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

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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

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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

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A quasi-experimental study was conducted among HIV-negative partners of HIV-infected individuals. 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-negative 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-negative 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’s α = .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 $\chi^2$ 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 testing 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.*

| Characteristics                                      | Value            |
|------------------------------------------------------|------------------|
| 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$450                                    | 2 (2)            |
| More than US$450                                     | 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 |                  |
| 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 |                  |
| Duration of the partner’s antiretroviral therapy, months, median (IQR) | 24 (7-84) |

Abbreviations: IQR, interquartile range.
* Data are in numbers (%) unless indicated otherwise.

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% versus 81%) and do circumcision in a male partner (39% versus 5%) as the methods to prevent HIV transmission.
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.

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

| 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,a median (IQR)                                                         | 21 (18-23)                        | 28 (26-29)                       | <.001   |

Abbreviation: IQR, interquartile range.

*a Data are in numbers (%) of participants with correct response to each statement unless indicated otherwise.

*b The 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.

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.

| Statement (Correct Answer)                                                                 | Before 1st Interventions | After 1st Interventions | $P_1$ | After 2nd Interventions | $P_2$ | Before 2nd Interventions | After 2nd Interventions | $P_3$ |
|-------------------------------------------------------------------------------------------|--------------------------|-------------------------|-------|-------------------------|-------|--------------------------|-------------------------|-------|
| 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)                | 1.00                    |       |
| 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)
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 prevent 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.

| Attitude                                                                 | Before the Interventions | After the Interventions | P    |
|-------------------------------------------------------------------------|--------------------------|-------------------------|------|
| 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 |                          |                         | .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)
stable relationship with the infected partners, so they had no difficulty sharing and discussing the important personal information with their partners. 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. 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.

Table 4. (continued)

| Attitude | Before the Interventions | After the Interventions | P |
|----------|--------------------------|-------------------------|---|
| n = 88   | n = 88                   |                         |   |
| 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 unsecure 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) |

* Data are in numbers (%).

b *P < 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 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 | 3 (9)           | 9 (26)                | .11     |
| Female sterilization                                                                         |                 |                       |         |
| 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)                                                                 |                 |                       | 1.00    |
| Nonreactive                                                                                   | 27/27 (100)     | 28/28 (100)           |         |

aData are in numbers (%).

bP < 0.05.
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  |
|------------------------------------------------|----------|-----------|----|
| Age, years, median (IQR)                       | 39 (30-49) | 38 (33-47) | .95 |
| Male sex                                       | 27 (51)  | 22 (63)   | .27 |
| Marital status                                 |          |           |    |
| Living with domestic partner                   | 25 (47)  | 21 (60)   | .47 |
| Marriage                                       | 25 (47)  | 13 (37)   |    |
| Living separately from partner                 | 3 (6)    | 1 (3)     |    |
| Highest education                              |          |           |    |
| Primary school                                 | 13 (25)  | 11 (31)   | .51 |
| 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 |
Table 6. (continued)

| Variables                                                                                           | One Time | Two Times | P  |
|-----------------------------------------------------------------------------------------------------|----------|-----------|----|
| 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, 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                                        |          |           |    |
| Before the first sexual intercourse                                                                | 29 (55)  | 28 (80)   | .10|
| 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                                               |          |           |    |
| No more relationship                                                                            | 1 (2)    | 1 (3)     | .88|
| 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)   | .44|
| If you are HIV infected, would you tell your sexual partner?                                       |          |           |    |
| 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       |          |           |    |
| HIV-infected partner                                                                               | 2 (4)    | 1 (3)     | .93|
| 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?                                                 |          |           |    |
| No need                                                                                            | 1 (2)    | 0 (0)     | .70|
| 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?            |          |           |    |
| Not at all                                                                                        | 1 (2)    | 0 (0)     | .70|
| 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?                                                       |          |           |    |
| Yes                                                                                                | 48 (91)  | 33 (94)   | .34|
| 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|
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. 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, a single and multiple sessions on risk reduction and counseling that increased condom use, 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.

According to the information–motivation–behavioral skills model of HIV preventive behavior, 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

| Table 6. (continued) |
|----------------------|

| Variables |
|-----------|
| Would you use PrEP if it costs US$30/month? |
| 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 |
| Yes | 51 (96) | 35 (100) |
| No | 2 (4) | 0 (0) |
| Reasons that may make you worry about use PrEP |
| Compliance | 20 (38) | 16 (46) |
| Side effect | 31 (59) | 22 (63) |
| Efficacy less than 100% | 12 (23) | 11 (31) |
| Cost | 19 (36) | 9 (26) |
| If you decide to use PrEP, how would you use condom? |
| More | 19 (36) | 8 (23) |
| The same | 34 (64) | 27 (77) |
| If you decide to use PrEP, what number of sexual partner would be? |
| 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 |
| 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? |
| 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 |
| 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? |
| 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 your infected partner anytime when living together? |
| Yes | 16 (30) | 9 (26) |
| No | 34 (64) | 25 (71) |
| Uncertain | 3 (6) | 1 (3) |

Abbreviation: IQR, interquartile range.

*Data are in numbers (%) unless indicated otherwise.

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

*P < 0.05.
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. 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.

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