Effect of social cognitive theory-based HIV education prevention program among high school students in Nanjing, China

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Abstract

This study was designed to evaluate potential preventive effects of a cultural adaption of the Focus on Kids (FOK) program among Chinese adolescents through a quasi-experimental intervention trial in Nanjing, China. High school students were assigned to either experimental groups (n = 140) or control groups (n = 164) by schools (with three schools in each condition). The participants completed a confidential questionnaire at baseline and 6-month post-intervention with a follow-up rate of 94.4% (287 of 304). The outcome measures included HIV knowledge, HIV-related perceptions based on the protection motivation theory, stigmatizing attitude toward people living with HIV/AIDS (PLWHA), intentions of health-related risk behaviors and sexual intercourse in the previous 6 months. Results showed a significant intervention effect at 6-month post-intervention in increasing HIV knowledge, decreasing perceptions of response cost associated with abstinence and reducing stigmatizing attitudes toward PLWHA, after controlling for key demographic characteristics and relevant baseline measures. Further mediation analysis suggested that HIV knowledge mediated the effect of intervention on stigma reduction. Findings from this study support the feasibility and initial efficacy of the cultural adaptation of FOK HIV prevention program among high school students in China.

Introduction

Adolescent HIV prevention interventions aimed to delay sex initiation and reduce sexual risk behaviors have been conducted in many developed and developing countries in response to the growing HIV epidemic [1]. Global literature indicates that many theory-based HIV prevention interventions conducted among adolescents in developed countries have been efficacious, resulting in substantial reduction of sexual risk behaviors [2–5]. A recent study suggested that about two-thirds of HIV intervention programs implemented among youth in schools, clinics and community settings in the United States showed a positive impact on delaying the debut of sex, reducing the number of sexual partners and increasing contraception use [6]. Another literature review by Speizer et al. [7] suggested that some school-based HIV educational programs in developing countries had effects on behavioral changes.

Many school-based HIV interventions in developing countries have demonstrated significant effects on knowledge and attitudes. For example, an intervention implemented among high school students in KwaZulu Natal in South Africa demonstrated significant improvements in HIV-related
knowledge and attitudes [8]. Another intervention implemented among 845 students in four high schools in the semi-urban district of Metro Manila, the Philippines, demonstrated a significant effect in increasing HIV-related knowledge and in improving attitudes toward people living with HIV/AIDS (PLWHA) [9]. However, some school-based interventions failed to demonstrate an effect. For instance, a study conducted in Uganda among 20 intervention schools (n = 1274) and 11 control schools (n = 803) showed no post-intervention improvement in seven of nine areas of HIV-related knowledge, attitudes and intention [10].

HIV knowledge has been a focus of HIV prevention among adolescents. Although it may not be sufficient, HIV knowledge has been proven to be necessary to increase protective sexual behaviors [6]. In addition, incorrect information about HIV may lead to an increase of stigmatizing attitudes toward PLWHA [11]. Therefore, it is important to improve adolescents’ knowledge of HIV and understand the link between HIV knowledge and HIV-related stigma.

HIV is among the most stigmatized conditions [12]. HIV-related stigma impacts the social interaction of PLWHA with their family and other people in society [13]. HIV-related stigma has been documented throughout the world, including China [14–16]. Prejudicial attitudes toward PLWHA and the stigmatization against PLWHA are persistent in Chinese society [17]. For instance, medical personnel who were providing treatments for AIDS patients were less willing to interact with AIDS patients [18]. A study conducted among 4208 rural-to-urban migrants in Beijing and Nanjing suggested that misconception was positively associated with stigmatizing attitudes toward PLWHA [19]. A qualitative study by Yang et al. [20] suggested the existence of the institutional forms of stigma in health care settings and the authors emphasized the importance of stigma reduction interventions. However, few studies have examined the effect of HIV prevention intervention on stigma reduction in the Chinese setting. One HIV stigma reduction intervention study among health care providers conducted in four hospitals in Yunan province suggested that at 3- and 6-month post-intervention, health care providers were less likely to report negative feelings toward PLWHA [21]. Another study conducted in Hong Kong among 600 9th and 10th graders indicated that negative perceptions about PLWHA can be reduced substantially through the school-based stigma reduction intervention [17].

