

Application of the modified Health Belief Model for undergoing oral mucosal examination: comparison of different health risk groups

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Objectives: Oral mucosal examination (OME) is an effective measure for detecting oral cancer, which is the fourth leading cause of cancer deaths among males in Taiwan. Despite this fact, there is a lack of literature concerning the likelihood of undergoing an OME among different health risk groups based on individuals' habits of drinking alcohol, chewing betel quid, and smoking cigarettes. **Methods:** We applied a modified form of the Health Belief Model (HBM) to explore the likelihood that a sample of individuals participating in a "Community Free from Betel Quid Chewing" campaign would undergo an OME. Eight-hundred and sixty-six participants completed questionnaires measuring demographic characteristics, alcohol drinking, betel quid chewing, cigarette smoking, health beliefs, cues to action, self-efficacy, and likelihood of undergoing an OME. We used structural equation modeling (SEM) to investigate the direct and indirect paths, to predict the likelihood of undergoing an OME, in three different health risk groups. Classification of participants into groups of high, moderate, and low risk of developing oral cancer was based on the whether or not the participants drank alcohol, chewed betel quid, or smoked cigarettes. **Results:** The modified HBM demonstrated a good fit among the high, moderate, and low-risk groups, and explained 50%, 37%, and 30% of the variance of undergoing an OME, respectively. The direct and indirect paths influencing the likelihood of undergoing an OME varied significantly among the three groups. **Conclusions:** Based on the findings, care must be taken when selecting responsive health education for provision to participants with different health beliefs and levels of risks. (*Taiwan J Public Health*. 2013;32(4):358-371)

Key Words: *Health Belief Model, oral mucosal examination (OME), different health risk groups, Structural Equation Modeling*

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INTRODUCTIONS

Oral cancer is the fourth leading cause of cancer death among males in Taiwan [1]. In Taiwan, the life expectancy of patients with oral cancer is 52 years, which is approximately 10 years less than that for other types of cancer [2]. According to clinical data in Taiwan, when oral cancer patients seek treatment, their cancer is already advanced (stage 3 or 4A) [3]. Although treatment may increase the survival rate, it is likely to cause eating and speaking difficulties,

as well as facial deformities [4]. Moreover, the enormous loss of work years, and huge medical expenses, result in a heavy economic burden on society [5].

Empirical findings indicate that individuals who drink alcohol [6], chew betel quid [7], and smoke cigarettes [8] develop high risks for various types of oral cancer. For example, according to a report from the Bureau of Health Promotion in Taiwan (2012), as many as 88% of oral cancer patients chew betel quid regularly, while 50% of those chewing betel quid also drink alcohol and smoke cigarettes. The independent and synergistic effects of drinking alcohol, chewing betel quid, and smoking cigarettes results in high levels of health risk for oral cancer [9]. However, in a case-controlled study, oral cancer was detected early in patients who underwent oral mucosal examinations (OMEs) [10,11]. A review of the literature on the effectiveness of screening for oral cancer and precancer in developed countries, showed that screening of participants who drank alcohol, chewed betel quid, and smoked cigarettes was an effective preventive measure for oral cancer [3,12].

The Health Belief Model (HBM) [13,14] provides a useful framework for studying the psychological constructs of health protective behavior [15], and is especially useful for screening behaviors [16,17]. The HBM suggests four major beliefs that influence the adoption of health protective behavior: perceived susceptibility, severity, benefits, and barriers to engaging in the health protective behavior. Bandura [18] introduced the perception of self-efficacy, the belief in one's ability to perform health protective behavior. This construct was added to the model, to improve the model's ability to predict behavior [19]. In addition, the construct of cues to action, such as personal experience, prompts a heightened state of participation, thereby influencing the

probability of performing health protective behavior.

An investigation of the likelihood of different health risk groups undergoing an OME using the framework of HBM with goodness-of-fit testing is lacking in the literature. Thus, we studied high, moderate, and low-risk groups defined on the basis of three types of unhealthy habits, and used a modified HBM to compare differences in health beliefs, and influencing paths, to predict the likelihood of undergoing an OME. We formulated the following hypotheses: (1). No socio-demographic differences exist among the three risk groups. (2). No health belief differences exist among the three risk groups. (3). Differences among the three risk groups that influence paths to predict the likelihood of undergoing an OME do not exist.

