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Application of the Integrated Behavioral Model to oral self-care behavior of community-dwelling middle-aged and older people in Taiwan

Abstract

Objectives This study evaluated the Integrated Behavioral Model and examined oral self-care behavior of community-dwelling middle-aged and older people. **Design** A cross-sectional design was used. **Sample** Purposive sampling was employed to recruit middle and older age community-dwelling individuals, with research locations in public health centers in northern Taiwan. **Measurements** Structured questionnaires comprised: participant demographics, oral health literacy, oral self-care attitude, self-efficacy, intention, and behavior, and significant others' perceptions and beliefs as well as environmental constraints. The Model verification was evaluated by path analysis. **Results** Two hundred and sixty-three participants (N = 263) completed the questionnaire survey. Results identified significant direct effects of the independent variables of oral health care literacy, intention of oral self-care, and perception of environmental constraints on the dependent variable of oral self-care behavior; and significant indirect effects on attitude of oral self-care, perception of significant other beliefs, self-efficacy of oral self-care. **Conclusion** Public health nurses work with the whole community and can potentially improve the oral self-care behavior of middle-aged and older adults by enhancing their oral health knowledge, maintaining their positive attitudes, assisting acceptance of recognition and support from others, increasing their ability to perform oral self-care, reducing environmental constraints, and thereby enhancing their oral self-care awareness.

Keywords

model, oral, behavioral, taiwan, people, older, middle-aged, community-dwelling, integrated, behavior, application, self-care

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TITLE PAGE

Title: Application of the Integrated Behavioral Model to Oral Self-Care Behavior of Community-Dwelling Middle-Aged and Older People in Taiwan

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ABSTRACT

Objectives: This study evaluated the Integrated Behavioral Model and examined oral self-care behavior of community-dwelling middle-aged and older people.

Design: A cross-sectional design was used.

Sample: Purposive sampling was employed to recruit middle and older age community-dwelling individuals, with research locations in public health centers in northern Taiwan.

Measurements: Structured questionnaires comprised: participant demographics, oral health literacy, oral self-care attitude, self-efficacy, intention, and behavior, and significant others' perceptions and beliefs as well as environmental constraints. The Model verification was evaluated by path analysis.

Results: Two hundred and sixty-three participants (N=263) completed the questionnaire survey. Results identified significant direct effects of the independent variables of oral health care literacy, intention of oral self-care, and perception of environmental constraints on the dependent variable of oral self-care behavior; and significant indirect effects on attitude of oral self-care, perception of significant other beliefs, self-efficacy of oral self-care.

Conclusion: Public health nurses work with the whole community and can potentially improve the oral self-care behavior of middle-aged and older adults by enhancing their oral health knowledge, maintaining their positive attitudes, assisting acceptance of recognition and support from others, increasing their ability to perform oral self-care, reducing environmental constraints, and thereby enhancing their oral self-care awareness.

Key Words: oral health, health behavior, health literacy, health promotion

BACKGROUND

Oral functions include eating, chewing, swallowing, digestion, and aesthetics, which are embedded within daily life. Oral health can be affected during aging due to changes in oral tissue and mucosa as well as the deterioration of oral function. It could also be affected by factors such as chronic disease and degeneration of movement function, which may further cause psychological and nutritional problems (Blanco-Aguilera et al., 2017; Deshpande & Amrutiya, 2017). Poor oral health conditions, such as tooth loss, can impact more than just physical function, nutrition, and socialization and may also influence quality of life, which argues for the importance of good oral health and the urgency to identify relevant factors affecting oral health (Bidinotto et al., 2016; Hoeksema et al., 2018; Masood, Newton, Bakri, Khalid, & Masood, 2017). Oral health promotion among middle aged and older adults is an important part of the public health nurses' role (U.S. Department of Health and Human Services Oral Health Coordinating Committee, 2016)

