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Predictors of Condom Use Behavior among Male Street Laborers in Urban Vietnam Using a Modified Information-Motivation-Behavioral Skills (IMB) Model

Abstract

Background: HIV risk in vulnerable groups such as itinerant male street laborers is often examined through individual determinants. This study provides a test of a modified IMB model to predict condom use behavior among male street workers in urban Vietnam.

Methods: In a cross-sectional survey, using a social mapping technique, 450 male street laborers in 13 districts of Hanoi, Vietnam were recruited and interviewed. The collected data was first examined for its completeness; structural equation modeling was then employed to test the model fit.

Results: Condoms were used inconsistently by many of these men, and usage varied in relation to a number of factors. The modified IMB model had better fit than the original IMB model in predicting condom use behavior. This modified model accounted for 49% of the variance versus 10% by the original version. In the modified model, levels of psychosocial factors were moderately high, whilst levels of HIV prevention information, motivation, and perceived behavioral skills were moderately low, explaining in part the limited level of condom use behavior.

Conclusions: This study provides insights into social contexts that should be taken into account in public health planning to promote safer sexual behavior among Asian male street laborers.

Key words: HIV/AIDS; IMB Model; Modified IMB Model; Condom use; Vietnam.

INTRODUCTION

Vietnam is one of the rapidly developing economies in Asia that is confronting unprecedented rapid urbanization. Results from the 2009 census indicated that 7.7 per cent of the population (6.6 million people) migrated to cities, an increase from 6.5 per cent recorded in the 1999 census (Duong, Linh, and Thao 2011). This creates challenges for
cities in terms of sustainable development and the provision of social services (Tibaijuka 2010). Young people who migrate from rural to urban settings can become separated from traditional family and social bonds that influence health-related behaviors, including sexual behavior (Pyne 1999). Consequently, the risk of HIV infection must be considered amongst these challenges.

To date the HIV epidemic has affected all 63 provinces, 97.5% of the 659 districts and more than 70% of the 10,732 wards/communes (Ministry of Health 2010). As of 31 December 2011, there had been 249,660 reported HIV cases and 52,325 deaths due to AIDS-related illnesses (National Committee for AIDS Drugs and Prostitution Prevention and Control 2012). It is estimated that up to 263,317 people were living with HIV by 2015 (National Technical Working Group on HIV Estimates and Projections 2011). Despite a low overall HIV prevalence, some provinces and cities have more than 1% of the general population living with infection (National Committee for AIDS Drugs and Prostitution Prevention and Control 2012).

Most previous studies have focused on traditional “core transmitter” groups for HIV transmission (Tuan et al. 2007; Huy et al. 2011; Huy, Dunne, Debattista, Hien, et al. 2010). However, this concentration on high risk groups may leave other people under-resourced or uninformed as to the consequences of acquiring HIV and effective means for prevention. Several behavioral studies show a critical transmission role for itinerant manual workers, who often adopt norms and values in favor of partner concurrency/commercial sex use (FHI 2006; Phinney 2008; Trinh, Madan, and O'Connell 2008). However, data about behavioral patterns and factors influencing their risk behaviors for HIV remains limited. For many of these workers, the separation from family, social disruption, breakdown of social networks, lack of social control and support and anonymity of urban living create opportunities for multiple unprotected sexual encounters (Huy et al. 2012). Consequently, migrant men are
more likely to report having acquired a HIV infection compared with non-migrant men (Population Council 2008).

To date, there has been little utilization of behavioral science theory to improve understanding of sexual risks within socially-marginalized groups such as male street laborers. From the literature, the Information-Motivation-Behavioral Skills (IMB) model (Fisher and Fisher 2002; Fisher, Fisher, and Shuper 2009) has been validated for a wide range of issues - breast self-examination, motorcycle safety gear use, HIV preventive behavior, and medical treatment adherence (Fisher and Fisher 2002); in various populations - heterosexual and homosexual, rural and urban, working people and students, males and females; and people from developed and developing countries (Fisher and Fisher 2003b; Fisher, Fisher, and Shuper 2009). The IMB model (see Figure 1) proposes that HIV preventive behavior, such as condom use, is a function of HIV preventive information, motivation, and behavioral skills (Fisher and Fisher 2002). In the model, preventive behavioral skills represent a common pathway for preventive behaviors. In 2013, Kiene, Fisher, Fisher and colleagues validated this model among HIV-infected South Africans receiving antiretroviral therapy (Kiene et al. 2013). Findings confirmed the assumptions of the IMB model and demonstrated that HIV prevention information and HIV prevention motivation work through HIV prevention behavioral skills and affect HIV transmission risk behavior in this population.