MATERIALS AND METHODS

Participants and procedures

Participants in this study consisted of adult residents in Taiwan who participated in the "Community Free from Betel quid Chewing" Campaign, which was a health campaign supported by the Bureau of Health Promotion of the Department of Health in 2009. The study was conducted in 50 communities in 18 cities and counties. Letters were sent to the campaign coordinators of participating communities, inviting them to be involved in this study. A total of 18 coordinators agreed to participate and recruit volunteer participants for the study; 915 questionnaires were collected from local residents who provided an informed consent, whereas 48 incomplete questionnaires were excluded, resulting in a total of 866 (94.6%) completed questionnaires. No significant differences in demographic characteristics were found between those who completed the questionnaire and those did not after statistical analyses. Participants were subsequently

divided into the three different health risk groups in accordance with the adjusted odds ratios (ORs) of alcohol, betel quid, and cigarette use [9]. Because we used structural equation modeling (SEM), each group consisted of more than 200 participants to provide an adequate sample for model testing [20].

Classification of health risk groups

A widely-cited Taiwanese study [9] revealed the independent and synergistic effects of alcohol drinking, betel quid chewing, and cigarette smoking on the incidence of oral cancer. After adjusting for education and occupation covariates, the results showed that the synergistic effects of alcohol (A), betel quid (B), and cigarette (C) use develop into oral cancer of adjusted ORs: $A + B + C > B + C > A + B > B > A + C > C > A > \text{abstainers}$. Based on our study findings, we classified the participants who reported the combined use of alcohol, betel quid, and cigarettes and those who reported using alcohol and betel quid or betel quid and cigarettes as belonging to a group that is at a high risk of developing oral cancer. The participants who reported alcohol and cigarette or individual alcohol, betel quid, or cigarette use were classified as belonging to a group that is at a moderate risk of developing oral cancer. Abstainers or quitters of alcohol, betel quid, and cigarettes were classified as belonging to a group that is at a low risk of developing oral cancer.

Measures

The questionnaire assessed demographic characteristics, alcohol use, betel quid use, cigarette use, health beliefs, cues to action, self-efficacy, and the likelihood of undergoing an OME, which was previously used in a pilot study of adult visitors to a Health Center in Taipei [21]. The results of the pilot test

indicated a face validity (represented by the CVI score) of 0.89, and an acceptable Cronbach's α of 0.68–0.96, across the HBM constructs. The HBM constructs consisted of 29 items. At the development stage of the questionnaire, we applied exploratory factor analysis by using the principal component method, to extract the factors. The obtained factors were rotated orthogonally using the Varimax procedure. Any factor with an Eigenvalue ≥ 1 was considered significant for factor extraction, resulting in seven extracted components. The Kaiser-Mayer-Olkin was 0.713–0.945 across HBM constructs, and Bartlett's tests of sphericity ($p < 0.001$) were all significant. The 29 items were measured using a 5-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Perceived susceptibility

Perceived susceptibility was measured by three items. Each participant subjectively assessed the probability of him or her suffering from oral cancer; that is, the probability of falling sick because of individual characteristics and related addictive behaviors (e.g., "I think that I will have the possibility of oral cancer at some time in my life"). The Cronbach's alpha coefficient was 0.87.

Perceived severity

Perceived severity was measured by six items that were designed to help participants assess the severity of their oral cancer and understand their personal feelings. These items included questions about whether the disease caused deformity, and the effects on the patient and the family of the patient (e.g., "If I suffer from oral cancer, I may increase the burden on my family"). The Cronbach's alpha coefficient was 0.95.

Perceived benefits of undergoing an OME

The perceived benefits of undergoing an OME were measured subjectively, using three items that were designed to assess whether participants believed that undergoing an OME would reduce the possibility of suffering from oral cancer (e.g., “I believe that if I underwent an oral mucosal examination, oral cancer could be detected early”). The Cronbach’s alpha coefficient was 0.92.

Perceived barriers of undergoing an OME

The perceived barriers of undergoing an OME were measured with five items intended to help participants to assess the barriers that prevented them from taking action to undergo an OME, such as inconvenient transportation or lack of time (e.g., “I do not know where or how to go for an oral mucosal examination”). The Cronbach’s alpha coefficient was 0.93.

