5.2)	64% (4.9)	84% (3.5)	85% (3.4)	38.02 (756)	1.81 (756)
	CS	45% (5.0)	62% (4.7)	81% (3.6)	93% (2.2)	<0.0001	0.1443
Using condoms in one night stands	ES	18% (3.7)	22% (4.0)	30% (4.5)	44% (4.9)	13.24 (752)	0.51 (752)
	CS	21% (3.8)	33% (4.4)	41% (4.6)	47% (4.7)	<0.0001	0.6765
Latex condoms (rubbers) can protect from getting HIV	ES	39% (4.9)	56% (4.9)	64% (4.7)	66% (4.7)	13.32 (744)	1.43 (744)
	CS	52% (4.8)	55% (4.7)	67% (4.4)	78% (3.8)	<0.0001	0.2315
Vaseline/baby oil should never be used with condoms	ES	40% (5.0)	56% (4.9)	75% (4.2)	83% (3.6)	30.50 (755)	0.93 (755)
	CS	46% (4.8)	67% (4.4)	80% (3.6)	79% (3.7)	<0.0001	0.4253
You can store condoms in your wallet for 2 months	ES	25% (4.2)	33% (4.5)	34% (4.5)	47% (4.8)	10.57 (751)	7.27 (751)
	CS	21% (3.7)	53% (4.6)	58% (4.6)	37% (4.4)	<0.0001	<0.0001
Avoiding sexual intercourse can help protect from HIV	ES	35% (4.5)	37% (4.4)	40% (4.5)	54% (4.6)	11.44 (746)	0.43 (746)
	CS	36% (4.3)	40% (4.3)	44% (4.3)	64% (4.2)	<0.0001	0.7324
HIV can be transmitted through breast feeding	ES	60% (4.9)	69% (4.5)	75% (4.1)	82% (3.6)	14.03 (749)	0.58 (749)
	CS	62% (4.6)	72% (4.1)	84% (3.3)	89% (2.8)	<0.0001	0.6307
HIV can be transmitted by sharing a needle	ES	78% (4.0)	80% (3.8)	86% (3.2)	88% (3.0)	8.92 (749)	1.78 (749)
	CS	75% (4.1)	78% (3.8)	85% (3.2)	96% (1.7)	<0.0001	0.1487
Pulling out can prevent HIV	ES	24% (4.2)	45% (5.0)	57% (4.9)	60% (4.9)	26.64 (745)	0.45 (745)
	CS	25% (4.2)	44% (4.7)	65% (4.4)	62% (4.6)	<0.0001	0.7144
A baby and HIV infection	ES	54% (5.0)	76% (4.1)	86% (3.2)	80% (3.8)	20.99 (753)	1.12 (753)
	CS	56% (4.8)	66% (4.4)	84% (3.3)	83% (3.4)	<0.0001	0.3416
HIV testing a day after sex can prove your HIV status	ES	28% (4.5)	42% (5.0)	54% (5.1)	66% (4.8)	26.69 (750)	1.18 (750)
	CS	29% (4.5)	55% (4.9)	69% (4.4)	69% (4.5)	<0.0001	0.3175
HIV infection through knives and forks, etc	ES	68% (4.8)	86% (3.3)	93% (2.4)	95% (1.9)	16.62 (759)	0.88 (759)
	CS	81% (3.6)	86% (3.1)	94% (2.0)	95% (1.8)	<0.0001	0.4497
HIV and oral sex	ES	21% (3.8)	41% (4.5)	33% (4.3)	31% (4.2)	3.37 (756)	3.00 (756)
	CS	28% (4.0)	27% (3.9)	40% (4.3)	38% (4.3)	0.0183	0.0299
HIV infection through kissing an infected person	ES	56% (5.1)	61% (4.8)	76% (4.1)	76% (4.1)	11.77 (751)	0.13 (751)
	CS	55% (4.7)	57% (4.6)	72% (4.1)	76% (3.9)	<0.0001	0.9447
There is a medicine that completely cures AIDS	ES	59% (4.9)	73% (4.3)	88% (3.0)	92% (2.5)	20.15 (754)	1.59 (754)
	CS	65% (4.5)	80% (3.7)	82% (3.4)	88% (2.8)	<0.0001	0.1897
Condomizing for first time sex only	ES	23% (4.2)	28% (4.4)	31% (4.6)	37% (4.8)	6.15 (759)	0.37 (759)
	CS	26% (4.1)	37% (4.6)	45% (4.8)	48% (4.8)	0.0004	0.7755
Fewer sex partners will protect you from HIV	ES	68% (4.5)	75% (4.1)	75% (4.0)	70% (4.3)	1.41 (756)	1.97 (756)
	CS	66% (4.3)	63% (4.3)	72% (4.0)	78% (3.6)	0.24	0.1171

