


Educational Interventions Improved Knowledge, Attitude, and Practice to Prevent HIV Infection among HIV-Negative Heterosexual Partners of HIV-Infected Persons

Thana Khawcharoenporn, MD, MSc¹ , Chanika Srirach, RN², and Krongtip Chunloy, RN, MPH²

Journal of the International Association of Providers of AIDS Care
Volume 19: 1-15
© The Author(s) 2020
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/2325958219899532
journals.sagepub.com/home/jia


Abstract

A 1-year quasi-experimental study was conducted among HIV-noninfected heterosexual partners of HIV-infected patients cared at a Thai tertiary care hospital. The educational interventions comprised a 1-hour educational session, a condom use teaching session, focus group discussion, and free HIV testing. Of the 88 seronegative partners enrolled, 53 and 35 underwent the educational interventions once and twice, respectively. After the educational interventions, the median score for knowledge on HIV infection and transmission prevention significantly increased (28 versus 21; $P < .001$). After the interventions, higher proportions of the participants would use treatment of the HIV-infected partners (77% versus 58%) and preexposure prophylaxis (59% versus 38%) as methods to prevent HIV transmission and have a regular HIV blood test every 6 months (94% versus 81%). Among the 35 participants who participated in the educational interventions twice, most of the knowledge and positive attitudes were retained. The rates of regular HIV testing every 6 months had increased significantly from baseline to 1 year later (29% to 74%, respectively). None of the participants developed HIV infection. These findings suggest that the study interventions could improve knowledge about HIV infection and transmission prevention, attitude and practices toward prevention, and increase regular HIV testing among the seronegative partners.

Keywords

HIV, education, knowledge, transmission prevention, serodiscordant couple

Date received: 20 January 2019; revised: 05 November 2019; accepted: 16 December 2019.

Introduction

The number of new HIV-infected individuals has decreased over time since the commencement of combined antiretroviral therapy (cART) in Thailand. However, approximately 6400 new infections had occurred in recent years.¹ At-risk populations include men who have sex with men (MSM), commercial sex workers, and injection drug users.^{2,3} HIV-noninfected sexual partners of HIV-infected persons or seronegative partners is another group with increased HIV risk through high chances of HIV exposure. Effective strategies to prevent HIV transmission among serodiscordant couples include consistent condom use, treating the infected partner early with cART to achieve virologic suppression,⁴ and daily use of oral tenofovir/emtricitabine (TDF/FTC) as pre-exposure prophylaxis (PrEP).⁵ In addition, regular HIV testing for noninfected partners, fertility

management with prevention of horizontal and vertical HIV transmission, improving knowledge about HIV disease and transmission prevention, and risk behaviors reduction are recommended among serodiscordant couples.⁶

Effective HIV transmission prevention requires data on knowledge, attitudes, risk behaviors, and safe sex practices

¹ Division of Infectious Diseases, Faculty of Medicine, Thammasat University, Pathum Thani, Thailand

² HIV/AIDS Care Unit, Thammasat University Hospital, Pathum Thani, Thailand

Corresponding Author:

Thana Khawcharoenporn, Division of Infectious Diseases, Faculty of Medicine, Thammasat University, Pathum Thani, Thailand.
Email: thanak30@yahoo.com



What Do We Already Know about This Topic?

Limited data exist on the effectiveness of an educational intervention in improving knowledge about HIV infection, attitude and practice to prevent HIV infection among HIV-negative partners of HIV-infected individuals.

How Does Your Research Contribute to the Field?

The interventions comprise a 1-hour educational session, a condom use teaching session, focus group discussion and free HIV testing improved HIV knowledge, attitude and practice to prevent HIV infection among the seronegative partners of HIV-infected individuals.

What Are Your Research's Implications toward Theory, Practice, or Policy?

The study interventions could be incorporated into clinical practice and national policies for HIV transmission prevention.

among serodiscordant partners. However, such data are currently limited in Thailand. Educating about HIV disease and transmission prevention for patients and health-care personnel is widely practiced in the country. Nonetheless, there have been no studies that clearly demonstrate the effectiveness of such educational interventions in improving knowledge and applying such knowledge into daily life practices among serodiscordant couples.

The primary objective of this study was to assess the effectiveness of educational interventions provided for HIV-noninfected partners of HIV-infected patients in improving knowledge about HIV infection and transmission prevention. The secondary objective was to assess the impact of educational interventions on attitudes toward HIV transmission prevention and practices to prevent HIV transmission among the seronegative partners.

Materials and Methods

Study Design and Setting

A quasi-experimental study was conducted among HIV-noninfected heterosexual partners aged ≥ 18 years of the HIV-infected patients who had been cared at Thammasat University Hospital (TUH). The study period was from October 1, 2016, to September 30, 2017.

Study Protocol, Definitions, and Outcome Measurement

All of the HIV-noninfected heterosexual partners were approached and asked to participate in the study. The inclusion criteria were the participants who were aware of their partners'

HIV infection status, had nonreactive anti-HIV test results within 6 months, and had sixth-grade reading level.

After enrollment, the participants completed the 30-minute survey asking about demographic and their infected partner's characteristics, knowledge about HIV infection and transmission prevention, attitude toward HIV prevention, couple status, and practice to prevent HIV transmission. The participants were asked to respond to the provided 30 statements in the survey whether the statements were true, false, or they did not know. Score was given for the correct response to each statement (the total score was 30). The level of knowledge about HIV infection and transmission prevention was measured by this score and defined as high level (score of 24 and more), moderate level (score of 18-23), and low level (score of less than 18). Attitude toward HIV prevention was defined as a settled way of thinking or feeling about how to prevent HIV transmission from the participants' partners. Positive attitude was a state of mind that envisioned and expected favorable results of HIV transmission prevention. Couple status was assessed from intimate and sexual relationship and problems encountered when living as a couple, while preventive practices were actions, methods, or strategies used to prevent HIV transmission among a couple. The survey questions were reviewed for its HIV content and validity by members of the TUH HIV Research Committee, HIV specialists, and experts in survey research of Faculty of Medicine, Thammasat University. We did a pilot survey with 10 HIV-noninfected partners of HIV-infected persons, and the results revealed a good internal consistency of the survey (Cronbach $\alpha = .79$).

The educational interventions were arranged by the HIV/AIDS Care Unit of TUH after the participants completed the survey and were defined as a set of strategic sessions used to teach knowledge, build skill, modify behaviors, and provide update information relevant to HIV transmission prevention among serodiscordant couples. The interventions consisted of a 1-hour educational session on general knowledge about HIV infection, route of transmission, risk behaviors, transmission prevention, and fertility management provided by an infectious disease specialist, a condom use session taught by a nurse specialized in HIV and an HIV-infected peer volunteer, and focus group discussion on topics about HIV transmission prevention among the participants. The educational session was conducted using PowerPoint slide presentation and was interactive. For each topic, the participants were assessed for understanding by the infectious diseases specialist and allowed to ask any questions to improve their understanding. A penis model and different kinds of sample condoms were used during the condom use teaching. The participants were taught about the effectiveness of condom in HIV prevention, types of commercially available condoms, and how to appropriately use and keep condoms. The participants had opportunities to practice skills of wearing condoms on the model and were provided feedbacks about their skills. A focus group discussion consisted of 5 to 6 participants and one of the staff of HIV/AIDS Care Unit of TUH (infectious diseases specialist, HIV specialized nurses, and HIV-infected peer volunteers). Steps of the group

discussion included (1) allowing the participants to introduce themselves; (2) establishing some ground rules of conduct; (3) explaining the topics of discussion by the staff which included route of HIV transmission, HIV risk behaviors, HIV transmission prevention, and fertility management (if applicable); (4) asking open-ended questions to begin discussion of each topic by the staff and encouraging every participant to participate; and (5) wrapping up discussion by the staff. These educational interventions occurred in a private conference room of TUH. The differences between this study's educational interventions and other HIV education programs in Thailand were that (1) the educational sessions were more focused and detailed on HIV transmission prevention among serodiscordant couples; (2) the interventions allowed for real-time interaction between the participants and a multidisciplinary health-care professional team; and (3) the interventions combined the interactive lecture, hand-on experience on condom use, and focus group discussion in the same interventional session.