Cues to action

Cues to action were measured by four items that investigated internal and external stimuli that influenced a participant’s choice to take action and undergo an OME. Such stimuli included self-perceived oral health, mass media communication on oral cancer, and reminders by medical staff (e.g., “I will undergo an oral mucosal examination because of my oral condition”; “I will undergo an oral mucosal examination because the medical staff recommended it”). The Cronbach’s alpha coefficient was 0.82.

Self-efficacy

Self-efficacy was measured by five items aimed at determining whether participants were confident that, under special circumstances, they could overcome the barriers to undergoing an OME, such as being too busy, inconvenient

transportation, and inconvenient location of the examination (e.g., “I have the confidence to overcome being too busy to undergo the oral mucosal examination”). The Cronbach’s alpha coefficient was 0.92.

Likelihood of undergoing an OME

The likelihood of undergoing an OME was measured by three items that were designed to assess the possibility that a participant would undergo an OME within the following six months (e.g., “I plan to have an oral mucosal examination in the next 6 months”). The Cronbach’s alpha coefficient was 0.94.

Data analysis

Comparisons of demographic characteristics among the different risk groups were analyzed using the χ^2 test and an analysis of variance (ANOVA). Post-hoc comparisons of ANOVA were made using Scheffe’s method (homogeneity of between-group variance) or Dunnette’s T3 method (non-homogeneity of between-group variance). SPSS Statistics 17.0 (SPSS Chicago, IL) was used for the aforementioned analyses.

A two-step approach, suggested by Anderson [22], was used to test the predictive (hypothesized) models. First, a measurement model was tested for an adequate fit to the data by confirmatory factor analysis. Second, once the measurement model showed goodness of fit, a structural model was tested [20,23]. A maximum likelihood estimation of the SEM was performed using SPSS AMOS 18 [24]. Model fit was evaluated by examining the following four estimates: (a) a ratio of χ^2 and degrees of freedom of $\chi^2/df < 3$ indicated a good fit; (b) a comparative fit index (CFI) ≥ 0.90 was defined as an acceptable fit; (c) a standardized root-mean square residual (SRMR) ≤ 0.08 indicated an acceptable fit; and

(d) a root-mean square error of approximation (RMSEA) with 90% CI, where 0.06– 0.10, indicated an adequate fit [20,25].

Finally, multi-group analyses were conducted to compare the three groups, in the following order: measurement weights (factor loadings) followed by structural weights (path regression coefficients). A χ^2 difference test was conducted to compare the two models (baseline model compared constrained model). A value of $\Delta\chi^2 < 0.05$ was considered significant [26].

RESULTS

Descriptive and inferential comparisons among groups

Table 1 shows that significant differences existed between the health risk groups with respect to gender, age, educational background, alcohol drinking, betel quid chewing, and cigarette smoking. The results indicate that most participants in the moderate and high-risk groups were men (89% and 90%, respectively), and that the educational level was mostly senior high school or lower (67% and 89%, respectively). The mean age was lowest (43.3 years) in the high-risk group. In the high-risk group, the frequency of alcohol drinking (68%), betel quid chewing (100%), and cigarette smoking (88%) was very high. In the moderate-risk group, the frequency of alcohol drinking (46%), betel quid chewing (12%), and cigarette smoking (66%) was substantially lower. The χ^2 statistic for having oral cancer screening experience (OCSE) among the three risk groups approached significance ($p = 0.059$).

Table 2 indicates that mean scores for perceived susceptibility and perceived barriers were significantly higher in the high and moderate-risk groups compared to the low-risk group. Mean scores for perceived severity, perceived benefits, cues to action, self-efficacy, and the likelihood of undergoing an OME were

significantly lower in the high and moderate-risk groups, when compared with the low-risk group.

Measurement model

Analysis of the hypothesized measurement model, using confirmatory factor analysis, demonstrated a good fit to the data: $\chi^2_{(357)} = 2.87$, $p < 0.001$, CFI = 0.965, SRMR = 0.035, RMSEA = 0.046 (90% CI = 0.043–0.050). All paths from health beliefs, cues-to-cues, self-efficacy, and the likelihood of undergoing an OME to their observed variables were statistically significant ($p < 0.001$), with factor loadings ranging from 0.71 to 0.96, indicating good measurement reliability and validity (Fig. 1). All the standardized factor loadings were significant ($p < 0.001$), and $R^2 > 0.50$ (accounted variance), indicating that the observed variables were good indicators of the seven latent variables. Therefore, this measurement model was used for further testing of the structural model.

