

# Oral Cancer Screening Intentions of Residents in Eastern Taiwan

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**Abstract**—The incidence of oral cancer in Taiwan increased year by year. It replaced the nasopharyngeal as the top incidence among head and neck cancers since 1994. Early examination and earlier identification for earlier treatment is the most effective medical treatment for these cancers. Although the government fully subsidized the expenses with tremendous promotion program for oral cancer screening, the citizen's participation remained low. Purpose of this study is to understand the factors affecting the citizens' behavior intentions of taking an oral cancer screening. Based on the Theory of Planned Behavior, this study adopted four distinctive variables in explaining the captioned behavior intentions. 700 questionnaires were dispatched with 500 valid responses or 71.4% returned by the citizens with an age 30 or above from the eastern counties of Taiwan. Test results has shown that attitude toward, subjective norms of, and perceived behavioral control over the oral cancer screening varied from some demographic factors to another. The study proofed that attitude toward, subjective norms of, and perceived behavioral control over the oral cancer screening had positive impacts on the corresponding behavior intention. The test concluded that the theory of planned behavior was appropriate as a theoretical framework in explaining the influencing factors of intentions of taking oral cancer screening. This study suggested the healthcare professional should provide high accessibility of screening services other than just delivering knowledge on oral cancer to promote the citizens' intentions of taking the captioned screening. This research also provided a practical implication to the healthcare professionals when formulating and implementing promotion instruments for lifting the screening rate of oral cancer.

**Keywords**—Theory of planned behavior, oral cancer, cancer screening

## I. INTRODUCTION

ALTHOUGH the cancers had been received country-levels attention, it remained the major causes of death around the world [1]. It was estimated that headcounts for deaths caused by cancers would increase from 7.9 to 11.5 million. Among the cancers, head and neck cancers was one of the troublesome diseases that cause death through a highly painful approach. Oral cancer (OC), as one of the head and neck cancers that grew every year in Taiwan, caused major damages to the victims' appearance, and deteriorates the dietary and phonetic systems [2]. This would greatly detrimental to the patient's life. As the sixth incidence of the top ten death-causes, cases of oral cancers were approximately 23.8 per 100,000 populations. Major group of patients of this kind is those males aged

between 40-59 years old. The literature generally proofed cigarette smoking, alcoholic drinking, and betel chewing are the most important factors that cause oral cancers [3][4][5][6][7][8][9], particularly in the eastern part of Taiwan[10].

To early detect the cases of oral cancers, the government offered free oral cancer screening services to the nationals who aged over 18 and had smoking or betel chewing experiences. In the meantime, a total of 45 classes of special designed training programs specific for the oral cancer screening (OCS) were offered free to the dentists and physicians around the country [2] in 2009. However, the governmental data indicated that there were 1.44 million of nationals had taken such free screening (and 1,248 cases had been identified), roughly the 28% of the focus group. Oral cancer is terrified, the screening is easy and free to the nationals, yet the participating rate is as low as a quarter of the prospects.

This research attempted to examine the factors that affect the nationals' behavior intention toward taking a free oral cancer screening. Based on the framework of the theory of planned behavior, this research assume that the national's attitude toward OCS, subjective norm of OCS, and the national's perceived behavior control over the acceptance of OCS may have varied levels of impacts on the national's intention of taking a free OCS. Research questions included in this research are 1. Whether the attitudes, subjective norms, perceived behavioral control, and the behavior intentions vary across different demographic factors? 2. How the attitudes, subjective norms, perceived behavioral control of the OCS prospects will significantly affect their behavior intentions?