However, this model also has some limitations. First, although it is based on an integration of theory and research in the HIV prevention and social psychological literature and some of the model elements do impact one another (Fisher and Fisher 2000; Fisher, Fisher, and Shuper 2009), they are sometimes dealt with in isolation (Odutolu 2005). Second, the focus on the psychological or individual-level factors can limit the predictive power of behaviors. Some studies recommend that broader social factors that accommodate
individual action should be further investigated (Odutolu 2005; Maticka-Tyndale and Tenkorang 2010; Kiene et al. 2013).

Addressing some of the IMB model’s limitations, consideration should be given to adapting broader social factors to the model and validating it in diverse populations, as Odutolu suggested (2005). Johnson et al. (Johnson et al. 2010) recognized the role of the social context of people’s lives and introduced a Network-Individual-Resource (NIR) model for HIV prevention that extends the reach of IMB model to include tangible and mental resources of the individuals networked to members of particular groups at elevated risk for HIV. Tangible resources include income, access to health care, migration, access to alcohol use, etc and mental resources include levels of depression, isolation, attitudes, perceived norms, and intentions to act. It is important to further validate the more inclusive model in various populations, especially among people living with limited economic resources such as itinerant street laborers.

To address limitations of the earlier IMB model and to inform the modified version, we conducted a qualitative study to explore how social factors affect HIV risk and protective behaviors among male street laborers in Vietnam. It was found that social disconnection, stress, and poor access to health services as a result of family separation or long distance migration to the city influenced engagement in sex with different partners without using condoms (Huy et al. 2011; Huy, Dunne, Debattista, Hien, et al. 2010).

The purpose of the present study was to include new variables such as heavy alcohol use, migration, social isolation, depression, and access to HIV prevention resources to test this modified model. On the basis of previous qualitative work (Huy et al. 2012; Huy, Dunne, Debattista, and An 2010), we incorporated these new variables into a common construct labelled ‘psychosocial factors’. It was hypothesized that male street laborers who have better HIV prevention information and motivation and positive psychosocial factors
are more likely to use condoms. Measuring psychosocial factors should add explanatory power to the model. Ultimately we hope that the results of the study will inform public health policy and planning.

METHODS

Research Site. Data were collected from cross-sectional, face-to-face interviews with men aged 18 to 59 years in the city of Hanoi. With its large industries and service attractions, Hanoi is a primary destination for street laborers, migrant laborers and other rural-urban migrants (Duong, Linh, and Thao 2011). The most recent data (General Statistical Office 2010) estimated up to 292,000 migrants (6.6% of the national migrants) traveled to Hanoi to search for employment opportunities.

Measures

To check the reliability of the translation, the original English questionnaire was simultaneously translated into Vietnamese by two Vietnamese professionals with English language skills. No major differences were found between the transcriptions and the translations.

Psychosocial factors. This construct was informed first by a literature review followed by a qualitative pilot study (Huy et al. 2012). In-depth qualitative interviews had revealed that five social and contextual factors were important - depression, social isolation, alcohol use, rural-to-urban mobility and lack of access to HIV prevention. An access to HIV prevention measure was developed based on 12 items (alpha = .55) asking respondents if they accessed one or more of 12 HIV prevention resources such as receiving advice from relatives, from mass organization staff, or from health workers/health facilities; exposure to HIV/AIDS information through public speakers, radio, TV; or communication materials; received a condom; and referral to a HIV/STD screening/testing/care service. The ratio of the number of geographical locations of residence to years of total migration was employed as an index of mobility (Li et al. 2004). The scale of alcohol use from the WHO (2002) was a
composite of the number of standard drinks and frequency of use over the past 4 weeks (alpha = .60). We used this measure because it is simple and feasible to apply given the low educational level of our sample. Social isolation was assessed with 6 items based on the work of Hawthorne (2006) (alpha = .74). To measure depression, a short version “Boston form” of the Center for Epidemiological Studies Depression Scale (CEDS) was used (Radloff and Locke 2000). This short form was validated and utilized in prior research, comprising experiences that participants with less formal education could interpret and demonstrated to be reliable and valid for labor migrants (Joseph et al. 2006). With ten 4-point items the scale of depression experience has an alpha of .88. Together, the above five indicators serve as a latent construct of psychosocial factors (alpha = .60) because they were statistically correlated (Table 2) and CFA demonstrated that the scale structure was of good fit to the data (RMSEA=.043, CFI=.98), with all items loading significantly on the factor (β’s ranged from .13 to .75, p<0.05). Further, they were combined because they were supported in part by the prior literature (Johnson et al. 2010; Danielsson et al. 2012; Deuba et al. 2013).