Adolescents in China appear to have limited knowledge about HIV and limited formal sources for HIV-related knowledge and information [22, 23]. In a recent study, while adolescents were aware of the main routes through which HIV is transmitted, they had numerous misconceptions about whether HIV can be transmitted through some daily contacts [24]. A substantial proportion of participants (over 40%) believed that some routine daily activities such as ‘eating food at a restaurant where the cook has HIV/AIDS’, ‘sharing plates, forks or glasses with someone who has HIV/AIDS’, ‘using public toilets’ and ‘coughing or sneezing’ could transmit HIV. Such misconceptions may cause undue fears of HIV contagion, which in turn results in stigmatizing attitudes toward PLWHA.

The existing HIV prevention literature has also documented the importance of a theoretical framework in guiding the development of an HIV prevention program [25]. One of such theoretical framework is the protection motivation theory (PMT). PMT is a social cognitive theory, which emphasizes the cognitive processes of behavioral change [26]. PMT describes adaptive and maladaptive responses to a health threat that are the result of two appraisal processes—the threat appraisal process and the coping appraisal process (Fig. 1). The threat appraisal process is the process through which people assess a threat based on environmental and personal factors combining to pose a potential threat. This process includes four factors: intrinsic and extrinsic rewards, which increase the probability of selecting a maladaptive response, and severity and vulnerability, which decrease the probability of selecting a maladaptive response [27].

The coping appraisal process is the process of coping options based on a person’s perceived efficacy and cost of the social and personal factors that contribute to their ability to avert the threat. The
coping appraisal includes three factors: self-efficacy which is the perceived ability to carry out the adaptive response, response efficacy which is the belief of the adaptive response being effective and response cost which is associated with taking the adaptive coping response. Response efficacy and self-efficacy increase the probability of selecting an adaptive response, while the response costs decrease the probability of selecting an adaptive response. The two appraisal processes combine to form protection motivation. The interaction of appraisals for the threat and coping responses results in the intention to perform an adaptive response to avert the threat, which promote or mediate behavior changes.

Guided by the PMT, the ‘Focus on Kids’ (FOK) was designed as a comprehensive HIV/STI education and prevention program for adolescents and young adults [28]. Supported by the National Institutes of Health, the FOK program was developed, implemented and evaluated among urban African American adolescents in Baltimore in the 1990s [5]. In 1998, Centers for Disease Control and Prevention designated FOK as one of the ‘Programs that Work’ nationwide in the United States. FOK has been identified as an efficacious evidence-based intervention program for HIV prevention and has been disseminated both national and internationally [29]. The FOK program has been demonstrated to reduce adolescent risk behaviors and/or perceptions in many non-Western cultural settings, including Namibia [30], Vietnam [31], China [32] and the Bahamas [33].

A study conducted in 1997 among Namibian adolescents indicated that the culturally adapted FOK intervention program had an effect on condom use at 2-month post-intervention and had an effect on abstinence at 12-month post-intervention [30]. The study conducted in Vietnam in 2001 showed a significant intervention effect on the seven PMT constructs at immediate post-intervention and at 6-month post-intervention [31]. The Vietnam study also showed effect on intention of future-condom-use but not intention of abstinence. Several studies in Asian countries did not find significant intervention effect on sexual behaviors because of the relatively low rates of sexual activities among adolescents in those countries [31, 32]. The culturally adapted FOK program demonstrated a significant effect on delaying behavioral progression toward risky sex among children and adolescents in the Bahamas [33].

