Published in final edited form as:
Southeast Asian J Trop Med Public Health. 2014 November ; 45(6): 1425–1436.

ASSOCIATION BETWEEN HIV KNOWLEDGE AND RISK BEHAVIOR IN PERSONS WHO INJECT DRUGS IN THAI NGUYEN, VIETNAM

Travis W. Lim[1], **Wendy W. Davis**[2], **Vu Minh Quan**[2], **Constantine Frangakis**[3], **Tran Viet Ha**[4], **Nguyen Le Minh**[5], **Carl Latkin**[6], **Carla Zelaya**[2], **Tran Thi Mo**[4], and **Vivian F. Go**[1,2,7]

[1]Department of International Health, Johns Hopkins University Bloomberg, School of Public Health, Baltimore, MD

[2]Department of Epidemiology, Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD

[3]Department of Biostatistics, Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD

[4]Johns Hopkins University Bloomberg School of Public Health, Hanoi, Vietnam

[5]Center for Preventive Medicine, Thai Nguyen, Vietnam

[6]Department of Health, Behavior and Society, Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD

[7]Department of Health Behavior, University of North Carolina, Gillings School of Global Public Health, Chapel Hill, NC

Abstract

In Vietnam, HIV infection is concentrated in key populations including persons who inject drugs (PWID). The majority of PWID can name specific transmission routes of HIV, yet risk behaviors remain high. We conducted a cross-sectional survey of 1355 PWID in Thai Nguyen Province, Vietnam, to and compare their HIV knowledge with their self-reported risk behavior. Broader knowledge of HIV transmission, measured by a higher composite HIV knowledge score, was associated with a 19.5% lower adjusted odds of giving a used needle to another (p=0.011), and 20.4% lower adjusted odds of using a needle that another had used (p=0.001). A higher knowledge score was associated with 13.1% higher adjusted odds of consistent condom use (p=0.083). These results suggest a broader knowledge may reflect characteristics about how individuals obtain knowledge or the way that knowledge is delivered to them, and may be associated with their ability to engage in risk reduction behavior.

Correspondence: Vivian F. Go, University of North Carolina, Gillings School of Global Public Health, Department of Health Behavior, 361 Rosenau Hall, Campus Box 7440, Chapel Hill, NC 27599-7440 USA, Tel: 919-966-3908, vgo@unc.edu.

Keywords

HIV; HIV knowledge; persons who inject drugs; injection drug users; risk behavior; needle sharing; Vietnam

INTRODUCTION

In Vietnam, the HIV epidemic is concentrated among persons who inject drugs (PWID), with more than 70% of all current cases of HIV attributed to injection drug use (Vietnam Administration of HIV/AIDS Control, 2010). The prevalence of HIV among PWID in Vietnam is 13.4%, and several provinces have rates above 45% (UNAIDS and National Committee for AIDS Drugs and Prostitution Prevention and Control, 2012). Self-reported rates of risk are also high, with between 15 and 37% of PWID reporting sharing needles during the previous month, and nearly 50% reporting no condom use at last sexual intercourse (UNAIDS and National Committee for AIDS Drugs and Prostitution Prevention and Control, 2012). However, a recent study found more than 80% of PWID have a good knowledge about the transmission and prevention of HIV (Vian *et al*, 2012).

Among PWID, knowledge does not always appear to be predictive of risk reduction behavior. In their 2010 review of cognitive behavioral theories of risk behavior, Wagner *et al* (2010) concluded while associations between greater knowledge and lower risk have been observed, frequently an inverse association between knowledge and risk does not appear to exist. However, a study of PWID in China found a greater “awareness” of HIV transmission mechanisms was associated with a lower HIV infection rate (Jia *et al*, 2008) and a greater knowledge of HIV transmission modes was associated with greater condom use (Zhao *et al*, 2006). In a study among Most at Risk Populations (MARPs) in Vietnam, Vian *et al* (2012) found a small association between knowledge and needle sharing did not hold up on multivariable logistic regression analysis.

In this study, we examined HIV transmission knowledge among PWID in Thai Nguyen Province, Vietnam, to identify factors associated with greater HIV knowledge and investigate associations between HIV risk behavior and both specific and general HIV transmission knowledge.

