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Abstract

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Keywords

Knowledge; Self-efficacy; Condom use; Intention; Behavioral intervention; Migrant; China

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Abstract

Previous studies have suggested HIV knowledge and self-efficacy are important cognitive factors that might influence condom use behaviors. However, data were limited regarding their mediating effects on condom use during behavioral interventions. This study examined the mechanistic roles of these two factors on the effect of a community-based intervention aiming to increase condom use behaviors and intention among young rural-to-urban migrants in China. Data were derived from a community-based HIV behavioral intervention trial among 639 young sexually active rural-to-urban migrants in Beijing, China. Path analyses were used to examine the direct and indirect effects of the intervention program on condom use behaviors and intention over a 12-month follow-up. HIV knowledge and condom use self-efficacy at 6-month follow-up served as mediators in models. Path analyses revealed that intervention program increased condom use behaviors at 12 months through the increase of HIV knowledge at 6 months. Likewise, the intervention program increased condom use intention through the increases of HIV knowledge and condom use self-efficacy. The results suggested HIV knowledge played an important mediating role on the effect of the intervention program on condom use behaviors and intention. Additionally, condom use self-efficacy played an important role in increasing condom use intention. To increase condom use behaviors and intention among migrants, future studies are warranted that focus on improving HIV knowledge and helping migrants overcome cognitive barriers of condom use. Other efforts targeting structural and environmental barriers, such as limited healthcare access due to household registration status, are also needed to increase HIV protective behaviors.

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Since the implementation of the "open-door" policy in China in the late 1970s and the economic reforms in the middle of the1980s, China has witnessed a significant change in sexual behaviors and attitudes (Gao, Lu, Shi, Sun, & Cai, 2001; Zhang & Beck, 1999). In traditional Chinese society, premarital sex and extramarital sex would be disdained, especially among women. Same-sex behavior or multiple sexual partners would also be denounced by traditional Chinese culture (Zhang & Beck, 1999). However, with the change of sexual behaviors and attitudes, these aforementioned activities (e.g., premarital sex, extramarital sex, same-sex behavior) become more tolerable and prevalent, especially in the urban areas with maximum exposure to this change (Gao et al., 2001; Li et al., 2014; Zhang & Beck, 1999).

The rapid modernization and economic development in China has generated a population of more than 200 million rural-to-urban migrants (China National Bureau of Statistics [CNBS], 2016). Rural-to-urban migrants were defined as the individuals who move from rural areas to

urban centers for economic opportunities and better lives but without obtaining permanent local household registrations, because the existing household registration system in China has made it difficult for them to change from rural to urban residence permanently (Zhang, 2001). Due to the lack of urban household registration, a large number of migrant workers have poor employment conditions (e.g., dirty, difficult, and dangerous), suffer from stigma and discrimination, and cannot obtain the same benefits available to urban residents, including subsidized healthcare access. Thus, their migratory status may put these individuals, especially the younger ones, at risk of poor health outcomes including sexual risk behaviors (Lehrer, Shrier, Gortmaker, & Buka, 2006; Lin et al., 2005).

In addition, there are other factors that may contribute to sexual risk behaviors among rural-to-urban migrants. For example, most of the rural-to-urban migrants have low levels of education and limited knowledge of HIV (Li, Lin et al., 2004; Wu, Wu, Li, & Lu, 2016). At the same time, growing up in rural areas adhering to traditional Chinese values and sexual culture, rural-to-urban migrants are confronting the change of sexual behaviors and attitudes after coming to live and work in urban areas.

With limited healthcare access, less HIV knowledge, and exposure to the sexual culture change in urban areas, rural-to-urban migrants are more prone to engage in sexual risk-taking behaviors and have been identified as a key population in HIV prevention intervention in China (Li et al., 2007; Xu, Wu, & Zhang, 1998). A comparative study in China found that rural-to-urban migrants who had returned from urban areas to their rural homes had higher levels of sexual risk and were more likely to have unprotected sex than non-migratory rural residents (Li et al., 2007). Thus, rural-to-urban migrants have a relatively high HIV/sexually transmitted diseases (STD) prevalence. For instance, migrants account for 94.5% (259/274) of the new HIV/AIDS cases reported in 2004 in Shenzhen, 77.0% (184/239) in Shanghai, and 75.3% (333/442) in Beijing (China National Center for AIDS/STD Control and Prevention, 2005). The issue of sexual risk among migrants becomes even more significant with the changes in the HIV epidemic in China. Currently, the prevalence of HIV infection has grown steadily in China with sexual intercourse being the primary transmission mode of HIV (Xu et al., 2015; Zhang et al., 2017). It is estimated that nearly 90% of new HIV cases in China are infected through sexual transmission (Zhang et al., 2017).