Information. HIV preventive information was assessed with ten true/false/don’t know items (Misovich, Fisher, and Fisher 1998; Cornman et al. 2007; Fisher, Fisher, and Shuper 2009). Prior to their inclusion in the main survey, these items were assessed for face validity and adapted through two smaller scale studies, the explorative qualitative (Huy, Dunne, Debattista, and An 2010; Huy et al. 2012) and a pilot survey. Scoring the information scale was accomplished by dichotomizing each item into a value of 1 (correct) and 0 (incorrect or don’t know) and then summing the item values to form a composite score with higher scores reflecting increased knowledge about HIV prevention (alpha = .60). The scale was split into two subscales. One subscale included 5 items (alpha = .57) measuring theoretical knowledge relevant to the sexual transmission of HIV; for which the sum of correct responses constituted the sexual transmission information score. The other subscale
comprised 5 items (alpha = .62) that addressed HIV prevention heuristics. The sum of correct responses formed the *heuristic information* score. These two scores served as indicators of the latent construct of HIV prevention information.

**Motivation** was measured by three subscales.

1) *Attitudes towards condom use.* To determine respondents’ attitudes towards condom use, respondents rated their performance on seven aspects of condom use on a 5-point semantic scale (*bad-good*) from 1 (negative evaluation) to 5 (positive evaluation) (Misovich, Fisher, and Fisher 1998; Cornman et al. 2007; Fisher, Fisher, and Shuper 2009). A composite score was obtained by summing responses to items, with higher scores indicating more positive attitudes towards condom use (alpha = .89).

2) *Social norms regarding condom use.* This scale assessed respondents’ subjective norms or generalized perceptions of social support for their practice of condom use. Respondents rated their performance on seven items of social norms using a 5-point semantic scale (*untrue-true*) from 1 (negative evaluation) to 5 (positive evaluation). A composite score was obtained by summing responses to items, with higher composite scores indicating higher social norms toward condom use (alpha = .92).

3) *Intentions regarding condom use.* Respondents’ intentions to perform each condom behavior were measured by asking them seven questions to rate on a 5-point semantic scale ranging from *very unlikely* (1) to *very likely* (5). A composite score was computed by summing responses to items, with higher scores indicating higher levels of intention for condom use (alpha = .87).

The above three indicators - attitudes, subjective norms, and intentions toward condom use - made up the latent construct of HIV prevention *motivation* (alpha = .90).

**Behavioral Skills.** Behavioral skills toward safer sex were assessed with seven items dealing with perceived self-efficacy to perform behaviors related to condom use. The answers were on a 5-point semantic scale ranging from *very hard* (1) to *very easy* (5)
(Misovich, Fisher, and Fisher 1998; Cornman et al. 2007; Fisher, Fisher, and Shuper 2009; Bryan, Fisher, and Benziger 2001). Again, prior to the main survey, these items were assessed for face validity and adapted during pilot work. A composite score was obtained by summing responses to items, with higher scores reflecting higher levels of behavioral skills for condom use (alpha = .86). The items were split into three factors based on the previous work of Bryan et al. (2000) and the process of scale validation such as correlation and factor analysis. They were: Preparation with 3 items; Negotiation (or Discussion) with 2 items; and Practice of condom use with 2 items, (alpha’s of .73, .82, and .62, respectively). The above three factors were combined to produce an empirically identified latent construct (alpha = .80).

**Condom Use Behavior** was assessed with an item asking respondents about how often they used condoms when having sex with a partner (sex worker, casual partner, or a regular partner) during the past 12 months. The item employed a 4-point scale (0=never used a condom to 4=always used a condom) and had been previously evaluated to work when using the time internal of the previous year (Do et al. 2006), for example, condom use in the previous year.

**Participants and Survey Procedures**

Sampling male street laborers in cities like Hanoi is methodologically challenging, because individualized sampling frames are not available. Consequently, the study commenced with a social mapping exercise to generate an optimal number of sites at which male laborers could be recruited. In each district, trained field workers traveled to places where men congregated in search of casual paid jobs. In each site, key informants were consulted for site mapping. Field workers estimated the number of potential participants. Finally, using a list of all the sites (135 across 13 city districts), a total number of possible participants was estimated.
This research was informed by our two earlier pilot studies. First, a qualitative study was conducted with 16 explorative indepth interviews (Huy, Dunne, Debattista, and An 2010; Huy et al. 2012). Secondly, a field test survey was conducted to assess the instrument with 55 participants. The test survey showed that the instrument had both face validity and internal consistency (Cronbach’s alpha≥.70 in most scales) for the main survey. The field test also identified that the survey could be most appropriately delivered as a face-to-face interview.

Potential participants were verbally informed about the study, that participation was voluntary, that they had the right to withdraw at any point, and, that data would be managed confidentially and with anonymity. After obtaining informed consent, a structured, face to face interview was conducted. Interviews were conducted by trained interviewers either in participants’ homes, at their worksites, or a nearby place convenient to participants. Prior to commencing the interviews, participants were assessed as to their eligibility i.e. being male, aged 18 to 59 years, seeking work or engaged in low skilled, unregistered employment, and had not been previously interviewed. In total 450 eligible participants completed interviews (duration of 35-45 minutes each). They received $10 compensation upon completion. The study protocol was approved by the Institutional Review Boards at both Queensland University of Technology in Australia and Hanoi Medical University in Vietnam.