Structural model

The test of the hypothesized structural model resulted in a significant improvement over the null model ($\chi^2_{(367)} = 3.85$, $p < 0.001$, SRMR = 0.125, CFI = 0.946, RMSEA = 0.057 (90% CI = 0.054–0.061). We took the modification index and its theoretical significance as a reference, and established correlations between perceived susceptibility and perceived benefit, and between measurement errors of cues to action and self-efficacy. [27,28]. After improvement, the structural model fit (χ^2/df) decreased to 2.99, which is lower than the reference standard of 3; the SRMR was 0.062, which is lower than the reference standard of 0.08; the CFI was 0.962; and the RMSEA was 0.048 (90% CI = 0.045–0.051), which shows that the performance of all indicators improved (Fig. 2).

Table 1 Comparison of demographic characteristics by risk group

Characteristic	Total sample (n = 866)			p value
	Low-risk group (n = 366)	Moderate-risk group (n = 290)	High-risk group (n = 210)	
Gender				< 0.001
Male	211 (58%)	259 (89%)	190 (90%)	
Female	155 (42%)	31 (11%)	20 (10%)	
Age, years				0.024
Mean (standard error)	46.21 (15.65)	46.6 (13.13)	43.3 (12.1)	
Educational level				< 0.001
Elementary school	74 (20%)	43 (15%)	33 (16%)	
Junior high school	46 (13%)	46 (16%)	49 (23%)	
Senior high school	74 (20%)	104 (36%)	105 (50%)	
University	169 (47%)	96 (33%)	22 (11%)	
Marital status				0.49
Unmarried	91 (25%)	67 (23%)	57 (27%)	
Married (no children)	30 (8%)	32 (11%)	12 (6%)	
Married (with children)	238 (65%)	186 (64%)	137 (65%)	
Others	7 (2%)	5 (2%)	4 (2%)	
Alcohol drinking				<0.001
No	302 (83%)	114 (40%)	48 (23%)	
Quit	64 (17%)	42 (14%)	19 (9%)	
Yes	0	134 (46%)	143 (68%)	
Betel quid chewing				< 0.001
No	293 (80%)	157 (54%)	0	
Quit	73 (20%)	98 (34%)	0	
Yes	0	35 (12%)	210 (100%)	
Cigarette smoking				< 0.001
No	266 (73%)	65 (23%)	21 (10%)	
Quit	99 (27%)	32 (11%)	4 (2%)	
Yes	0	192 (66%)	185 (88%)	
Oral cancer screening experience				0.059
Yes	64 (17%)	70 (24%)	51 (24%)	
No	302 (83%)	220 (76%)	159 (76%)	

Figure 2 shows the path coefficients from the perceived severity to the cues to action ($\beta = 0.13$, $p < 0.001$), the perceived benefits to the cues to action ($\beta = 0.39$, $p < 0.001$), and the perceived barriers to the cues to action ($\beta = -0.18$, $p < 0.001$). That is, the participants' perceived severity and perceived benefits positively influenced the cues to action and the inverse relationship between the perceived barriers and the cues to action. The

path coefficients from the perceived benefits to self-efficacy ($\beta = 0.32$, $p < 0.001$) and the perceived barriers to self-efficacy ($\beta = -0.41$, $p < 0.001$), which indicated the participants' perceived benefits, positively affected their self-efficacy and negatively affected the relationship between perceived barriers and self-efficacy. Moreover, the path coefficients from self-efficacy, cues to action, perceived susceptibility, and perceived benefits to the

Table 2 Means and standard deviations of seven variables for the different risk groups