A recent study documented a significant positive correlation between oral health conditions and quality of life (QOL) among community dwelling adults in Taiwan (Wang, Fang, Hsiao, & Chou, 2018). Oral self-care behavior is a modifying factor that is related to oral health conditions (Dumitrescu, Wagle, Dogaru, & Manolescu, 2011; Guevara-Canales et al., 2018); however, few studies have explored oral self-care behavior and relevant factors including literacy, attitude, and environmental constraints, which could lead to oral self-care behavior change. Therefore, the purpose of this study was to investigate oral self-care behaviors in middle-aged and older adults. Further, we used Fishbein's (2000) Integrated Behavioral Model (IBM) as a theoretical framework, consisting of various constructs including knowledge, attitude, self-efficacy, intention, environmental constraint and so on, to explain behavior. We also aimed to identify barriers affecting implementation of oral self-care behavior. The outcomes of this study can assist public health nurses to be more aware of

the importance of oral health conditions among community dwelling middle and older age adults, and may help them improve methods to promote oral self-care behaviors, develop effective educational programs, and foster oral health and self-care in potentially populations who have poor oral health conditions and self-care behaviors.

Oral Care

Despite availability of oral care professionals, clinic locations, methods, tools, etc., daily oral self-care requires more attention and supervision and should not be overlooked by care providers, including public health nurses. Previous studies suggest that among older adults oral health self-care habits need to be advocated for and oral cleaning knowledge and skills should be strengthened by oral health professionals as well as public health nurses. (Horowitz & Kleinman, 2012; Naghibi Sistani, Virtanen, Yazdani, & Murtomaa, 2017). Health, QOL, oral health conditions, and oral self-care behavior are all interrelated, but there are various factors that could be explained by models such as IBM that potentially determine whether daily oral self-care can be correctly implemented (Dumitrescu et al., 2011; Kato, Abrahamsson, Wide, & Hakeberg, 2018; Wang et al., 2018).

Integrated Behavioral Model

The IBM was constructed from the Theory of Rationed Action (TRA) and Theory of Planned Behavior (TPB) developed by Ajzen and Fishbein (1969, 1970). These authors introduced the TRA and emphasized that there are many concepts correlated with behaviors including beliefs, attitudes, and intentions (Fishbein & Ajzen, 1975). The TRA and TPB were adopted in many behavioral research and health-related fields including smoking cessation, health promotion, and use of condoms, all of which are issues of concern to public health nurses (Prati, Mazzoni, & Zani, 2014; Vieira, Hilands, & Braun, 2015). Studies have also explored oral hygiene behavior using the TPB to recognize factors affecting intention

regarding this behavior. Other factors, such as oral health knowledge and skills, as well as environmental constraints, were missing from the whole picture (Astrom, Lie, & Gulcan, 2018; Patel et al., 2018).

The IBM is a theory of behavioral prediction that is assumed to be applicable to understanding any given behavior. Similar to the TRA and TPB, the IBM proposes that intentions (as a function of attitudes, subjective norms, and perceived self-efficacy) are the primary determinants of behavior. Four additional components directly affect behavior: knowledge, salience of the behavior, environmental constraints, and habits (Fishbein, 2000). This study employed health behavior theory to identify potential variables that can serve to support public health nurses' understanding of middle-aged and older adults' awareness, attitudes, intention, knowledge, environmental constraints and behavior of oral health self-care.

Research hypotheses

The following hypotheses were tested: (1) Middle aged and older adults who report higher oral health literacy, will have more positive attitudes toward oral self-care; (2) The following six independent variables (IV) will have a direct or indirect positive effect on oral self-care behavior (dependent variable): a) oral health literacy, b) perceptions of environmental constraints, c) perception of significant other beliefs, d) oral self-care attitude, e) efficacy, and f) intention.

METHODS

Design and Sample

A cross-sectional design, using a questionnaire survey method, was employed. Questionnaires were distributed by the researchers, using participant self-report to collect information from community-dwelling middle-aged and older adults.

Purposive sampling was used to recruit participants, with research locations in public health centers, service centers for older people, sports centers, community colleges for older people, community activity centers, and neighborhood offices in Taipei, which is an urban area in Taiwan. In each location, we invited and recruited eligible participants for the study. Inclusion criteria were middle-aged and older adults, aged 45~80 years; able to communicate, having no serious visual impairment, and able to read contents of the questionnaire; self-report of being able to perform oral self-care without help; and agreeing to participate in the study. Exclusion criteria included being of an age that did not meet the selection criteria, without the ability to perform oral self-care and being illiterate.