**Data Analysis.** Simple descriptive statistics were included such as frequency, percentage, mean, standard deviation (SD), and graphics. Mean and SD were used given the normal distribution of most variables. Pearson correlation coefficients helped to examine the relationships among the modified IMB model constructs. Structural equation modeling (SEM) via Amos 18 (SPSS 2009) was conducted with 450 male street laborers. Since most of the constructs and sub-constructs were normally distributed with both univariate and multivariate kurtosis coefficients showing values ranging from -2 to +2, the Maximum Likelihood (ML) estimation, was adopted. Model fit was evaluated with the initial indices.
including $p$-value of $\chi^2_{\text{GoF}} (>0.05)$, and key indices, “Comparative Fit Index (CFI>0.90)” (Bentler 1990; Norman and Steiner 1997), and “Root Mean Square Error of Approximation (RMSEA<0.05)” (Norman and Steiner 1997; Brown and Cudeck 1993). Both the CFI and the RMSEA are sensitive to model misspecification and are minimally affected by sample size (Hu and Bentler 1995). The CFI ranges from 0 to 1, with .90 indicating acceptable fit and .80 indicating marginal fit (Bentler 1990). The RMSEA ranges from 0 to $\infty$, with fit values less than 0.05 indicating close fit and those less than 0.10 indicating a fairly acceptable fit (Norman and Steiner 1997). Pearson correlation and path analysis were adopted to assess the mediating effect of behavioral skills in the expanded model of IMB. Statistical significance yields were at a threshold of $P \leq 0.05$.

**RESULTS**

**Demographic and Social Characteristics**

Most (98.7%) of the sample were ethnic Kinh, 84% were married, 74% followed one type of religion (Buddhism, catholic, or ancestor worship), 87% were migrants, and 60% were from rural areas. Mean age of the sample was 39 years (SD=10.29) and many had fairly limited school education (mean years completed=8.19; SD=2.52;). The majority (almost 60%) had been farmers in their hometown and the most common occupation during their urban stay was motorbike taxi or haulage driver (~65%), followed by manual laborer and construction worker, each contributing more than 10% of the total. Their average monthly income was estimated to be 2.6 million VND (equivalent to US$140).

**Sexual Practices of Male Street Laborers**

Most (92.2%) participants indicated they were heterosexual, 5.6% were bi-sexual, and 2.2% were homosexual (Table 1). The number of reported lifetime sexual partners ranged from 0 to 77 with a median of 38. Previous year sexual partner numbers ranged from 0 to 20 with a median of 10. Approximately 95% of the participants reported ever having sexual encounters with regular partners, one third with sex workers, and almost 25% with casual
partners. Over 50% of the participants talked about condom use with partners before having sex. Condom use was inconsistent with a mean score of 1 to 3 of the 0-4 point scale (with higher scores reflecting more frequent level of condom use). Almost a third of the participants used a condom with regular and commercial sex workers (CSW) and very few (17.6%) with casual partners.

**Description of Modified IMB Model Constructs**

The means, standard deviations and inter-correlations between the scales and item factors utilized in the model estimation are shown in Table 2. The majority of the scales and subscales were significantly related to one another (r’s=.30-.77).

**Model Estimation**

The elements of the original IMB model estimated with standardized path coefficients appear in Figure 2. There was a significant path from motivation to behavioral skills (\(\beta=0.66; \ p<0.001\)), and from motivation to condom use behavior (\(\beta=0.14; \ p<0.05\)), indicating that individuals who were motivated to engage in safe sex were more likely to have the behavioral skills necessary as well as more likely to use condoms when having sex. The relationship between information and behavior, and with behavioral skills was not significant (\(\beta’s=0.01\ and \ 0.03\), respectively), yet there was a significant relationship between behavioral skills and condom use. All but one path from the main construct to sub-construct – HIV preventive information to transmission information - were statistically
significant. Just 10 percent of the variance in condom use behavior was accounted for by the conventional IMB model. However, the model was not fit (ML $\chi^2 = 63.18$, $P < .001$).