Prior research suggests that high levels of HIV knowledge are necessary, although not sufficient, for reducing sexual risk and preventing HIV transmission (DiMatteo, 1991; Fisher & Fisher, 1992; Sio et al., 2015). Fisher and Fisher (1992) have suggested that AIDS-risk-reduction information (i.e., HIV knowledge), motivation, and behavioral skills were three fundamental determinants for AIDS-risk reduction. Both AIDS-risk-reduction information and motivation can affect AIDS-risk-reduction behavioral change through AIDS-risk-reduction skills (Fisher & Fisher, 1992). Low levels of HIV knowledge are associated with various kinds of risk behaviors, such as unprotected sex, multiple sexual partners, and low rates of HIV testing (Kong, 2008; Sio et al., 2015; Wu et al., 2016). Wu and colleagues found that migrant men who have sex with men (MSM) who had lower levels of HIV knowledge than local MSM reported higher rates of unprotected anal intercourse and having multiple homosexual partners (Wu et al., 2016). A previous study found that Chinese female entertainment workers, many of whom were also migrants, with lower levels of HIV knowledge reported higher rates of inconsistent condom use (Sio et al., 2015). HIV knowledge may be an especially enabling factor that can promote protected sex and other HIV preventive behaviors among rural-to-urban migrants given their low education and lack of knowledge regarding the HIV transmission and prevention.

Besides HIV knowledge, existing studies have suggested other cognitive factors associated with condom use behaviors. For instance, based on the Information-Motivation-Behavioral Skills model, Fisher and colleagues found that improving condom use motivation and skills could significantly increase condom use behaviors among college students (Fisher, Fisher, Misovich, Kimble, & Malloy, 1996). DiClemente and colleagues found that safer sex communication was positively associated with consistent condom use among African American adolescent girls (DiClemente et al., 2004). Previous research has also suggested that among cognitive factors that may affect condom use behaviors, self-efficacy may be one of the most important factors that can intervene to reduce HIV risk among rural-to-urban migrants (Strecher, McEvoy DeVellis, Becker, & Rosenstock, 1986; Guerra-Ordonez et al., 2017).

Self-efficacy, an individual's confidence in performing a specific behavior, is correlated with sexual behaviors in high-risk populations (Guerra-Ordoñez et al., 2017). Migrants with high condom use self-efficacy may be willing to initiate condom use behaviors, spend efforts on condom use, and use condoms consistently in the face of resistance from partners (Wulfert & Wan, 1993). A previous study has also suggested that migrant female sex workers with higher levels of condom use self-efficacy were more likely to use condoms than those with lower self-efficacy (Ye et al., 2012). Another study conducted among 307 migrant MSM in Beijing, China, found that condom use self-efficacy was positively associated with sexual communication, which in turn was associated with increased condom use in the three most recent sexual episodes (Xiao et al., 2013).

To improve condom use among rural-to-urban migrants, our research team designed and conducted a social cognitive theory-based HIV behavioral prevention program among young rural-to-urban migrants in China (Li et al., 2014). The intervention was evaluated through a cluster randomized controlled trial with 6-month and 12-month follow-ups. We found that condom use behaviors (frequency of condom use, last three-time condom use, and proper condom use) with regular partners increased over time, and this increase was significantly greater among the intervention group than the control group at 6-month and 12-month follow-ups (Li et al., 2014). In addition, at the 6-month follow-up, the intervention group was significantly higher than the control group on HIV knowledge and condom use intention (Li et al., 2014). The increases in knowledge and intention in the intervention group were sustained through 12-month follow-up. Although no significant difference was found on condom use self-efficacy between intervention and control groups, condom use self-efficacy increased over time in these two groups (Li et al., 2014).

As the theory-based behavioral HIV intervention program proved to be overall efficacious in improving the condom use behaviors and condom use intention among rural-to-urban migrants, the current study aimed to further investigate the mechanism of such program effects by examining the mediating roles of HIV knowledge and self-efficacy on condom use. We hypothesized that a theory-based HIV prevention behavioral program could indirectly increase condom use behaviors and intention through the increase of HIV knowledge and self-efficacy on condom use.

Methods

Data Source and Study Sample

The data in this study were derived from a community-based HIV behavioral intervention trial in Beijing, the capital of China, from 2011-2012 (Li et al., 2014). The behavioral intervention program aimed at increasing condom use and reducing HIV risk among young rural-to-urban migrants.

The sampling and recruitment procedure have been described in detail elsewhere (Li et al., 2014). Briefly, a venue-based recruitment procedure was adapted, and young rural-to-urban migrants were recruited from their workplaces (e.g., shop, club, factory), migrant settlements, streets, and job markets. The inclusion criteria for the intervention trial were: a) ≤30 years of age (i.e., young migrants); b) migrants without a permanent Beijing household registration; c) having been in Beijing for at least 3 months; d) being unmarried or if married, not living with their spouse in Beijing; and e) being sexually active (e.g., had one or more sexual partners in Beijing). Exclusion criteria included unwillingness to provide informed written consent or unwillingness to be randomized to either the intervention or control condition. Based on the findings of the initial program evaluation (Li et al., 2014), the current study only focused on the behaviors and intention of condom use with regular partners. Therefore, two participants in the initial program evaluation were excluded from the current study because they did not report having a regular sexual partner, resulting in a sample of 639 young migrants in the current analysis.