A number of HIV prevention programs have been carried out in China in recent years [34, 35]. However, these efforts mainly targeted high risk or adult populations, including intravenous drug users.
[36], female sex workers [37–39], men who have sex with men [40] and college students [32]. Some school-based HIV prevention intervention studies demonstrated some positive effects on knowledge, attitudes and behaviors. However, they were either with a short follow-up period (e.g. 3 months) or with a low follow-up rate [41, 42]. Moreover, there have been limited efforts to design and implement theoretically driven school-based HIV prevention interventions targeting adolescents in China.

To promote HIV prevention intervention among adolescents and youth in China, we have culturally adapted FOK for college students and high school students in China since 2001. The findings from the college students intervention study showed that at 6-month post-intervention, HIV knowledge and protective perceptions were increased while the intention to have sex in the next 6 months was decreased among youth in the intervention condition [32]. However, data from high school students have not been reported to date. The purpose of the current study was to examine the intervention effects on HIV-related knowledge, perceptions, attitudes and intentions among high school students. The findings may inform the development of effective school-based HIV education prevention programs in China and other developing countries.

Methods

Study site and participants

Nanjing, the capital city of Jiangsu province in eastern China, was the site for the current study. Nanjing, with a population over 6 million, is the second largest commercial center after Shanghai in the east region of China. Nanjing has also served as a national hub of education, research, transportation and tourism throughout Chinese history.

Six high schools in the Nanjing metropolitan area participated in this pilot intervention program in which three schools were randomly assigned to the intervention condition. In these three schools, 140 students (one classroom per school) voluntarily received the culturally adapted FOK prevention curriculum. The other three schools were assigned to the control condition in which 164 students (one classroom per school) voluntarily participated in the assessment. The follow-up rate at 6-month post-intervention was 94.4% (287 of 304). The research protocol was approved by the Institutional Review Boards of West Virginia University in the United States and Nanjing University in China.

Cultural adaptation of the FOK curriculum

The intervention curriculum in this study was a cultural adaptation of the FOK HIV prevention program [5]. The FOK curriculum and its assessment tool—the Youth Health Risk Behavior Inventory [43] were adapted into Chinese settings based on extensive qualitative and quantitative data collected from high school students and college students [32, 44]. The culturally adapted curriculum consists of eight sessions with a total delivery time of approximately 12 hours (90 min for each session). Each of the sessions explored one or more of the seven PMT constructs (i.e. extrinsic rewards, intrinsic rewards, severity, vulnerability, response efficacy, self-efficacy and response cost). The process and context of the cultural adaption of the curriculum into Chinese setting have been described elsewhere [32, 44].

In addition to the changes made to the curriculum and survey instrument for college students [32], further modifications were made in response to the developmental stage of high school students. These additional changes include (i) the change of intervention focus from both abstinence and safe sex for college students to mainly abstinence for high school students as the rate of sexual initiation was low (e.g. 4.8%) among high school students at the time of the study [44], (ii) the removal of explicit materials related to condom use (e.g. condom demonstration and condom race—activities to demonstrate the correct way of using a condom on a penis model) in both curriculum and survey instrument at the request of the local schools and (iii) change of stories, games and fictional figures in the vignettes in the intervention curriculum so that the content/format is developmentally appropriate for the high school students. Although condom use was one of the primary outcomes in the original FOK curriculum, similar adaptation (i.e. removal
of condom-related materials from the intervention curriculum) has been done among adolescents in both the United States (e.g. rural West Virginia) [45] and overseas (e.g. Vietnam) [31], where the inclusion of explicit materials or content related to condom use was considered either developmentally or culturally inappropriate.

Delivery of the intervention
After receiving extensive training from the US and Chinese investigators, four graduate students and seven faculty members from a university in Nanjing delivered the culturally adapted high school student version of FOK curriculum to students in the intervention group. Permission was obtained from the local education bureau and school administrators to conduct research in participating schools. Written informed consent forms were provided by all students before their participation in the study. Consistent with the common practice of involving school students in research in China at the time of the study [22, 44], no parental consent was obtained. Students in the intervention classrooms were divided into several small groups (e.g. about 10 students in each group) for curriculum-related activities (e.g. games, role-play).