HBM Variables	I. Low-risk group	II. Moderate-risk group	III. High-risk group	F value	Post hoc test (I, II, III)
	Mean (S D)	Mean (S D)	Mean (S D)		
Perceived susceptibility	2.52 (0.81)	2.76 (0.63)	2.76 (0.77)	11.28***	I < II & III (b)
Perceived severity	4.40 (0.62)	4.21 (0.69)	4.02 (0.83)	19.26***	I > II & III (b)
Perceived barriers	2.56 (0.80)	2.81 (0.80)	2.80 (0.72)	10.67***	II > III (b) I < II & III (a)
Perceived benefits	4.30 (0.62)	4.11 (0.61)	3.90 (0.74)	27.18***	I > II & III (a)
Cues to action	3.87 (0.51)	3.66 (0.53)	3.60 (0.59)	21.66***	II > III (a) I > II & III (b)
Self-efficacy	3.62 (0.60)	3.40 (0.62)	3.34 (0.70)	15.83***	I > II & III (a)
Likelihood of undergoing an OME	3.54 (0.71)	3.42 (0.70)	3.39 (0.78)	3.99*	I > II & III (a)

Note. OME = oral mucosal examination; (a) In case of homogeneity of variance, a post-hoc test was performed using Scheffe's method; (b) In case of non-homogeneity of variance, a post-hoc test was performed using Dunnett's T3.

* p < 0.05; ** p < 0.01; *** p < 0.001.

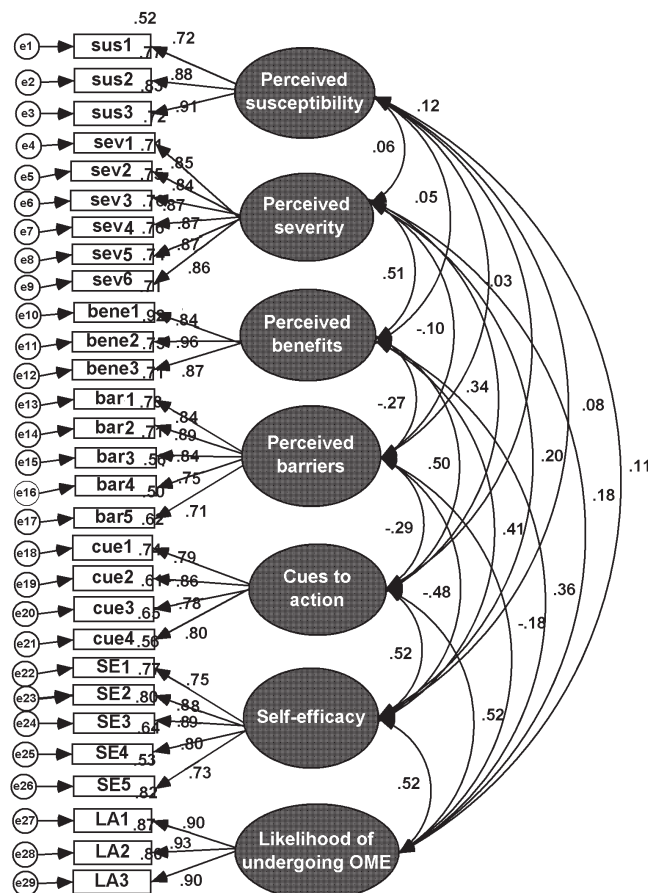


Fig. 1 A priori measurement model of the theoretical constructs.(Full sample sizes=866)

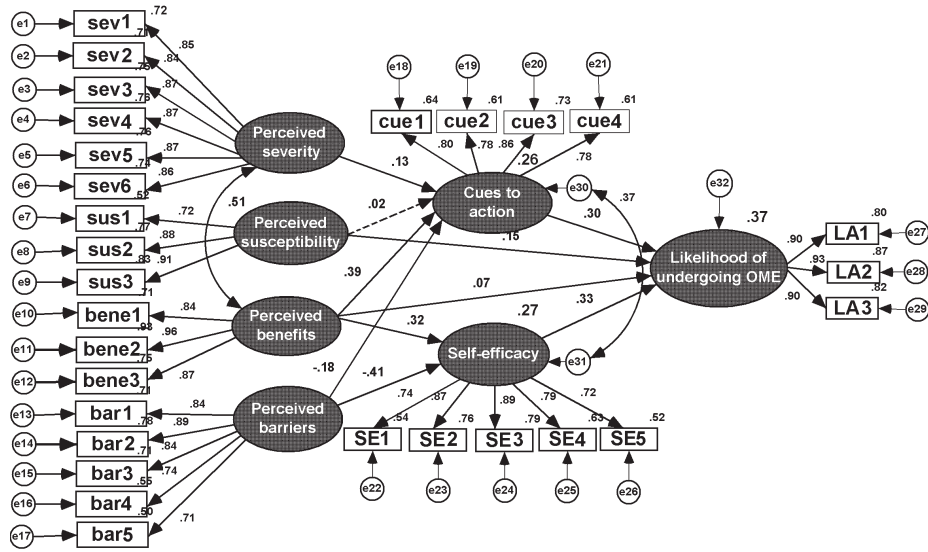


Fig. 2 Final Structural Equation Model. (N=866) ; the rectangles represent observed variables. The ovals represent unobserved latent variables. The number next to each connector is the value of the standardized regression weight, and their significance is represented by solid “—” and dashed “----” lines (non-significant).