After the educational interventions, the participants were asked to complete the same survey on HIV knowledge and attitude toward prevention. The participants were then asked whether they were interested in having a free HIV test. Those who were interested will receive pretest counseling by a counselor and undergo a blood test in a private room. They will be notified the test result within 48 hours by the counselor along with posttest counseling. The pre- and posteducational intervention survey and HIV testing occurred on the same day. At the end of the educational interventions, the participants were told that they will be approached for participation in the second educational interventions 1 year later. The second educational interventions consisted of the same survey, educational activities, and the free HIV testing similar to the first interventions.

Primary outcome was the median HIV knowledge score comparing between before and after the first educational interventions (immediate effectiveness of the intervention). Secondary outcomes were the median HIV knowledge score comparing between after the first educational interventions and just before the second educational interventions (retaining knowledge) and between before and after the second educational interventions (regaining knowledge), the changes in the attitude toward HIV transmission prevention, changes in risk behaviors, the rates of HIV test acceptance, and HIV infection among the participants.

Statistical Analysis

Given that no prior studies have evaluated the effectiveness of the same type of educational interventions, we anticipated 30% improvement in the median HIV knowledge score after the first educational interventions among the participants (the median score increased from 20 to 26). To detect this difference in the score between pre- and posteducational interventions with a statistical power of 80%, a significant level of 0.05, and a range of 10, the required sample size was 22. Data analysis was performed using SPSS version 15 (SPSS Inc, Chicago, Illinois). Pearson χ^2 or Fisher exact test was used to compare categorical

data, as appropriate. Continuous variables were compared using the Mann-Whitney *U* test. All *P* values were 2 tailed; *P* < .05 was considered statistically significant.

Ethical Approval and Informed Consent

This study was conducted in accordance with the World Medical Association amended Declaration of Helsinki and was approved by the Faculty of Medicine, Thammasat University Ethics Committee (Approval number 068/58). Verbal consent was obtained prior to study participation. The consent was recorded using the study number and was signed by the study investigators who obtained the consent from each participant. Written consent was not sought in this study to preserve the participants' confidentiality.

Results

Characteristics of the Study Participants and Their HIV-Infected Partners

Of the 102 eligible seronegative partners approached, 14 (14%) declined to participate in the study. A total of 88 HIV-noninfected partners were enrolled, of which 53 (60%) received the educational interventions one time, while 35 (40%) received the educational interventions twice (the second time was 1 year later). Characteristics of the study participants and their HIV-infected partners are shown in Table 1. The median duration of relationship with their HIV-infected partners was 69 months. The majority of the participants knew that their partners were HIV infected when their partners were hospitalized or had health checkup (45%). Most of the participants and their partners did not have a child together (57%), while among those who had children together, none of their children were HIV infected. Eighty-three percent of the infected partners had been on antiretroviral therapy.

Knowledge About HIV Infection and Transmission Prevention of the Study Participants Before and After the Educational Interventions

At baseline, most (>80%) of the participants correctly responded to the statements about routes of HIV transmission, except for the statements "a mosquito can transmit HIV," "you can get HIV from oral sex," and "HIV can be transmitted via kissing despite no oral ulcer or bleeding in the kissers" that less proportion of the participants responded correctly (Table 2). Most of the participants had high level of general knowledge about HIV prevention, except for the knowledge about HIV vaccine, free HIV tests available for Thai people, and whether pregnancy in HIV-infected women is an indication for abortion (Table 2). Less than 40% of the participants correctly responded to the statements about HIV transmission prevention among serodiscordant couples willing to have a child. The median HIV knowledge score increased significantly after the educational interventions compared to baseline (28 versus 21;

Table 1. Characteristics of the Study Participants and Their HIV-Infected Partners.^a

Characteristics	Value (N = 88)
Age, years, median (IQR)	39 (32-38)
Male sex	49 (56)
Marital status	
Living with domestic partner	46 (52)
Marriage	38 (43)
Living separately from partner	4 (5)
Highest education	
Primary school	24 (27)
High school	45 (51)
Bachelor's degree	17 (19)
Master's degree or higher	2 (2)
Occupation	
Company worker	50 (57)
Merchant	15 (17)
Government officer	9 (10)
Housewife/husband	6 (7)
Farmer	2 (2)
College student	1 (1)
Taxi driver	1 (1)
Unemployed	4 (5)
Monthly household income	
Less than US\$450	33 (38)
US\$450 to US\$1800	51 (58)
US\$1800 to US\$4500	2 (2)
More than US\$4500	2 (2)
Duration of relationship with the HIV-infected partner, months, median (IQR)	69 (36-153)
Time that the participants knew the partner's HIV status	
At the beginning of relationship	16 (18)
After having the relationship	72 (82)
Duration of relationship before knowing HIV status, months, median, (IQR)	24 (7-80)
Time/event leading to the partner's HIV status disclosure	
Before the first sexual intercourse	4 (5)
Before developing deep relationship	4 (5)
Before marriage	6 (7)
When the couple want to have a baby/At the time of antenatal care	24 (27)
Known by self-investigation at the specific time/event	44 (50)
When the partner was hospitalized	20/44 (45)
When the partner had health checkup/blood test	20/44 (45)
After the partner delivered a baby	2/44 (5)
When accidentally found the partner's antiretroviral drugs at home	2/44 (5)
Told by the partner after marriage	6 (7)
HIV-infected partner characteristics	
Age, years, median (IQR)	37 (30-44)
Known duration of the partner's HIV-infected status	42 (48)
Duration of the partner's HIV-infected status, months, median (IQR)	80 (24-123)
The partner is on antiretroviral therapy	
Yes	73 (83)
No	8 (9)
Unknown	7 (8)
Known duration of the partner's antiretroviral therapy	60 (68)
Duration of the partner's antiretroviral therapy, months, median (IQR)	24 (7-84)

Abbreviations: IQR, interquartile range.

^a Data are in numbers (%) unless indicated otherwise.