Assessment procedure
Data collection was conducted at baseline (before intervention delivery) and 6-month post-intervention by trained interviewers. All participating students (both intervention and control groups) completed a self-administered confidential questionnaire in their classrooms during regular school hours. The participants were assured of the confidentiality of their responses. School personnel were not allowed to present in the classroom during the survey. A total of 304 high school students aged 15–19 years participated in the baseline survey and 287 (94.4%) of the baseline cohort participated in the 6-month post-intervention survey.

Measures
Demographic characteristics
Participants were asked to provide information on their age, gender, school performance, family composition, parental education and family income (in Chinese currency Yuan, 1 US dollar equals 8.27 Chinese Yuan at the time of survey). The school performance in academic classes was measured in letter grade using a 5-point scoring system (5 = mostly As, 4 = mostly Bs, 3 = mostly Cs, 2 = mostly Ds and 1 = mostly <Fs). Family composition was measured in the current study as living with both parents versus other living arrangement (e.g. living with a single parent or non-parents). Parental education was initially measured with six categories (<primary school, middle school, high school, 3-year college, 4-year college and graduate school) and was dichotomized into two categories (<middle school and ≥high school) in the current study because of the small frequency in categories of ‘<primary school’ or ‘3-year college’ and beyond. Family monthly income was assessed with six categorical responses (i.e. <300, 301–500, 501–1000, 1001–3000, 3001–5000 and >5000 Yuan).

PMT constructs
Seven PMT constructs related to early sexual initiation or abstinence were measured using 24 questions in the survey.

Extrinsic rewards. Perception of extrinsic rewards was assessed using eight items (e.g. perceived number of boys and girls who were dating, who had had sex, who had multiple sex partners). The Cronbach’s alpha for this scale is 0.62. These items had a 4-point response option ranging from ‘none’ to ‘most’.

Intrinsic rewards. Youth’s perception of intrinsic rewards was assessed with one item by asking participants how likely for them to take the risk (having sex) in order to ‘be the same’ as some other classmates. This item had a 4-point response option (unlikely, somewhat likely, likely and very likely).

Severity. Perceived severity or negative consequences of early sexual initiation and sexual risk behavior were assessed using five items (α = 0.61) (e.g. ‘It is possible to get HIV in the first sex’, ‘It is possible to get (someone) pregnant in the first sex’, ‘One may get HIV through a single sexual intercourse’ and ‘One may get HIV if he/she
has multiple sexual partners’). Each of these statements had a 4-point response option (strongly disagree, disagree, agree and strongly agree).

**Vulnerability.** Perceived vulnerability to early sexual initiation was assessed using two items (α = 0.46) regarding the likelihood of having sex before graduation or before marriage. These items had a 5-point response option (very unlikely, unlikely, uncertain, likely and very likely).

**Response efficacy.** Response efficacy had four items (α = 0.67) assessing perceptions of the effectiveness of abstinence (e.g. ‘It is better for adolescents to have no sex’, ‘No sex at my age is good for health’ and ‘No sex at my age is good for study’). These items had a 4-point response option (strongly disagree, disagree, agree and strongly agree).

**Self-efficacy.** Self-efficacy was measured using two questions (‘Even though many of my friends have sex, I will not have sex at a young age’ and ‘If my boy/girlfriend wants to have sex, I will not do it’). The two items had a 4-point response option (strongly disagree, disagree, agree and strongly agree). This scale had Cronbach’s alpha of 0.68.

**Response cost.** This construct was assessed using two items (α = 0.47) regarding the possible barriers or negative consequences of abstinence (e.g. not having sex make relationship unstable, not having sex is not good for love relationship). These two items had a 4-point response option (strongly disagree, disagree, agree and strongly agree).