## II. MAJOR DETERMINANTS OF ORAL CANCERS

The literature generally proofed several habits or behaviors were detrimental to the human's health, notably the betel chewing, cigarette smoking, and alcoholic drinking to the incidence of oral cancers. A plethora of evidence had indicated that betel had been one of the major hazardous to OC because of it contained special chemistry elements. As a result of frequent betel taking, these contents kept deteriorating the oral that later becomes alpthous ulcer, and eventually may result in oral cancers for those cases of being not proper treated to revitalize the oral function [11]. Additional evidences indicated strong association between OC and betel chewing, and stop chewing betel may reduce 26% of incidence rate of OC [12]. Next to the betel chewing, cigarette smoking was another major detrimental factor to the oral health. It was particular hazardous because it used to come with betel chewing. Cigarette contained Polycyclic Aromatic Hydrocarbons (PAH) and N-nitrosamines, both of which had been proofed causing OC at 2.6 times over non-smoking population [13] and higher mortality rate [14]. Combination of chemistry elements from the betel-nuts and cigarettes had

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several compound effects other than its original effects alone, of which even brought higher probability incurring the OC at a faster speed.

Another risky factor that the literature generally reported causing oral cancers is the alcoholic drinking. The higher percentage of alcohol contained in a drink, the higher the incurred rate of OC [15], because the ethanol will activate the metabolism gene in an abnormal way.

Frequent stimulation other than the risky factors as above-mentioned may also trigger the mechanism of OC incurrence. Stimuli of this kind may include denture or artificial tooth, sharp edge of problem tooth, oral infectiousness, poor dental hygiene, and overexposure of sun, or even frequent use of mouthwash (or saliva rinses) that contained alcohol [16] [17]. There are plenty of advices regarding the preventive actions toward the incurrence of OC, and the most notable advices went to staying away from taking betel-nut, cigarette smoking, and binge drinking, and maintaining a habitual dental hygiene. However, some kinds of culture may hold a manner of sympathy over or even encourage such risky behaviors, of which defeated the efforts made by the health program specific for changing these behaviors. To ease the threat of oral cancers, the government had not only promoted the health education to persuade stop risky behaviors, but also or more important provided free OCS to the particular risky group. The latter is even more critical than the former in early identifying the oral cancer patients to stop the progress of OC to secure the life quality of the patients.

### III. THEORY OF PLANNED BEHAVIOR

The theory of planned behavior (TPB) [18] was developed by extending the theory of reasoned action (TRA) [19][20] [21][22]. TRA had been used to successfully explain and predict behavioral issues in a wide variety of contexts [23]. However, it exposed to several critiques by ignoring the respondent's self-confidence over the controlling of own behavior. The TPB added perceived behavioral control (PBC) refers to the level of control over or perceived easiness or perceived difficulty of the intended behavior [18][24][25] [26][27][28][29].

#### A. Attitude

Attitude (AT) refers to a positive or negative judgment an individual holds toward a particular behavior [28], and could be either measured directly or by a product of "behavior belief" and "outcome expectation" [29]. This could be expressed as

$$AT \propto \sum_{i=1}^n bi * ei$$

where  $bi$  is the focus behavior to be performed;  $ei$  is the expected outcomes toward focus behavior, and  $n$  refers to the numbers of beliefs appeared when performing the focus behavior

#### B. Subjective Norms

Subjective norm (SN) refers to the external pressures of the social or the reference group an individual perceived when performing a particular behavior [31][30]. This could be

expressed as a function of

$$SN \propto \sum_{j=1}^n bi * mj$$

where  $bi$  is the  $i^{th}$  source to be included as a reference,  $m_j$  is the extent of motivation to comply with the  $j^{th}$  reference, and  $n$  is the number of such beliefs. Past studies generally concluded that the higher the influences of references, the higher the inclination of performing the behavior [34] [32] [33].

#### C. Perceived Behavior Control

Perceived behavior control (PBC) refers to the extent of facilitators and barriers an individual perceived when performing a particular behavior, of which similar to the concept of self-efficacy (SE) [34][35]. This means how confident of an individual will successfully execute a planned behavior. Some argued that SE and PBC are look similar but in fact are distinctive. PBC could be measured directly [34] or as a product of "control belief" and "control facilitator". The equation that is expressed as follow would be a good representation of this construct.

$$PBC \propto \sum_{k=1}^n C_k * P_k$$

where  $C_k$  represents the  $k$ th fers control belief that may influence the willingness or actual performance of the focus behavior,  $P_k$  represnets the importance of the  $k^{th}$  control belief an individual perceived toward the focus behavior, and  $n$  is the number of the control belief. The literature has generally proofed the TPB is more powerful than the TRA, mainly because of adding this particular variable [32] [34].