Measures

Following translation and back translation from source language (English) to target language (Mandarin), this study used a structured questionnaire survey, prepared by the researchers, based on theory and literature review, as well as an extant instrument, the Oral Health Literacy-Adult Questionnaire (OHL-AQ). We invited experts in relevant fields including public health nursing, dentistry, and oral hygiene, to generate a content validity index (CVI). Scoring all parts of the questionnaire included suitability of the content, clarity of expression, and consistency of translation. The scoring range on each question of the CVI was 1~4 points. A higher score, above the mean, indicated that a question was appropriate; otherwise it was modified or deleted. The CVI for each of the items (N=7) in the questionnaire was >0.90.

In order to investigate the research hypotheses, data collection included participant demographics, oral health literacy (OHL) and scales to measure attitude toward oral self-care, perceptions of significant other beliefs, self-efficacy of oral self-care, perceptions of environmental constraints, intention of oral self-care, and oral self-care behavior.

Oral Health Literacy. To measure oral health literacy, we used the Oral Health Literacy-Adult Questionnaire (OHL-AQ) developed by Naghibi (2014) to examine oral health literacy in non-English speaking countries. The OHL-AQ contains 17 items. A correct answer to each item earns 1 point, with a maximum score of 17 points. Scores of 0~9 points indicate inadequate oral health literacy, those with scores of 10 or 11 points are marginal, and those with 12~17 points are considered adequate. Cronbach's α coefficient for the internal consistency of the scale was 0.72, and the intraclass correlation coefficient (ICC) was 0.84. In the present study, the scale was translated and back-translated by the first author and a bilingual oral health care professional. Following the experts' content validity testing of the suitability, clarity, and consistency, the CVI was 0.95 and Cronbach's α coefficient was 0.78.

Perceptions of Environmental Constraints, Oral Self-Care Attitudes and Behavior. Instruments to measure perceptions of environmental constraints, oral self-care attitudes, and behavior were developed by the researchers following a literature review and expert advice. For perceptions of environmental constraints, there were six items, scored using a four-point Likert rating scale. Scores can range from 6 to 24 points, with higher scores indicating a greater perception of environmental constraints, including "It is hard to find a dentist", "I do not have enough time to do oral self-care", "There is no appropriate place for me to do oral self-care in my work place" ...etc. There was one negatively worded item. The CVI was 0.90, and Cronbach's α coefficient for the reliability analysis was 0.68 (marginal reliability).

Oral Self-Care Behavior

The attitude toward oral self-care scale included nine items, scored using a four-point Likert rating scale. The maximum score was 36 points, and the minimum score was 9 points. The score reflected the respondent's positive attitudes toward oral self-care behavior. The CVI was 0.96, and Cronbach's α coefficient was 0.64 (marginal reliability).

There were 10 items assessing oral self-care behavior, which required "yes" and "no" responses, and yielded possible scores of 1 and 0, respectively. The maximum score was 10 points, and the minimum score was 0 points. A higher score indicated better oral self-care behavior. The CVI was 0.97, and the reliability analysis Kuder-Richardson formula 20 was 0.67 (marginal reliability).

Perceptions of Significant Other Beliefs, Oral Self-Care Self-efficacy and Intention.

Perceptions of significant other beliefs, self-efficacy of oral self-care, and intention of oral self-care included items developed by the researchers following a literature review and recommendations derived from the IBM. These three variables were measured using a visual analogue scale (VAS), with a maximum score of 100 points. For the perceptions of significant other beliefs, there were two items. The CVI was 0.91, and Cronbach's α coefficient was 0.93. One item examined the self-efficacy of oral self-care and one item addressed intention of oral self-care, each with a CVI of 1.

Ethical Considerations

As noted earlier, the research sites were community organizations in Taipei which is an urban area in Taiwan. Prior to the study, we contacted the research sites to obtain consent and set up a schedule for all related activities. Participants were recruited into the study according to the aforementioned selection criteria.

This study was reviewed and approved by the University Institutional Review Board (approval number: N201507041) to protect the rights of research participants and for ethical

considerations, the researchers explained the purpose of the research and research methods to all participants. To ensure the participants' full awareness, they were informed of their rights, and their consent was obtained before beginning the questionnaire survey.

