

Modeling HIV Prevention Strategies among Two Puerto Rican Samples

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Abstract

The Information-Motivation-Behavioral Skills model examines factors that are used to initiate and maintain sexual and reproductive health promotion behaviors. The present study evaluated the association among these constructs as it is applied to sexually active heterosexual adults with steady partners, using a Structural Equation Modeling approach. At the same time, it was analyzed if the same model structure could be generalized to two samples of participants that produced the results following two different formats for data collection. Two-hundred ninety one participants completed the Information-Motivation-Behavioral Skills Questionnaire (Spanish version), and 756 participants completed an Internet version on the instrument. The proposed model fits the data for both groups, supporting a predictive and positive relationship among all of the latent variables, with Information predicting Motivation, and Motivation therefore predicting Behavioral Skills. The findings support the notion that there are important issues that need to be addressed when promoting HIV prevention.

Keywords: Condom; heterosexuals; IMB model; HIV.

Modelación de Estrategias para la Prevención del VIH en dos Muestras Puertorriqueñas

Compendio

El modelo de Información-Motivación-Destrezas (IMB) evalúa factores que facilitan la promoción de prácticas sexuales de menor riesgo. El presente estudio examinó la aplicación de este modelo en una muestra puertorriqueña utilizando la modelación de ecuaciones estructurales con adultos heterosexuales con al menos una pareja estable. A la vez, evaluamos si el modelo podía ser aplicado a más de una muestra. La primera muestra ($N= 291$) completó la versión en papel y lápiz de el instrumento, mientras la segunda muestra ($N= 756$) completó la versión electrónica del mismo. Los resultados reflejan que existe una asociación de predicción entre los componentes del modelo IMB, donde el tener información sobre el VIH/SIDA predijo el nivel de motivación para tener sexo más seguro, y este factor a la vez predijo el nivel de autoeficacia para la negociación sexual (destrezas). Estos resultados apuntan la necesidad de identificar múltiples factores que facilitan las prácticas sexuales de menor riesgo.

Palabras claves: Condón; heterosexuales; modelo IMB; VIH.

The idea that specific ideologies, attitudes, intentions, and skills have important predictive implications for the HIV prevention has been studied by different theoretical approaches (Fisher & Fisher, 2000). The Information-Motivation-Behavioral Skills Model (IMB) was designed to predict AIDS preventive behavior (Barak & Fisher, 2003; Fisher & Fisher, 1992, 2002; Fisher & Fisher, 1998). It is based on analysis and synthesis of theory and research in the HIV prevention and social psychology literature. The IMB model specifies that independent constructs as sexual and reproductive health information and motivation work primarily through behavioral skills to influence sexual and repro-

ductive health-related behaviors (Bazargan, Kelly, Stein, Husaini, & Bazargan, 2000; Fisher & Fisher, 1992; Fisher, Fisher, Williams, & Malloy, 1994). Within the model, it may be possible to have individuals well informed about AIDS, but may not be motivated to apply prevention strategies. At the same time, individuals could be motivated, but not well informed. It is suggested that once both factors are present, there is a higher chance of predicting a significant path toward the manifestation of behavioral skills necessary for performing preventive behaviors (Amico, Toro-Alfonso, & Fisher, 2005; Kalichman et al., 2002). In essence, sexual and reproductive health information and motivation stimulate the development and application of sexual and reproductive health behavioral skills, which are used to initiate and maintain sexual and reproductive health promotion behaviors over time (Fisher & Fisher, 1998).

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HIV and HIV Risk Behavior among the Puerto Rican Population

Risky sexual behaviors have made HIV infection among the most damaging threats to the health of Puerto Ricans today, making it important to conduct research about HIV infection and prevention in this population (Hansen, Lopez-Iftikhar, & Alegria, 2002). By 2005, Puerto Rico was one of the top ten states – dependent areas in the United States with highest number of AIDS cases and highest number of cumulative AIDS cases, including persons with a diagnosis of AIDS from the beginning of the epidemic through 2005 (Centers for Disease Control and Prevention [CDC], 2007). Over 28,000 cumulative cases of AIDS have already been reported (CDC, 2004).