likelihood of undergoing an OME ($\beta = 0.33$, 0.30, 0.15 and 0.07, respectively) were all significant ($p < 0.05$). This demonstrated that self-efficacy had the most significant direct effect on the likelihood of undergoing an OME; the second most significant direct effect was cues to action. As shown, the model explained 26% of the variance in the cues to action, 27% of the variance in self-efficacy, and 37% of the variance in the likelihood of undergoing an OME.

Multi-group analyses of the SEM by risk group

The model fit test results for all three groups were as follows: high-risk group: $\chi^2_{(365)} = 2.02$, $p < 0.001$, SRMR = 0.052, CFI = 0.933, RMSEA = 0.070 (90% CI = 0.062–0.077); moderate-risk group: $\chi^2_{(365)} = 2.02$, $p < 0.001$, SRMR = 0.075, CFI = 0.941, RMSEA = 0.059 (90% CI = 0.053–0.065); low-risk group: $\chi^2_{(365)}$

= 2.30, $p < 0.001$, SRMR = 0.075, CFI = 0.937, RMSEA = 0.060 (90% CI = 0.054–0.065). These test results met the fit index and predicted the likelihood of undergoing an OME to be 50%, 37%, and 30% for the high, moderate, and low-risk groups, respectively.

We performed multi-group comparisons, taking the low-risk group as the reference group, and found that the baseline model compared constrained model critical ratio of differences was non-significant when the measurement weights were constrained (low vs. moderate $\Delta\chi^2_{(22)} = 16.3$, $p = 0.800$; low vs. high $\Delta\chi^2_{(22)} = 31.64$, $p = 0.084$). This indicates invariance of the parameters across the different risk groups. However, with structural weights constrained as equal, the baseline model compared constrained model critical ratio for structural weights was significant (low vs. moderate $\Delta\chi^2_{(10)} = 28.65$, $p = 0.001$; low vs. high $\Delta\chi^2_{(10)} = 27.37$, $p = 0.020$), which

indicates that there were significant differences among the paths influencing the likelihood of undergoing an OME between the groups.

The three groups have three dissimilar paths that influence the likelihood of undergoing an OME, as shown in Figure 3. Path 1 is a direct or indirect path of influence between the perceived susceptibility and the likelihood of undergoing an OME, the standardized structural regression weights for which were significantly different between the groups. Path 2 shows that in the moderate and high-risk groups, perceived benefits can directly influence the likelihood of undergoing an OME. Path 3 shows that in the moderate and high-risk groups, perceived severity did not significantly influence the likelihood of undergoing an OME.

In addition, we further compared structural models between participants with and without OCSE, and paths influencing the likelihood of undergoing an OME, among the three groups. Results indicated that the model fit was still

in the acceptable range when participants with OCSE were excluded from the model. The accounted variance for the likelihood of undergoing an OME was 61%, 34%, and 29% for the high, moderate, and low-risk groups, respectively (Fig. 3). The accounted variance of the model especially improved (to 61%) for the high-risk group when participants with OCSE were excluded.

When we compared the paths influencing the likelihood of participants among the three groups, with and without OCSE, undergoing an OME, the perceived susceptibility of participants without OCSE only directly influenced the likelihood of undergoing an OME, but the perceived susceptibility through cues to action indirectly influencing the likelihood of undergoing an OME was not significant ($p > 0.05$).