$P < .001$; Table 2). Significantly higher proportion of the participants correctly responded to the statements about routes of HIV transmission, risk of HIV transmission with illicit drug use, HIV testing, HIV vaccine, and strategies to prevent HIV transmission among serodiscordant couples including consistent condom use, treating the infected partner early with cART to achieve virologic suppression, PrEP use in seronegative partners, regular HIV testing for noninfected partners, fertility management with prevention of horizontal and vertical HIV transmission, and risk behaviors reduction after the educational interventions (Table 2). Among the 35 participants who received the educational interventions twice, the proportions of the participants who correctly responded to most of the statements were not significantly different between after the first educational interventions and before the second educational interventions (1 year later; Table 3). After the second educational interventions, significantly higher proportion of the participants correctly responded to the statements about some of the strategies to prevent HIV transmission among serodiscordant couples compared to before the interventions (Table 3).

Attitude Toward HIV Infection and Transmission Prevention of the Study Participants

At baseline, most of the participants stated that couples should disclose their HIV status to each other and the most appropriate time to do so was before the first sexual intercourse (Table 4). After knowing that their partners were HIV infected, most (88%) of the participants would continue the relationship, get themselves tested for HIV infection, and advise their partners to receive HIV treatment. To prevent HIV transmission, the most common methods they would use were condom (78%), followed by treating the infected partner (58%) and using PrEP (38%). Most of the participants would have a blood test for HIV infection every 6 months (81%). In regard to PrEP use, most of the participants would use PrEP daily (73%), use PrEP if it costs US\$30 per month (80%), and will be 100% compliant to PrEP (86%). The most common reasons that make the participants worry about using PrEP were side effects (55%), followed by cost (43%) and the need for compliance (38%). If the participants decide to use PrEP, most of them would use condom (78%). After knowing their partners' HIV-infected status, most of the participants would love their partners the same (78%), would not feel insecure about their partners' future (66%), and would not have more difficulty living with their partners (76%). Less proportion of the participants think that they could not have a baby with their partners without HIV transmission (52%) and would be worried that they could get HIV from their partners anytime when living together (35%). After the educational interventions, significantly higher proportion of the participants would use treatment of the HIV-infected partners (77% versus 58%), use PrEP (59% versus 38%), and do circumcision in a male partner (39% versus 5%) as the methods to prevent HIV transmission. After the educational interventions, higher proportions of the participants would have an HIV blood test every 6 months (94%

Table 2. Knowledge About HIV Infection and Transmission Prevention of the Study Participants Before and After the First Educational Interventions.^a

Statement (Correct Response)	Before the Interventions (n = 88)	After the Interventions (n = 88)	P
A mosquito can transmit HIV (False)	61 (69)	80 (91)	<.001
You can get HIV from dining with an infected person (False)	76 (86)	79 (90)	.49
You can get HIV from vaginal sex (True)	84 (96)	87 (99)	.37
You can get HIV from anal sex (True)	72 (82)	86 (98)	.001
You can get HIV from oral sex (True)	41 (47)	71 (81)	<.001
Having multiple sexual partners increases risk of getting HIV (True)	84 (96)	87 (99)	.37
Consistent condom use with sex decreases risk of getting HIV (True)	87 (99)	87 (99)	1.00
Getting high by using drugs increases risk of getting HIV (True)	55 (63)	80 (91)	<.001
You can get HIV from tattooing (True)	83 (94)	86 (98)	.44
You can get HIV from using a shared needle (True)	85 (97)	87 (99)	.62
Without prevention, HIV can be transmitted from mother to a baby during delivery (True)	83 (94)	85 (97)	.72
HIV can be transmitted via kissing despite no oral ulcer or bleeding in the kissers (False)	50 (57)	65 (74)	.02
An HIV-infected person can be asymptomatic for many years (True)	79 (90)	87 (99)	.02
An asymptomatic HIV-infected person can transmit HIV (True)	77 (88)	83 (94)	.12
A blood test is required for HIV diagnosis (True)	79 (90)	87 (99)	.02
A vaccine that can prevent HIV is currently available (False)	18 (21)	44 (50)	<.001
Antiretroviral therapy can increase lifespan of an HIV-infected person (True)	82 (93)	87 (99)	.12
Free HIV test is available for Thai people with national ID cards 2 times a year (True)	46 (52)	84 (96)	<.001
If you and your partner are both HIV infected, condom use is not required when having sexual intercourse (False)	65 (74)	75 (85)	.06
Couples should disclose their HIV status before having sexual intercourse (True)	79 (90)	86 (98)	.06
Treatment of an HIV-infected partner can reduce risk of transmission to the noninfected partner (True)	32 (36)	77 (88)	<.001
You should have HIV test at least every 6 months to monitor you HIV status (True)	79 (90)	87 (99)	.02
An HIV-noninfected partner can use antiretroviral drugs along with consistent condom use as a new method to prevent HIV infection from a partner (True)	32 (36)	76 (86)	<.001
Pregnancy in an HIV-infected woman is an indication for abortion (False)	39 (44)	70 (80)	<.001
In case of HIV-infected male and HIV-noninfected female couples who want to have a baby, sperm washing to get rid of HIV before intravaginal sperm injection can reduce the risk of HIV transmission (True)	18 (21)	77 (88)	<.001
In case of HIV-infected male and HIV-noninfected female couples who want to have a baby, they should increase the frequency of sexual intercourse without using condom to increase chance of pregnancy (False)	59 (67)	80 (91)	<.001
In case of HIV-infected male and HIV-noninfected female couples who want to have a baby, using antiretroviral drugs before and after sexual intercourse in the female partners can reduce the risk of HIV transmission (True)	11 (13)	68 (77)	<.001
In case of HIV-noninfected male and HIV-infected female couples who want to have a baby, self-intravaginal sperm injection without sexual intercourse can prevent HIV transmission (True)	23 (26)	77 (88)	<.001
In case of HIV-infected male and HIV-noninfected female couples who want to have a baby, in vitro fertilization is a method to prevent HIV transmission (True)	27 (31)	78 (89)	<.001
HIV knowledge score, ^b median (IQR)	21 (18-23)	28 (26-29)	<.001

Abbreviation: IQR, interquartile range.

^aData are in numbers (%) of participants with correct response to each statement unless indicated otherwise.

^bThe score was based on the number of correct response to the 30 statements in the survey (the total score was 30).

^cP < 0.05.

versus 81%) and think that they and their partners could have a baby together without HIV transmission (48% versus 17%), while less proportion of them would be worried that they can get HIV from their partners anytime when living together (25% versus 35%). Among the 35 participants who received the educational interventions twice, there were no significant differences in most attitudes toward HIV infection and transmission prevention between after the first educational interventions and

before the second educational interventions and before and after the second educational interventions.