MATERIALS AND METHODS

We used cross-sectional baseline survey data from a prospective cohort study of a peer-network intervention for PWID living in Thai Nguyen Province, northern Vietnam. Details of this trial are described elsewhere (Quan *et al*, 2011). A total of 1434 PWID living in different sub-districts of Thai Nguyen Province were recruited for the study conducted between August 2005 and September 2007. The subject pool included both index recruits from known PWID gathering areas, as well as network recruits from peer-referral within PWID peer networks. To be included in this study, respondents had to be current injectors (injecting drugs at least once during the past three months), aged 18–49 years, and able to give informed consent to participate. Subjects were excluded if they were unwilling to provide locator information, or if they were enrolled in another study or intervention related to PWID or HIV. A remuneration of 50,000 Vietnamese Dong ($2.50 USD) was paid to each person who participated.

The cross-sectional survey, including demographic, behavioral and knowledge variables, was administered to consenting participants by trained interviewers in private interview rooms at the Center for Preventative Medicine in Thai Nguyen. HIV-specific knowledge was assessed using a panel of eleven true-false questions about HIV transmission (Table 2). Similar question panels have been used in studies both internationally and domestically (Lindan *et al*, 1991; Maswanya *et al*, 1999; Parker and Ruutel, 2010; Phillips, 1993; Todd *et al*, 2007). This study was approved by the Thai Nguyen Center for Preventative Medicine and the Johns Hopkins Bloomberg School of Public Health ethics boards.

Data Analysis

P-values for differences in the mean HIV knowledge score were calculated both for the overall sample and also using bootstrapped samples to account for within-network correlations between index and network participants.

We examined the risk behavior implications of a greater HIV knowledge score using multivariate regression models. First, we looked at risky injecting behavior, both as giving or taking a used needle for re-use. Secondly, we asked whether HIV knowledge was associated with sexual risk behavior among unmarried PWID, as a function of HIV knowledge and covariates.

Our first outcome of interest was recent needle sharing behavior among those who reported ever sharing a needle during their lifetime, as a function of HIV knowledge. To reduce recall errors, we focused on needle sharing behavior during the previous three months preceding the interview. The null hypothesis was that having a good knowledge about HIV transmission was not associated with self-reported recent needle sharing. Our alternative hypothesis was that having a good knowledge about HIV transmission was associated with reduced needle sharing in this population.

To test these hypotheses, we examined the outcome of either sharing a needle recently vs. not sharing a needle recently as a function of HIV knowledge and covariates. Two logistic regression models were used: one for the log odds of giving a used needle for re-use, and the other for taking a used needle for personal use. We used the following logistic regression model:

$$\begin{aligned}\mathrm{Log}[\mathrm{Pr}(\mathrm{Y}=1)/[1-\mathrm{Pr}(\mathrm{Y}=1)]]=&\beta_0+\beta_1\mathrm{Age}+\beta_2\mathrm{Male}+\beta_3\mathrm{School}\\&+\beta_4\mathrm{HIV}+\beta_5\mathrm{Knowledge}+\beta_6\mathrm{Group}+\beta_7\mathrm{Injectfreq}\\&+\beta_8\mathrm{Treatment}\end{aligned} \quad \text{(Equation 1)}$$

In Equation 1: (Y = 1) is an indicator variable of any needle sharing behavior in the previous 3 months; “Age” is a continuous variable for age; “Male” is an indicator variable for male sex; “School’’ represents dummy variables for having some high school education, high school, or a college or higher education compared to having no education; “HIV” is an indicator variable for laboratory-confirmed HIV seropositivity; “Knowledge” is a continuous

HIV knowledge score; "Group" is a continuous variable for size of peer injection group; "Injectfreq" is a dichotomous variable for daily vs. less than daily injection; and "Treatment" is a dichotomous variable for ever having been in a treatment program.

The odds ratios for these logistic models were also checked against the direct estimates of the prevalence ratio using a Poisson model with robust standard errors, as suggested previously (Barros and Hirakata, 2003). As expected, the odds ratios overestimated the prevalence ratios, but the direction and statistical significance were the same. Finally, we used generalized estimating equations to check for non-independence of observations within peer networks, as defined by our recruiting process (an index PWID recruiting "network" peer PWID).