Analytic Strategy

Descriptive statistics included frequency distributions, percentages, means, and standard deviations (*SD*) to describe distributions of independent variables and dependent variables used in the study. Path analysis was used to evaluate the Model application on oral self-care behavior. All data processing and statistical analyses were carried out using Statistics Analysis System (SAS Institute, Cary, NC, USA) version 9.4. An alpha of 0.05 was used as the significance level.

RESULTS

The total number of questionnaires issued during this research was 308. Of these, 27 individuals were unwilling to respond to the questionnaires and six others withdrew during the process of responding to the questionnaire. There were 12 invalid questionnaires, with incomplete responses on fewer than 50% of the items answered (oral health literacy had the most incomplete items followed by oral self-care attitudes). In total, there were 263 valid questionnaires, yielding a response rate of 85.4%.

Participants' Demographics

Among the 263 participants in this study, 148 were women (56.3%) and 115 were men (43.7%). The average age was 61.0 (*SD*=10.7) years, with middle-aged people (45~64 years old) accounting for the majority (162 people; 61.6%), and 101 (38.4%) seniors (65~80 years old). In terms of educational attainment, 109 people (41.5%) had a college education or above, and accounted for the largest number of participants (Table 1).

Path Analysis for the Original Integrated Behavioral Model

We used multiple regression analysis to establish pathways for the four dependent variables: oral self-care attitudes, perceptions of environmental constraints, oral self-care intention and behavior (Figure 1).

Oral Self-Care Attitudes as a Dependent Variable. Results showed that oral health literacy had a significant direct effect on attitudes toward oral self-care; with a path coefficient of 0.245 ($p < 0.001$), an explained variance (R^2) of 0.056 ($F(1,261)=16.660$), and a standard error of estimate (Se) of 0.972 (see Table 2).

Perceptions of Environmental Constraints as a Dependent Variable. The path coefficient for self-efficacy of oral self-care on perceptions of environmental constraints was -0.144 ($p=0.019$), with a significant direct effect, $R^2=0.017$, $se=0.991$ ($F(1,261)=2.678$; see Table 2).

Oral Self-Care Intention as a Dependent Variable. The direct effect of oral health literacy ($\beta=-0.007$, $p=0.881$) and perceptions of environmental constraints ($\beta=-0.067$, $p=0.147$) were not significant. Attitude toward oral self-care ($\beta=0.144$, $p=0.002$), perceptions of beliefs of significant others ($\beta=0.378$, $p < 0.001$), and self-efficacy oral self-care ($\beta=0.483$, $p < 0.001$) jointly explained intention of oral self-care, with a significant direct effect and an explained variance of 0.551. The estimated standard error was 0.670 ($F(5,257)=65.291$); oral health literacy ($0.245 \times 0.144=0.035$) and self-efficacy of oral self-care ($-0.144 \times -0.067=0.001$) had an indirect effect on intention of oral self-care (Table 2).

Oral Self-Care Behavior as a Dependent Variable. Oral health literacy ($\beta=-0.255$, $p < 0.001$), intention of oral self-care ($\beta=0.327$, $p < 0.001$), and perceptions of environmental constraints ($\beta=-0.148$, $p=0.014$) had significant direct effects on oral self-care behavior. The explained variance was 0.169, and the estimated standard error coefficient was 0.912

($F(3,259)=18.714$). Oral health literacy ($-0.007 \times 0.327 + 0.245 \times 0.144 \times 0.327=0.010$), attitude of oral self-care ($0.144 \times 0.327=0.047$), perceptions of significant other beliefs ($0.378 \times 0.327=0.124$), and self-efficacy of oral self-care ($0.483 \times 0.327 + (-0.144 \times -0.148) + (-0.144 \times -0.067 \times 0.327)=0.182$) had indirect effects on behavior of oral self-care (Table 2).