By 1999, in terms of exposure/transmission categories for island born Puerto Rican people, 25% of all the cases identified were transmitted by high-risk heterosexual contact, which is a high rate compared to that of U.S. born Latinos (CDC, 2000). It has been suggested that that gender roles and communication about sex are factors that influence the acquisition of safer sex practices by heterosexual individuals (Pérez-Jiménez, Cunningham, Serrano-García, & Ortiz-Torres, 2007). In the Puerto Rican culture, gender roles are shaped by both machismo and the importance of virginity, which may affect the acquisition of accurate and pertinent information about sexual and reproductive health issues, and result in silencing the men and women of Puerto Rico when it comes to communicating meaningfully about sex, adopting safer sex practices and developing healthy intimate relationships (Herbst et al., 2007; Noland, 2006). Preventive efforts have been mainly interested in providing to individuals and couples the resources, strategies and tools (i.e. condoms, communication and negotiation skills, and educational materials) necessary to facilitate changing risky sex practices, in helping high-risk participants be aware that they have a problem which needs to be addressed, and in encouraging them to follow the recommendations offered (Kang, Deren, Andia, Colón, & Robles, 2004; Robles et al., 1998).

This study evaluated if the *Information* and *Motivation* constructs are significant predictors of *Behavioral Skills*. This analysis sought to identify important predictors of safer sex practices, and assess the applicability of the IMB Model for the prevention of HIV to two Puerto Rican samples.

Hypotheses

In previous studies that used a Structural Equation Modeling approach, the model simultaneously examined whether information and motivation are significant predictors of skills and sexual self-efficacy, and whether skills and/or sexual self-efficacy in turn are predictors

of safer sex (Barak & Fisher, 2003; J. D. Fisher et al., 1994; Kalichman, Malow, Dévieux, Stein, & Piedman, 2005; Kalichman et al., 2002; Robertson, Stein, & Baird-Thomas, 2006). The present study will analyze if there are associations among IMB-related constructs as it is applied to sexually active heterosexual adults with steady partners, and if the model can be generalized to two Puerto Rican samples that differed in the way the measures were administered. It is expected that having accurate information about HIV transmission and a strong sense of decision-making toward HIV prevention (*Information*) will strongly predict positive attitudes toward condom use, the level of perceived susceptibility to AIDS, and the access to valued referents that approved pro-condom and pro-prevention norms (*Motivation*). It is expected that the *Motivation* factor will predict a strong sense of self-efficacy to negotiate safer sex in different situations (*Behavioral Skills*).

Comparisons of paper-and-pencil, and web-based surveys have been a controversial topic (Chang, 2005; Morrel-Samuels, 2003). Increase in the use of technology in specific areas, cost-efficiency issues, and the convenience that is related to the ease of constructing, administering, accessing, and analyzing data makes the development of web-based surveys a method that is starting to be widely used in different fields of research. But at the same time, concerns about the influence of survey method on the results of the study make the selection of one format a troublesome process. Findings suggest that respondents who used the Web format might feel more able to respond in front of their computers than those who had to face the researchers (Perkins & Yuan, 2001). Also, more participants may be recruited during the same amount of time with an Internet-based survey, which may lead to sample size differences depending on the survey mode. (Perkins & Yuan, 2001; Tomsic, Hendel, & Matross, 2000). On the other hand, other findings suggest minimal differences in results from the Web and paper surveys (McCabe, Couper, Cranford, & Boyd, 2006; Miller et al., 2002). It is hypothesized that the same model structure will be generalizable to two samples of participants: *Group 1* (paper-and-pencil survey) and *Group 2* (Web-based survey).