To evaluate the association between HIV knowledge and sexual risk behavior, we modeled the log odds of consistent condom use as a function of HIV knowledge score, controlling for demographic and sexual risk covariates. Sexual risk behavior was defined as self-reported consistent (100%) condom use with all sex partners during the previous 12 months vs. less than consistent condom use. The null hypothesis was the HIV knowledge score was not associated with condom use, while the alternative hypothesis was that greater HIV knowledge was associated with increased odds of consistent condom use. We restricted the analysis to unmarried PWID because consistent condom use among married couples is lower given factors such as trust and intentional pregnancy. The final model is shown in Equation 2:

$$\mathrm{Log}[\mathrm{Pr}(\mathrm{C}=1)/[1-\mathrm{Pr}(\mathrm{C}=1)]]=\beta 0+\beta 1\mathrm{Age}+\beta 3\mathrm{School}+\beta 4\mathrm{HIV}+\beta 5\mathrm{Knowledge}+\beta 6\mathrm{Sex\ \ Worker}+\beta 7\mathrm{NumPartners} \quad \text{(Equation 2)}$$

In Equation 2: (C=1) is consistent condom use during the previous 12 months; "Sex worker" is having sex with a sex worker during the previous 12 months; and "NumPartners" is the number of different sex partners during the previous 12 months. The other covariates are the same as for Equation 1.

For both models, we pooled HIV knowledge questions into a continuously scaled variable based on the number of correctly answered knowledge questions. To confirm whether the individual questions might be combined to form a scale measuring the construct "knowledge," we looked at inter-item correlations. The Cronbach's alpha coefficient was 0.59, which is a fair to good inter-item correlation score (Helmstater, 1964). We also confirmed the log-odds of the probability of having the outcome was the approximate monotone of the knowledge score, by fitting a logit-corrected lowess curve (data not shown).

All data were analyzed using STATA 10 statistical analysis software (StataCorp, 2007).

RESULTS

Of the 1434 screened subjects, 1402 reported active injection drug use during the previous 3 months, and 1355 met criteria for age and response quality. 42.73% (95% CI: 40.09 - 45.37) of PWID reported having ever shared needles (given or taken a used needle for re-use) during their lifetime. Among PWID who had ever given a used needle to another for re-use, 68.9% (95% CI: 64.4 - 73.5) had done so in the previous 3 months. Among PWID who had ever taken a used needle from another for re-use, 55.5% (95% CI: 50.6 - 60.5) had done so recently. Among unmarried PWID, 60.3% (95% CI: 56.2 - 64.3) did not use condoms consistently during the previous 12 months with at least one partner.

The transmission knowledge question with the least number of correct responses was, "Can a person get HIV from a bite by an HIV infected person?" 43.78% correctly answered no. The question with the most correct responses was, "Can HIV be transmitted by sharing needles or injection equipment with an infected person?" 98.75% of respondents correctly answered yes. The question, "Can HIV be transmitted by having sex (anal, vaginal) with an infected person?" was correctly answered by 96.31% of participants.

The mean score on the HIV transmission knowledge panel was 8.97 out of 11 (95% CI: 8.87 - 9.06; SD=1.73), corresponding to 82% correct, on average. Responses followed an approximately normal distribution missing its right tail at the maximum score cutoff (data not shown). Table 1 shows HIV transmission knowledge based on the 11-question true/false panel, by selected participant characteristics, including education, demographic factors and needle-sharing risk behavior.

Age was significantly associated with a greater knowledge score, with younger respondents scoring higher on average than older respondents. Greater levels of schooling were associated with higher HIV transmission knowledge scores; those with a primary education or no schooling had an average score of 8.09 (95% CI: 7.75 - 8.43) while those with at least some college or vocational school had an average score of 9.30 (95% CI: 9.10 - 9.51). Respondents who had ever been in a treatment program had an average score of 9.12 (95% CI: 8.97 - 9.27) and those who had never been in treatment had a score of 8.88 (95% CI: 8.77 - 9.00). Among PWID who have ever given used needles to others, those who did so recently (in the previous 3 months) had an average knowledge score of 8.86 (95% CI: 8.64 - 9.07), compared to a score of 9.34 (95% CI: 9.08 - 9.61) among those who have not done so in the previous 3 months. Among PWID who have ever taken used needles from another to re-use, those who did so during the previous 3 months had an average score of 8.67 (95% CI: 8.42 - 8.92), compared to a score of 9.29 (95% CI: 9.06 - 8.51) among those who had not done so in the previous 3 months. This shows an unadjusted association between HIV knowledge and recent needle sharing behavior.