DISCUSSIONS

We applied the modified HBM and SEM

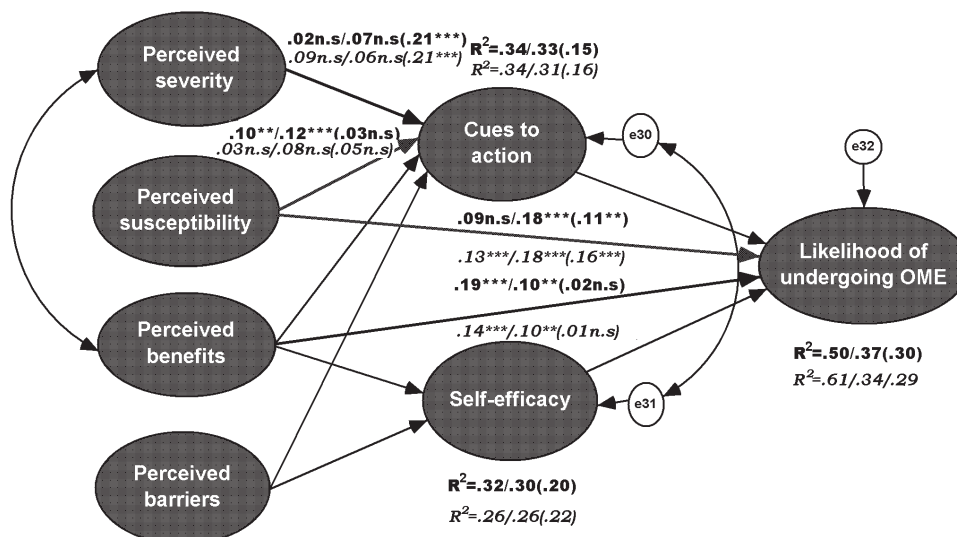


Fig. 3 Comparisons of the models for participants with (blue italics) (Full N=866) and without OCSE (black) (Full N=681) of influencing the likelihood of undergoing an OME based on multi-group analysis. The first, second, and bracketed numbers are for high, moderate and low-risk groups, respectively. Their significance is represented with asterisks: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

to develop a predictive model for the likelihood of undergoing an OME in different health risk groups to compare differences regarding health beliefs and influencing paths. Results indicate that the model fit the data well and successfully explained substantial variance in the likelihood of undergoing an OME for participants in the high, moderate, and low-risk groups (50%, 37%, and 30%, respectively). In addition, significant differences were found among the three groups in demographic characteristics (gender, educational level, age, alcohol use, betel quid use, and cigarette use), health beliefs, cues to action, self-efficacy, and paths influencing the likelihood of undergoing an OME.

Comparison of sociodemographic findings and health beliefs

Based on our findings, the modified HBM had the highest accounted variance for predicting the likelihood of undergoing an OME (50%) for the high-risk group, which consisted of mostly men with the lowest mean age and an educational level of senior high school or lower. Prior studies [29,30] also indicated that younger oral cancer patients are mostly male, are more likely to have a low educational level, and have unhealthy alcohol drinking, betel quid chewing, and cigarette smoking habits. We suggest that the classification of participants into different health risk groups by alcohol, betel quid, and cigarette use as indications for development of oral cancer was acceptable in our Taiwanese sample.

We found that perceived susceptibility and barriers to participation in the moderate and high-risk groups were both significantly higher than those in the low-risk group. In contrast, perceived severity, perceived benefits, self-efficacy, and the likelihood of undergoing an OME were all significantly lower than that in

the low-risk group. These findings are similar to those of prior studies [31-34] and indicate a gap in the high-risk group between a high perceived susceptibility and low likelihood of seeking cancer screening. By discussing the paths of influence, we found the determinants influencing the likelihood of undergoing an OME across the different health risk groups. This indicates the potential for health education programs to close the gap by developing effective strategies to persuade people to change their health beliefs, improve self-efficacy, and provide meaningful cues to action.

Comparison of paths influencing the likelihood of undergoing an OME

In all three groups, there were different direct or indirect paths of influence between perceived susceptibility and the likelihood of undergoing an OME. Figure 3 shows that when there is a high perceived susceptibility in the low-risk group, there is a corresponding higher likelihood of undergoing an OME. In the moderate-risk group, the likelihood of undergoing an OME was directly influenced by a high perceived susceptibility, but also indirectly, because high perceived susceptibility initiated high cues to action. Interestingly, high perceived susceptibility in the high-risk group did not directly influence the likelihood of undergoing an OME, but required high cues-to action. This demonstrates that, in the high-risk group, cues to action served as a critical determinant.