**HIV knowledge**

Participants were asked to give answers to a list of 13 questions related to transmission/non-transmission routes (e.g. ‘Share plates, fork or glasses with someone who has HIV’, ‘Share needles for intravenous drug use with some HIV-infected drug users’). These 13 items initially had a 4-point response option (very likely, likely, unlikely and very unlikely) which were dichotomized into ‘0 = incorrect’ and ‘1 = correct’ for the purpose of data analysis. The sum score was used as a composite score ranging from 0 to 13 with a higher score indicating a higher level of HIV knowledge. These 13 items had an adequate reliability estimate (Cronbach’s alpha = 0.79).

**Stigmatizing attitude**

Stigmatizing attitude toward PLWHA was measured using one question (‘If I know someone who has HIV, I will stay far away from him/her’). Participants were asked whether they agreed with the statement or not. This item had a 4-point response option (i.e. strongly disagree, disagree, agree and strongly agree).

**Intentions to engage in sexual behavior and other health risk behaviors**

Participants were asked about their intentions to engage in sexual intercourse and some other health risk behaviors (i.e. smoking, alcohol consumption and visiting pornographic website) in the next 6 months. Each intention was assessed with a 4-point response option ranging from ‘very unlikely’ to ‘very likely’.

**Sexual behavior**

Participants were asked a dichotomous question: ‘Did you have sexual intercourse in the past 6 months’ (yes/no).

**Statistical analysis**

Analysis of variance (ANOVA) or chi-square test was used to examine the baseline differences in age, gender, school performance, family composition, parental education and family income between the intervention group and the control group. In addition, the differences in primary outcomes of the intervention (e.g. HIV-related knowledge, perception and stigmatizing attitude toward PLWHA) between the intervention group and control group at baseline and 6-month post-intervention were examined using ANOVA. Because the majority of PMT constructs had low reliability estimates (e.g. Cronbach’s alpha <0.70 for all PMT scales), the analysis related to PMT constructs was conducted at item level rather than scale level.

Following the guidelines by Baron and Kenny [46], multivariate linear regression analysis was performed to examine the role of HIV knowledge in mediating the effect of the intervention program.
on stigma reduction (Fig. 2). Three multivariate linear regression models were used to test the effect of mediator (HIV knowledge at 6-month post-intervention, M). In the first model, the independent variable (intervention condition, X) was regressed on the mediation variable (M) with a regression coefficient $a$. In the second model, the independent variable (intervention condition, X) was regressed on the dependent variable (stigmatizing attitude measured at 6-month post-intervention, Y) with a regression coefficient $c$. In the third model, the independent variable (X) and the mediation variable (M) were simultaneously regressed on dependent variable (Y) with regression coefficients $c'$ (X on Y) and $b$ (M on Y). In addition, age, gender, school performance, family composition, parental education, family income, baseline HIV knowledge and baseline stigmatizing attitude were controlled in each of the regression models.

### Results

#### Demographic characteristics

The mean age for all participating students was 16.3 years ($SD = 0.66$). The majority of participants (88.5%) were living with both parents. The intervention group and control group were similar in age, school performance, family composition, parental education and family income at baseline (Table I). There were more male students in the intervention group (54.2%) than in the control group (46.2%), although such difference did not reach statistical significance.

#### Intervention effect

Table II shows that there were no differences in baseline HIV knowledge between the intervention group and the control group. There was a significant increase of HIV knowledge scores from baseline to 6-month post-intervention in the intervention group (8.49 versus 9.08, $P < 0.01$) but not in the control group (8.03 versus 8.01). There were no significant differences between the intervention group and the control group in the seven PMT constructs at 6-month post-intervention except the response cost items, which significantly differed between the intervention group and the control group ($P < 0.05$ for both items). One extrinsic rewards item (e.g. number of female classmates who have a boyfriend) showed a significant difference with the perception being reduced in the intervention group at the 6-month post-intervention.