Table 3 shows adjusted multivariate odds ratios (exponentiated coefficients) of any recent risky injecting behavior as a function of HIV transmission knowledge score, controlling for other covariates. For each additional correctly answered question about HIV transmission, the odds of giving a used needle to others decreased by 19.5% (p=0.011) and of accepting a used needle decreased by 20.4% (p<0.001). To account for the correlation of observations within peer injection networks, as defined in our study recruitment scheme, we used generalized estimated equations (GEE) (Liang and Zeger, 1986) with bootstrapped standard errors, and found similar values for the direction, magnitude and statistical significance of coefficients of our logistic model covariates (data not shown). Our HIV knowledge scale was robust for simple sensitivity analysis, in which removing individual questions from the scale did not appreciably affect the magnitude or statistical significance of the coefficients of the other covariates in the model (data not shown).

We controlled for injection group size as a possible confounder because additional injecting peers may be conveying HIV information and encouraging, or discouraging, needle sharing and found each additional group peer increased the odds of recently giving a used needle to others by 23.0% (p<0.001) and increased the probability of recently accepting a used needle by 8.00% (p=0.005). In our model, PWID daily had 3.68 fold greater odds of recently giving a used needle to others (p<0.001) and 3.02 fold greater odds of recently accepting a used needle (p<0.001) compared to those who injected less than daily. Both perceived risk of HIV infection and having had a previous HIV test were not significantly associated with needle sharing, nor did they mediate the effect of knowledge on needle sharing; therefore, they were excluded from the model (data not shown).

Table 4 shows the adjusted multivariate odds ratios (exponentiated coefficients) of consistent condom use for each predictor. A higher HIV knowledge score was associated with 13.1% higher odds of consistent condom use (p=0.083). HIV positive PWID had 1.50-fold higher odds of consistent condom use in the previous twelve months (p=0.072). PWID who had sex with a commercial sex worker reported 2.71-fold higher odds of consistent condom use (p<0.001) during the previous 12 months. The number of sex partners, age, and schooling were not associated with consistent condom use.

DISCUSSION

In Vietnam, mass communication campaigns and peer education networks for PWID have highlighted HIV risks associated with needle sharing and unprotected sex. The literature on health education interventions for PWID has yielded mixed results, with some studies suggesting a reduction in risk behaviour (Martin *et al*, 1990), but others finding little effect (Calsyn *et al*, 1992). Similar to other studies in Ho Chi Minh City (Hien *et al*, 2001) and Estonia (Wilson *et al*, 2007), participants in our study demonstrated a high level of knowledge about the specific HIV transmission risk of sharing needles (98.7%) and unprotected sexual intercourse (96%) while reporting relatively high rates of sharing needles and having unprotected sex.

While knowledge of specific HIV transmission risks did not necessarily translate to lower HIV risk behavior, our results suggest a broader, more holistic HIV knowledge is associated with lower HIV risk behavior. Specifically, in our study, a higher overall HIV knowledge score was associated with lower odds of having shared needles during the previous 3 months with lower odds of consistent condom use among unmarried PWID. Multivariable adjustment revealed the association between holistic knowledge and needle sharing is independent of HIV testing, drug treatment programs, general education level or personal risk perception.

There are several possible explanations for this finding. Holistic HIV knowledge may provide PWID with a more nuanced comprehension about HIV transmission and better understanding of how their risk behavior fits within the broader context of the epidemic. An alternative explanation may be that greater holistic knowledge is a reflection of other individual characteristics associated with lower risk behaviors. For example, individuals who can grasp both a broader and deeper awareness of HIV transmission may also have greater motivation or a better attitude toward HIV prevention behavior (Bazargan *et al*, 2000). Finally, those who have a greater holistic knowledge may have received more-in-depth HIV programs conveyed over the course of multiple sessions, which increases the level of engagement with PWID.

