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Psychosocial Predictors of HBV Screening Behavior among Vietnamese Americans

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Abstract

Objective—We evaluated the influence of psychosocial factors on HBV screening.

Methods—Sample consisted of 1716 Vietnamese participants in our previous HBV intervention trial, recruited from 36 community-based organizations in Pennsylvania, New Jersey, and New York City between 2009 and 2014. Using the Health Belief Model and Social Cognitive Theory, we measured self-efficacy, knowledge, perceived barriers, perceived benefits, perceived severity,

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Human Subjects Approval Statement

The Temple University Institutional Review Board (protocol #11187) approved this research program.

Conflict of Interest Disclosure Statement

All authors declare that they have no conflict of interest.

and risk susceptibility. Analysis of covariance was used to compare pre- and post-intervention changes of psychosocial variables. Structural equation modeling was used to explore the direct and indirect effects of the psychosocial variables on HBV screening.

Results—Knowledge, self-efficacy, perceived benefits, and perceived barriers were directly associated with HBV screening; knowledge had the strongest effect. Perceived severity and risk susceptibility had indirect association with HBV screening through other variables. Indirect paths among the 6 psychosocial variables were also identified.

Conclusion—To promote HBV screening among Vietnamese Americans, intervention efforts should focus on increasing knowledge, self-efficacy, and perceived benefits, decreasing perceived barriers, and accounting for the dynamic cognitive processing.

Keywords

HBV screening; hepatitis B; psychosocial variables; Vietnamese Americans; liver cancer

Hepatitis B virus (HBV) infection is the leading underlying cause of chronic hepatitis, cirrhosis, hepatocellular carcinoma (HCC, the primary liver cancer), and liver failure.¹ It is estimated that approximately 50% to 80% of HCC incidents worldwide can be attributed to chronic HBV infection, depending on the geographic regions.² Factors influencing the clinical course of HBV infection include demographic characteristics, lifestyles, and clinical conditions, as well as the host genetic variants.^{2–4}

Chronic HBV infection is prevalent in Asian immigrants who immigrated to the United States (US) from Asian countries where HBV is endemic.⁵ In the US, an estimated 2.2 million residents are infected with HBV, of whom 58% are foreign-born Asian Americans who comprise 6% of the US population.⁶ As the fastest growing population in the US, Asian Americans have a higher prevalence of HBV infection than any other racial/ethnic groups do. Vietnamese Americans have the highest prevalence among all Asian-American subgroups with 7%–14% of chronic HBV infections.^{6,7} Moreover, Vietnamese men have the highest rate of liver cancer which is likely to associated with chronic HBV infection.⁸ Chronic HBV infection represents one of the major health disparities for Asian Americans in the US.

To reduce the HBV disparity with Asian Americans, evidence-based interventions to improve HBV screening among high-risk Asian populations are in need. Furthermore, identifying the key components of intervention programs that promote behavioral change is essential for developing and enhancing the screening interventions. According to the Health Belief Model (HBM) and Social Cognitive Theory (SCT), psychosocial variables such as self-efficacy, knowledge, perceived barriers, perceived benefits, perceived severity, and risk susceptibility are the main predictors of health-related behaviors, individually or in combination.^{9,10} Many studies have examined the role of psychosocial variables in predicting screening behaviors for breast, cervical, and colorectal cancer screening in different ethnic populations. Findings from these studies demonstrate that, in general, high perceived barriers and low risk susceptibility delay or prevent cancer screening, whereas increased knowledge, increased self-efficacy, and high levels of perceived benefits and

perceived severity promote cancer screening.^{11–16} The role of psychosocial variables also has been explored to explain many other health-related behaviors including breast self-examination and medication adherence.^{17,18}

However, studies about the underlying process of how psychosocial variables influence HBV screening remain largely limited. To our knowledge, no study has examined the interrelationships among psychosocial variables to predict HBV screening, particularly in Asian Americans. Therefore, the purpose of this study was to fill the gap in current literature about the role of psychosocial variables on HBV screening by analyzing the interplay of the psychosocial components of our previous successful intervention to enhance HBV screening behavior.

We have previously conducted a community-based randomized trial to enhance HBV screening among never screened Vietnamese Americans who reside in the eastern region of the US. The intervention for the study was designed to address both individual level and healthcare system barriers and consisted of interactive group education, navigation services, and the engagement of community leadership and healthcare providers in advocacy and referrals. The group education program was guided by the HBM and SCT and addressed HBV knowledge, health beliefs about HBV screening (perceive risk, severity, benefits, and barriers to screening) and self-efficacy of obtaining screening. Our main research areas for the present study included: (1) whether the education program significantly changed the psychosocial variables; (2) which variables were key factors that had direct impact on HBV screening; and (3) how the psychosocial variables were related to each other in predicting the HBV screening outcome. Clarifying the relationships among the psychosocial variables and identifying the key factors will enhance understanding of the underlying process of making culturally appropriate behavioral intervention effective to improve HBV screening.