Method

Participants

In the first study, participants ($N = 291$) were students at the Continuing Education Programs at the University of Puerto Rico, Río Piedras Campus and the Sacred Heart University (located in Santurce/PR), as well as participants in activities sponsored by the Corporación de Servicios de Salud y Medicina Avanzada (COSSMA), a community-based organization located in Cidra/PR. Thirty-seven (37%) percent of them were male and sixty-

three percent (63%) were female. Fifty-three percent of the participants were currently married, and 25% stated that they were single. Participants were sexually active with at least one steady partner in the three months previous to the study, and met the entry criteria of being heterosexual. In the second study ($N = 756$), participants were recruited due to access to the Internet: thirty-six percent (36%) were male and sixty-four percent (64%) were female. Fifty-six percent was currently married, and 44% stated they were single. Participants ranged in age from 21 to 45 years old in Group 1 ($M = 31.07$, $SD = 3.96$), and from 21 to 48 years old in Group 2 ($M = 29.32$, $SD = 6.78$). The same inclusion criteria were applied to this sample. There was a significant difference due to age between the groups ($t = 5.20$, $p < .001$). Consent for participation was obtained from participants in both studies.

Instrument

The latent variables used were primarily based on responses to adaptation to scales included in the Information-Motivation-Behavioral Skills Questionnaire, Spanish version (Pérez-Jiménez, Varas-Díaz, Serrano-García, Cintrón-Bou, & Cabrera-Aponte, 2004a). The scales used from this instrument were adapted with the purpose of including the same items in both groups. The Information-Motivation-Behavioral Skills Questionnaire, Internet version (IIMC-EI; Pérez-Jiménez, Varas-Díaz, Serrano-García, Cintrón-Bou, & Cabrera-Aponte, 2004b) was also used. The same items were used when both groups were analyzed.

Information was assessed by two measures. *Knowledge* regarding HIV transmission modes was assessed using a 7-item Likert-style scale, which measured the level of HIV/AIDS transmission and prevention knowledge (Cronbach alpha = .71). Typical items from the scale included 'HIV can be transmitted by saliva', and 'You can tell if someone has HIV or AIDS just by looking at him/her'. The items were scored on a 1, definitely true, to 5, definitely false, scale (Total range = 7-35). Higher scores indicated a possession of more accurate information about HIV/AIDS transmission. The processing of accurate information regarding HIV transmission (*Decision Making*) was assessed using a 5-item Likert-style scale, which measured decision-making processes. Cronbach alpha ranged from .63 to .67 in both samples. Typical items from the scale included 'If you really know your partner, you don't have to use a condom', and 'If you love someone, you don't have to worry about getting HIV'. The items were scored on a 1, definitely true, to 5, definitely false, scale (Total range = 5-25). Higher scores indicated a healthier application of information about HIV/AIDS transmission.

Motivation was assessed by three measures. *Perceived Risk* was measured by one item scored on a 1, no

risk, to 5, high perception of personal vulnerability to get infected. *Condom Attitudes* was measured as a second motivational indicator using a 5-item Likert-style, which measured condom-related beliefs, responsiveness, and perceived benefits or inconveniences of using condoms. Cronbach alpha ranged from .74 to .81 in both samples. Typical items from the scale included 'Using a condom makes it hard to enjoy having sex' and 'I don't like the idea of using condoms'. The items were scored on a 1, strongly agree, to 5, strongly disagree, scale (Total range = 5-25). Higher scores indicated more positive attitudes toward condom use. *Social Support* toward safer sex was measured using a 5-item Likert-style scale, which measured the access to referents that approved safer sex practices. Cronbach ranged from .87 to .90 in both samples. Typical items from the scale included 'Did someone provide you information on how to discuss with your partner about using a condom?' and 'Did someone help you to learn how to negotiate condom use with your partner without arguing with her/him?' The items were scored on a 1, never, to 5, always, scale (Total range = 5-25). Higher scores indicated higher level of access to social support toward the application of preventive strategies.