Hypothesized Model

The intervention curriculum was guided by Protection Motivation Theory (PMT), a social cognitive theory of behavioral change (Rogers, Cacioppo, & Petty, 1983). The PMT emphasizes that relevant social, cultural, cognitive, psychological variables are related to behavior and behavioral change, and envisions that environmental and personal factors are combined to pose a potential response to a health threat (Rogers, Cacioppo, & Petty, 1983). Based on PMT, we hypothesized that the intervention could significantly improve 12-month condom use behaviors and intention with regular partners among young rural-to-urban migrants through both HIV knowledge and condom use self-efficacy at 6-month. The hypothesized model is shown in Figure 1.

Data Collection

The baseline and follow-up data collection were administered one-on-one or to small migrant groups in private settings in the community-based venues where migrants were recruited. Interviewers began with a description of the purpose of the study, reassurance of confidentiality, and a brief instruction on how to complete the paper-and-pencil questionnaire. The interviewers provided assistance during the survey when necessary. Upon completion, all participants received an educational package containing free condoms, brochures on HIV/STD knowledge and prevention, and contact information of local HIV/STD clinics, counseling centers, and hotlines. The participants also received a small gift equivalent to 2 U.S. dollars as a token of appreciation for their participation in each data collection. The study protocol was

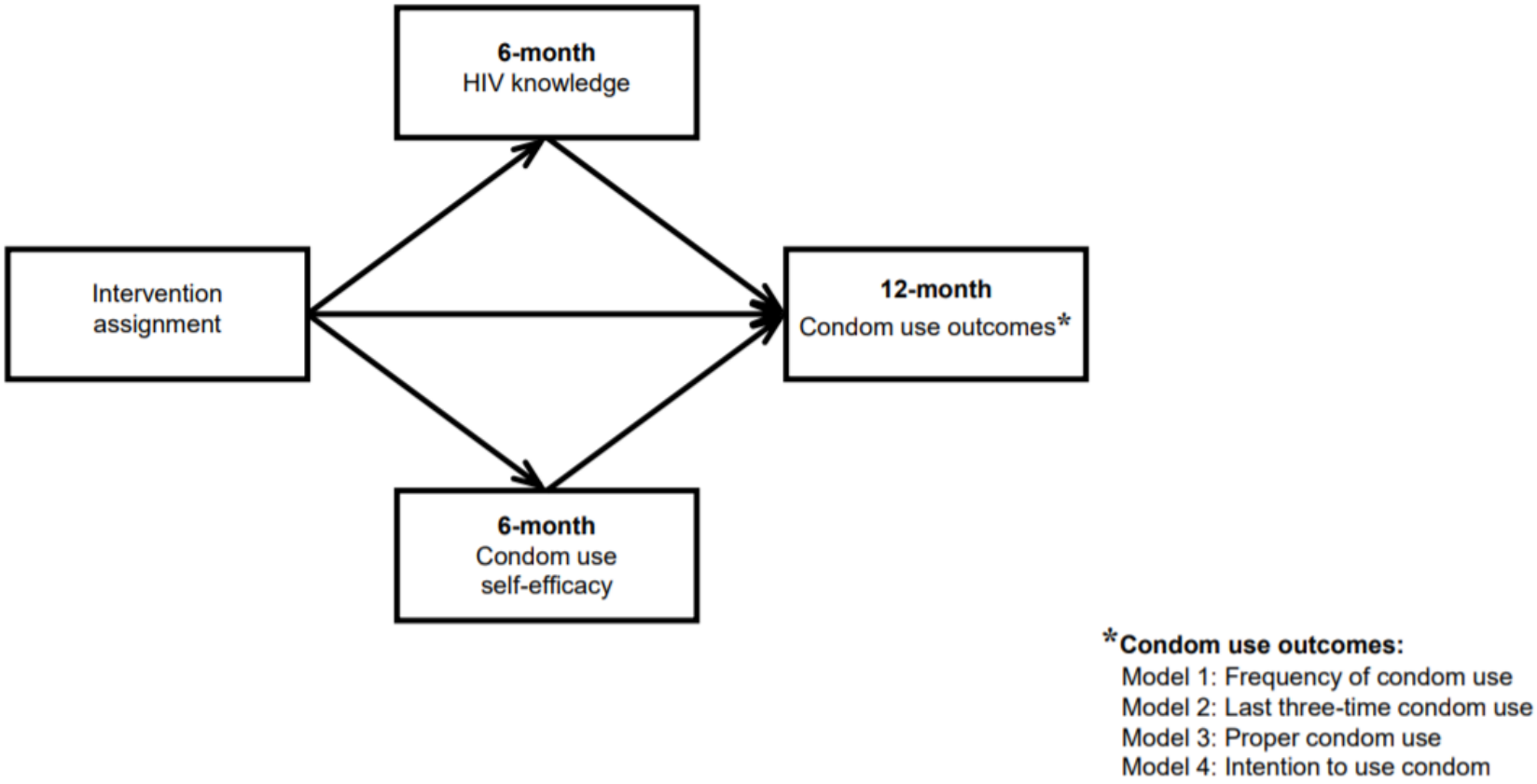

Figure 1. Hypothesized model.

approved by the Institutional Review Boards at both Wayne State University in the United States and Beijing Normal University in China.