METHODS

The Center for Asian Health (CAH) at Temple University has a longstanding collaborative relationship with Asian-American community-based organizations that are partner members of the Asian Community Health Coalition. Vietnamese community-based organizations (VCOs) participated in the present study as part of the Asian Community Health Coalition. More detailed information about methods was described in a previously published article.¹⁹

Participants

Following the approval of Temple University's Institutional Review Board, the CAH invited Vietnamese-American community leaders and representatives of eligible Vietnamese community-based organizations (VCOs) to be involved in the research study. A total of 36 VCOs in Pennsylvania, New Jersey, and New York City consented and enrolled; 18 of the VCOs were randomly assigned to the intervention condition and 18 VCOs were randomly assigned to the control condition using a matched-pair design.¹⁹ The eligibility of study participants was assessed based on the following criteria: (1) self-identified Vietnamese ethnicity; (2) aged 18 years or older; (3) access to a telephone (for scheduling and contact purposes); (4) not currently or previously enrolled in any HBV intervention program; (5) never had HBV screening; and (6) not aware of any previous HBV infections or diagnoses.

Study Procedure

Among the eligible participants, 2337 consented and completed the baseline assessment. Participants then received HBV screening intervention (intervention condition) or a general cancer education and preventive care (control condition). After the intervention, participants completed post-intervention assessment of psychosocial variables. Screening behavior was assessed at 6-month post-intervention and 2254 participants completed the 6-month follow-up assessment. For this study, we only included participants who completed the assessment questions on psychosocial variables both at pre- and post-intervention, and HBV screening at 6-month follow-up. After further excluding cases with missing values on demographic factors, the final analytic sample for the study consisted of 1716 participants.

Measurements

All measures in English were translated, back-translated, and pretested in Vietnamese to ensure the scientific and cultural appropriateness of the instrument for participants from the Vietnamese community. The baseline assessment tool was provided in Vietnamese and English versions, and bilingual assistance was available at all sites.

Demographic variables—Sex, age, education level, marital status, education, and employment were used for descriptive purposes to delineate critical characteristics of the sample and to explore whether demographic variables modify participants' responses to the intervention. English proficiency was measured in 3 categories (not at all, not well, and well/very well).

Screening status—At 6-month follow-up conducted via telephone interview, HBV screening status was measured with the question: "Have you had a blood test for Hepatitis B during the past 6 months?" Validation by a chart review showed no discordance.

Psychosocial variables—The Health Belief Model²⁰ and Social Cognitive Theory²¹ were used as an integrative framework to guide the intervention design, and provided theoretical ground for psychosocial constructs. Previous studies have designed and used HBM constructs to assess their association with various screening behaviors, and the scales showed high reliability.^{22,23} A meta-analysis found that the HBM constructs were valid and significant predictors of various health behaviors.²⁴ We adjusted some of the items for the assessment of HBV screening behavior. The constructs in the framework were measured as described in the sections below.

Self-efficacy—Seven items were used to construct the self-efficacy scale. For example, participants were asked how confident they are that they can "obtain Hep B screening," "get vaccinated for Hep B," and "get information about Hepatitis B screening and vaccination." Each item was measured with a Likert scale from 1 "not at all confident" to 10 "totally confident." The final score of self-efficacy was computed by taking the average of the 7 items. A higher numeric value indicated a higher level of self-efficacy. The scale's internal consistency reliability was high (Cronbach's alpha = .98).

Knowledge—Participants were asked if they know the right answers to the 7 questions, such as: “What is the best way that can prevent people from getting Hepatitis B?” and “Which ethnic group in the US has the highest incidence of Hepatitis B?” Their answers to each question was dichotomized as “right” or “wrong,” and then summed to obtain a knowledge score. The score ranged from 0 to 7, with a higher numeric value indicating a higher level of knowledge. The scale’s internal consistency reliability was high (Cronbach’s $\alpha = .78$).

Perceived barriers—Participants were asked about their opinion toward 5 statements, such as “I am scared to have blood-screening test for Hepatitis B because I might learn that I am a Hep B carrier,” “I do not need to get a blood-screening test for Hepatitis B if I feel OK or healthy,” or “I do not know where to go to get a blood-screening test and vaccine for Hep B.” Each item was measured with a Likert scale from 1 “strongly disagree” to 5 “strongly agree.” The final score of perceived barriers was computed by taking the average of the 5 items. A higher numeric value indicated a higher level of perceived barriers. The scale’s internal consistency reliability was high (Cronbach’s $\alpha = .83$).

Perceived benefits—Participants were asked about their opinion toward the 5 statements, such as “Having a blood-screening test for Hepatitis B will help me find and treat liver disease early” “Having a blood-screening test for Hepatitis B will help me to prevent transmitting to other ones,” or “If I get a vaccine to prevent Hepatitis B, I would not worry about liver disease and liver cancer.” Each item was measured with a Likert scale from 1 “strongly disagree” to 5 “strongly agree.” The final score of perceived benefits was computed by taking the average of the 5 items. A higher numeric value indicated a higher level of perceived benefits. The scale’s internal consistency reliability was high (Cronbach’s $\alpha = .93$).