Notes: ES, School 1 (ES); CS, School 2 (CS).

improvements in the other variables were substantially less. In particular, the improvements in subjective norms and behavioural intentions were weak (Cohen's $D = 0.17$ and 0.33, respectively), while the improvement in motivation and behavioural skills was, at best, moderate (Cohen's $D = 0.44$ and 0.47, respectively). This suggests that the improvement in HIV&AIDS information was not associated with a commensurate improvement in motivation and behavioural skills.

Discussion

This study hypothesized that levels of HIV&AIDS IMB among the Grade 11 learners in the two participating schools were likely to

Table 4. Results on HIV/AIDS information: tests of statistical significance.

	1 (ES)		2 (CS)		Significance of change	
	Pre	Post	Pre	Post	*F*	*P*
Infection by someone you love	67% (4.5%)	80% (3.7%)	83% (3.3%)	88% (2.8%)	6.90	0.0091
Symptoms of HIV infection	61% (4.8%)	83% (3.6%)	80% (3.7%)	90% (2.6%)	17.46	<0.0001
HIV infection for homosexuals and drug addicts only	40% (4.6%)	66% (4.4%)	67% (4.2%)	80% (3.6%)	19.60	<0.0001
No need for a condom if you know someone very well	83% (3.5%)	88% (3.0%)	84% (3.3%)	91% (2.5%)	3.77	0.0531
Condoms in single relationships	86% (3.5%)	94% (2.3%)	89% (2.8%)	95% (1.8%)	7.92	0.0053
HIV and a drug abusing lover	80% (3.9%)	87% (3.2%)	89% (2.8%)	94% (2.1%)	4.04	0.0456
Telling possible HIV infection from someones actions	51% (5.1%)	64% (4.8%)	61% (4.7%)	81% (3.6%)	14.76	0.0002
Using condoms in one night stands	18% (3.7%)	22% (4.0%)	33% (4.4%)	41% (4.6%)	2.07	0.1517
Latex condoms (rubbers) can protect from getting HIV	40% (4.7%)	55% (4.7%)	55% (4.5%)	67% (4.2%)	9.69	0.0021
Vaseline/baby oil should never be used with condoms	41% (4.7%)	56% (4.6%)	67% (4.2%)	79% (3.5%)	11.24	0.0009
You can store condoms in your wallet for 2 months	26% (4.2%)	33% (4.5%)	53% (4.5%)	58% (4.5%)	2.13	0.1460
Avoiding sexual intercourse can help protect from HIV	35% (4.6%)	37% (4.5%)	40% (4.4%)	44% (4.5%)	0.56	0.4540
HIV can be transmitted through breast feeding	60% (4.9%)	69% (4.5%)	72% (4.1%)	84% (3.3%)	7.23	0.0077
HIV can be transmitted by sharing a needle	78% (4.1%)	80% (3.8%)	78% (3.8%)	85% (3.2%)	1.97	0.1617
Pulling out can prevent HIV	25% (4.3%)	46% (5.0%)	44% (4.7%)	65% (4.4%)	21.92	<0.0001
A baby and HIV infection	54% (4.9%)	76% (4.0%)	66% (4.3%)	83% (3.3%)	22.61	<0.0001
HIV testing a day after sex can prove your HIV status	28% (4.5%)	42% (4.9%)	55% (4.7%)	68% (4.3%)	9.87	0.0019
HIV infection through knives and forks, etc	68% (4.6%)	85% (3.3%)	85% (3.2%)	94% (2.1%)	12.79	0.0004
HIV and oral sex	20% (3.8%)	41% (4.6%)	27% (3.9%)	39% (4.3%)	15.10	0.0001
HIV infection through kissing an infected person	56% (5.0%)	60% (4.8%)	56% (4.6%)	72% (4.1%)	5.07	0.0252
There is a medicine that completely cures AIDS	59% (4.9%)	73% (4.3%)	79% (3.7%)	82% (3.4%)	3.29	0.0709

increase as a result of an HIV-risk reduction intervention based on the IMB model. In other words, the mean scores at school 1 (ES) were expected to rise at Time 2 as a result of the intervention at that school between Times 1 and 2. The mean scores at school 2 (CS) were expected to remain unchanged at Time 2, until the intervention at that school, between Times 2 and 3, which would raise the scores at Time 3.