The marginal statistical significance of the association between knowledge score and sexual behavior in our study confirms extensive literature showing that sexual behavior may be more difficult to change than injecting risk behavior among PWID (Peters *et al*, 1998; van den Hoek *et al*, 1990; Yao *et al*, 2009; Zhao *et al*, 2006) and suggests HIV communication campaigns may need to be supplemented with additional, more intensive intervention approaches, including peer network programs to increase consistent condom use (Go *et al*, 2013).

Limitations

Our unit of knowledge measurement, the question item, represents an abstract quantity of knowledge. In our model, an increase in one unit of knowledge was associated with an approximately 20% lower odds of needle re-use, but it is not well defined what quantity of health education corresponds to a one unit increase in knowledge. The true/false questions have been used in other studies of HIV knowledge (Lindan *et al*, 1991; Maswanya *et al*, 1999; Parker and Ruutel, 2010; Phillips, 1993; Todd *et al*, 2007), but a more in-depth questionnaire with detailed questions might be more sensitive in quantifying HIV knowledge. Since the distribution of respondent knowledge scores was cut off at the maximum score of 11, scores may be artificially similar (clustered around 11) than the true level of knowledge in this population, which means the magnitude of the effect of HIV transmission knowledge may be underestimated in our model. It may be that respondents with a greater knowledge of HIV were also more inclined to appease investigators and be more likely to underreport risk behavior. Finally, since this is cross-sectional data, we cannot be certain that HIV knowledge preceded changes to risky behavior, although we attempted to mitigate this by restricting needle sharing to the previous three months, as has been done in other cross-sectional studies (Metsch *et al*, 2007). With this design, the subjects' total knowledge about HIV, harm reduction and risk behavior was assumed to accumulate over their life largely prior to the previous three months.

Our study confirms broader health literature showing direct health knowledge does not necessarily translate into changes in corresponding risk behavior (Gordon-Larsen, 2001; Jones *et al*, 1992). However, our findings suggest understanding HIV more broadly may be associated with lower HIV risk behavior. Further research that can account for individual characteristics, social environment and past exposure to HIV prevention programs is needed to understand the mechanisms through which more comprehensive HIV knowledge may reduce HIV risk behavior. However, our findings suggest that a more comprehensive prevention strategy that includes multiple approaches and messages and supplements short, repetitive messages often delivered through mass communication may be a more effective approach to reducing HIV risk behaviors. Previous studies have shown the use of peer or network-oriented programs may have greater resonance and provide more powerful motivations to engage in risk reduction behavior (Medley *et al*, 2009) than messages delivered through mass communication, (Bertrand *et al*, 2006).

Acknowledgments

We thank Teerada Sripaipan, Chu Viet Anh, Nguyen Tuyet Mai, Le Thuc Anh and Tran Thi Mo for their assistance in the collection, entry and cleaning of data during the study.

This paper, including the salaries for the faculty, was supported by the National Institute on Drug Abuse (NIDA) grant R01 DA022962-01. Co-authors not affiliated with Johns Hopkins were not compensated.

REFERENCES

Barros AJ, Hirakata VN. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. BMC Med Res Methodol. 2003; 3:21. [PubMed: 14567763]

Bazargan M, Kelly EM, Stein JA, Husaini BA, Bazargan SH. Correlates of HIV risk-taking behaviors among African-American college students: the effect of HIV knowledge, motivation, and behavioral skills. J Natl Med Assoc. 2000; 92:391–404. [PubMed: 10992684]

Bertrand JT, O'Reilly K, Denison J, Anhang R, Sweat M. Systematic review of the effectiveness of mass communication programs to change HIV/AIDS-related behaviors in developing countries. Health Educ Res. 2006; 21:567–597. [PubMed: 16847044]

Calsyn DA, Saxon AJ, Freeman G Jr, Whittaker S. Ineffectiveness of AIDS education and HIV antibody testing in reducing high-risk behaviors among injection drug users. Am J Public Health. 1992; 82:573–575. [PubMed: 1546776]