Perceived severity—Two items were used to construct the perceived severity scale. Participants were asked about their opinion toward the following 2 statements: “My whole life would change if I had Hepatitis B” and “People who are infected with Hepatitis B will develop liver cancer and die from it.” Each item was measured with a Likert scale from 1 “strongly disagree” to 5 “strongly agree.” The final score of perceived severity was computed by taking the average of the 2 items. A higher numeric value indicates a higher level of perceived severity. The scale has a high internal reliability (Cronbach’s $\alpha = .73$).

Risk susceptibility—Three items were used to construct the risk susceptibility scale. Participants were asked about their opinion toward the following 3 statements: “I feel I am at high risk of getting Hepatitis B,” “I often worry about myself getting Hepatitis B,” and “I often worry about myself getting liver cancer.” The final score of risk susceptibility was computed by taking the average of the 3 items. A higher numeric value indicates a higher level of risk susceptibility. The scale’s internal consistency reliability was high (Cronbach’s $\alpha = .87$).

Statistical Analysis

Three data analysis steps were adopted. First, we compared the intervention and control groups with regards to the sample characteristics with cross tabulations and χ^2 statistics. The significant social demographic differences were selected to be included as the covariates in the following statistical comparisons. Second, the analysis of covariance (ANCOVA) was conducted on each social psychological variable to see if: (1) scores of each variable changed significantly from pre- to post-intervention survey, separately for the intervention and the control group (indicated with first 2 p-values in Table 2); and (2) changes of the scores were significantly different between the intervention and the control group (indicated with the F-statistics and p-value in the last 2 columns).

The third step tested the direct and indirect effects of the post-intervention scores of all 6 psychosocial variables on HBV screening controlling for the pre-intervention scores using structural equation modeling (SEM). Multicollinearity was not detected as bivariate correlations did not exceed .70 and each variance inflation factor (VIF) was less than 3. Results were used to construct a path model. Multiple fit was estimated with comparative fit indices (CFI) and Tucker-Lewis Index (TLI), and the root mean square error of approximation (RMSEA). For both CFI and TLI, a value of .90 or higher is considered acceptable, and for RMSEA, a value below .08 indicates a good fit.^{25,26} Because our final structural model is a nonrecursive model (ie, a bidirectional model with reciprocal causation or feedback loops), we used the Bentler-Raykov squared multiple correlation coefficient, instead of the R-squared value, as the measure of explained variance.²⁷ The goodness-of-fit statistics and the unstandardized maximum likelihood estimates for the parameters of the final structural model were presented in Figure 2. The CFI for the SEM was .999, indicating good model fit. The TYL yielded a value of .998. The RMSE compares the observed variances and covariance with those resulting from the models' parameter estimates, and is not sensitive to the sample size. The RMSEA value of .011 indicates a good fit of the measurement model. All analyses were conducted with Stata 14.²⁸

RESULTS

Sample Characteristics

After listwise deletion, our sample consisted of 1716 participants (731 in intervention group, and 985 in control group). Table 1 compares the intervention and control groups on demographic characteristics and the HBV screening test. Chi-square (χ^2) test p-values are presented to indicate significant differences between the intervention and control groups. The intervention and control groups had similar average age and sex composition, and the rate of having a regular physician ($p > .05$). The intervention group had significantly higher proportions of participants who had never married (18.47%), had a college degree or higher (10.26%), were unemployed (9.17%), rated their English proficiency as "well or very well" (10.26%), or did not have health insurance (57.46%), than the control group (13.91%, 8.22%, 7.41%, 7.21%, or 36.55%, respectively). Therefore, we controlled for these 5 factors in the repeated measure ANOVA. Among the participants who completed the 6-month follow-up, those in the intervention group had a significantly higher HBV screening rate

(86.18%) than did those in the control group (only 5.18%). There was no significant difference of screening rates in Vietnamese participants among the 3 states.

Effects of HBV Education Intervention on 6 Psychosocial Variables

We conducted a repeated measures ANOVA to compare the differences in score changes of 6 psychosocial variables between the intervention and the control group, controlling for 4 factors: marital status; employment status; English proficiency; and having insurance coverage. Table 2 presents the adjusted means of score changes and significance test results. The t-test results showed that perceived barriers decreased significantly, and the other 5 factors, self-efficacy, knowledge, perceived benefits, perceived severity, and risk susceptibility increased significantly for the intervention group ($p < .001$); only one variable, knowledge, increased significantly for the control group ($p < .05$). The score changes for all 6 variables were significantly different between the intervention and the control group ($p < .05$ for perceived barriers, and $p < .001$ for the other 5 factors). These results indicate significant intervention effects on all 6 psychosocial variables.