Couple Status and Practices to Prevent HIV Transmission

At baseline, 64 (73%) of 88 participants reported history of consistent condom use. None of the study participants reported history of PrEP use. Twenty-seven participants reported

Table 3. Knowledge About HIV Infection and Transmission Prevention Before and After Each Educational Intervention among the Study Participants Who Received the Educational Interventions Twice.^a

Statement (Correct Answer)	Before 1st Interventions	After 1st Interventions	P_1	P_2	Before 2nd Interventions	After 2nd Interventions	P_3
	n = 35	n = 35			n = 35	n = 35	
A mosquito can transmit HIV (False)	23 (66)	32 (91)	.02	1.00	33 (94)	33 (94)	1.00
You can get HIV from dining with an infected person (False)	31 (89)	29 (83)	.73	.26	33 (94)	30 (86)	.43
You can get HIV from vaginal sex (True)	33 (94)	35 (100)	.49	1.00	35 (100)	35 (100)	1.00
You can get HIV from anal sex (True)	29 (83)	34 (97)	.11	.20	30 (86)	33 (94)	.43
You can get HIV from oral sex (True)	20 (57)	28 (80)	.04	0.07	21 (60)	31 (89)	.01
Having multiple sexual partners increases risk of getting HIV (True)	33 (94)	35 (100)	.49	1.00	35 (100)	35 (100)	1.00
Consistent condom use with sex decreases risk of getting HIV (True)	34 (97)	34 (97)	1.00	1.00	35 (100)	35 (100)	1.00
Getting high by using drugs increases risk of getting HIV (True)	25 (71)	33 (94)	.02	1.00	32 (91)	35 (100)	.24
You can get HIV from tattooing (True)	33 (94)	34 (97)	1.00	1.00	35 (100)	35 (100)	1.00
You can get HIV from using a shared needle (True)	33 (94)	35 (100)	.49	1.00	35 (100)	33 (94)	.49
Without prevention, HIV can be transmitted from mother to a baby during delivery (True)	33 (94)	34 (97)	1.00	1.00	33 (94)	35 (100)	.49
HIV can be transmitted via kissing despite no oral ulcer or bleeding in the kissers (False)	20 (57)	27 (77)	.08	.29	23 (66)	23 (66)	1.00
An HIV-infected person can be asymptomatic for many years (True)	29 (83)	35 (100)	.03	1.00	35 (100)	33 (94)	.49
An asymptomatic HIV-infected person can transmit HIV (True)	32 (91)	35 (100)	.24	.24	32 (91)	29 (83)	.48
A blood test is required for HIV diagnosis (True)	31 (89)	35 (100)	.11	1.00	34 (97)	35 (100)	1.00
A vaccine that can prevent HIV is currently available (False)	9 (26)	22 (63)	.002	.09	15 (43)	14 (40)	.81
Antiretroviral therapy can increase lifespan of an HIV-infected person (True)	33 (94)	35 (100)	.49	1.00	34 (91)	31 (89)	.36
Free HIV test is available for Thai people with national ID cards 2 times a year (True)	19 (54)	35 (100)	<.001	.11	31 (89)	35 (100)	.11
If you and your partner are both HIV infected, condom use is not required when having sexual intercourse (False)	30 (86)	29 (83)	.74	.74	30 (86)	28 (80)	.53
Couples should disclose their HIV status before having sexual intercourse (True)	32 (91)	34 (97)	.61	1.00	33 (94)	31 (89)	.67
Consistent condom use is required for serodiscordant couple when having sexual intercourse to prevent HIV transmission (True)	34 (97)	35 (100)	1.00	1.00	34 (97)	35 (100)	1.00
Treatment of an HIV-infected partner can reduce risk of transmission to the noninfected partner (True)	13 (37)	28 (80)	<.001	.27	24 (68)	31 (89)	.03
You should have HIV test at least every 6 months to monitor you HIV status (True)	33 (91)	34 (97)	.61	1.00	35 (100)	34 (97)	1.00
An HIV-noninfected partner can use antiretroviral drugs along with consistent condom use as a new method to prevent HIV infection from a partner (True)	11 (31)	31 (89)	<.001	.006	21 (60)	32 (91)	.004
Pregnancy in an HIV-infected woman is an indication for abortion (False)	18 (51)	31 (89)	.001	.22	26 (74)	28 (80)	.57
In case of HIV-infected male and HIV-noninfected female couples who want to have a baby, sperm washing to get rid of HIV before intravaginal sperm injection can reduce the risk of HIV transmission (True)	6 (17)	33 (94)	<.001	.08	27 (77)	33 (94)	.08
In case of HIV-infected male and HIV-noninfected female couples who want to have a baby, they should increase the frequency of sexual intercourse without using condom to increase chance of pregnancy (False)	23 (66)	33 (94)	.006	1.00	32 (91)	33 (94)	1.00
In case of HIV-infected male and HIV-noninfected female couples who want to have a baby, using antiretroviral drugs before and after sexual intercourse in the female partners can reduce the risk of HIV transmission (True)	4 (11)	30 (86)	<.001	.004	19 (54)	26 (74)	.08

(continued)

Table 3. (continued)

Statement (Correct Answer)	Before 1st Interventions	After 1st Interventions			Before 2nd Interventions	After 2nd Interventions	<i>P</i> ₃
	<i>n</i> = 35	<i>n</i> = 35	<i>P</i> ₁	<i>P</i> ₂	<i>n</i> = 35	<i>n</i> = 35	
In case of HIV-noninfected male and HIV-infected female couples who want to have a baby, self-intravaginal sperm injection without sexual intercourse can prevent HIV transmission (True)	9 (26)	33 (94)	<.001	.02	25 (71)	31 (89)	.13
In case of HIV-infected male and HIV-noninfected female couples who want to have a baby, in vitro fertilization is a method to prevent HIV transmission (True)	11 (31)	34 (97)	<.001	.006	25 (71)	34 (97)	.006
HIV knowledge score, ^b median (IQR)	21 (19-24)	29 (26-29)	<.001	<.001	27 (24-28)	28 (27-29)	.001

Abbreviation: IQR, interquartile range.

^a Data are in numbers (%) of participants with a correct answer for each statement unless indicated otherwise. *P*₁: Comparison between before and after the first educational interventions. *P*₂: Comparison between after the first educational interventions and before the second educational interventions. *P*₃: Comparison between before and after the second educational interventions.

^bThe score was based on the number of correct response to the 30 statements in the survey (the total score was 30).

^c*P* < 0.05.

willingness or thinking about having a baby with the infected partners. Among these 27 participants, the most common actions they would do to prevent HIV transmission were sperm injection (22%) and in vitro fertilization (15%) in cases of HIV-infected female and noninfected male partners. Thirty-one participants (35%) reported that their family had been aware of their partners' HIV infection status, of which 31 (100%) received good support from their family. The rate of HIV testing acceptance right after the educational interventions was 70 (80%) of 88. Practice to prevent HIV transmission after the educational intervention in real life can be assessed only in the 35 participants who received the educational interventions twice (during the 1-year interval between the 2 interventions). Among these 35 participants, couple status and most practices to prevent HIV transmission were not significantly different between baseline and 1 year later (Table 5). However, significantly higher proportion of the participants had undergone HIV testing regularly (29% versus 74%) during the 1-year period after the educational interventions, while there was a nonsignificant increase in rates of consistent condom use after the interventions (71% versus 91%). The rates of HIV testing acceptance were not significantly different between baseline and 1 year later (77% versus 80%). None of the 35 participants developed HIV infection during the 1-year follow-up period.

Comparison Between the Participants Receiving 1-Time and 2-Time Educational Interventions

Baseline characteristics of the participants receiving 1-time and 2-time educational interventions were not significantly different (Table 6). Overall knowledge about HIV infection and transmission prevention was comparable between the 2 groups, except that higher proportion of those who received educational interventions twice responded to the statement “in vitro fertilization is a method to prevent HIV transmission” correctly. In regard to attitude toward HIV prevention, those who

received educational interventions twice were more likely to report having the same number of sexual partner if using PrEP, to think that they and their infected partners can have a baby together without HIV transmission, and to report that they would not love their infected partners less after knowing their partners' HIV infection status.