Behavioral skills were assessed by three items measuring the ability to implement and maintain condom use under different challenging situations (*Self-efficacy 1*, *Self-efficacy 2*, and *Self-efficacy 3*). The three items were 'I can refuse to have sex if my partner don't use a condom', 'I can request to use a condom even if we've been together for a long time', and 'I can insist on using a condom even if I am accused of ruining the spontaneity of the moment'. The items were scored on a 1, definitely can't, to 5, definitely can, scale. Higher scores indicated higher level of self-efficacy to negotiate safer sex across different challenging situations.

Procedure

In the first study, a paper and pencil administration of the instrument was conducted in participants' classes, as well as in individuals participating in community activities, after providing them with a consent form and explaining confidentiality and anonymity guidelines. Participants received discounts for products, restaurants, and hotel stays among others as incentives for their participation. In the Internet-based study, the link was accessed through the website of one of the newspaper of major circulation in Puerto Rico. The link was accessible for one month. Participants received discounts for products, restaurants, and hotel stays among others as incentives for their participation. All participants were given an informed consent form before filling out an anonymous survey (both in paper, and electronically). All participants were informed that the participation in the study was voluntary and confidential.

Results

A Structural Equation Modeling strategy was used to test our hypothesis about the specification and applicability of the IMB Model of AIDS preventive behavior in a Puerto Rican population. In the current study, associations between latent variables were tested using EQS 6.1 (Bentler, 2006). For this analysis, series of variables were entered to three different linear combinations for the identification of the three latent constructs included in the model: *Information*, *Motivation*, and *Behavioral Skills*. A regressive approach is employed – the more important variables in each equation could be recognized. Also, the predictive structure of the model was assessed to evaluate if more *Information* would lead to higher levels of *Motivation*, and if *Motivation* would lead to the prediction of *Behavioral Skills* for the negotiation of safer sex practices. The proposed model was independently tested in each sample. The confidence intervals for the Root Mean square Error of Approximation (RMSEA) index, and the Comparative Fit Index (CFI) were determined to evaluate the estimation of the model within each sample.

It was hypothesized that the same model structure will be generalizable to the two samples of participants that produced the results following two different formats for data collection: Group 1 (paper-and-pencil survey) and Group 2 (Web-based survey). Once the model was tested using each individual groups a multiple sample approach was used to analyze group differences on individual parameters, or on a set of parameters. This procedure is followed in order to assess the homogeneity of the correlation matrices of the data from each group. For this case, an initial baseline model with no constraints was evaluated. A second model that assumed invariance across all statistical parameters (11 variance indexes, 2 factor covariance, and 5 factor loadings), and a third model where partial constraints were imposed between samples for cross-group equality (5 factor loadings and two factor covariance) followed the evaluation of the initial baseline model.

The assumptions of multivariate normality and linearity were evaluated for the data. In none of the samples a variable did have a large standard deviation in comparison with their mean. In Group 1, *Self-efficacy 1* and *Self-efficacy 2* were highly correlated (.71). Standardized Average Absolute Residual was less than .05 in Group 1 (.023) and in Group 2 (.0180). No standardized residuals were higher than .20 in any of the samples.

The hypothesis that states that the sample covariance matrix shows no difference when compared to the population covariance matrix wasn't rejected for both Group 1 and Group 2, when tested independently. For Group 1, $ML \chi^2(18, N = 291) = 15.86, p = .60$, RMSEA = .000, 90% confidence intervals (CIs) for the RMSEA

= (.000; .048), CFI = 1.00. For Group 2, $\chi^2(18, N = 576) = 26.83, p = .08$, RMSEA = .026, 90% confidence intervals (CIs) for the RMSEA = (.000; .045), CFI = .992. After analyzing significant paths and factor loadings, for Group 1, social support toward pro-condom norms wasn't a significant indicator of *Motivation* of the participants to promote preventive strategies; for Group 2, perceived risk wasn't a significant indicator of *Motivation* of the participants to promote preventive strategies. In both samples, *Information* significantly predicted *Motivation* (Group 1 = .52, $p < .05$; Group 2 = .48, $p < .05$), which significantly predicted *Behavioral Skills* (Group 1 = .60, $p < .05$; Group 2 = .64, $p < .05$). No supplementary paths were added to the initial models.