Direct and Indirect Effects of Psychosocial Variables on HBV Screening

We conducted an SEM-based path analysis to determine the direct or indirect effects of the post-intervention scores of psychosocial variables on HBV screening at 6-month follow-up, controlling for pre-intervention scores and other covariates that are significantly associated with HBV screening in bivariate analyses (results not shown). Because of the exploratory nature of our inquiry, we started with a simple model, with hypothesized direct links from each psychosocial variable to HBV screening. *Post hoc* modifications were then performed to develop a better fitting model, following results of the Lagrange multiplier test. The final model appears in Figure 2, and the total, indirect, and direct effects of the 6 psychosocial factors on HBV screening from the structural model appear in Table 3.

The results of the path model revealed that a higher level of knowledge ($\beta = .22$, $p < .001$), a higher level of self-efficacy ($\beta = .04$, $p < .05$), more perceived benefits ($\beta = .03$, $p < .05$), and more perceived barriers ($\beta = -.04$, $p < .001$) were directly associated with a higher probability of having HBV screening at 6-month follow-up. Among the 4 variables, knowledge had the strongest direct and total effects ($\beta = .20$, $p < .001$), and perceived barriers had the second largest direct and total effects ($\beta = -.14$, $p < .001$). Perceived benefits and perceived barriers also were significantly, indirectly associated with screening through other variables, as Table 3 shows. Perceived severity had only indirect positive association with screening through risk susceptibility and then knowledge or perceived barriers. However, perceived susceptibility was not associated with screening – either directly or indirectly. The Bentler-Raykov squared multiple correlation coefficient for HBV screening was .3952, indicating that 39.52% of HBV screening was explained by its predictors.

Interaction Patterns among the Psychosocial Variables

Among the psychosocial variables, knowledge was associated with increased self-efficacy ($\beta = .32$, $p < .05$) and increased perceived benefits ($\beta = .60$, $p < .01$). The association between knowledge and self-efficacy also was mediated by perceived benefits. Perceived barriers

were associated with decreased knowledge ($\beta = -.40, p < .05$), decreased perceived benefits ($\beta = -.28, p < .01$), and decreased risk susceptibility ($\beta = -.24, p < .05$). Although not related to screening behavior, risk susceptibility was associated with decreased perception of barriers, increased knowledge, and increased perception of benefits. The association between risk susceptibility and perceived benefits also was mediated by perceived barriers. Perceived severity was only associated with increased risk susceptibility ($\beta = .50, p < .001$). There were 2 pairs of variables with reciprocal effects. One pair included perceived barriers and perceived benefits: decreased perception of barriers was associated with increased perception of benefits ($\beta = -.28, p < .01$), and an increased perception of benefits was associated with increased perception of barriers ($\beta = .56, p < .001$). The other pair involved perceived barriers and risk susceptibility: increased risk susceptibility was associated with decreased perception of barriers ($\beta = -.12, p < .01$), which, in return, was associated with increased risk susceptibility ($\beta = -.24, p < .001$).

DISCUSSION

In this study, we examined the effects of an education intervention on psychosocial variables and found the intervention was associated with a statistically significant increase in self-efficacy, knowledge, perceived benefits, perceived severity, and risk susceptibility, and significant decrease in perceived barriers. We also examined the impact of the improved psychosocial variables on HBV screening at 6-month follow-up and the relationships among the psychosocial variables. Through the path analysis, we found that the post-intervention scores (controlling for pre-intervention scores) of 4 psychosocial variables, knowledge, self-efficacy, perceived benefits, and perceived barriers had significant direct effects on HBV screening at 6-month follow-up, indicating important independent influence on HBV screening behavior. This finding is consistent with the general body of existing literature on HBV screening behaviors in Asian communities^{25–28} that highlights the importance of developing interventions that address these factors to improve screening behavior.

Notably, our findings indicate that HBV knowledge improvement played a key role in increasing HBV screening rates among Vietnamese Americans, which is consistent with other HBV intervention studies among Asian Americans.^{31–35} Evidence showed that improving HBV knowledge serves as an important factor in disease prevention by increasing the probability of earlier detection among Asian Americans. However, public awareness of HBV and its associated liver cancer is still low in many high-risk populations such as Vietnamese Americans and other Asian Americans.³⁶ Indeed, the average baseline knowledge score in our sample was approximately 3.4 on a score range from 0 to 7, which indicates that the community in general lacks knowledge on hepatitis B risk and prevention. Given that the HBV knowledge gaps could lead to a low level of HBV screening, increased HBV transmission, delayed treatment, and poorer outcomes, and that HBV screening is the first step in preventing and controlling HBV infection and liver cancer,^{37,38} educational intervention for improving HBV knowledge should focus primarily on increasing the knowledge of hepatitis B in this community.

In addition, perceived barriers were identified as the second most important predictor for HBV screening among Vietnamese Americans. Studies have demonstrated that Vietnamese

Americans face various barriers in seeking and receiving healthcare services in general.^{39–42} Consistent with those studies, the sample in our study reported a moderately high level of perceived barriers in various domains, including financial, linguistic, knowledge, and psychological barriers to hepatitis B screening. Our findings confirm the importance of addressing these barriers to facilitate screening behavior, particularly in Asian Americans. Future research is also needed to improve understanding of the level of each specific type of barrier the community experiences and its effect on screening behaviors.