INSERT FIGURE 2 ABOUT HERE

Figure 3 displays standardized path coefficients of the modified IMB model constructs. All of the paths, except for those from psychosocial factors to behavior and from information to behavioral skills, were statistically significant. Standardized coefficients for such significant paths held moderate to very high values, ranging from .16 to .52 ($P < .05$). In particular, there was a significant path from psychosocial factors and motivation to behavioral skills, then from behavioral skills to condom use behavior. There was also a significant path from information, and motivation to behavior; however, the paths from information to behavioral skills, and from psychosocial factors to behavior were not statistically significant. All but one path from the main construct to sub-constructs – HIV preventive information to heuristic information - were statistically significant. In this model, forty-nine percent of the variance in condom use behavior was accounted for by the constructs. The model was fit [ML $\chi^2 (68, N = 450) = 109.1$, $P > .05$; CFI = .94; RMSEA = .043].

INSERT FIGURE 3 ABOUT HERE

Mediation

A single mediational model was specified to examine whether the modified model constructs – psychosocial factors, information and motivation – mediated the relationships between these and condom use behavior through behavioral skills (Figure 3). It was expected that the effect of psychosocial factors, information and motivation on condom use behavior would be completely mediated by behavioral skills. As shown in Figure 3, positive psychosocial factors and motivation significantly predicted behavioral skills which, in turn, predicted condom use. As shown in Table 3, initial and partial correlations among the constructs were significant with reduced partial correlations after controlling for the
mediator – behavioral skills. The standardized path coefficient from psychosocial factors to behavior was statistically not significant, while that from information and motivation to behavior was statistically significant and the path from behavioral skills to behavior was significant. These parameters indicate that behavioral skills were a mediator between psychosocial factors and behavior and a partial mediator between information and motivation, and behavior.

INSERT TABLE 3 ABOUT HERE

DISCUSSION

The IMB Model

According to the IMB model, sexual risk behavior is influenced primarily by prevention information, motivation and behavioral skills. Among male street laborers in Hanoi, levels of HIV prevention information, motivation, and perceived behavioral skills were fairly low, explaining in part the limited levels of condom use behavior (Table 2). HIV prevention motivation had both a direct and indirect relationship with condom use through behavioral skills, but for HIV information, there was no relationship with any constructs in the model. There was also a significant association between HIV prevention behavioral skills and condom use when simultaneously assessing the contributions of all of the IMB model constructs with behavior. This analysis suggests that behavioral skills is a mediator of motivation and behavior, while not true for information. This suggests that male street laborers who are better motivated are more likely to use condoms when having sex, and that variability in motivation appears to alter both behavioral skills and condom use behavior. By contrast, HIV prevention information does not appear to contribute to behavioral skills and condom use. This result may be different from the original IMB model (Fisher and Fisher 1992) and with some other studies (Cornman et al. 2007; Misovich et al. 2003) placing behavioral skills in the role as a mediating factor of all the constructs of the model.
The present findings are consistent with research among US heroin users undertaken by Bryan et al. (2000). In their research there was a significant path from motivation to behavioral skills and from motivation to the level of safe sexual behavior, however the relationship between information and behavioral skills was only suggestive and there appeared to be little or no relationship between behavioral skills and the level of safe sexual behavior. In some studies, motivation is found to mediate the link between information, behavioral skills and behavior. For example, Harman and Amico (2009) reported that, in contrast to traditional IMB models, their modified IMB model places motivation in the role of a mediating variable, rather than behavioral skills.

Overall, in this study, the constructs of the traditional IMB model accounted for a modest proportion of the variance (10%) in condom use. The majority of variance was unaccounted for, indicating that additional factors should be identified to better explain the level of condom use. Further, this model did not provide adequate fit to the data (P-value of ML $\chi^2$<.001; RMSEA=.065).

The Modified IMB Model

A common construct termed “psychosocial factors” was theoretically and statistically formed from five sub-constructs - depression, social isolation, low access to HIV prevention resources, alcohol consumption, and geographical mobility ($r$’s>.30; alpha=.60; beta’s=.78, .79, .34, .41, .14; $P$<.001). Socio-economic status was excluded from this latent variable as it was in many cases not related to each of the above five sub-constructs ($r$’s<.30; alpha=.53; beta is small; $P$>.05), possibly due to limited variation in economic conditions among these men. As seen in figure 3, negative psychosocial factors has significant loadings to all of the five sub-constructs, suggesting that male street laborers who are more depressed, more socially isolated, more mobile, consume more alcohol, and have less access to HIV prevention resources are more likely to be psychologically and socially stressed. The other two latent variables suggest fairly predictable associations. Men who display positive
attitudes and support social norms and intentions toward safe sex are more likely to show a more positive motivation for HIV prevention behavior (beta’s=.85, .90, .84, respectively; \(P<.001\)). Likewise, men who report better skills in preparation, negotiation and practice are more likely to engage in HIV prevention behavior (beta’s=.86, .76, .65, respectively; \(P<.001\)). Results for HIV prevention information are, however, different. Men who report a greater level of HIV transmission knowledge are more likely to report a better level of HIV prevention knowledge (beta=0.90; \(P<.05\)), while heuristic knowledge on HIV prevention appears as not significantly associated with HIV prevention knowledge (beta=0.11; \(P>.05\)).