#### D. Behavior Intention

Behavior intention (BI) is the most effective predictor of a behavior [11]. It is described as the levels of readiness of an individual to perform a particular behavior. According to the TPB, the behavior intention is affected either by single antecedent of AT, SN, and PBC respectively or jointly [36]. This could be expressed as  $B \sim BI = AT (W1) + SN (W2) + PBC (W3)$ , where  $W1$ ,  $W2$  and  $W3$  are weights of AT, SN, and PBC respectively.

Several meta-analyses had proofed that the TPB having greater power in explaining and predicting focus behaviors than TRA [40][37][38][39]. As a result, TPB became one of the major theories that being adopted in explaining and predicting behavior intention and behaviors in varied contexts, such as in health and health maintenance [41], medication [42], leisure [43], and marketing (consumer behavior) at large [44] with great success [45]. In this study, we can also conclude that the behavior intention of taking OCS of the focus group of people will be affected by the people's attitude, subjective norm, and perceived behavior control [38] [37]. We then hypothesize this argument as follow.

*H1*: The higher the extent of the national's attitude toward, subjective norm of, and perceived control over the oral cancer screening, the higher the intention of taking a free oral cancer screening.

### E. Extrinsic Factors to TPB

Although the TPB included external influences such as varied reference groups in the model as part of independent effects to predict the behavior intention, there are some other factors external to the model and that may pre-determine the extent of these independent effects [11]. In other words, the AT, SN, and PBC could be view as the intrinsic factors that could be affected by different extrinsic factors [46]. It is thus common to find in the past studies that had adopted several extrinsic factors such as demographic factors, personality, job characteristics, and contextual factors, into the model pursuing for more precise results [50] [47][48][49].

We may conclude that the levels of respondents' behavior intention and associated independent effects may be affected by the personal factors. Therefore, a hypothesis is then proposed as follow.

H2: The attitude toward, subjective norm of, perceived control over, and behavior intention of taking the free oral cancer screening will vary along with the individual's personal factors.

## IV. MATERIALS AND METHODS

### A. Measurement

Instrument adopted to measure the constructs of the model, the attitudes, subjective norms, perceived behavioral control, and the corresponding behavior intentions is drawn from what Ajzen (2002) suggested with minor modification in response to the research context of OCS. Demographic factors in this research were limited to the factors that had been examined by the past studies [8].

### B. Factor Analysis and Reliability

A factor analysis was conducted to extract the major component of a construct. Consistent with the Ajzen (2002) [34], four factors were identified by a Varimax rotation with 82.37% variance explained, shown as the table I in detail.

Reliability of the factors, in terms of *Cronbach's alpha*, are 0.893 for behavior intention, 0.867 for attitude, 0.865 for subjective norm, and 0.915 for perceived behavioral control with total reliability of 0.972. Each and overall reliability were larger than 0.6, thus acceptable for further analyses [51].

### C. Samples

Samples are taken from the patients that had just completed their doctor visiting in the outpatient departments of the hospitals in Taitung and Hualien counties. 700 questionnaires were dispatched with 580 valid responses returned in the month of April, 2011.

Major responses of the current research are 277 females (55.4%), more than 82% of the respondents are older than 41 years old, 77.2% are married, around 75% of them were high school educated or lower, and with more than half of the respondents were state employees or worked in the primary industries, shown as the table II.

TABLE I  
FACOR ANALYSIS FOR TPB

Items	BI	AT	SN	PBC
9	0.76			
16	0.79			
17	0.86			
20	0.81			
8		0.89		
12		0.80		
15		0.81		
7			0.87	
11			0.78	
18			0.77	
6				0.85
10				0.83
13				0.78
14				0.87
19				0.81
Eigen value	3.98	3.43	2.82	2.11
Variance (%)	26.56	22.92	18.82	14.06
Variance T. (%)	26.56	49.48	68.31	82.37
<i>KMO=0.963; Bartlett=6480.281, p=0.000</i>				

Ironically, respondents were not so much involved with unhealthy behaviors. For example, more than 59 %, 48.8%, and 56.1% of the respondents were free of drinking, smoking, and betel chewing. This is somehow strange in this particular area where the prevalence of OS was one of the highest in the country.