Discussion

Our study findings indicated that the educational interventions were associated with significant improvement in the level of knowledge about HIV infection and transmission prevention. Among the participants who received educational interventions twice (1-year apart), the participants' knowledge in most of the HIV topics had been retained for this short-term period and some regained after the second educational interventions. To our knowledge, this is the first study that demonstrates the effectiveness of the educational interventions in improving and retaining HIV knowledge among the seronegative partners of serodiscordant couples. The topics that most of the participants lacked the knowledge of were oral sex as the route of HIV transmission, the availability of effective HIV vaccine, and strategies to prevention HIV transmission among serodiscordant couples willing to have a child, while the knowledge in a more complicated topic such as in vitro fertilization as a method to prevent HIV transmission was improved after the second educational interventions. These suggest that implementation of the future educational interventions should focus and clearly discuss in detail on these topics and repeat interventions may be needed for complicated topics of HIV prevention.

The important findings about attitude toward HIV transmission prevention were that most of the participants were willing to disclose their HIV infection status and thought that both HIV-infected and noninfected partners are responsible for transmission prevention between the couples. These findings may be explained by the study participants' monogamous and

Table 4. Attitudes Toward HIV Infection and Transmission Prevention of the Study Participants Before and After the Educational Interventions.^a

Attitude	Before the Interventions	After the Interventions	P
	n = 88	n = 88	
Couples should disclose their HIV status to each other	86 (98)	87 (99)	1.00
Appropriate time to disclose their HIV status to each other			.38
Before the first sexual intercourse	52 (59)	57 (65)	
Before having deep relationship	19 (22)	19 (22)	
Before marriage	8 (9)	7 (8)	
Before having a child together	4 (5)	0 (0)	
At the time of HIV infection diagnosis	3 (3)	5 (5)	
Action after knowing that the partner is HIV infected			1.00
No more relationship	1 (1)	1 (1)	
Asking the reasons for nondisclosure and decide what to do depending on the reasons	10 (11)	10 (11)	
Continuing the relationship, getting self-testing for HIV, and advising the partner to receive treatment	77 (88)	77 (88)	
If you are HIV infected, would you tell your sexual partner?			.24
Yes	83 (94)	87 (99)	
No	1 (1)	0 (0)	
Uncertain	4 (5)	1 (1)	
Persons who are responsible for HIV transmission prevention between a serodiscordant couple			0.26
HIV-infected partner	6 (7)	2 (2)	
HIV-noninfected partner	5 (6)	3 (3)	
Both HIV- and non-HIVinfected partners	77 (88)	83 (94)	
Methods you would use to prevent HIV transmission between a serodiscordant couple			
Treatment of HIV-infected partner	51 (58)	68 (77)	.006
Consistent condom use	69 (78)	78 (89)	.07
Pre-exposure prophylaxis (PrEP) with antiretroviral drugs for a noninfected partner	33 (38)	52 (59)	.004
Circumcision in a male partner	4 (5)	34 (39)	<.001
How would you have a blood test for HIV infection?			.02
No need	0 (0)	1 (1)	
Every 6 months	71 (81)	83 (94)	
Every year	15 (17)	3 (3)	
Sometimes, not every year	2 (2)	1 (1)	
How would you use condom when having sexual intercourse with the HIV-infected partner?			.53
Not at all	3 (3)	1 (1)	
Sometimes	0 (0)	1 (1)	
Half of the time	1 (1)	0 (0)	
Most of the time	4 (5)	3 (3)	
Always	80 (91)	83 (94)	
Would you use antiretroviral drugs for PrEP?			.36
Yes	74 (84)	80 (91)	
No	4 (5)	3 (3)	
Uncertain	10 (11)	5 (6)	
How would you prefer to administer PrEP?			
Weekly	48 (55)	51 (58)	.65
Daily	64 (73)	64 (73)	1.00
Monthly	44 (50)	48 (55)	.55
Once, 1 day before sexual intercourse	33 (38)	40 (46)	.28
Once, 1 hour before sexual intercourse	37 (42)	40 (46)	.65
Would you use PrEP if it costs US\$30/month?			.85
Yes	70 (80)	73 (83)	
No	6 (7)	5 (6)	
Uncertain	12 (14)	10 (11)	
If you decide to use PrEP, will you be 100% compliant			.31
Yes	76 (86)	80 (91)	
No	2 (2)	0 (0)	
Uncertain	10 (11)	8 (9)	

(continued)

Table 4. (continued)

	Before the Interventions	After the Interventions	P
	n = 88	n = 88	
Attitude			
Reasons that may make you worry about use PrEP			
Compliance	33 (38)	35 (40)	.76
Side effect	48 (55)	46 (52)	.76
Efficacy less than 100%	28 (32)	22 (25)	.32
Cost	38 (43)	31 (35)	.28
If you decide to use PrEP, how would you use condom?			.22
Less	0 (0)	1 (1)	
More	19 (22)	27 (31)	
The same	69 (78)	60 (68)	
If you decide to use PrEP, what number of sexual partner would be?			.61
Less	23 (26)	26 (30)	
The same	65 (74)	62 (71)	
As a serodiscordant couple, do you think you and your partner can have a baby together without HIV transmission			<.001
Yes	15 (17)	42 (48)	
No	46 (52)	35 (40)	
Uncertain	27 (31)	11 (13)	
Would you love your infected partner less after knowing his/her HIV infection status?			.19
Yes	7 (8)	9 (10)	
No	69 (78)	74 (84)	
Uncertain	12 (14)	5 (6)	
Would you feel insecure about your infected partner's future			.33
Yes	17 (19)	12 (14)	
No	58 (66)	67 (76)	
Uncertain	13 (15)	9 (10)	
Would you have more difficulty living with your infected partner after knowing his/her HIV infection status?			.16
Yes	17 (19)	11 (13)	
No	67 (76)	76 (86)	
Uncertain	4 (5)	1 (1)	
Would you be worried that you could get HIV from you infected partner anytime when living together?			.02
Yes	31 (35)	22 (25)	
No	43 (49)	60 (68)	
Uncertain	14 (16)	6 (7)	

^a Data are in numbers (%).

^b *p* < 0.05.

stable relationship with the infected partners, so they had no difficulty sharing and discussing the important personal information with their partners.⁷ The educational interventions were shown to be associated with changes in attitudes and willingness to prevent HIV transmission among the couples. These included the following: (1) more proportion of the participants were willing to use treatment of the infected partner, PrEP, and male circumcision as the preventive methods; (2) more participants were willing to have regular HIV blood test every 6 months; (3) more participants had positive attitudes about having a baby with their infected partners safely with appropriate preventive measures; and (4) less participants were worried that they could get HIV from their infected partners. The effect of educational interventions on attitude was also demonstrated in another study.⁸ The study revealed that the 2 sexual health seminars increased intentions to avoid HIV transmission

among the participating MSM. In addition, our study findings suggest that the positive attitudes and willingness to prevent HIV transmission had mostly been retained for a short-term period after the interventions. When comparing between the participants who received 1-time and 2-time educational interventions, our study demonstrated that the repeating educational interventions could improve the attitude toward behaviors after PrEP use, horizontal HIV transmission prevention, and couple relationship after knowing the infected partners' HIV infection status.