Overall, the current modified model offers robust prediction of condom use (49% of the variance) among male street laborers. This model appeared to support both a complete and partial mediating role of behavioral skills for the constructs which was fairly consistent with the traditional IMB model. This suggests that male street laborers who are psychologically and socially less stressed and more informed and motivated are more likely to protect themselves. For the latent variable of “psychosocial factors”, the construct was most closely associated with depression and social isolation (\(\beta\’s=.78\) and .79, respectively), followed by alcohol use (\(\beta=.41\)), low access to HIV prevention resources (\(\beta=.34\)), and level of mobility (\(\beta=.14\)). The relationships between motivation and their respective sub-constructs (attitudes, norms and intentions) and between behavioral skills and their respective skills (skill 1=preparation, skill 2=negotiation, and skill 3=practice) appear strong. It appears that all sub-constructs, except for heuristic information, make significant contributions to the level of condom use. The data also suggest that behavioral skills are a mediator between psychosocial factors and behavior and a partial mediator between information and motivation, and behavior.

To our knowledge, this study provides the first test of a modified IMB model to predict condom use behavior among male street laborers in an urban developing country setting. Comparing the two models, both have sub-constructs significantly contributing to
two constructs - motivation and behavioral skills. Both have a significant relationship between motivation and behavioral skills and between motivation and condom use behavior. However, the two models differ in several aspects. In the traditional model, motivation is a mediator of the constructs, while in the modified one, behavioral skills act as a mediator among all the constructs. The latter appears better at explaining condom use because it provides a greater variance than the traditional model. More importantly, the modified model gives more adequate fit than the original. This suggests that with psychosocial factors added, the model has improved significantly.

The study makes a strong case for public health planning and practice for male street laborers which should focus not only on HIV knowledge, motivation and behavioral skills, but also on reducing psychosocial factors associated with depression, social isolation, low access to HIV prevention resources, alcohol consumption, and rural-to-urban mobility. Psychosocial factors does not directly influence sexual behavior, but instead affects behavioral skills which further influence safe sexual behavior. Given that behavioral skills appear to be a mediator between psychosocial factors and behavior, interventions that reduce psychosocial factors would contribute to improving behavioral skills among male street laborers, facilitating safe sexual practice. However, behavioral skills is a partial mediator for information and motivation, and therefore interventions to improve these could directly modify sexual behavior.

Limitations and Strengths of the Study

This study has some limitations. As the design is cross-sectional, the direction of effects cannot be determined. From a measurement perspective, it is subject to the usual limitations of self-report bias with respect to condom use behavior. As the study was conducted among male street laborers in urban settings, the applicability of our findings may be limited to such a population. Further research is needed to examine how well the modified IMB model would fit data derived from other populations. Although the sampling strategy employed
here entailed an exhaustive effort to enumerate as many community-based sites as possible, it is unlikely that we identified all relevant sites throughout the 13 districts sampled.

Five sub-constructs - depression, social isolation, alcohol use, mobility index, and low access to HIV prevention, were combined into psychosocial factors. Although they were theoretically and statistically related to one another, each of them may work somewhat differently and may to some extent limit straightforward interpretation of the results. The subscale of low access to HIV prevention was of relatively low internal consistency (alpha=.55). However, if we were to separate these factors, the model would become much more complex, violating the rule of parsimony in structural equation modeling.

While some limitations are inherent, this research also has several strengths. As discussed earlier, this is the first study to examine the fit of the modified IMB model in the above population. We adapted the previous IMB model questionnaire that had been validated by Misovich et al. (1998). We conducted in-depth qualitative pilot interviews to inform introduction of a new construct into an expanded IMB model. All of the model constructs were measured with multiple items with adequate reliability (alpha’s=.55-.90).

**Conclusions**

Overall, the study suggests that public health planning and preventive interventions for male street laborers based on the original IMB model may not be as effective as strategies based on the expanded IMB model. Interventions to increase safer sex among unregistered male street laborers should prioritize reducing levels of psychosocial factors and increasing HIV prevention information, safer sex motivation (consisting of attitudes, social norms, and intentions toward safer sex), and safer sex behavioral skills. To reduce psychosocial factors, it may be necessary to address causes of each of the main elements experienced by men living and working in these challenging conditions. It is recommended that HIV risk reduction efforts not only attend to psychosocial factors, information, and motivation, but focus on behavioral skills if safe sex promotion programs are to be effective. To maximize
behavioral change, it may be necessary to conduct a parallel intervention focusing on safe sexual behavior among sexual partners of these male laborers. As the study is limited to one socially marginalized group, it is recommended that further research should examine the consistency and explanatory power of the modified IMB model among other populations.