However, some inconsistencies were observed in the study. For instance, overall estimates in all three variables indicate that the mean scores at school 2 (CS) rose at Time 2, despite the absence of the intervention between Times 1 and 2 at that school. Based on this and other observations, we argue that while there was clear change, it was not directly linked to the intervention. Possible explanations for this could be the following:

The testing effect: The testing effect refers to enhanced memory resulting from the act of retrieving information, as compared to simply reading or hearing the information (Carpenter, Pashler, Wixted & Vul 2008; McDaniel, Roediger & McDermott 2007; Roediger & Karpicke 2006). As learners responded to questionnaire items repeatedly in this study, they tended to do better and better. As a result, their improved scores could be a result of the testing effect, and not necessarily of the intervention. In order to reduce the testing effect, it is recommended that future research should vary questionnaire items at different time points. With mentally challenging and varied assessments at the end of the sessions, respondents would be given an opportunity to reflect carefully on what they have learned. In that way, their responses would be a result of carefully reasoned out answers, reflecting the respondents' genuine knowledge and capability.

Proximity of schools to each other: The two participating schools were approximately a kilometre apart, in terms of their location, near enough for learners to exchange intervention-related information. In addition, the fact that the intervention at each school was conducted at different times increased chances of a diffusion of treatment, thus influencing the results of the study. To minimize such diffusion, future studies could be conducted in many more schools, spread over a wider area and at greater distance from each other.

As a behavioural intervention model, the IMB model has been criticized for its failure to sustain behavioural change over a long period of time (Global HIV Prevention Working Group 2008). Besides, consistency in the learners' behaviour may not endure as learners may face challenging social contexts that might not reinforce newly exhibited behavioural changes in them. For instance, the Global HIV Prevention Working Group (2008) reports that HIV prevention successes in Uganda, Thailand and many high income countries were followed years later by marked increases in risk behaviour. In fact, little is known

Table 5. Results on HIV/AIDS information: tests of statistical significance.

Question		Pre-test equivalence	Change over intervention	Change over whole	Differential change
Infection by someone you love	*T*	−1.03 (764)	2.64 (764)	7.94 (764)	−1.15 (764)
	P	0.3015	0.0086	<0.0001	0.2488
Symptoms of HIV infection	*T*	0.80 (762)	4.20 (762)	7.29 (762)	1.01 (762)
	P	0.4264	<0.0001	<0.0001	0.3133
HIV infection for homosexuals and drug addicts only	*T*	1.81 (760)	4.52 (760)	9.45 (760)	0.43 (760)
	P	0.0701	<0.0001	<0.0001	0.6671
No need for a condom if you know someone very well	*T*	−1.35 (763)	1.97 (763)	5.34 (763)	−0.72 (763)
	P	0.1772	0.0494	<0.0001	0.4699
Condoms in single relationships	*T*	0.66 (766)	2.83 (766)	3.94 (766)	0.11 (766)
	P	0.5115	0.0047	<0.0001	0.9141
HIV and a drug abusing lover	*T*	−0.87 (762)	2.04 (762)	5.09 (762)	−0.68 (762)
	P	0.3857	0.0414	<0.0001	0.4949
Telling possible HIV infection from someones actions	*T*	−0.91 (756)	3.88 (756)	9.20 (756)	−0.38 (756)
	P	0.3618	0.0001	<0.0001	0.7043
Using condoms in one night stands	*T*	0.63 (752)	1.49 (752)	5.94 (752)	−0.56 (752)
	P	0.5321	0.1356	<0.0001	0.5751
Latex condoms (rubbers) can protect from getting HIV	*T*	1.93 (744)	3.20 (744)	5.85 (744)	1.16 (744)
	P	0.0537	0.0014	<0.0001	0.2458
Vaseline/baby oil should never be used with condoms	*T*	0.90 (755)	3.44 (755)	8.33 (755)	−0.55 (755)
	P	0.3668	0.0006	<0.0001	0.5815
You can store condoms in your wallet for 2 months	*T*	−0.78 (751)	1.46 (751)	4.46 (751)	−1.44 (751)
	P	0.4378	0.1454	<0.0001	0.1506
Avoiding sexual intercourse can help protect from HIV	*T*	0.13 (746)	0.73 (746)	5.28 (746)	−0.06 (746)
	P	0.894	0.4648	<0.0001	0.9499
HIV can be transmitted through breast feeding	*T*	0.41 (749)	2.69 (749)	5.94 (749)	0.49 (749)
	P	0.6847	0.0074	<0.0001	0.6225
HIV can be transmitted by sharing a needle	*T*	−0.49 (749)	1.42 (749)	4.80 (749)	0.09 (749)
	P	0.6251	0.1571	<0.0001	0.9284
Pulling out can prevent HIV	*T*	0.18 (745)	4.76 (745)	7.76 (745)	0.83 (745)
	P	0.8548	<0.0001	<0.0001	0.4044
A baby and HIV infection	*T*	0.32 (753)	4.84 (753)	6.17 (753)	1.31 (753)
	P	0.7495	<0.0001	<0.0001	0.1897
HIV testing a day after sex can prove your HIV status	*T*	0.17 (750)	3.20 (750)	8.29 (750)	−0.54 (750)
	P	0.8646	0.0015	<0.0001	0.5908
HIV infection through knives and forks, etc	*T*	2.23 (759)	3.64 (759)	5.84 (759)	0.95 (759)
	P	0.0258	0.0003	<0.0001	0.3416
HIV and oral sex	*T*	1.35 (756)	3.88 (756)	2.52 (756)	2.82 (756)
	P	0.1781	0.0001	0.0121	0.005
HIV infection through kissing an infected person	*T*	−0.17 (751)	2.27 (751)	4.71 (751)	0.09 (751)
	P	0.8682	0.0236	<0.0001	0.9244
There is a medicine that completely cures AIDS	*T*	0.81 (754)	1.84 (754)	6.87 (754)	−1.34 (754)
	P	0.4207	0.0663	<0.0001	0.1803
Condomizing for first time sex only	*T*	0.55 (759)	1.54 (759)	4.13 (759)	−0.04 (759)
	P	0.5842	0.125	<0.0001	0.9715
Fewer sex partners will protect you from HIV	*T*	−0.34 (756)	1.80 (756)	1.76 (756)	1.20 (756)
	P	0.7332	0.0718	0.0792	0.2298