In the previous studies,⁹⁻¹¹ risk factors associated with HIV transmission among serodiscordant couples included inconsistent condom use, negative attitudes about condom use, more frequency of sexual intercourse, nondisclosure of HIV status of infected partners, and infected partners' plasma HIV viral load of more than 100 000 copies/mL. As demonstrated in our study

Table 5. Couple Status and Practices to Prevent HIV Transmission among the Study Participants and Their HIV-Infected Partners at Baseline and 1 Year Later.^a

Characteristics and Practices	Baseline N = 35	One Year Later N = 35	P
Having sexual intercourse with your partner within 6 months	31 (89)	27 (77)	.34
Condom use when having sexual intercourse with your partner			.24
Not at all	4 (11)	2 (6)	
Sometimes	1 (3)	0 (0)	
Half of the time	2 (6)	0 (0)	
Most of the time	3 (9)	1 (3)	
Always	25 (71)	32 (91)	
Having prior HIV testing			<.001
Not at all	8 (23)	0 (0)	
Last time more than 1 year ago	5 (14)	3 (9)	
Every 1 year	8 (23)	5 (14)	
Every 6 months	10 (29)	26 (74)	
Every 3 months	4 (11)	1 (3)	
Last HIV test results (n = 27, 35)			
Nonreactive	27/27 (100)	35/35 (100)	1.00
HIV-infected partner currently on antiretroviral therapy	33 (94)	34 (97)	1.00
Current use of pre-exposure prophylaxis (PrEP)	0 (0)	2 (6)	.49
Willingness to have a baby with your partner			.66
No	14 (40)	17 (49)	
Yes	6 (17)	6 (17)	
Not sure	5 (14)	2 (6)	
Having enough children already	10 (29)	9 (26)	
Actions you would do to prevent HIV transmission if thinking of having a baby (n = 11, 8)			
No condom use, no additional measures	0/11 (0)	1/8 (13)	.42
Limiting sexual intercourse without condom only to around the ovulation day	0/11 (0)	0/8 (0)	-
Limiting sexual intercourse without condom only to around the ovulation day and use of PrEP	1/11 (9)	1/8 (13)	1.00
Sperm injection in cases of HIV-infected female and noninfected male partners	4/11 (36)	4/8 (50)	.66
In vitro fertilization	2/11 (18)	2/8 (25)	1.00
Consulting physician	1/11 (9)	0/8 (0)	1.00
No answer	3/11 (27)	0/8 (0)	.23
Contraceptive methods you would use if you and your partner have enough children or do not want to have a baby together			
Female sterilization	3 (9)	9 (26)	.11
Consistent condom use	21 (60)	23 (66)	.62
Oral contraceptive pill	2 (6)	1 (3)	1.00
Problems you have encountered within the past 6 months			
Separating from your partner due to the partner's HIV infection status	0 (0)	0 (0)	-
Worrying about getting HIV from your partner	8 (23)	6 (17)	.55
Caring less about your partner	0 (0)	2 (6)	.49
Worrying about the future of your HIV-infected partner	16 (46)	12 (34)	.33
Your family know about your partner's HIV infection status	12 (34)	12 (34)	1.00
Your family provide you good support about this issue	12/12 (100)	12/12 (100)	1.00
Your partner's family know about his/her HIV infection status	13 (37)	16 (46)	.47
Your partner's family provide him/her good support about this issue	13/13 (100)	14/16 (88)	.49
HIV test acceptance	27 (77)	28 (80)	.77
HIV test result (n = 27, 28)			
Nonreactive	27/27 (100)	28/28 (100)	1.00

^aData are in numbers (%).^bP < 0.05.

population, Thai seronegative partners of HIV-infected individuals generally had low monthly income and low to moderate formal education level. Most (82%) of them did not disclose their HIV infection status until they had HIV testing. These characteristics may pose obstacles for HIV transmission

prevention in the serodiscordant couples. In addition, our study participants were found to be at some risks for HIV acquisition given that about a quarter reported using condoms inconsistently, while not all of their HIV-infected partners were on cART and achieved virologic suppression. The barriers to

Table 6. Comparison of Characteristics, HIV Knowledge, and Attitude Toward HIV Transmission Prevention Between the study Participants Who Received One-Time and Two-Time Educational Interventions.^a

Variables	One Time	Two Times	P
	n = 53	n = 35	
Characteristic			
Age, years, median (IQR)	39 (30-49)	38 (33-47)	.95
Male sex	27 (51)	22 (63)	.27
Marital status			.47
Living with domestic partner	25 (47)	21 (60)	
Marriage	25 (47)	13 (37)	
Living separately from partner	3 (6)	1 (3)	
Highest education			.51
Primary school	13 (25)	11 (31)	
High school	27 (51)	18 (51)	
Bachelor degree	11 (21)	6 (17)	
Master degree or higher	2 (4)	0 (0)	
Occupation			.27
Company worker	27 (51)	23 (66)	
Merchant	11 (21)	4 (11)	
Government officer	7 (13)	2 (6)	
Housewife/husband	2 (4)	4 (11)	
Farmer	2 (4)	0 (0)	
College student	1 (2)	0 (0)	
Taxi driver	0 (0)	1 (3)	
Unemployed	3 (6)	1 (3)	
Monthly household income			.16
Less than US\$450	18 (34)	15 (43)	
US\$450-US\$1800	33 (62)	18 (51)	
US\$1800-US\$4500	2 (4)	0 (0)	
More than US\$4500	0 (0)	2 (6)	
Duration of relationship with the HIV-infected partner, months, median (IQR)	120 (45-170)	57 (24-120)	.06
HIV knowledge (correct response to statement)			
A mosquito can transmit HIV (False)	48 (91)	33 (94)	.7
You can get HIV from dining with an infected person (False)	50 (94)	30 (86)	.23
You can get HIV from vaginal sex (True)	52 (98)	35 (100)	1.00
You can get HIV from anal sex (True)	52 (98)	33 (94)	.56
You can get HIV from oral sex (True)	43 (81)	31 (89)	.39
Having multiple sexual partners increases risk of getting HIV (True)	52 (98)	35 (100)	1.00
Consistent condom use with sex decreases risk of getting HIV (True)	53 (100)	35 (100)	1.00
Getting high by using drugs increases risk of getting HIV (True)	47 (89)	35 (100)	.08
You can get HIV from tattooing (True)	52 (98)	35 (100)	1.00
You can get HIV from using a shared needle (True)	52 (98)	33 (94)	.56
Without prevention, HIV can be transmitted from mother to a baby during delivery (True)	51 (96)	35 (100)	.52
HIV can be transmitted via kissing despite no oral ulcer or bleeding in the kissers (False)	38 (72)	23 (66)	.55
An HIV-infected person can be asymptomatic for many years (True)	52 (98)	33 (94)	.56
An asymptomatic HIV-infected person can transmit HIV (True)	48 (91)	29 (83)	.29
A blood test is required for HIV diagnosis (True)	52 (98)	35 (100)	1.00
A vaccine that can prevent HIV is currently available (False)	22 (42)	14 (40)	.89
Antiretroviral therapy can increase lifespan of an HIV-infected person (True)	52 (98)	31 (89)	.08
Free HIV test is available for Thai people with national ID cards 2 times a year (True)	49 (93)	35 (100)	.15
If you and your partner are both HIV infected, condom use is not required when having sexual intercourse (False)	46 (87)	28 (80)	.39
Couples should disclose their HIV status before having sexual intercourse (True)	52 (98)	31 (89)	.08
Consistent condom use is required for serodiscordant couple when having sexual intercourse to prevent HIV transmission (True)	53 (100)	35 (100)	1.00
Treatment of an HIV-infected partner can reduce risk of transmission to the noninfected partner (True)	49 (93)	31 (89)	.71
You should have HIV test at least every 6 months to monitor you HIV status (True)	53 (100)	34 (87)	.40
An HIV-noninfected partner can use antiretroviral drugs along with consistent condom use as a new method to prevent HIV infection from a partner (True)	45 (85)	32 (91)	.52