Moreover, our findings suggest that raising self-efficacy and highlighting the benefit of HBV screening would also be an effective means for facilitating screening intention and performance in Vietnamese-American communities. Interestingly, although both self-efficacy and perceived benefits had a positive significant direct effect on HBV screening, the total and indirect effects of self-efficacy were not statistically significant, and the total and indirect effects of perceived benefits were negative. These results imply that interrelationships among the psychosocial variables could suppress the positive direct effects of self-efficacy and perceived benefits on screening behavior, giving rise to the possibility that researchers could make inconsistent conclusions. Indeed, previous studies of health behaviors in Asian communities have generated conflicting findings on the effects of self-efficacy. A summary of 9 meta-analytic studies have concluded that low self-efficacy is a significant contributor to motivation and performance of health behaviors.⁴³ In contrast, several other studies found that the effects of self-efficacy are contingent on the specific health behaviors recommended (eg, detection vs prevention).^{44,45} Specifically, they argued that self-efficacy plays a lesser role in affecting behaviors, such as screening, or one-time-only vaccination. Discrepancy between the total and direct effects of self-efficacy on screening behavior in our study may give some clues to understanding the conflicting findings in the existing literature. Better understanding of the potential suppressive indirect effects of self-efficacy and perceived benefits on screening behavior through other psychosocial variables will be an important future research topic for a development of effective interventions.

We did not find any direct effects of risk susceptibility or perceived severity on HBV screening, which contradicts previous findings of screening behaviors among Asian immigrants.^{46–48} Scholars of health communication and health behavior argue that interventions focusing on the negative consequences “evoke in-depth processing and careful evaluation of the tradeoffs in deciding to comply and would be more effective...”,⁴⁹ which was why it was of vital importance to alert community members of their risk level and the severe consequences of the illness. However, in Eastern culture that is influenced by both Buddhism and Taoism, it is emphasized that things should be permitted to assume their natural courses. Such notions could be manifested as fatalism in health belief: fate was decided by a superior power and should be accepted stoically. Such fatalistic attitudes towards health and disease could result in reluctance to participate in detection behavior and proactive help-seeking.^{48,50} Therefore, the intention to prevent negative consequences might have been concealed by the fatalistic attitude among Vietnamese Americans, causing no direct effects of perceived severity and risk susceptibility in this population. This finding indicates that perceiving risk or severity of hepatitis B would not necessarily motivate screening behavior among Vietnamese Americans. Instead, the significant indirect effects of

perceived severity on HBV screening behavior through knowledge, self-efficacy, perceived barriers, or perceived benefits suggest that educational efforts should be accompanied by increasing knowledge and benefits, raising self-efficacy, and addressing perceived barriers.

Besides the information about the relative importance of each psychosocial factor revealed by the direct and indirect effects, SEM-based path analysis allowed us to explore the relationships among the variables. The complex interactions among the 6 psychosocial variables indicate that screening is dynamic and progresses through multiple stages of contemplation and action.¹³ The interplay of psychosocial factors is not linear, but intertwined and nonrecursive. Therefore, to promote screening behaviors better, intervention efforts need to account for the relationships among the psychosocial variables and focus on the links that are most effective.

We acknowledge the limitation of the study that we mainly included cognitive measures but not emotional measures (such as fear) as psychosocial variables. Emotional variables are reported to have a strong association with screening behaviors.¹² The lack of measurement of emotional variables in this study limited our ability to explore their role in the causal relationships with HBV screening. Future research needs to examine the combined effects of cognitive as well as emotional components in affecting screening behavior.

Despite the limitation, this study is one of the few prospective studies examining the role of theory-based psychosocial variables on disease screening behavior. The exploration of dynamic interaction patterns among the psychosocial variables that affect HBV screening behavior is informative and innovative. The application of the HBM and SCT in understanding how the psychosocial variables influence HBV screening is well supported by this study and provides future direction for implementation and dissemination of HBV screening intervention programs.