There were no statistically significant group differences on intention of having sex and other health

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**Fig. 2.** Results of the mediation analysis. Note: Numbers are unstandardized coefficients and standard errors are given inside the brackets. *$P < 0.05$; **$P < 0.01$.**

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risk behaviors. As shown in Table II, stigmatizing attitude scores were similar at baseline between the intervention group and the control group. The stigmatizing attitude in the intervention group was reduced from 2.62 (SD = 0.86) at baseline to 2.57 (SD = 0.76) at 6-month post-intervention ($P < 0.05$), while there was no significant change on stigmatizing attitude in the control group (2.77 versus 2.81). There were no statistically significant differences between the intervention group and control group on percentage of participants who reported having sexual intercourse at either the baseline (2.5 versus 3.4%) or the 6-month post-intervention (4.8 versus 2.6%).

**Mediation effect of HIV knowledge**

Mediation analysis indicated that HIV knowledge mediated the effect of intervention on stigma reduction (Fig. 2). HIV knowledge was positively associated with the intervention condition (regression coefficient = 0.900, $P < 0.01$) controlling for key demographic factors (age, gender, school performance, family composition, parental education and family monthly income) (Table III). In addition, HIV knowledge was also positively associated with the baseline HIV knowledge (regression coefficient = 0.272, $P < 0.01$). Model 2 showed a direct effect of intervention on stigma. Stigmatizing attitude was negatively associated with the intervention condition (regression coefficient = $-0.186$, $P < 0.05$). Model 3 showed that when both HIV knowledge and intervention condition were included in the model, HIV knowledge was negatively associated with stigmatizing attitude (regression coefficient = $-0.052$, $P < 0.01$) while the significant direct effect of intervention on stigmatizing attitude was diminished (regression coefficient was decreased from $-0.186$, $P < 0.05$ to $-0.138$, $P > 0.05$).

**Discussion**

Findings from this study suggest that the cultural adaption of the FOK intervention program among
**Table II. Effect of social cognitive theory-based HIV education intervention among high school students in China**

<table>
<thead>
<tr>
<th>Outcome measures</th>
<th>Pre-intervention</th>
<th>6-month post-intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Intervention</td>
</tr>
<tr>
<td>N</td>
<td>156</td>
<td>131</td>
</tr>
<tr>
<td>HIV knowledge (mean, SD)</td>
<td>8.03 (3.0)</td>
<td>8.49 (3.0)</td>
</tr>
</tbody>
</table>

**PMT constructs**

- **Extrinsic rewards**
  - ‘How many of your male classmates have a girl friend’
    - Control: 2.95 (0.7), Intervention: 2.86 (0.7), 6-month post-intervention: 3.07 (0.7), 2.92 (0.8)
  - ‘How many of your female classmates have a boy friend’
    - Control: 2.85 (0.7), Intervention: 2.80 (0.7), 6-month post-intervention: 2.94 (0.8), 2.73 (0.8)*
  - ‘How many of your male classmates have had sex’
    - Control: 1.47 (0.7), Intervention: 1.55 (0.8), 6-month post-intervention: 1.54 (0.7), 1.66 (0.9)
  - ‘How many of your female classmates have had sex’
    - Control: 1.37 (0.6), Intervention: 1.42 (0.7), 6-month post-intervention: 1.44 (0.7), 1.55 (0.8)
  - ‘How many of your classmates have visited sex-related internet’
    - Control: 2.27 (0.9), Intervention: 2.31 (1.0), 6-month post-intervention: 2.36 (0.9), 2.39 (1.0)
  - ‘My friends think that it is very cool to have sex with a boy/girl friend’
    - Control: 1.71 (1.0), Intervention: 1.61 (0.9), 6-month post-intervention: 1.75 (0.9), 1.66 (1.0)
  - ‘Most students think that it is cool for a male student having multiple sex partner’
    - Control: 2.04 (0.8), Intervention: 1.89 (0.7), 6-month post-intervention: 1.85 (0.8), 1.82 (0.9)
  - ‘Most students think that it is cool for a female student having multiple sex partner’
    - Control: 2.73 (0.9), Intervention: 2.80 (0.9), 6-month post-intervention: 1.69 (0.8), 1.77 (0.8)