(continued)

Table 6. (continued)

Variables	One Time	Two Times	P
	n = 53	n = 35	
Pregnancy in an HIV-infected woman is an indication for abortion (False)	39 (74)	28 (80)	.61
In case of HIV-infected male and HIV-noninfected female couples who want to have a baby, sperm washing to get rid of HIV before intravaginal sperm injection can reduce the risk of HIV transmission (True)	44 (83)	33 (94)	.19
In case of HIV-infected male and HIV-noninfected female couples who want to have a baby, they should increase the frequency of sexual intercourse without using condom to increase chance of pregnancy (False)	47 (89)	33 (94)	.47
In case of HIV-infected male and HIV-noninfected female couples who want to have a baby, using of antiretroviral drugs before and after sexual intercourse in the female partners can reduce the risk of HIV transmission (True)	38 (72)	26 (74)	.79
In case of HIV-noninfected male and HIV-infected female couples who want to have a baby, self-intravaginal sperm injection without sexual intercourse can prevent HIV transmission (True)	44 (83)	31 (89)	.55
In case of HIV-infected male and HIV-noninfected female couples who want to have a baby, in vitro fertilization is a method to prevent HIV transmission (True)	44 (83)	34 (97)	.04
HIV knowledge score, ^b median (IQR)	28 (26-29)	28 (27-29)	.92
Attitude toward HIV infection and transmission prevention			
Couples should disclose their HIV status to each other	53 (100)	34 (97)	.34
Appropriate time to disclose their HIV status to each other			.10
Before the first sexual intercourse	29 (55)	28 (80)	
Before having deep relationship	15 (28)	5 (14)	
Before marriage	6 (11)	1 (3)	
Before having a child together	3 (6)	1 (3)	
Action after knowing that the partner is HIV infected			0.88
No more relationship	1 (2)	1 (3)	
Asking the reasons for nondisclosure and decide what to do depending on the reasons	6 (11)	3 (7)	
Continuing the relationship, getting self-testing for HIV, and advising the partner to receive treatment	46 (87)	31 (89)	
If you are HIV infected, would you tell your sexual partner?			.44
Yes	52 (98)	33 (94)	
No	0 (0)	1 (3)	
Uncertain	1 (2)	1 (3)	
Persons who are responsible for HIV transmission prevention between a serodiscordant couple			.93
HIV-infected partner	2 (4)	1 (3)	
HIV-noninfected partner	1 (2)	1 (3)	
Both HIV- and non-HIVinfected partners	50 (94)	33 (94)	
Methods you would use to prevent HIV transmission between a serodiscordant couple			
Treatment of HIV-infected partner	41 (77)	24 (69)	.36
Consistent condom use	47 (89)	29 (83)	.53
Pre-exposure prophylaxis (PrEP) with antiretroviral drugs for a non-infected partner	36 (68)	24 (69)	.95
Circumcision in a male partner	21 (40)	12 (34)	.61
How would you have a blood test for HIV infection?			.70
No need	1 (2)	0 (0)	
Every 6 months	49 (93)	34 (97)	
Every year	2 (4)	1 (3)	
Sometimes, not every year	1 (2)	0 (0)	
How would you use condom when having sexual intercourse with the HIV-infected partner?			.70
Not at all	1 (2)	0 (0)	
Sometimes	1 (2)	0 (0)	
Most of the time	1 (2)	1 (3)	
Always	50 (94)	34 (97)	
Would you use antiretroviral drugs for PrEP?			.34
Yes	48 (91)	33 (94)	
No	3 (6)	0 (0)	
Uncertain	2 (4)	2 (6)	
How would you prefer to administer PrEP?			
Weekly	30 (57)	14 (40)	.13
Daily	38 (72)	27 (77)	.57
Monthly	25 (47)	14 (40)	.51
Once, 1 day before sexual intercourse	23 (43)	11 (31)	.26
Once, 1 hour before sexual intercourse	24 (45)	10 (29)	.12

(continued)

Table 6. (continued)

Variables	One Time	Two Times	P
	n = 53	n = 35	
Would you use PrEP if it costs US\$30/month?			.75
Yes	44 (83)	28 (80)	
No	4 (8)	2 (6)	
Uncertain	5 (9)	5 (14)	
If you decide to use PrEP, will you be 100% compliant			.52
Yes	51 (96)	35 (100)	
No	2 (4)	0 (0)	
Reasons that may make you worry about use PrEP			
Compliance	20 (38)	16 (46)	.46
Side effect	31 (59)	22 (63)	.68
Efficacy less than 100%	12 (23)	11 (31)	.36
Cost	19 (36)	9 (26)	.32
If you decide to use PrEP, how would you use condom?			.20
More	19 (36)	8 (23)	
The same	34 (64)	27 (77)	
If you decide to use PrEP, what number of sexual partner would be?			.04
Less	20 (38)	6 (17)	
The same	33 (62)	29 (83)	
As a serodiscordant couple, do you think you and your partner can have a baby together without HIV transmission			.04
Yes	23 (43)	22 (63)	
No	23 (43)	13 (37)	
Uncertain	7 (13)	0 (0)	
Would you love your infected partner less after knowing his/her HIV infection status?			.02
Yes	6 (11)	0 (0)	
No	43 (81)	35 (100)	
Uncertain	4 (8)	0 (0)	
Would you feel insecure about your infected partner's future			.52
Yes	5 (9)	2 (6)	
No	42 (79)	31 (88)	
Uncertain	6 (11)	2 (6)	
Would you have more difficulty living with your infected partner after knowing his/her HIV infection status?			.72
Yes	6 (11)	4 (12)	
No	46 (87)	31 (88)	
Uncertain	1 (2)	0 (0)	
Would you be worried that you could get HIV from you infected partner anytime when living together?			.71
Yes	16 (30)	9 (26)	
No	34 (64)	25 (71)	
Uncertain	3 (6)	1 (3)	

Abbreviation: IQR, interquartile range.

^aData are in numbers (%) unless indicated otherwise.

^bThe score was based on the number of correct response to the 30 statements in the survey (the total score was 30).