Measures

Socio-demographic characteristics. Participants provided socio-demographic characteristics including age, gender (1=Male, 0=Female), ethnicity (1=Han, 0=non-Han), marital status (1=Unmarried, 2=Unmarried but living together, 3=Married, 4=Divorced, widowed or separated), years of being migrant workers in Beijing, years of education, monthly income, and frequency of home visit.

Condom use. The participants were assessed on their condom use behaviors and intention with their partners with whom the migrants frequently had sex or maintained a sexual relationship for at least six months ("regular partners"). Due to the methodological challenges of measuring condom use (Zhou et al., 2012), three measures were used to assess the condom use in this trial. The first was the overall frequency of condom use during sexual intercourse (i.e., never, occasionally, sometimes, most of the time, always). The second was the number of times (0 to 3) using a condom during the most recent three sex episodes. The third was the frequency (never, occasionally, sometimes, most of the time, always) of proper use of condoms (i.e., putting on a condom prior to intercourse). Condom use intention was measured using one item "Will you use condoms with your regular partners in the future?" (no, occasionally, sometimes, often, and every time).

HIV knowledge. HIV knowledge was assessed using 20 items which included general knowledge of HIV/AIDS (e.g., "everyone can get HIV"), symptoms or clinical outcomes of HIV/AIDS (e.g., "HIV reduces body immune system against other diseases"), transmission modes (e.g., "share needles for intravenous drug use with some HIV infected drug users"), and preventive measures (e.g., "using a condom during sex can reduce the chance of getting HIV") (Li, Fang et al., 2004; Li et al., 2014). All of these items have a dichotomous response option ("True=1" or "False=0"). With appropriate recording, the sum score was used as a composite score ranging from 0 to 20, with a higher score indicating a higher level of HIV knowledge. Similar items have been used with different populations in China and confirmed with adequate reliability and validity (Li et al., 2008; Li, Zhang, Mao, Zhao, & Stanton, 2011). The internal consistency estimate (Cronbach's alpha) for the 20 items was 0.66 at baseline.

Condom use self-efficacy. Nine items were employed to assess participants' belief about their own ability to use condoms (Li et al., 2008; Li et al., 2011). The sample items included, "I will refuse to have sex if my partner does not want to use a condom," and, "I know how to use condoms." Items were scored from 1 (strongly disagree) to 4 (strongly agree). The total score of the scale ranged from 9 to 36 with a higher score indicating a greater level of self-efficacy to use condoms. Internal consistency estimate of reliability (Cronbach's alpha) of the scale was 0.91 at baseline.

Statistical analysis. First, descriptive statistics were reported on socio-demographic characteristics and outcome measures that were used in the current analysis (e.g., frequency of

condom use, last three-time condom use, proper condom use, intention to use condoms, HIV knowledge, and condom use self-efficacy).

Second, baseline comparisons were conducted to examine whether there were any significant differences in sociodemographic characteristics among intervention and control groups. Two samples *t*-tests were used to examine the differences between continuous variables and group assignment, *Chi-square* test and *Fisher* exact test were used for categorical variables.

Then, as outcome measures (i.e., condom use behaviors and intention) in this study were ordinal variables, spearman correlation analyses were used to examine the relationships among HIV knowledge, condom use self-efficacy, condom use, and intention to use condoms. Four path models corresponding to different condom use measures were used to examine our hypotheses (Model 1: frequency of condom use; Model 2: last three-time condom use; Model 3: proper condom use; Model 4: intention to use condoms). The baseline measures of outcome variables (condom use, intention to use condoms, HIV knowledge, and condom use self-efficacy) and socio-demographic characteristics (i.e., age, gender, frequency of home visit) that differed by intervention assignment ($p<0.05$) were included as covariates in the path models. The missing values in the predictors were handled by using full information maximum likelihood (FIML) estimation.

Multiple indicators were employed to evaluate the models' goodness of fit in the current study, including Chi-square/df ratio (χ^2/df), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). χ^2/df<3.00, CFI≥0.95, RMSEA≤0.06, and SRMR≤0.08 indicate a good model fit (Wang & Wang, 2012). All of the analyses were performed using SAS software version 9.4 (SAS Institute, Inc., Cary, NC).

Results

Socio-demographic Characteristics

Participants' socio-demographic characteristics are shown in Table 1. The mean age of the participants was 24.1 (±3.29) with a range from 17 to 30 years. The average numbers of regular partners were 1.09 (±0.31). More than half of the individuals were male (58.5%, 374/639) and unmarried (59.7%, 374/627). The majority (95.9%, 600/626) of the participants were of Han ethnicity. The mean number of years of being migrant workers in Beijing was 3.63 (±2.53). About two-third (60.5%, 379/627) of the participants visited their hometown once a year.