The fit indices for testing the homogeneity of all correlation matrices were calculated for both groups. The testing procedure started with the analysis of differences between the models by first specifying an initial baseline model with no constraints: $ML \chi^2(36, N = 1,047) = 36.47.12, p = .44$, RMSEA = .005, 90% confidence intervals (CIs) for the RMSEA = (.000; .033), CFI = 1.0. The null hypothesis was not rejected. Then, a model in which factors structures for both samples were constrained was tested. A second analysis assumed invariance across all model parameters: 11 variances (of 1 factor and 8 measurement errors), 2 factor covariance, and, and 5 factor loadings. For this model: $ML \chi^2(53, N = 1,047) = 772.43, p < .0001$, RMSEA = .17, 90% confidence intervals (CIs) for the RMSEA = (.16, .18), CFI = .75. The fit indices didn't support the model with total cross-group invariance. Partial constraints were then imposed for cross-group equality on 5 factor loadings (5 free parameters among measured variable loadings), and two factor covariance: $ML \chi^2(43, N = 1,047) = 64.30, p = .024$, RMSEA = .03, 90% confidence intervals (CIs) for the RMSEA = (.01, .05), CFI = .99. The *Chi-square* index is too sensitive to sample size. When sample size is large, it is likely that proposed models will be rejected based on the *Chi-square* test (Cheung, Leung, & Au, 2006; Dudgeon, 2004; Kline, 2005). Using the RMSEA cut off values, the null hypothesis was not rejected. In both successful analyses (with no constraints, and with partial constraints), and in both groups, *Information* significantly predicted *Motivation*, which significantly predicted *Behavioral Skills*. After analyzing significant paths from the non-fixed individual factors for each partially invariant linear combination, and the related latent construct (the regression coefficient of the *Knowledge*, *Social Support*, and *Self-efficacy 1* indicators were fixed in order to give the factor the same variance as the latent variable), it was found that *Perceived Risk* didn't indicate a significant path. The loadings weren't significant ($< .40$) for the *Knowledge* indicator of the *Information*

latent construct, and the *Perceived Risk* and *Social Support* indicators of the *Motivation* latent construct. Three constraints on the equality of factor loadings were identified as untenable in the LM test: the association between the *Motivation* latent variable and *Perceived Risk*, the association between the latent variable *Behavioral Skills* and *Self-Efficacy 3* (“I can insist on using a condom even if I am accused of ruining the spontaneity of the moment”), and the strength of the predictive path between *Information* and *Motivation*, which still was significant in both samples. The LM test is a technique that identifies cross-group constraints that might be causing lack of overall fit when trying to compare the model between two different contexts at the same time; the model can be resubmitted by removing cross-group constraints that are unlikely to be true in the population (Bentler, 2006). For our model, the appropriate fit indices indicated a well fitting structure.

Discussion

The current findings account for the applicability and reliability of the Information-Motivation-Behavioral Skills (IMB) model to predict the relevance of specific HIV prevention strategies among two Puerto Rican samples, where one group was analyzed using a standard format to collect self-report data (paper-and-pencil), and another group was analyzed with a contemporary format that has been used by recent generations of researchers. When it was tested with each sample independently, or with a multi-group approach (with no constraints and with partial cross-group equality), the model suggested a predictive and positive relationship among all of the latent variables, with *Information* predicting *Motivation*, and *Motivation* therefore predicting *Behavioral Skills*. The findings support the notion that there are important issues that need to be addressed when promoting HIV prevention.