- **Intrinsic rewards**
  - ‘To be same as some other classmates, I likely to take the risk of having sex’
    - Control: 1.72 (0.8), Intervention: 1.80 (1.0), 6-month post-intervention: 1.93 (0.9), 1.82 (1.0)

- **Severity**
  - ‘People obtaining HIV/AIDS usually die soon in a short period after diagnosis’
    - Control: 2.36 (0.7), Intervention: 2.21 (0.7), 6-month post-intervention: 2.24 (0.7), 2.29 (0.8)
  - ‘It is possible to get HIV in the first sex’
    - Control: 2.84 (0.7), Intervention: 2.77 (0.9), 6-month post-intervention: 2.79 (0.8), 2.95 (0.8)
  - ‘It is possible to get (someone) pregnant in the first sex’
    - Control: 2.95 (0.7), Intervention: 2.78 (0.9), 6-month post-intervention: 2.85 (0.8), 2.91 (0.7)
  - ‘One may get HIV through a single sexual intercourse’
    - Control: 2.95 (0.7), Intervention: 2.86 (0.9), 6-month post-intervention: 2.94 (0.7), 2.98 (0.7)
  - ‘One may get HIV if he/she has multiple sexual partners’
    - Control: 3.30 (0.6), Intervention: 3.22 (0.8), 6-month post-intervention: 3.29 (0.6), 3.15 (0.7)

- **Vulnerability**
  - ‘The likelihood to have sex before graduation’
    - Control: 3.70 (0.7), Intervention: 3.62 (0.9), 6-month post-intervention: 3.65 (0.8), 3.60 (0.9)
  - ‘The likelihood to have sex before married’
    - Control: 2.97 (1.1), Intervention: 2.93 (1.2), 6-month post-intervention: 2.79 (1.1), 2.86 (1.2)

- **Response efficacy**
  - ‘Having premarital sex can affect my career’
    - Control: 3.10 (0.9), Intervention: 2.93 (0.9), 6-month post-intervention: 2.92 (0.8), 3.01 (0.9)
  - ‘It is better for adolescents to have no sex’
    - Control: 3.25 (0.8), Intervention: 3.23 (0.8), 6-month post-intervention: 3.21 (0.7), 3.23 (0.9)
  - ‘No sex at my age is good for health’
    - Control: 2.80 (0.8), Intervention: 2.66 (0.9), 6-month post-intervention: 2.86 (0.7), 2.78 (0.8)
  - ‘No sex at my age is good for study’
    - Control: 2.49 (0.9), Intervention: 2.54 (0.9), 6-month post-intervention: 2.63 (0.8), 2.68 (0.9)

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high school students in China was effective in increasing HIV knowledge and decreasing perceptions of response cost associated with abstinence. In addition, the FOK intervention program had demonstrated an effect in reducing negative attitude toward PLWHA. Data in the current study also showed that HIV knowledge had a mediation effect on reduction of stigma against PLWHA. The intervention appears to reduce stigmatizing attitudes toward PLWHA by increasing the accurate HIV knowledge among adolescents.

However, the intervention program has limited effects on PMT constructs. There were several possible reasons for the non-significant changes of most PMT items over time. First, there might be some measurement issues of the PMT constructs.
Given the young age of the participants, operationalizing these theoretical constructs has always been a challenge [31]. The low Cronbach’s alpha for most PMT constructs may contribute to the non-significant findings in the current study, although these alphas were comparable with those in the previous FOK intervention studies [31, 33]. Second, there might be an insufficient statistical power to detect the significance due to the relatively small sample size. Although the changes of most PMT constructs between the intervention group and the control group at the 6-month post-intervention did not reach statistical significance, many of them showed a trend of changes in the expected direction (e.g. decrease in scores of extrinsic rewards, increases in scores of severity, vulnerability and response efficacy).