Table 1 and Table 2 show that intervention and control groups did not differ (at a=0.05) in the baseline measures except for age, gender, and frequency of home visit. Of the migrants in this study, 93.1% completed the 6-month follow-up data collection and 74.7% completed the 12-month follow-up data collection.

Correlations among Main Study Variables

Table 3 shows correlations among HIV knowledge, condom use self-efficacy, condom use behaviors, and condom use intention. Results of correlation analyses indicated that both HIV knowledge and condom use self-efficacy at 6 months were positively associated with condom use behaviors and condom use intention at 12 months ($p<0.01$).

Table 1

Socio-demographic Characteristics, Rates of Follow-ups, and Changes of Outcome Measures

	Total (%)	*Intervention (%)*	*Control (%)*	*p*
***N* (%)**	639 (100.0)	348 (54.5)	291(45.5)	-
Age (*SD*)	24.1 (3.29)	24.3 (3.33)	23.8 (3.22)	0.04[a]
Gender				0.01[b]
Male	374 (58.5)	219 (62.9)	155 (53.3)	
Female	265 (41.5)	129 (37.1)	136 (46.7)	
Ethnicity				0.25[b]
Han	600 (95.9)	324 (95.0)	276 (96.8)	
Non-Han	26 (4.1)	17 (5.0)	9 (3.2)	
Marital status				0.15[c]
Unmarried	374 (59.7)	191 (56.0)	183 (64.0)	
Unmarried but living together	47 (7.5)	30 (8.8)	17 (5.9)	
Married	204 (32.5)	119 (34.8)	85 (29.8)	
Divorced, widowed, or separated	2 (0.3)	1 (0.4)	1 (0.3)	
Years of being migrant workers in Beijing (*SD*)	3.63 (2.53)	3.72 (2.61)	3.53 (2.41)	0.35[a]
Years of education (*SD*)	10.10 (2.54)	9.97 (2.44)	10.27 (2.65)	0.14[a]
Mean monthly income in Yuan (*SD*)	2451.96 (1223.45)	2363.57 (1203.58)	2561.70 (1242.41)	0.05[a]
Number of regular partners (*SD*)	1.09 (0.31)	1.08 (0.28)	1.10 (0.34)	0.58[a]
Frequency of home visit				0.01[b]
At least once every 6 mo.	158 (25.2)	79 (23.3)	79 (27.4)	
Once a year	379 (60.5)	199 (58.7)	180 (62.5)	
Once every 2 years	72 (11.4)	52 (15.3)	20 (6.9)	
Once every 3 or more years	11 (1.8)	4 (1.2)	7 (2.5)	
Never	7 (1.1)	5 (1.5)	2 (0.7)	
6-month follow-up				0.21[b]
Completed	595 (93.1)	328 (94.3)	267 (91.8)	
Lost-to-follow-up	44 (6.9)	20 (5.7)	24 (8.2)	
12-month follow-up				0.69[b]
Completed	477 (74.7)	262 (75.3)	215 (73.9)	
Lost-to-follow-up	162 (25.3)	86 (24.7)	76 (26.1)	

Note. a: two samples *t* test; *b*: *Chi-square* test; *c*: *Fisher* exact test.

Table 2

Outcome Measures at Baseline and Follow-ups

Variables	*Baseline (%)*		*First follow-up (%)*		*Second follow-up (%)*	
	Control	*Intervention*	*Control*	*Intervention*	*Control*	*Intervention*
***N* (%)**	291(45.5)	348(54.5)	267 (44.9)	328 (55.1)	215 (45.1)	262 (54.9)
Condom use (regular partners)						
Frequency of condom use	2.78(1.18)	2.96(1.35)	2.86(1.22)	3.57(1.30)†††	2.94 (1.33)	3.66(1.25)†††
Last three-time condom use	2.29(1.08)	2.44(1.18)	2.42(1.16)	3.06(1.14)†††	2.52 (1.20)	3.15(1.07)†††
Proper condom use	3.06(1.20)	3.15(1.38)	3.20(1.34)	3.95(1.33)†††	3.34 (1.43)	4.06(1.25)†††
Intention to use condom	2.66(1.29)	2.57(1.29)	2.86(1.38)	3.68(1.27)†††	3.06 (1.42)	3.75(1.23)†††
HIV knowledge	13.13(2.86)	12.92(2.97)	13.58(2.83)	14.93(2.41)†††	13.36(3.08)	14.81(2.60)†††
Condom use self-efficacy	2.77(0.55)	2.73(0.46)	2.83(0.53)	2.89(0.38)	2.82(0.55)	2.88(0.39)

Note. $\dagger\dagger\dagger$: $p<0.001$.