Additionally, in the high and moderate-risk groups, but not the low-risk group, perceived benefits directly influenced the likelihood of undergoing an OME, which is a finding consistent with prior studies [35-37]. In other words, perceived benefits had a positive and direct influence in the moderate and high-risk groups. Thus, future educational

intervention should target increasing the recognition of OME benefits in the moderate and high-risk groups. Moreover, unlike in the low-risk group, perceived severity did not significantly influence, either directly or indirectly, the likelihood of undergoing an OME in the moderate and high-risk groups. Cunningham, Kerrigan [38], Moon, Kim [39] pointed out that perceived severity was not a significant predictor for participants seeking cancer screening, implying that health education targeting cancer screening based on fear arousal to increase perceived severity might not produce the desired effect.

Comparison of paths between participant with and without OCSE influencing the likelihood of undergoing an OME

In order to accurately explain and compare the influence of participants' with OCSE among the three groups for the likelihood of undergoing an OME, we established a structural model excluding participants with OCSE in all three groups. The results indicated that, when we excluded participants with OCSE from the three groups, the accounted variance for the high-risk group improved from 50% to 61%; the moderate and low-risk groups were broadly similar. In the high-risk group, the model displayed a high level of accounted variance, which was better than those of prior findings for screening intention [16,40,41].

In addition, compared to the model including participants with and without OCSE, the model excluding participants with OCSE showed that perceived susceptibility only directly influenced the likelihood of undergoing an OME, but through cues to action in the indirect path, it was no longer statistically significant. As a result, we suggest that perceived susceptibility may occur through cues to action, such as mass

communication and medical staff and family recommendations, that indirectly influence the likelihood of undergoing an OME in the model of participants with OCSE, for high and moderate-risk groups with and without OCSE. The modified HBM models are still appropriate for participants of different levels of health risk for oral cancer.

Limitations

We could not avoid some limitations in the study. First, we used a cross-sectional design and did not confirm that participants underwent an OME. Therefore, we suggest that future studies explore OME behavior in the different risk groups using a follow-up design. Second, this study classified participants into different levels of health risks based on alcohol, betel quid, and cigarette use, and did not take social demographics into consideration [42,43]. We suggest that future studies incorporate intensity, duration, and frequency of alcohol, betel quid, and cigarette use to test other possible classifications. In addition, our study sample consisted of residents from Taiwan's Betel Quid Free Communities, a program of the Bureau of Health Promotion of the Department of Health in Taiwan, and the results may not be applicable to participants in the other communities.

Conclusions

This study provides evidence of the different patterns of health beliefs and influencing paths among low, moderate, and high-risk groups for the likelihood of undergoing an OME. It contributes to the literature and provides insightful ideas for designing effective health education interventions that prompt participants to undergo an OME, with the goal of a commensurate reduction in oral cancer rate.

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運用修正型健康信念模式比較不同健康風險族群接受口腔黏膜檢查之信念與可能性——以台灣無檳社區計畫活動為例

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目標：口腔黏膜檢查為偵測口腔癌之有效措施，口腔癌為台灣男性第四位之惡性腫瘤，本研究旨在探討具有酒精、檳榔及吸菸等習慣造成罹患口腔癌之不同健康風險族群接受口腔黏膜檢查的社會心理差異。**方法：**本研究運用修正型健康信念模式探討參與無檳社區活動計劃居民接受口腔黏膜檢查之信念，共有866位完成問卷測量，我們依據參與者是否有喝酒、嚼食檳榔、吸菸等習慣區分為罹患口腔癌之高、中與低風險組，並採用結構方程模式建立及比較三組不同健康風險族群接受口腔黏膜檢查的可能性與影響路徑之差異。**結果：**證明修正後的健康信念模式對高、中與低風險組模型配適度良好並可解釋三組接受口腔黏膜檢查之可能性分別為50%、37%、30%，且三組在健康信念影響接受口腔黏膜檢查可能性之直接與間接路徑上有顯著差異。**結論：**不同健康風險族群接受口腔黏膜檢查可能性之健康信念與影響路徑有顯著差異，建議未來教育介入針對不同健康風險族群宜採取不同介入模式以提高無檳社區計畫之有效性。(台灣衛誌 2013；32(4)：358-371)

關鍵詞：健康信念模式、口腔黏膜檢查、不同健康風險族群、結構方程模式

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