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References

1. World Health Organization. [Accessed April 7, 2016] Hepatitis B. 2016. Available at: <http://www.who.int/mediacentre/factsheets/fs204/en/>
2. Nguyen VTT, Law MG, Dore GJ. Hepatitis B-related hepatocellular carcinoma: epidemiological characteristics and disease burden. *J Viral Hepat.* 2009; 16(7):453–463. [PubMed: 19302335]
3. Matsuura K, Isogawa M, Tanaka Y. Host genetic variants influencing the clinical course of hepatitis B virus infection. *J Med Virol.* 2016; 88(3):371–379. [PubMed: 26255971]
4. Moudi B, Heidari Z, Mahmoudzadeh-Sagheb H. Impact of host gene polymorphisms on susceptibility to chronic hepatitis B virus infection. *Infect Genet Evol.* 2016; 44:94–105. [PubMed: 27346643]
5. Kew MC. Epidemiology of chronic hepatitis B virus infection, hepatocellular carcinoma, and hepatitis B virus-induced hepatocellular carcinoma. *Pathol Biol (Paris).* 2010; 58(4):273–277. [PubMed: 20378277]

6. Kowdley KV, Wang CC, Welch S, et al. Prevalence of chronic hepatitis B among foreign-born persons living in the United States by country of origin. *Hepatology*. 2012; 56(2):422–433. [PubMed: 22105832]
7. Jorgensen C, Chen S, Carnes CA, et al. “Know Hepatitis B:” a multilingual communications campaign promoting testing for hepatitis B among Asian Americans and Pacific Islanders. *Public Health Rep*. 2016; 131(Suppl 2):35–40.
8. Burke NJ, Jackson JC, Thai HC, et al. “Honoring tradition, accepting new ways”: development of a hepatitis B control intervention for Vietnamese immigrants. *Ethn Health*. 2004; 9(2):153–169. [PubMed: 15223574]
9. Janz NK, Becker MH. The Health Belief Model: a decade later. *Health Educ Behav*. 1984; 11(1):1–47.
10. Bandura A. Social cognitive theory: an agentic perspective. *Annu Rev Psychol*. 2001; 52:1–26. [PubMed: 11148297]
11. Hay JL, Buckley TR, Ostroff JS. The role of cancer worry in cancer screening: a theoretical and empirical review of the literature. *Psychooncology*. 2005; 14(7):517–534. [PubMed: 15490428]
12. Magai C, Consedine N, Neugut AI, Hershman DL. Common psychosocial factors underlying breast cancer screening and breast cancer treatment adherence: a conceptual review and synthesis. *J Womens Health*. 2007; 16(1):11–23.
13. Parsa P, Kandiah M, Abdul Rahman H, Zulkefli NM. Barriers for breast cancer screening among Asian women: a mini literature review. *Asian Pac J Cancer Prev*. 2006; 7(4):509–514. [PubMed: 17250418]
14. Sung JJY, Choi SYP, Chan FKL, et al. Obstacles to colorectal cancer screening in Chinese: a study based on the health belief model. *Am J Gastroenterol*. 2008; 103(4):974–981. [PubMed: 18047545]
15. Paskett ED, McLaughlin JM, Reiter PL, et al. Psychosocial predictors of adherence to risk-appropriate cervical cancer screening guidelines: a cross sectional study of women in Ohio Appalachia participating in the Community Awareness Resources and Education (CARE) project. *Prev Med*. 2010; 50(1–2):74–80. [PubMed: 19744509]
16. Farmer D, Reddick B, D’Agostino R, Jackson SA. Psychosocial correlates of mammography screening in older African American women. *Oncol Nurs Forum*. 2007; 34(1):117–123. [PubMed: 17562638]
17. Jirojwong S, MacLennan R. Health beliefs, perceived self-efficacy, and breast self-examination among Thai migrants in Brisbane. *J Adv Nurs*. 2003; 41(3):241–249. [PubMed: 12581112]
18. Khdour MR, Hawwa AF, Kidney JC, et al. Potential risk factors for medication non-adherence in patients with chronic obstructive pulmonary disease (COPD). *Eur J Clin Pharmacol*. 2012; 68(10):1365–1373. [PubMed: 22476392]
19. Ma GX, Fang CY, Seals B, et al. A community-based randomized trial of hepatitis B screening among high-risk Vietnamese Americans. *Am J Public Health*. 2017; 107(3):433–440. [PubMed: 28103075]
20. Becker MH. The Health Belief Model and personal health behavior. *Health Educ Monogr*. 1974; 2:324–508.
21. Bandura A. Social Cognitive Theory: an agentic perspective. *Annu Rev Psychol*. 2001; 52(1):1–26. [PubMed: 11148297]
22. Champion VL. Instrument development for health belief model constructs. *ANS Adv Nurs Sci*. 1984; 6(3):73–85. [PubMed: 6426380]
23. Champion, VL., Skinner, CS. The Health Belief Model. In: Glanz, K., Rimer, BK., Viswanath, K., editors. *Health Behavior and Health Education*. 4. San Francisco, CA: Jossey-Bass; 2008. p. 45–65.
24. Carpenter CJ. A meta-analysis of the effectiveness of Health Belief Model variables in predicting behavior. *Health Commun*. 2010; 25(8):661–669. [PubMed: 21153982]
25. Muthén B, Muthén LK. Integrating person-centered and variable-centered analyses: growth mixture modeling with latent trajectory classes. *Alcohol Clin Exp Res*. 2000; 24(6):882–891. [PubMed: 10888079]