Table 3

Correlation Matrix

	6-Month			*12-Month*		
	1.	*2.*	*3.*	*4.*	*5.*	*6.*
1. HIV knowledge	1.00					
2. Self-efficacy*	0.26†††	1.00				
3. Frequency of condom use	0.29†††	0.28†††	1.00			
4. Last three-time condom use	0.23†††	0.27†††	0.79†††	1.00		
5. Proper condom use	0.28†††	0.17†††	0.66†††	0.67†††	1.00	
6. Intention to use condom	0.31†††	0.34†††	0.60†††	0.54†††	0.57†††	1.00

Note. $\dagger\dagger\dagger$: $p<0.001$; *: Condom use self-efficacy.

Path Model and Path Coefficients

Controlling for baseline measurement of outcome variables (condom use, intention to use condoms, HIV knowledge, and condom use self-efficacy) and socio-demographic characteristics, all of the four models demonstrated good model fits (Table 4). Results of path coefficients in each model are shown in Table 5.

In Model 1 with measure of overall frequency of condom use, intervention assignment was significantly related to both HIV knowledge and condom use self-efficacy at 6 months, which in turn positively associated with the measures of overall condom use frequency at 12 months.

In Model 2 ("last three-time condom use"), intervention assignment was significantly associated with HIV knowledge at 6 months (standardized path coefficient=0.27, $p<0.01$), but the path from HIV knowledge at 6 months to last three-time condom use at 12 months was not statistically significant (standardized path coefficient=0.06, $p=0.14$). Compared with HIV knowledge, intervention assignment was positively associated with condom use self-efficacy at 6 months (standardized path coefficient=0.09, $p=0.01$), which in turn positively associated with last three-time condom use at 12 months (standardized path coefficient=0.10, $p=0.02$).

In Model 3 ("proper condom use"), intervention assignment was positively associated with both HIV knowledge (standardized path coefficient=0.27, $p<0.01$) and condom use self-efficacy (standardized path coefficient=0.09, $p=0.01$), but only HIV knowledge was significantly associated with proper condom use (standardized path coefficient=0.14, $p<0.01$).

In Model 4 ("condom use intention"), intervention assignment was significantly associated with both HIV knowledge (standardized path coefficient=0.27, $p<0.01$) and condom use self-efficacy (standardized path coefficient=0.09, $p=0.01$) at 6 months, which in turn is positively related to intention to use condoms at 12 months (HIV knowledge: standardized path coefficient=0.15, $p<0.01$; condom use self-efficacy: standardized path coefficient=0.20, $p<0.01$).

Mediation Analyses

Table 6 shows results of mediation analyses. Direct paths from intervention assignment to all four condom use outcomes (i.e., frequency of condom use, last three-time condom use, proper condom use, and intention to use condoms) were statistically significant.

Out of the four models, significant mediating effects of HIV knowledge were identified in three of them (Model 1, Model 3, and Model 4). In these models, the mediating effects of HIV knowledge on effect of intervention on condom use behaviors (frequency of condom use and proper condom use) and condom use intention were statistically significant (standardized path coefficient=0.03, $p=0.01$; standardized path coefficient=0.04, $p<0.01$; standardized path coefficient=0.04, $p<0.01$). The results indicated that there were partial mediating effects of HIV knowledge in these three models.

The mediating effect of condom use self-efficacy on the effect of the intervention on intention to use condoms was also found to be statistically significant in Model 4 (standardized path coefficient=0.02, $p=0.03$). The mediating effects of self-efficacy were marginally significant in Model 1 and Model 2 (standardized path coefficient=0.01, 95%*C.I.*: 0.00~0.05, $p=0.07$; standardized path coefficient=0.01, 95%*C.I.*: 0.00~0.04, $p=0.08$) and non-significant in Model 3 (standardized path coefficient=0.01, $p=0.23$).

Table 4

Model Fit Information

Models	χ^2/df	*p-value*	*CFI*	*RMSEA*	*SRMR*
Model 1	2.90	<0.01	0.96	0.06	0.03
Model 2	2.50	<0.01	0.97	0.05	0.03
Model 3	2.36	<0.01	0.97	0.05	0.03
Model 4	3.10	<0.01	0.95	0.06	0.03

Note. Model 1: Frequency of condom use; Model 2: Last three-time condom use; Model 3: Proper condom use; Model 4: Intention to use condom.