The limited intervention effect on PMT constructs may also be a result of the changes in the curriculum including the removal of condom use-related materials. The materials related to condom use were removed from the original FOK curriculum during the adaption process. Although the local schools initiated the motion of removal, the removal was developmentally justified (e.g. very few of the students were sexually experienced) and consistent with the change of the program focus (i.e. from safe sex to abstinence). It was possible that the effect of the culturally adapted curriculum was affected by the removal of the condom use materials. However, given the program focus on abstinence among adolescents of this age group, it was also unlikely that such effect will be substantial. Nevertheless, future study is needed to examine this longstanding issue of balance between the program fidelity and cultural adaptation and explore the potential effect of removing a core program component, although justified, on the effectiveness of the program in a new cultural setting or among a new population.

There are several methodological limitations in this study. First, the single item measure of the stigmatizing attitude toward PLWHA might not reflect other aspects of stigma against PLWHA. Second, the sample in the current study was a convenience sample. Therefore, our ability to generalize the findings to other populations of adolescents may be limited. Third, the current study employed a quasi-experimental research design, so potential treats to the internal validity of the study may exist. Fourth, this study evaluated only the effects at 6-month post-intervention, longer term effects need to be evaluated in the future research. Fifth, most PMT scales had low reliability estimates (e.g. Cronbach’s $\alpha <0.70$). Future study is needed to develop culturally appropriate and psychometrically adequate measurement of PMT constructs in China and other non-Western cultural settings.

Despite these potential limitations, to the best of our knowledge, the current study is one of the first efforts to implement and evaluate a theory-driven school-based HIV prevention intervention among high school students in China. The findings of the current study have several implications for the future HIV prevention efforts among adolescents in China and other developing countries. First, school-based HIV prevention intervention programs among adolescents need to include a focus on HIV awareness. The lack of HIV awareness (e.g. seeing HIV infection as a remote possibility) may reduce the perceptions of severity and vulnerability of contracting HIV, which in turn, may reduce one’s protection motivation.

Second, HIV stigma reduction should be built into the existing HIV prevention programs among adolescents. HIV-related stigma reduction intervention among children and adolescents is critical for effective HIV prevention, diagnosis, treatment and care. HIV knowledge education and stigma reduction intervention among adolescents may benefit the HIV testing and treatment that subsequently prevent the HIV epidemic.

Third, the HIV prevention program among children and young adults in China needs to prepare them for future engagement in protective behaviors such as condom use by improving their knowledge in relation to vulnerability and severity of HIV/AIDS and their perceptions of self-efficacy and response efficacy of condom use. In China and other Asian countries, there is a strong social pressure against premarital sex, which may contribute the delay in sexual initiation among adolescents.
and young adults [31, 44]. However, the same social pressure also may contribute to youth being unprepared to engage in protective behaviors. Given the rapid social and economic changes in China and resultant changes in youth’s sexuality and personal freedom, there is an increased likelihood that these youth need to be prepared to make informed decision regarding protective sexual behaviors including use of condoms (to prevent HIV/STD and unwanted pregnancy) in the near future. While the main focus of the current research, in respond to the low rate of sexual initiation among the target population, was on abstinence rather than safe sex, future research is needed to examine the link of the improvement in HIV/AIDS knowledge and other attitudes with safe sex behaviors among these adolescents if and when they become sexually active.

Finally, future research needs to reconceptualize the theoretical constructs related to HIV-related sexual risk so that they can be used to adequately assess the perceptions of adolescents and guide the development and implementation of effective HIV prevention education in China and other developing countries.

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