Go VF, Frangakis C, Le Minh N, et al. Effects of an HIV peer prevention intervention on sexual and injecting risk behaviors among injecting drug users and their risk partners in Thai Nguyen, Vietnam: a randomized controlled trial. Soc Sci Med. 2013; 96:154–164. [PubMed: 24034963]

Gordon-Larsen P. Obesity-Related Knowledge, Attitudes, and Behaviors in Obese and Non-obese Urban Philadelphia Female Adolescents. Obesity Research. 2001; 9:112–118. [PubMed: 11316345]

Helmstater, G. Principles of psychological measurement. New York: Appleton-Century-Crofts; 1964.

Hien NT, Giang LT, Binh PN, Deville W, van Ameijden EJ, Wolffers I. Risk factors of HIV infection and needle sharing among injecting drug users in Ho Chi Minh City, Vietnam. J Subst Abuse. 2001; 13:45–58. [PubMed: 11547623]

Jia Y, Lu F, Zeng G, et al. Predictors of HIV infection and prevalence for syphilis infection among injection drug users in China: community-based surveys along major drug trafficking routes. Harm Reduct J. 2008; 5:29. [PubMed: 18724872]

Jones DH, Harel Y, Levinson RM. Living Arrangements, Knowledge of Health Risks, and Stress as Determinants of Health-Risk Behavior Among College Students. Journal of American College Health. 1992; 41:43–48. [PubMed: 1460172]

Liang K-Y, Zeger SL. Longitudinal data analysis using generalized linear models. Biometrika. 1986; 73:13–22.

Lindan C, Allen S, Carael M, et al. Knowledge, attitudes, and perceived risk of AIDS among urban Rwandan women: relationship to HIV infection and behavior change. AIDS. 1991; 5:993–1002. [PubMed: 1777178]

Martin GS, Serpelloni G, Galvan U, et al. Behavioural change in injecting drug users: evaluation of an HIV/AIDS education programme. AIDS Care. 1990; 2:275–279. [PubMed: 2088523]

Maswanya ES, Moji K, Horiguchi I, et al. Knowledge, risk perception of AIDS and reported sexual behaviour among students in secondary schools and colleges in Tanzania. Health Educ Res. 1999; 14:185–196. [PubMed: 10387499]

Medley A, Kennedy C, O'Reilly K, Sweat M. Effectiveness of peer education interventions for HIV prevention in developing countries: a systematic review and meta-analysis. AIDS Educ Prev. 2009; 21:181–206. [PubMed: 19519235]

Metsch LR, Pereyra M, Purcell DW, et al. Correlates of lending needles/syringes among HIV-seropositive injection drug users. J Acquir Immune Defic Syndr. 2007; 46(Suppl 2):S72–S79. [PubMed: 18089987]

Parker RD, Ruutel K. Associations of high-risk behaviour and HIV status with HIV knowledge among persons in Tallinn, Estonia. Scand J Public Health. 2010; 38:748–755. [PubMed: 20823046]

Peters A, Davies T, Richardson A. Multi-site samples of injecting drug users in Edinburgh: prevalence and correlates of risky injecting practices. Addiction. 1998; 93:253–267. [PubMed: 9624726]

Phillips KA. Subjective knowledge of AIDS and use of HIV testing. Am J Public Health. 1993; 83:1460–1462. [PubMed: 8214240]

Quan VM, Minh NL, Ha TV, et al. Mortality and HIV transmission among male Vietnamese injection drug users. Addiction. 2011; 106:583–589. [PubMed: 21054619]

StataCorp. Stata Statistical Software: Release 10. College Station, TX: StataCorp LP; 2007.