## V. RESULTS AND DISCUSSIONS

The research examines whether the major constructs of the respondents' behavior intentions and associated determinants vary from respective demographic factors, and so as the effects of the independent variables on the behavior intention of OCS.

### A. Differences in Extrinsic Factors

*Gender.* An independent t-test indicated that all variables of the theory of planned behavior, i. e. attitudes (AT) ( $t=-3.21^{***}$ ), subjective norm (SN) ( $t=-2.68^*$ ), perceived behavior control (PBC) ( $t=-4.08^{***}$ ) as well as intentions (IT) ( $t=-2.95^{**}$ ) of taking OCS are significant different along with gender. This means men and women are different in their perception of taking OCS. Test results are consistent with some past researches [47] [50], and inconsistent with the others [52] [49], shown as table III. (Figures with \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$  indicated the  $p$ -values for the tests in this sections and hereafter).

TABLE II  
SAMPLE DISTRIBUTION

Variables	Categories	n	%
Gender	Male	223	44.6
	Female	277	55.4
Age	40 -	91	18.2
	41~50 yrs.	160	32.0
	51~60	132	26.4
	61+	117	23.4
Marital	Married	386	77.2
	Single	61	12.2
	Divorced	53	10.6
Education	Primary	61	12.2
	Junior H.	94	18.8
	Senior H.	207	41.4
	College	99	19.8
Occupation	Bachelor +	39	7.8
	State employee	149	29.8
	Blue collar	124	24.8
	Commerce	94	18.8
Drinking	Agri-business	133	26.6
	Never	297	59.4
	1-5 yrs.	75	15.0
	6-10 yrs.	50	10.0
Smoking	11 yrs.+	78	15.6
	Never	244	48.8
	1-5 yrs.	156	31.2
	6-10 yrs.	38	7.6
Betel	11 yrs.+	62	12.4
	Never	281	56.2
	1-5 yrs.	101	20.2
	6-10 yrs.	50	10.0
	11 yrs.+	68	13.6

*Age* as the results provided by the one-way ANOVA, patients' ages were not a significant factors in differentiating the respondents' perception in taking OCS. The current research results are consistent with Nigg et al. (2009) [49], whereas deviate from the research results that were done by Saunders-Goldson and Edwards (2004) [48] and by Keeney and colleagues (2010) [49].

*Marital status.* Based on the test results, we may infer that SN ( $F=1.95$ ) and BI ( $F=2.44$ ) are not significant in the types of marital status, yet AT ( $F=3.96^*$ ) and PBC ( $F=3.68^*$ ) are different. Past studies had not achieved consensus on the effects of marital status on these constructs [53].

*Cigarette smoking.* The experiences of cigarette smoking may cause the differences in AT ( $F=3.90^{**}$ ), BI ( $F=2.94^*$ ) and PBC ( $F=3.66^*$ ), but not in SN ( $F=2.14$ ). This denotes that whether intent to take an OCS, smoking experience may assume a significant factor.

*Alcohol consumption.* The extent of drinking experience has no significant difference in the respondents' subjective norm of taking OCS ( $F=0.79$ ), yet it appears to have significant differences in other variables of AT ( $F=3.26^*$ ), PBC ( $F=3.29^*$ ), and BI ( $F=3.62^*$ ), shown as in table III.

*Betel chewing.* The differences of each variable in the model may vary across different levels of betel taking experiences. Test results from one-way ANOVA had shown that AT ( $F=4.01$ ,  $p=0.007$ ), PBC ( $F=4.62$ ,  $p=0.003$ ), SN ( $F=2.65$ ,  $p=0.047$ ), and BI ( $F=5.28$ ,  $p=0.001$ ) are significantly different in terms of the experiences of betel chewing. Test result also reveals that the fans of betel-nut chewing are weaker in the attitude toward, subjective norm of, perceived control over the OCS, and are more reluctant to take an OCS.