Notes: *T*, *t*-value; *P*, *p*-value.

about the long-term impact of HIV&AIDS education (Michielson, Bosmans & Temmerman 2008). The longest known post-measure studies were only 18 months after the intervention (Brieger, Delano, Lane, Oladepo & Oyediran 2001; Maticka-Tyndale, Wildish & Gichuru 2007).

One of the factors contributing to the failure of the intervention to effect change in some behaviours of participants could be lack of spacing between the intervention and testing time. According to Rotheram-Borus, Gwadz, Fernandes and Srinivasan (1998), shorter sessions spread over time are significantly more desirable

Table 6. Mean changes in scales across the period of the study.

Scale		Time 1	Time 2	Time 3	Time 4	Time *F* (Den Df) *P*-value	Interaction *F* (Den Df) *P*-value
HIV knowledge	ES	0.51 (0.01)	0.63 (0.01)	0.72 (0.01)	0.76 (0.01)	591.0 (743)	0.80 (743)
	CS	0.53 (0.01)	0.65 (0.01)	0.75 (0.01)	0.79 (0.01)	<0.0001	0.4957
Motivation	ES	3.95 (0.06)	4.24 (0.06)	4.30 (0.06)	4.17 (0.06)	13.91 (765)	1.56 (765)
	CS	3.83 (0.06)	4.11 (0.06)	4.16 (0.06)	4.25 (0.06)	<0.0001	0.1975
Subjective norms	ES	3.82 (0.07)	4.11 (0.07)	3.98 (0.07)	3.96 (0.07)	2.96 (741)	0.81 (741)
	CS	3.88 (0.07)	3.98 (0.07)	3.96 (0.07)	4.01 (0.07)	0.0315	0.4877
Intention	ES	3.76 (0.07)	4.03 (0.07)	4.02 (0.07)	4.07 (0.07)	5.88 (756)	0.95 (756)
	CS	3.88 (0.07)	3.93 (0.07)	4.04 (0.07)	4.11 (0.07)	0.0006	0.4138
Skills	ES	3.59 (0.07)	3.66 (0.07)	3.83 (0.07)	3.87 (0.07)	11.58 (762)	1.04 (762)
	CS	3.49 (0.07)	3.64 (0.07)	3.73 (0.07)	3.98 (0.07)	<0.0001	0.3731

than longer sessions over a briefer span of time. Considering that the IMB model-based intervention in this study did not give learners much time to practice what they had learned, it is recommended that further research should investigate interventions that will provide shorter sessions spread over time, rather than longer sessions over a briefer span of time. This approach would increase spacing between the intervention and testing time, making it possible for the intervention to effect change.