Todd CS, Abed AM, Strathdee SA, et al. Association between expatriation and HIV awareness and knowledge among injecting drug users in Kabul, Afghanistan: A cross-sectional comparison of former refugees to those remaining during conflict. Confl Health. 2007; 1:5. [PubMed: 17411457]

UNAIDS, National Committee for AIDS Drugs and Prostitution Prevention and Control. [Cited 2013 Feb 7] Viet Nam AIDS Response Progress Report. 2012. Reporting period: January 2010–December 2011. Available from: http://www.unaids.org/en/dataanalysis/knowyourresponse/countryprogressreports/2012countries/ce_VN_Narrative_Report.pdf

van den Hoek A, van Haastrecht HJ, Coutinho RA. Heterosexual behaviour of intravenous drug users in Amsterdam: implications for the AIDS epidemic. AIDS. 1990; 4:449–453. [PubMed: 2372379]

Vian T, Semrau K, Hamer DH, Loan le TT, Sabin LL. HIV/AIDS-Related Knowledge and Behaviors Among Most-at-Risk Populations in Vietnam. Open AIDS J. 2012; 6:259–265. [PubMed: 23173025]

Vietnam Administration of HIV/AIDS Control. Report on the current situation of HIV infection in 2009. Hanoi: Vietnam Administration of HIV/AIDS Control; 2010.

Wagner KD, Unger JB, Bluthenthal RN, Andreeva VA, Pentz MA. Cognitive behavioral theories used to explain injection risk behavior among injection drug users: a review and suggestions for the integration of cognitive and environmental models. Health Educ Behav. 2010; 37:504–532. [PubMed: 20705809]

Wilson TE, Sharma A, Zilmer K, Kalikova N, Uuskula A. The HIV prevention needs of injection drug users in Estonia. Int J STD AIDS. 2007; 18:389–391. [PubMed: 17609027]

Yao Y, Wang N, Chu J, et al. Sexual behavior and risks for HIV infection and transmission among male injecting drug users in Yunnan, China. Int J Infect Dis. 2009; 13:154–161. [PubMed: 18778963]

Zhao M, Du J, Lu GH, et al. HIV sexual risk behaviors among injection drug users in Shanghai. Drug Alcohol Depend. 2006; 82(Suppl 1):S43–S47. [PubMed: 16769445]

Table 1

Mean HIV transmission knowledge score by study participant characteristics.

	Mean HIV Knowledge score (sd)	95% CI	p-value (Student's t)	p-value (bootstrap with network cluster)*
Full sample	8.97 (1.73)	8.87–9.06		
HIV Status				
Negative	9.01 (1.72)	8.89–9.12		
Positive	8.89 (1.76)	8.73–9.04	0.208	0.213
Age				
18–29	9.14 (1.56)	8.97–9.31		
30–39	8.95 (1.77)	8.83–9.08		
40–49	8.79 (1.80)	8.58–9.00	0.048 (ANOVA)	0.180
Gender				
Female	8.89 (1.66)	8.22–9.55		
Male	8.97 (1.73)	8.87–9.06	0.810	0.810
Education				
No School/Primary	8.09 (2.10)	7.75–8.43		
Some Secondary	8.84 (1.76)	8.70–8.99		
Secondary	9.26 (1.50)	9.11–9.40		
College or Vocational	9.30 (1.57)	9.10–9.51	<0.001 (ANOVA)	0.001
Income				
Lowest Quartile	8.91 (1.80)	8.73–9.09		
Second Quartile	9.08 (1.57)	8.90–9.26		
Third Quartile	8.92(1.80)	8.74–9.09		
Highest Quartile	8.99 (1.69)	8.79–9.20	0.547	0.553
Treatment Program				
Never	8.88 (1.76)	8.77–9.00		
Ever	9.12 (1.67)	8.97–9.27	0.017	0.010
Number of peers in injecting group				
1–2	9.07 (1.57)	8.93–9.20		
3–4	8.79 (1.87)	8.63–8.96		
5+	9.07 (1.71)	8.88–9.26	0.016 (ANOVA)	0.204
Gave a used needle to others for re–use				
In the past 3 mo.	8.86 (1.82)	8.64–9.07		
Not in the past 3 mo.	9.34 (1.52)	9.08–9.61	0.011	0.006
Took a used needle from another for re–use				
In the past 3 mo.	8.67 (1.90)	8.41–8.92		
Not in the past 3 mo.	9.28 (1.54)	9.06–9.51	0.001	0.001
Frequency of injecting, in past 3 months				

	Mean HIV Knowledge score (sd)	95% CI	p-value (Student's t)	p-value (bootstrap with network cluster)*
Every day	8.95 (1.76)	8.83–9.17		
Less than every day	9.00 (1.64)	8.85–9.06	0.669	0.652
Condom use, past 12 months				
Consistent	8.87 (1.79)	8.67–9.07		
Less than consistent	8.93 (1.72)	8.79–9.06	0.637	0.603

*To calculate p-values that accounted for clustering within injection networks, 100 bootstrap replicates of the sample were drawn, by network cluster. Bootstrapping was used because the correlation structure of the networks was not known.