In terms of the *Information* component of the model, the *Decision Making* indicator was the better predictor in the linear combination of variables. This indicator deals with the cognitive processing and application of accurate information about HIV transmission modes, which is a more complex process than just having a high level of HIV/AIDS transmission and prevention knowledge. For the *Motivation* component, *Condom Attitudes* was a more efficient and consistent predictor in the equation compared to *Perceived Risk* and *Social Support*. The measure of attitudes toward the male condom use evaluated condom-related beliefs, responsiveness, and perceived pros and cons of safer sex. The predictive structure of effect of risk perception in the cross-group comparison is supported by the initial assessment that evaluated the samples in a single group SEM analysis, where significant paths (when detected)

showed loadings that were not significant. This may be due to the fact that the perception of risk is highly biased idea. Usually, individuals in a steady relationship don't perceive themselves as vulnerable, even when they are able to identify risk behaviors. In Group 1, 53.4% of the participants perceived no vulnerability to get infected, while 40.6% of the participants in Group 2 reported the same reaction. Their level of risk perception may be based on their having a main sexual partner, or on their assessment of the behavior of the partner (Bailey & Hutter, 2006; Hobfoll, Jackson, Lavin, Britton, & Shepherd, 1993; Misovich, Fisher, & Fisher, 1997). The access to referent that approved safer sex practices showed a positive and highly skewed distribution in Group 1 ($M= 9.45$, $SD= 4.85$), meaning that most participants reported a low level of social support that would facilitate or encourage the application of preventive strategies.

The rates of confidence to negotiate safer sex across three different situations also were strong variables that defined the *Behavioral Skills* factor in both samples. After analyzing the partial constraint of the factor loadings, it is suggested that indicators, as the level of perceived risk to get infected (even when the loadings are the same), and how confident the participants are when negotiating condom use once a claim of “ruining the spontaneity of the moment” is made, were different between groups.

Less than three indicators were used to identify one of the factors. Models that include latent measures that have only two indicators, as the *Information* factor, are more prone to estimation problems, especially when the sample size is small (Kline, 2005). There is a big difference when comparing the sample sizes of each group. Also, some demographic and recruitment information is different between the groups. If participants with different characteristics are in the comparison groups, the results of the study may be due to group differences, not necessarily to the variable used to identify the groups (Mertens, 1998). Another limitation of the study is that other models were not included in the analysis. A full model and a direct-effect model should be considered for future analyses. A full model would include the direct effect of *Information* on *Behavioral Skills*, but also accounting for the effect of *Motivation* in the relation. A direct effect model would account for the influence of *Information* on *Behavioral Skills*.

Data are frequently gathered from individuals who can be identified as belonging to certain groups, such as males, females, age cohorts, or ethnic communities, encouraging the application of multiple sample analysis to make comparisons between relevant groups (Bentler, 2006). It has been found that, after the conduction of sexuality and HIV prevention research, some relevant parameter estimates are not precisely identical when

using gender or age as a basis for the identification of groups. Robertson et al. (2006) found that, among incarcerated juvenile offenders, even when peer influence and positive condom attitudes were significantly associated with condom use for both males and females, the influence of peer condom use on participants' condom use was slightly stronger for females than for males, whereas the relationship between positive condom attitudes and condom use was stronger for males. Future research would include the important control variables in the latent variable IMB model. Previous research suggest that participant age, gender, or both influenced the observed associations between information, motivation, and behavioral skills, and condom use, as well as exerting their own independent effects on the measured variables, and condom use (Kalichman et al., 2005; Kalichman et al., 2002; Kelly et al., 2004; Noar, Morokoff, & Harlow, 2002; Robertson et al., 2006). Also, the inclusion of a direct condom use measure in the model would make a more robust case to support the application of the IMB model to predict the relationship among its latent variables, and its use in the development of interventions that are looking to reduce unprotected sex among heterosexual adults (Barak & Fisher, 2003; Fisher et al., 1994; Kalichman et al., 2005; Kalichman et al., 2002; Robertson et al., 2006). Different from the present study, which followed a cross-sectional design, an intervention would measure the use of prevention strategies across time-points, allowing for the drawing of causal conclusions among the components of the IMB model.

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