Data in this study were collected using the questionnaire as a self-report behavioural instrument. Some researchers have been critical of this approach. Jemmott, Jemmott, Fong and McCaffree (1999) indicated that self-reporting measures used on risky sexual behaviour (which is a private behaviour) are, to some degree, unintentionally or intentionally inaccurate while Kalichman, Stein, Malow, Averhart, Devieux, Jennings, *et al.* (2002) indicate that self-reporting may lead to concealment of behaviours and therefore under-reporting. More recently, McAuliffe, Difranceisco and Reed (2007) argued that, in self-reporting, respondents tend to give socially desirable answers. For instance, in this study respondents may have under-reported on unsafe sexual behaviour and over-reported on abstinence and condom use. For that reason, results in this study should be taken with caution, as they may not be a true and accurate reflection of the behaviours of the respondents. The unreliable nature posed by 'self-reporting' approaches suggests that alternative ways of collecting data must be explored in behavioural research. More accurate results are likely to inform more effective strategies in HIV-preventive measures in future.

The fact that this study was conducted in one township in South Africa makes it difficult to generalize its results to other geographical regions with different demographic and cultural groups. This limitation was also noted by Simbayi, Kalichman, Jooste, Cherry, Mfecane and Cain (2005) in their study of the risk factors for HIV&AIDS among youth in Cape Town. Accordingly, the socio-economic dynamics around HIV&AIDS and risky behaviour among adolescent learners at Alexandra township, Johannesburg, may be unique to that township alone, and not necessarily applicable to other South African townships elsewhere.

In addition, the IMB model assumes that individuals will change their behaviour if they are fully informed and sufficiently motivated – that is, they can exercise personal agency in the context of HIV-associated risk (Global HIV Prevention Working Group 2008). The Working Group further argues that individual behaviour is heavily influenced by broader socio-economic, cultural and environmental factors. Based on this view, this study argues that successful IMB-based HIV&AIDS prevention interventions should adopt structural approaches (Gupta, Parkhurst, Ogden, Aggleton & Mahal 2008) which emphasize the need to change the context that contributes to vulnerability and risk, when implementing intervention programmes. For that reason, it is the

Table 7. Significance of changes in scales to key research questions.

Scale	Pre-test equivalence	Change over intervention	Change over whole	Differential change, T1 – T2	Differential change, T2 – T3	Differential change combined
HIV knowledge	1.23 (743) 0.2185	17.15 (743) <0.0001	38.70 (743) <0.0001	0.27 (743) 0.7889	0.92 (743) 0.3575	0.68 (743) 0.4944
Motivation	−1.27 (765) 0.2044	2.84 (765) 0.0046	5.27 (765) <0.0001	0.13 (765) 0.8933	−0.11 (765) 0.9147	0.02 (765) 0.9876
Subjective norms	0.53 (741) 0.5938	1.99 (741) 0.0465	2.09 (741) 0.0373	1.34 (741) 0.179	0.78 (741) 0.4362	1.23 (741) 0.2199
Intention	1.22 (756) 0.2221	2.82 (756) 0.005	4.00 (756) <0.0001	1.67 (756) 0.0944	0.87 (756) 0.3871	1.47 (756) 0.1428
Skills	−1.08 (762) 0.2786	1.18 (762) 0.2386	5.58 (762) <0.0001	−0.63 (762) 0.5264	−0.53 (762) 0.5967	−0.67 (762) 0.502

researchers' view that, the IMB model-based intervention at the two schools in Alexandra Township may only yield meaningful outcomes if the social, political, economic and environmental challenges facing the learners are also considered.

Conclusion

This paper has argued that an intervention based on the IMB model may, to some extent, be effective in reducing HIV-risk behaviour among adolescent learners because it departs from the traditional approaches to HIV&AIDS education where HIV&AIDS information has been the focal point, without motivating learners to act upon such information, as well as equipping them with behavioural skills that may influence changes in their sexual behaviour and practices. However, when the IMB model is applied in isolation, it may not lead to a genuine reduction in HIV-risk behaviour among adolescent learners. This paper argues for future HIV&AIDS preventive approaches that take into account behavioural, structural, as well as socio-cultural strategies in order to achieve meaningful and sustainable behavioural changes in adolescent behaviours.

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