ABBREVIATIONS


COMPETING INTERESTS

We declare that we have no competing interests.

AUTHORS’ CONTRIBUTIONS

NVH designed the study, wrote the protocol, conducted fieldwork, analyzed data, wrote and revised the manuscript. MPD reviewed the protocol, advised on the manuscript and edited the language. JD reviewed the protocol, reviewed the manuscript and edited the language.

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REFERENCES


Figure 1. IMB Model of HIV Prevention Behavior

Table 1. Characteristics of Sexual Practice of Male Street Laborers

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Median Mean ±SD</th>
<th>N (%)</th>
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<tbody>
<tr>
<td>Sexual orientation†</td>
<td></td>
<td></td>
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<tr>
<td>Sex only with men</td>
<td>10(2.2)</td>
<td></td>
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<tr>
<td>Sex only with women</td>
<td>415(92.2)</td>
<td></td>
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<tr>
<td>Sex with both men and women</td>
<td>25(5.6)</td>
<td></td>
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<tr>
<td>Multiple sex relations</td>
<td></td>
<td></td>
</tr>
<tr>
<td># of different partners (lifetime) (range=0-77)</td>
<td>38†</td>
<td></td>
</tr>
<tr>
<td># of different partners (past year) (range=0-20)</td>
<td>10†</td>
<td></td>
</tr>
<tr>
<td>Types of sexual partners</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular partners (participants don’t pay for sex)</td>
<td>427(94.9)</td>
<td></td>
</tr>
<tr>
<td>Commercial sex workers (participants pay for sex)</td>
<td>147(32.7)</td>
<td></td>
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<tr>
<td>Casual sex partners (participants don’t pay for sex)</td>
<td>109(24.2)</td>
<td></td>
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<tr>
<td>Safe sex discussion with sex partners before having sex (past year)</td>
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<td></td>
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<tr>
<td>Talking about condom use</td>
<td>255(58.6)</td>
<td></td>
</tr>
<tr>
<td>Level of persuading to use a condom (range=0-2)*</td>
<td>.78±.70</td>
<td></td>
</tr>
<tr>
<td>Condom accessibility (past year)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of buying a condom (range=0-4)*</td>
<td>1.55±1.10</td>
<td></td>
</tr>
<tr>
<td>Level of keeping a condom available (range=0-4)*</td>
<td>1.81±1.29</td>
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</tr>
<tr>
<td>Condom use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of past year condom use with regular partners (range=0-4)*</td>
<td>1.26±1.17</td>
<td></td>
</tr>
<tr>
<td>Level of past year condom use with commercial workers (range=0-4)*</td>
<td>3.32±1.10</td>
<td></td>
</tr>
<tr>
<td>Level of past year condom use with casual partners (range=0-4)*</td>
<td>2.47±1.42</td>
<td></td>
</tr>
<tr>
<td>Level of past year condom use with all sex partners (range=0-4)*</td>
<td>1.83±1.04</td>
<td></td>
</tr>
<tr>
<td>Last sex with regular partners</td>
<td>132(29.3)</td>
<td></td>
</tr>
<tr>
<td>Last sex with commercial workers</td>
<td>137(30.4)</td>
<td></td>
</tr>
<tr>
<td>Last sex with casual partners</td>
<td>79(17.6)</td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------</td>
<td></td>
</tr>
</tbody>
</table>

*Range from 0 to 5 with higher scores indicating higher levels of the practice. The total is 100%. †median.
Table 2. Means and Standard Deviations and Correlates among Modified IMB Model Constructs§ (n=450)