^cP < 0.05.

consistent condom use identified in a previous study were having infected male partner, female partner's inability to negotiate condom use, desire for children, and lack of knowledge.¹² Our educational interventions were shown to be associated with increase (20%) in consistent condom use and significant increase (45%) in regular HIV testing every 6 months. The effects of educational interventions on risk behavior reduction were also demonstrated in serodiscordant couples from other studies. These interventions included a couple-focused educational intervention and health promotion that increased condom use,¹³ a single and multiple sessions on risk reduction and counseling that increased condom use,¹⁴ and a couple-based

HIV prevention and relationship education that decreased risk behaviors, increased information, motivation, and behavioral skills related to HIV prevention, and improved couple relationship.¹⁵

According to the information-motivation-behavioral skills model of HIV preventive behavior,¹⁶ the individuals who are well informed about HIV infection and transmission prevention, motivated to act, and possess the behavioral skills required to act effectively will be likely to initiate and maintain effective HIV preventive behaviors. HIV prevention information needs to be directly relevant to preventive behavior, includes specific facts about HIV transmission, and can be

enacted easily in the social ecology of the individuals. HIV prevention motivation including attitude toward practicing specific preventive acts, perception of social support for performing such acts, and perceptions of personal vulnerability to HIV infection is required to drive the preventive behaviors, while behavioral skills for performing HIV preventive acts including objective and perceived abilities to manage critical situations are an additional prerequisite. Consistently, with this model, our study demonstrated that the participants were well informed about HIV infection and transmission prevention through the educational sessions that included interactive lecture specifically focused on transmission prevention for serodiscordant couple, hands-on experience for condom use, focus group discussion, and ability to enact the very first preventive behavior by undergoing HIV testing after the educational sessions. This led to the improvement in knowledge level and attitude toward HIV transmission prevention. Among the 35 participants in whom practices to prevent HIV transmission could be assessed, the high level of knowledge and positive attitude toward prevention along with reported preventive behavior skills were associated with good couple relationship and practices to prevent HIV transmission.

The HIV testing acceptance among our study participants after the first educational interventions was 80%. This rate was considered significantly higher than the rate of 37% among the stable seronegative heterosexual partners of long-term treated HIV-infected individuals in another Thai study.¹⁷ The higher rate of HIV testing acceptance in our study was most likely due to the effect of the educational intervention that had not been provided for the participants in the other study. Among the study participants who underwent HIV testing, none of them had HIV infection during the 1-year follow-up period. This reflects the low HIV risks and good practices to prevent HIV transmission among these participants.

There are notable limitations in this study. First, there may be recall biases of characteristics, risk behaviors, and practices among the participants, given the use of survey and self-reported data. Second, the small sample size of the participants who received the educational interventions twice may limit detection of difference in knowledge level, attitude, and practices to prevent HIV infection when comparing between after the first educational interventions and before the second educational interventions. However, this represents the real-life situation that it is difficult to have participants come for the education interventions twice and 1 year apart.

In conclusion, the study educational interventions could improve knowledge about HIV infection and transmission prevention, reduce HIV risk behaviors, improve attitude and practice toward HIV transmission prevention, and increase the rate of regular HIV testing among the seronegative partners of HIV-infected persons. The educational intervention is considered feasible and could be implemented in resource-limited settings. Further studies with larger sample sizes and randomized controlled design are needed to confirm the study findings and to be conducted in other settings.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was supported by Faculty of Medicine, Thammasat University Research Grant (to T.K.).

ORCID iD

Thana Khawcharoenporn, MD, MSc  <https://orcid.org/0000-0001-6093-2887>

References

1. Joint United Nations Programme on HIV/AIDS. HIV and AIDS estimates 2016. 2016. <http://www.unaids.org/en/regionscountries/countries/thailand>. Accessed December 8, 2017.
2. Bureau of Epidemiology, Ministry of Public Health of Thailand. AIDS situation in Thailand 2014. http://www.boe.moph.go.th/files/report/20141128_61345755.pdf. Accessed December 8, 2017.
3. Dokubo EK, Kim AA, Le LV, Nadol PJ, Prybylski D, Wolfe MI. HIV incidence in Asia: a review of available data and assessment of the epidemic. *AIDS Rev*. 2013;15(2):67–76.
4. Cohen MS, Chen YQ, McCauley M, et al. Prevention of HIV-1 infection with early antiretroviral therapy. *New Engl J Med*. 2011; 365(6):493–505.
5. Baeten JM, Donnell D, Ndase P, et al. Antiretroviral prophylaxis for HIV prevention in heterosexual men and women. *N Engl J Med*. 2012;367(5):399–410.
6. Curran K, Baeten JM, Coates TJ, Kurth A, Mugo NR, Celum C. HIV-1 prevention for HIV-1 serodiscordant couples. *Curr HIV/AIDS Rep*. 2012;9(2):160–170.
7. Conserve DF, King G, Dévieux JG, Jean-Gilles M, Malow R. Determinants of HIV serostatus disclosure to sexual partner among HIV-positive alcohol users in Haiti. *AIDS Behav*. 2014; 18(6):1037–1045.
8. Rosser BR, Hatfield LA, Miner MH, Ghiselli ME, Lee BR, Welles SL. Effects of a behavioral intervention to reduce serodiscordant unsafe sex among HIV positive men who have sex with men: the positive connections randomized controlled trial study. *J Behav Med*. 2010;33(2):147–158.
9. Lu W, Zeng G, Luo J, et al. HIV transmission risk among serodiscordant couples: a retrospective study of former plasma donors in Henan, China. *J Acquir Immune Defic Syndr*. 2010; 55(2): 232–238.
10. Nöstlinger C, Nideröst S, Gredig D, et al. Condom use with steady partners among heterosexual people living with HIV in Europe: testing the information-motivation-behavioral skills model. *AIDS Patient Care STDS*. 2010;24(12):771–780.
11. Kumarasamy N, Venkatesh KK, Srikrishnan AK, et al. Risk factors for HIV transmission among heterosexual discordant couples in South India. *HIV Med*. 2010;11(3):178–186.

12. Ngunjiri K, Mugo N, Celum C, et al. A qualitative study of barriers to consistent condom use among HIV-1 serodiscordant couples in Kenya. *AIDS Care*. 2012;24(4):509–516.
13. El-Bassel N, Jemmott JB, Landis JR, et al. National Institute of Mental Health Multisite Eban HIV/STD Prevention Intervention for African American HIV Serodiscordant Couples: a cluster randomized trial. *Arch Intern Med*. 2010;170(17):1594–1601.
14. Jones DJ, Chitalu N, Ndubani P, et al. Sexual risk reduction among Zambian couples. *SAHARA J*. 2009;6(2):69–75.
15. Newcomb ME, Macapagal KR, Feinstein BA, Bettin E, Swann G, Whitton SW. Integrating HIV prevention and relationship education for young same-sex male couples: a pilot trial of the 2GETHER intervention. *AIDS Behav*. 2017;21(8):2464–2478.
16. Fisher JD, Fisher WA, Shuper PA. The information-motivation-behavioral skills model of HIV preventive behavior. In: DiClemente RJ, Crosby RA, Kegler MC, eds. *Emerging Theories in Health Promotion Practice and Research*. 2nd ed. San Francisco, CA: Jossey-Bass; 2009:21–63.
17. Kancheva Landolt N, Phanuphak N, Khongpetch C, et al. Low uptake of HIV testing and no HIV positivity in stable serodiscordant heterosexual partners of long-term treated HIV-infected Thais. *AIDS Care*. 2015;27(5):587–594.