CI: Confidence Interval

Table 2

List of the true/false questions used to form the HIV transmission knowledge scale.

A person can get HIV from :	
1	A person can get HIV from kissing.
2	A person can get HIV from getting a tattoo or through body piercing.
3	A person can get HIV from a bite by an HIV-infected person.
4	A person can get HIV from shaking hands, hugging an infected person.
5	A person can get HIV from using a toilet or drinking from the same glass as an infected person.
6	A person can get HIV from mosquitoes.
7	HIV can be transmitted by having sex (anal, vaginal) with an infected person.
8	HIV can be transmitted by sharing needles or injection equipment with an infected person.
9	HIV can be transmitted from an infected woman to her baby before or during birth, or through breast-feeding.
10	HIV can be transmitted when a person puts something in his or her mouth (such as food or a beverage) that has been contaminated with the feces of an HIV-infected person.
11	HIV can be prevented through immunization.

Table 3

Multivariate Logistic Regression Estimation of Odds of Any Recent Needle Sharing, as a Function of HIV Knowledge Among Vietnamese PWID Who Have Ever Shared Needles.

	Adjusted odds ratio: gave a used needle for re-use (past 3 months)	Standard error (bootstrap)[b]	p-value	Adjusted odds ratio: taking a used needle for re-use (past 3 months)	Standard error (bootstrap)[b]	p-value
Coefficient	N=399			N=389		
Age	0.985	0.017	0.437	0.994	0.021	0.746
Sex = Male	0.322	1.034	0.320	2.110	1.798	0.428
Education						
None/primary	0.575	0.287	0.219	1.090	0.512	0.828
Some High School	0.952	0.299	0.865	0.898	0.291	0.682
High School	(reference)					
Vocational/college	1.040	0.405	0.912	1.260	0.484	0.485
HIV Knowledge[a]	0.805	0.084	0.011	0.796	0.055	0.001
HIV Infection	0.632	0.153	0.077	0.805	0.173	0.328
Treatment program	0.712	0.179	0.189	0.721	0.190	0.165
Injection Frequency						
Daily (vs. less than daily)	3.680	1.076	<0.001	3.020	0.939	<0.001
Inject group size	1.230	0.069	<0.0001	1.080	0.037	0.027

[a] Continuous score as assessed by panel of True/False questions

[b] To calculate standard errors that accounted for clustering within injection networks, 100 bootstrap replicates of the sample were drawn, by network cluster. Bootstrapping was used because the correlation structure of the networks was not known.

Table 4

Odds Ratios From a Multivariate Logistic Regression Model of Consistent Condom Use in the Previous Twelve Months, as a Function of HIV Knowledge Among Unmarried Vietnamese PWID.

	Adjusted odds ratio of consistent condom use (past 12 months)	Standard error (bootstrap)[b]	p-value	95% CI
Coefficient	N=465			
Age	1.015	0.0205	0.424	0.98–1.05
Education				
High School	(reference)			
None/primary	1.194	0.518	0.673	0.52–2.72
Some High School	1.208	0.336	0.460	0.73–1.99
Vocational/College	1.053	0.301	0.861	0.59–1.87
HIV Knowledge[a]	1.131	0.084	0.083	0.98–1.30
HIV Infection	1.499	0.371	0.072	0.96–2.33
Visited a Sex Worker	2.708	0.707	<0.001	1.73–4.24
Number of partners	0.950	0.052	0.107	0.89–1.01

[a]Continuous score as assessed by panel of True/False questions.

[b]To calculate standard errors that accounted for clustering within injection networks, 100 bootstrap replicates of the sample were drawn by network cluster. Bootstrapping was used because the correlation structure of the networks was not known.

CI: Confidence Interval.