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Mean±SD (Range)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mobility Index</td>
<td>.35±.77 (0-10)</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2. Alcohol Use</td>
<td>5.66±4.83 (0-28.50)</td>
<td>.14</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>3. Social Isolation</td>
<td>7.20±3.79 (0-20)</td>
<td>.23**</td>
<td>.25**</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>4. Depression</td>
<td>6.65±5.16 (0-27)</td>
<td>.17*</td>
<td>.33**</td>
<td>.65**</td>
<td></td>
<td></td>
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<tr>
<td>5. Access to AIDS Prevention</td>
<td>3.01±1.32 (0-9)</td>
<td>-.11*</td>
<td>-.14**</td>
<td>-.38**</td>
<td>-.25**</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>6. Heuristic Information</td>
<td>2.32±1.38 (0-5)</td>
<td>.01</td>
<td>-.01</td>
<td>-.10’</td>
<td>-.10’</td>
<td>.13’</td>
<td></td>
<td></td>
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<tr>
<td>7. Transmission Information</td>
<td>3.11±1.07 (1-5)</td>
<td>-.01</td>
<td>-.08</td>
<td>-.19**</td>
<td>-.14**</td>
<td>-.01</td>
<td>.32**</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>8. Attitudes</td>
<td>27.91±4.67 (7-35)</td>
<td>-.30**</td>
<td>-.39**</td>
<td>-.45**</td>
<td>-.31**</td>
<td>.33**</td>
<td>.31**</td>
<td>.18**</td>
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<td></td>
<td></td>
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<tr>
<td>9. Norms</td>
<td>27.26±5.02 (7-35)</td>
<td>-.11’</td>
<td>-.31**</td>
<td>-.35**</td>
<td>-.28**</td>
<td>.30**</td>
<td>.21**</td>
<td>.17**</td>
<td>.77**</td>
<td></td>
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<tr>
<td>10. Intentions</td>
<td>26.99±4.93 (8-35)</td>
<td>-.15**</td>
<td>-.30**</td>
<td>-.37**</td>
<td>-.31**</td>
<td>.35**</td>
<td>.30**</td>
<td>.09</td>
<td>.69**</td>
<td>.77**</td>
<td></td>
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</tr>
<tr>
<td>11. Skills 1 (Preparation)</td>
<td>11.44±2.51 (3-15)</td>
<td>-.17**</td>
<td>-.44**</td>
<td>-.42**</td>
<td>-.41**</td>
<td>.20**</td>
<td>.07</td>
<td>.19**</td>
<td>.52**</td>
<td>.54**</td>
<td>.48**</td>
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<tr>
<td>12. Skills 2 (Negotiation)</td>
<td>7.48±1.74 (2-10)</td>
<td>-.13**</td>
<td>-.36**</td>
<td>-.48**</td>
<td>-.44**</td>
<td>.17**</td>
<td>.04</td>
<td>.26**</td>
<td>.49**</td>
<td>.48**</td>
<td>.43**</td>
<td>.69**</td>
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<tr>
<td>13. Skills 3 (Practice)</td>
<td>6.86±1.85 (2-10)</td>
<td>-.10’</td>
<td>-.39**</td>
<td>-.26**</td>
<td>-.30**</td>
<td>.20**</td>
<td>.03</td>
<td>.18**</td>
<td>.46**</td>
<td>.45**</td>
<td>.39**</td>
<td>.60**</td>
<td>.49**</td>
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<tr>
<td>14. Condom Use</td>
<td>1.83±0.15 (0-4)</td>
<td>-.12</td>
<td>-.47**</td>
<td>-.30’</td>
<td>-.23*</td>
<td>.29*</td>
<td>.22*</td>
<td>.28*</td>
<td>.43**</td>
<td>.50**</td>
<td>.45**</td>
<td>.39**</td>
<td>.22*</td>
<td>.23*</td>
<td></td>
</tr>
</tbody>
</table>

Cell values are Pearson Product Moment correlation coefficient (r); *P<.05; **P<.01; ***P<.001
§Higher scores indicate higher levels of the construct.
<table>
<thead>
<tr>
<th>Constructs</th>
<th>Behavioral Skills</th>
<th></th>
<th></th>
<th>Condom Use</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r[^#]</td>
<td>r[^§]</td>
<td>r[^¶]</td>
<td>B[^¥]</td>
<td>β[^¥]</td>
</tr>
<tr>
<td>Psychosocial factors</td>
<td>-.59***</td>
<td>-12*</td>
<td>-.09*</td>
<td>-.26**</td>
<td>-.19</td>
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<tr>
<td>Information</td>
<td>.15**</td>
<td>.17*</td>
<td>.10*</td>
<td>.13*</td>
<td>.12*</td>
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<td>Motivation</td>
<td>.60***</td>
<td>.27***</td>
<td>.14**</td>
<td>.24**</td>
<td>.16*</td>
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<tr>
<td>Behavioral Skills</td>
<td>.27**</td>
<td></td>
<td></td>
<td></td>
<td>.36**</td>
</tr>
</tbody>
</table>

[^#]: initial or raw correlation coefficient;[^§]: partial correlation coefficient i.e., after controlling for the mediator - behavioral skills;[^¶]: standardized path coefficient in the non-mediating model;[^¥]: standardized path coefficient in the mediating model. *P<.05; **P<.01; ***P<.001.
Coefficients are standardized path coefficients. Overall model fit: ML $\chi^2$ (22, N = 450) = 63.18, $P < .001$; CFI = .97; RMSEA = .065. Paths: *$P < .05$; **$P < .01$; ***$P < .001$.

Figure 2. Estimation of the IMB Model of Condom Use Behavior for HIV
Coefficients are standardized path coefficients. Overall model fit: ML $\chi^2 (68, N = 450) = 109.1$, NS; CFI = .94; RMSEA = .043. Paths: *$P<.05$; **$P<.01$; ***$P<.001$.

Figure 3. Estimation of the Modified IMB Model of Condom Use Behavior for HIV