Table 5

Path Coefficients

Models and Paths	*β*	*Std. β*	*95% C.I.*	*S.E.*	*p-value*
Model 1 (Frequency of condom use)					
Intervention assignment-->HIV knowledge	1.45	0.27	1.04~1.85	0.21	<0.01
HIV knowledge-->Frequency of condom use	0.06	0.12	0.02~0.10	0.02	<0.01
Intervention assignment-->Self-efficacy*	0.08	0.09	0.02~0.15	0.03	0.01
Self-efficacy*-->Frequency of condom use	0.31	0.11	0.08~0.53	0.12	<0.01
Intervention assignment-->Frequency of condom use	0.52	0.20	0.32~0.72	0.10	<0.01
Model 2 (Last three-time condom use)					
Intervention assignment-->HIV knowledge	1.45	0.27	1.04~1.85	0.21	<0.01
HIV knowledge-->Last three-time condom use	0.03	0.06	-0.01~0.06	0.02	0.14
Intervention assignment-->Self-efficacy*	0.08	0.09	0.02~0.15	0.03	0.01
Self-efficacy*-->Last three-time condom use	0.25	0.10	0.05~0.45	0.10	0.02
Intervention assignment-->Last three-time condom use	0.47	0.20	0.28~0.65	0.09	<0.01
Model 3 (Proper condom use)					
Intervention assignment-->HIV knowledge	1.45	0.27	1.04~1.85	0.21	<0.01
HIV knowledge-->Proper condom use	0.07	0.14	0.03~0.12	0.02	<0.01
Intervention assignment-->Self-efficacy*	0.08	0.09	0.02~0.15	0.03	0.01
Self-efficacy*-->Proper condom use	0.17	0.06	-0.08~0.42	0.13	0.17
Intervention assignment-->Last three-time condom use	0.53	0.19	0.30~0.75	0.12	<0.01
Model 4 (Intention to use condom)					
Intervention assignment-->HIV knowledge	1.45	0.27	1.04~1.85	0.21	<0.01
HIV knowledge-->Intention to use condom	0.07	0.15	0.03~0.12	0.02	<0.01
Intervention assignment-->Self-efficacy*	0.08	0.09	0.02~0.15	0.03	0.01
Self-efficacy*-->Intention to use condom	0.57	0.20	0.33~0.82	0.12	<0.01
Intervention assignment-->Intention to use condom	0.54	0.20	0.32~0.76	0.11	<0.01

Note. *: Condom use self-efficacy; *Std. β:* Standardized estimate; *C.I.*: Confidence interval; *S.E.*: Standard error.

Table 6

Results of Mediation Analyses

Effects	*β*	*Std. β*	*95% C.I.*	*S.E.*	*p-value*
Model 1 (Frequency of condom use)					
Total effect	0.63	0.24	0.43~0.83	0.10	<0.01
Indirect effect					
Pathway 1	0.08	0.03	0.02~0.15	0.03	0.01
Pathway 2	0.03	0.01	0.00~0.05	0.01	0.07
Direct effect	0.52	0.20	0.32~0.72	0.10	<0.01
Model 2 (Last three-time condom use)					
Total effect	0.53	0.23	0.35~0.70	0.09	<0.01
Indirect effect					
Pathway 1	0.04	0.02	-0.01~0.09	0.03	0.15
Pathway 2	0.02	0.01	0.00~0.04	0.01	0.08
Direct effect	0.47	0.20	0.28~0.65	0.09	<0.01
Model 3 (Proper condom use)					
Total effect	0.65	0.24	0.43~0.87	0.11	<0.01
Indirect effect					
Pathway 1	0.11	0.04	0.04~0.18	0.04	<0.01
Pathway 2	0.01	0.01	-0.01~0.04	0.01	0.23
Direct effect	0.53	0.19	0.30~0.75	0.12	<0.01
Model 4 (Intention to use condom)					
Total effect	0.69	0.26	0.48~0.91	0.11	<0.01
Indirect effect					
Pathway 1	0.11	0.04	0.04~0.17	0.03	<0.01
Pathway 2	0.05	0.02	0.01~0.09	0.02	0.03
Direct effect	0.54	0.21	0.32~0.76	0.11	<0.01

Note. Std. β: Standardized estimate; *C.I.*: Confidence interval; *S.E.*: Standard error.
Pathway 1: Intervention assignment--»HIV knowledge--»Condom use.
Pathway 2: Intervention assignment--»Condom use self-efficacy--»Condom use.

Discussion

Using data from a community-based HIV behavioral intervention trial, the current study examined the mechanistic roles of HIV knowledge and condom use self-efficacy on the effect of an effective theory-based intervention on the use of condoms with regular partners as well as on condom use intention among young rural-to-urban migrants in China. Path analysis confirmed the overall intervention effects on condom use behaviors and condom use intention that were reported in the previous study using a different analytic procedure (Li et al., 2014). In addition, mediation analyses in the current study revealed that the intervention program could increase both HIV knowledge and condom use self-efficacy, which in turn could increase the intention to use condoms. For condom use behaviors with regular partners, the mediation models suggested that the behavioral intervention program could affect the use of condoms through HIV knowledge among rural-to-urban migrants.

The intervention program could increase condom use with regular partners and intention to use condoms through HIV knowledge among rural-to-urban migrants. This finding was consistent with previous studies (Campbell et al., 2008; Villar-Loubet et al., 2013; Wolf et al., 2007). For example, Villar-Loubet and colleagues (2013) found that HIV knowledge could mediate the relationship between sexual risk reduction intervention and consistent condom use among South African couples. HIV knowledge, as a fundamental determinant of behavioral change, could increase condom use behaviors and intention to use condoms through improving motivation and self-protection (Fisher & Fisher, 1992; Yang, Wu, Schimmele, & Li, 2015).