TABLE III  
DIFFERENCES OF VARIABLES BY EXTRINSIC FACTORS

Variables	Significant different	Non-significant different
BI	Gender, age, smoking, drinking, betel	Marriage
AT	Gender, age, smoking, drinking, betel	Age
SN	Gender, betel	Age, marriage, smoking, drinking
PBC	Gender, marriage, smoking, drinking, betel	Age

#### B. Predicting the OCS Intentions

As the table IV indicated, the association between independent variables with the behavior intention is significant at different levels. Although the relationships are all at strong levels with high correlation coefficients, the PBC ( $r=0.917$ ) appears to have the strongest association with the BI compare to AT ( $r=0.882$ ) and SN ( $r=0.881$ ). Consistent with previous studies, as what indicated in the Armitage and Conner (2001) [39], the average correlation coefficient with the behavior intention are 0.49 for AT, 0.34 for SN, and 0.43 for PBC [40], the current research provided additional and even stronger evidence for these associations. A regression analysis is then performed to gain the magnitude of effects of the independent variables. As shown in the table V, AT, SN, and OBC can be measured and employed to explain 87% variance of the respondents' behavior intentions ( $R^2=0.87$ ). This means the higher the perception of AT, SN, and PBC toward OCS, the more the respondents incline to take OCS. This means the hypothesis 2 is supported. Look into the detail of the effects from the independent variables, the most powerful indicator in predicting an individual's behavior intention is PBC ( $\beta=0.54$ ), followed by SN ( $\beta=0.27$ ), and AT ( $\beta=0.14$ ).

TABLE IV  
CORRELATION COEFFICIENTS OF AT, SN, PBC, AND BI

	1	2	3	4
1.BI	1			
2.AT	0.88***	1		
3.SN	0.88***	0.88***	1	
4.PBC	0.91***	0.91***	0.89***	1

n = 500; \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

TABLE V  
REGRESSION RESULTS

IV	B	SE	$\beta$	t
Constant	0.83	0.13		6.33
AT	0.14	0.04	0.14	3.29***
SN	0.26	0.04	0.27	7.03***
PBC	0.52	0.04	0.54	11.93***

DV: BI,  $R=0.93$ ,  $R^2=0.87$ ,  $Adj. R^2=0.87$ ;  $F=10.82$ ,  $d.f.=5/496$

## VI. CONCLUSION

Oral cancer screening is part of the national efforts in escorting the nationals' health that can effectively identify an oral cancer or risky case in the early stage. Although the government had trained sufficient screening experts and bear all expenses of OCS, the inspection rate remained low since it launched. Based on the theory of planned behavior, this study hypothesized and partially proofed that the attitudes toward, subjective norm of and the perceived behavior over the OCS of the risky group of oral cancers of the population varied along with several demographic factors as well as un-healthy behaviors. Consistent with previous studies, this research also proofed that the prospects' intentions of taking OCS is affected by their attitudes, subjective norms, and perceived behavior control. This study provides additional evidence to show that the validity of the theory of planned behavior in explaining and predicting the individuals' behavior intention.

OCS can effectively detect possible oral cancers for early treatments, most of which have satisfactory outcomes. The healthcare institutes and the public health organizations should formulate and implement various strategies to influence both the attitudes of the persons under the risk of oral cancers and the significant others of the persons in question through multiple media and channels, such as posters, brochures, health promotion events, and health education in the healthcare institutes. Since the perceived control over the OCS is the most viable factors to facilitate the intentions and the actual behavior, locating and locking the prospective cases with intensive communication techniques in enhancing their control beliefs would be the most critical approach to increase the participation rate. The research has also proofed that the theory of planned behavior is useful in predicting the OCS behavior intention, and that the questionnaire that Ajzen (2002) [34] suggested is valid and reliable in this behavior research. However, we do not include the actual behavior into the research. The question of whether the behavior intention and the perceived control have any impacts, as previous studies proposed, on the actual behavior remained unresolved.

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