26. Jöreskog, KG. Testing structural equation models. In: Bollen, KA., Long, JS., editors. *Testing Structural Equation Models*. SAGE; 1993. p. 294–316.
27. Bentler PM, Raykov T. On measures of explained variance in nonrecursive Structural Equation Models. *J Appl Psychol*. 2000; 85(1):125–131. [PubMed: 10740963]
28. StataCorp. *Stata Statistical Software: Release 14*. College Station, TX: StataCorp LP; 2015.
29. Ma GX, Tan Y, Wang MQ, et al. Hepatitis B screening compliance and non-compliance among Chinese, Koreans, Vietnamese and Cambodians. *Clin Med Insights Gastroenterol*. 2010; 3:1–11.
30. Ma GX, Gao W, Tan Y, et al. A community-based participatory approach to a hepatitis B intervention for Korean Americans. *Prog Community Health Partnersh*. 2012; 6(1):7–16. [PubMed: 22643783]
31. Nguyen TT, Taylor V, Chen MS, et al. Hepatitis B awareness, knowledge, and screening among Asian Americans. *J Cancer Educ*. 2007; 22(4):266–272. [PubMed: 18067441]
32. Wu CA, Lin SY, So SK, Chang ET. Hepatitis B and liver cancer knowledge and preventive practices among Asian Americans in the San Francisco Bay Area, California. *Asian Pac J Cancer Prev*. 2007; 8(1):127–134. [PubMed: 17477787]
33. Ma GX, Shive SE, Toubbeh JI, et al. Knowledge, attitudes, and behaviors of Chinese hepatitis B screening and vaccination. *Am J Health Behav*. 2008; 32(2):178–187. [PubMed: 18052858]
34. Ma GX, Shive SE, Fang CY, et al. Knowledge, attitudes, and behaviors of hepatitis B screening and vaccination and liver cancer risks among Vietnamese Americans. *J Health Care Poor Underserved*. 2007; 18(1):62–73. [PubMed: 17337798]
35. Ha NB, Trinh HN, Nguyen TT, et al. Prevalence, risk factors, and disease knowledge of chronic hepatitis B infection in Vietnamese Americans in California. *J Cancer Educ*. 2013; 28(2):319–324. [PubMed: 23564428]
36. McMahon BJ, Block J, Haber B, et al. Internist diagnosis and management of chronic hepatitis B virus infection. *Am J Med*. 2012; 125(11):1063–1067. [PubMed: 23098862]
37. Romano L, Paladini S, Van Damme P, Zanetti AR. The worldwide impact of vaccination on the control and protection of viral hepatitis B. *Dig Liver Dis*. 2011; 43:S2–S7. [PubMed: 21195368]
38. Post SE, Sodhi NK, Peng C, et al. A simulation shows that early treatment of chronic hepatitis B infection can cut deaths and be cost-effective. *Health Aff (Millwood)*. 2011; 30(2):340–348. [PubMed: 21289356]
39. Juon H-S, Lee S, Strong C, et al. Effect of a liver cancer education program on hepatitis B screening among Asian Americans in the Baltimore–Washington metropolitan area, 2009–2010. *Prev Chronic Dis*. 2014; 11:130258. [PubMed: 24503341]
40. Lee S, Martinez G, Ma GX, et al. Barriers to health care access in 13 Asian American communities. *Am J Health Behav*. 2010; 34(1):21–30. [PubMed: 19663748]
41. Ma GX, Gao W, Fang CY, et al. Health beliefs associated with cervical cancer screening among Vietnamese Americans. *J Womens Health*. 2013; 22(3):276–288.
42. Taylor VM, Yasui Y, Burke N, et al. Hepatitis B knowledge and testing among Vietnamese-American women. *Ethn Dis*. 2005; 15(4):761–767. [PubMed: 16259505]
43. Bandura A, Locke EA. Negative self-efficacy and goal effects revisited. *J Appl Psychol*. 2003; 88(1):87–99. [PubMed: 12675397]
44. Gallagher KM, Updegraff JA. Health message framing effects on attitudes, intentions, and behavior: a meta-analytic review. *Ann Behav Med*. 2012; 43(1):101–116. [PubMed: 21993844]
45. Montaño, DE., Kasprzyk, D. Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. In: Glanz, K., Rimer, BK., Viswanath, K., editors. *Health Behavior: Theory, Research, and Practice*. 5. San Francisco, CA: Jossey-Bass; 2015.
46. Bastani R, Glenn BA, Maxwell AE, Jo AM. Hepatitis B testing for liver cancer control among Korean Americans. *Ethn Dis*. 2007; 17(2):365–373. [PubMed: 17682372]
47. Ma GX, Shive SE, Fang CY, et al. Knowledge, attitudes, and behaviors of hepatitis B screening and vaccination and liver cancer risks among Vietnamese Americans. *J Health Care Poor Underserved*. 2007; 18(1):62–73. [PubMed: 17337798]
48. Taylor VM, Yasui Y, Burke N, et al. Hepatitis B testing among Vietnamese American men. *Cancer Detect Prev*. 2004; 28(3):170–177. [PubMed: 15225896]

49. Block LG, Keller PA. When to accentuate the negative: the effects of perceived efficacy and message framing on intentions to perform a health-related behavior. *J Mark Res.* 1995; 32(2):192–203.
50. Lee HY, Vang S. Barriers to cancer screening in Hmong Americans: the influence of health care accessibility, culture, and cancer literacy. *J Community Health.* 2010; 35(3):302–314. [PubMed: 20140486]

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Figure 1.
Flow Diagram of Study Procedure and Analysis Sample

Figure 2.