Working in the urban areas without permanent urban household registrations, rural-to-urban migrants with low levels of education are often marginalized and stigmatized (Du, Li, & Lin, 2015; Zhang, 2001). This marginalization and stigmatization might prevent these individuals from getting access to HIV preventive education (Du, Li, & Lin, 2015; Zhang, 2001). Due to a low level of education and insufficient HIV knowledge, these rural-to-urban migrants may have high rates of sexual risk behaviors (Kong, 2008; Sio et al., 2015; Wu et al., 2016). In addition, the marginalization and stigmatization might impair migrants' mental health, and many of them might maladaptively cope with mental health problems through sexual risk behaviors including unprotected sex practices (Lehrer at al., 2006; Lin et al., 2005). Thus, to reduce sexual risk among rural-to-urban migrants, at the micro level, further intervention studies focusing on increasing their social integration as well as HIV knowledge are needed. With adequate social integration, migrants may reconstruct their social capitals in migration communities, have more interaction with local residents, and gain better access to HIV preventive education (Chen et al., 2011; Wang, Li, Stanton, & Fang, 2010). At the macro level, household policy change should be made to reduce the negative impact of dual household registration systems on migrants, which may be helpful to intervene in the environmental determinants of unprotected sex practices.

The behavioral HIV prevention intervention efforts could also aim to improve condom use self-efficacy as a key component of the efforts among rural-to-urban migrants and other populations at risk of HIV infection. Self-efficacy on condom use is an important determinant of condom use (Heeren, Jemmott, Mandeya, & Tyler, 2007; Sheeran, Abraham, & Orbell, 1999). A meta-analysis of 82 studies found that although both condom use self-efficacy and response-efficacy are correlated with condom use, condom use self-efficacy is more predictive of intended and actual condom use (Casey, Timmermann, Allen, Krahn, & Turkiewicz, 2009). People who have high condom use self-efficacy are more likely to communicate with their sexual partners and seek for the use of condoms (Xiao et al., 2013). Effective interventions to improve condom

use intention and condom use behaviors among rural-to-urban migrants should target condom use self-efficacy as a key focus of the intervention.

The current analysis did not identify a significant mediating effect of self-efficacy for the actual use of condoms, which was not consistent with previous studies regarding the mediating role of self-efficacy in behavioral change (O'Leary, Jemmott, & Jemmott, 2008; Taymoori & Lubans, 2008). There are two potential explanations for this finding. First, there was not an overall intervention effect on condom use self-efficacy as it increased in both the intervention and control groups over time (Li et al., 2014). Second, behavioral change requires sustained motivation and support (Kelly & Barker, 2016). The intervention program was delivered over four weeks, which might not provide migrants with sustained condom use self-efficacy or change their condom use behaviors (Li et al., 2014). Indeed, path analysis suggested that intervention assignment was significantly associated with condom use self-efficacy in all of the four models, but condom use self-efficacy was only related to condom use intention (Model 4) instead of actual use condoms in Model 1, Model 2, and Model 3. Despite the non-significant mediating effect of self-efficacy on actual condom use behaviors, condom use self-efficacy may still play an important role in behavioral change and we need to target condom use self-efficacy as a key focus of behavioral intervention (Guerra-Ordoñez et al., 2017; Prochaska & Velicer, 1997). To increase condom use among rural-to-urban migrants, these individuals might need to increase their confidence to negotiate with their partners and address the cognitive barriers of condom use before they develop behavioral intention resulting in actual behavioral change in condom use (Coker, 2007; Murray et al., 2007).

The current study has several potential limitations. First, the participants were recruited from one urban district in Beijing and might not be representative of other migrant populations in China. Therefore, caution should be taken when generalizing the results from the current study to other migrant populations elsewhere. Second, as all outcome measures were self-reported, recall biases of condom use might exist. Third, the HIV knowledge scale had a relatively low reliability estimate (Cronbach's alpha=0.66), which might threaten the internal validity of the study. Fourth, baseline differences were found in some key variables due to the cluster-level randomization. Although we have adjusted these variables in the path models, these differences could still affect the results. Fifth, this study had a relatively low follow-up rate (e.g., 74.7% at 12-month follow-up). This low follow-up rate indicated both the challenges to and importance of preventing HIV risk among this sexually active and highly mobile population. Sixth, our condom use measures were focused on regular partners. While the term of "regular partners" included largely "non-spousal" partners for the study sample based on the inclusion criteria (e.g., being unmarried or if married, not living with their spouse in Beijing), future studies are needed to validate the findings with other types of sexual partnerships (e.g., commercial sex or casual sex).

Despite these limitations, the current study confirmed the important mechanistic roles of HIV knowledge and condom use self-efficacy on the effect of behavioral prevention programs on condom use intention and behaviors. To increase the use of condoms and to reduce HIV risk among rural-to-urban migrants or other low-educated populations, tailored interventions focusing on improving HIV knowledge and condom use self-efficacy and addressing cognitive barriers of condom use are warranted, especially in those resource-poor settings where there is a lack of financial or human capacity for more comprehensive efforts such as structural interventions or multilevel interventions.

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