Standardized Path Coefficients and Their Significance from the SEM Analysis (N = 1716)

* $p < .05$; ** $p < .01$; *** $p < .001$

Note.

All covariates have paths to intervention participation, the score change of 6 psychosocial variables, and/or HBV screening. To simplify the figure, those paths are not shown except for the path to intervention participation. The pre-scores of 6 psychosocial variables, employment status, English proficiency, having a regular physician, and having health insurance were included as covariates in the model.

CFI = .999; TLI = .998; RMSEA = .010

Table 1

Demographic Characteristics at Baseline and HBV Screening Rate at 6-month Follow-up for Vietnamese Americans (N = 1716)

	Intervention (N = 731, %)	Control (N = 985, %)
Age, mean (SD) (p > .05)	59.91 (16.24)	50.26 (13.55)
Sex (p > .05)		
male	296 (40.49)	421 (42.74)
female	435 (59.51)	564 (57.26)
Marital status (p < .05)		
married	548 (74.97)	768 (77.97)
never married	135 (18.47)	137 (13.91)
divorced/widowed	48 (6.57)	80 (8.12)
Education (p < .05)		
below high school	186 (25.44)	303 (30.76)
high school graduate	470 (64.30)	601 (61.02)
some college or higher	75 (10.26)	81 (8.22)
Employment (p < .05)		
employed	428 (58.55)	651 (66.09)
unemployed	67 (9.17)	73 (7.41)
retired/homemaker/student	236 (32.28)	261 (26.50)
English proficiency (p < .01)		
not at all	296 (40.49)	347 (35.23)
not well	360 (49.25)	567 (57.56)
well/very well	75 (10.26)	71 (7.21)
Health insurance (p < .001)		
no	420 (57.46)	360 (36.55)
yes	311 (42.54)	625 (63.45)
Have a regular physician (p > .05)		
no	177 (24.21)	210 (21.32)
yes	554 (75.79)	775 (78.68)
Had HBV screening in the past 6-month, 6-m FL (p < .001)	630 (86.18)	51 (5.18)

Note.

p-values indicate significant difference between intervention and control group.

Pre- and Post- Intervention Differences of Psychosocial Variables between the Intervention and Control Groups (N = 1716)

Table 2

	Intervention, mean (s.e.)				Control, mean (s.e.)				time × group
	Pre	Post	p-value ^a		Pre	Post	p-value ^a		
Self-Efficacy	6.22 (.08)	8.80 (.07)	< .001		7.20 (.07)	7.36 (.06)	ns		795.35 ***
Knowledge	3.11 (.05)	5.69 (.04)	< .001		3.60 (.04)	3.70 (.04)	< .05		2237.26 ***
Perceived Barriers	3.26 (.03)	2.70 (.03)	< .001		3.06 (.02)	3.04 (.02)	ns		210.81 *
Perceived Benefits	3.29 (.03)	4.22 (.03)	< .001		3.55 (.03)	3.59 (.03)	ns		673.30 ***
Perceived Severity	3.13 (.03)	3.57 (.02)	< .001		3.22 (.02)	3.22 (.03)	ns		125.63 ***
Risk Susceptibility	2.74 (.03)	3.33 (.03)	< .001		2.68 (.02)	2.73 (.03)	ns		161.22 ***

* p < .05,
** p < .01,
*** p < .001

Note.

^aThe p-value indicates significance of within group difference from pre- to post-intervention.
^bThe p-value for the F-statistics indicates significance of between group difference (intervention and control) from pre- to post-intervention.
ANOVA analyses controlled for marital status, education, employment status, English proficiency, and having insurance coverage.

Table 3

Standardized Coefficients of Total, Indirect, and Direct Effects of 6 Psychosocial Variables on HBV Screening at 6-month Follow-up (N = 1716)

Post-intervention score	Total effect (s.e.)	Indirect effect (s.e.)	Direct effect (s.e.)
self-efficacy	.04 (.03)	.01 (.03)	.04 (.01) *
Knowledge	.20 (.03) ***	-.02 (.03)	.22 (.01) ***
perceived benefits	-.10 (.04) **	-.13 (.04) ***	.03 (.02) *
perceived barrier	-.14 (.02) ***	-.10 (.02) ***	-.04 (.01) ***
perceived severity	.07 (.03) **	.06 (.03) **	.01 (.02)
risk susceptibility	.13 (.11)	.10 (.11)	.03 (.04)

*
p < .05,

**
p < .01,

***
p < .001