Path Analysis for the Revised Model

The model was revised as follows: 1) Pathways with non-significant effects were removed according to the results of the original model, and 2) pathways with statistically significant links to the dependent variables were retained, obtaining a final revised model for the regression analysis (Figure 2). In the revised model, when intention of oral self-care was the dependent variable, the independent variables were revised to include attitude toward oral self-care, perceptions of beliefs of significant others, and self-efficacy of oral self-care for the regression analysis (see Table 3).

Results showed that when intention of oral self-care was the dependent variable, oral self-care attitudes had a significant effect, with a path coefficient of 0.131 ($p=0.002$). The path coefficient for perceptions of beliefs of significant others was 0.391 ($p<0.001$), and the path coefficient for oral self-care self-efficacy was 0.484 ($p<0.001$). The direct effect was significant, with an explained variance of 0.550. The estimated standard error was 0.670 ($F(3,259)=107.952$; Table 3).

DISCUSSION

Oral Health Literacy

This study focused on people over 45 years old, with an average age of about 60 years. Average scores on the OHL scale were in the middle range (0 to 17 points), with an average score of 11.3 points, and revealed that OHL had significant effects on oral self-care attitudes,

which is consistent with previous findings (Brein, Fleenor Jr., Kim, & Krupat, 2015; Buunk-Werkhoven, Dijkstra, & van der Schans, 2011). However, this study also found that scores on OHL did not influence oral self-care intentions, and had a low negative effect on oral self-care behavior. Previous studies investigating the relationship between oral health knowledge and oral self-care attitudes, have found no significant correlation (Dumitrescu, et. al., 2011). Our study used self-administered questionnaires to examine oral self-care behavior and assumed honest responses from participants. One possible explanation for our unexpected finding of the negative effect of OHL on self-care behaviors is that some people with good OHL do not necessarily have good oral self-care behavior. It is also plausible that our well educated sample had higher self-expectations and scored lower on items related to self-care behavior because they felt they did not live up to self-imposed oral health care standards. The concept of OHL consists of oral health knowledge and skills. There is a well-documented relationship between oral health knowledge and behavior; however, there are inconsistent findings regarding the association between OHL and oral self-care behavior (Dumitrescu, et. al., 2011; Naghibi Sistani, et. al., 2017; Patel, et. al., 2018). Therefore, more studies are needed to understand relationships between OHL and oral self-care behavior.

Although our study did not support the hypothesis that OHL will have a direct or indirect positive effect on oral self-care behavior, and correlate positively with oral health; the concept of OHL has the potential to improve both health knowledge and allow people to pursue a healthy lifestyle; enable optimal utilization of medical resources and avoid their abuse, cooperate fully with medical systems, and ultimately promote people's health (Naghibi Sistani, et. al., 2014). Previous studies have confirmed that health literacy correlates positively with other outcome such as oral self-care attitude that in turn impact on oral self-care behaviors positively (Guo, Logan, Dodd, Muller, Marks, & Riley III, 2014; Hjertstedt, Barnes, & Sjostedt, 2014). Also, there is a lot of evidence in the literature to indicate that

literacy affects behavior (Astrom, et al., 2018; Dumitrescu, et. al., 2011; Hjertstedt, et al., 2014) Our study did not find that OHL was related to oral self-care behavior directly; therefore, the relationship between OHL and oral self-care behavior requires further examination. In sum, to enhance OHL and improve oral self-care behavior, oral self-care attitudes need to be considered. Increasing not only public OHL but also positive oral care attitudes may help to motivate people to maintain good oral self-care behaviors.

Perception of significant others' beliefs and oral self-care self-efficacy

Our study found that people with better perceptions of significant others' beliefs in oral health, also scored higher on their intentions to improve their oral self-care behavior. Our results were similar to findings from previous studies (Brein, Fleenor, Kim, & Krupat, 2015; Dumitrescu, et. al., 2011). This suggests that when significant others (e.g., partner, family, and friends) express the importance of and support for good oral self-care behavior, people intend to improve their own oral self-care behavior. Therefore, in designing strategies to promote good oral self-care behavior, public health nurses can facilitate oral care programs using the family as a unit, similar to Japan's dental health project "Healthy Japan 21" plan. For example, all age groups have different oral health prevention goals, such as cavity prevention in early childhood, tooth decay prevention for school-age children, periodontal disease prevention in adulthood, and tooth loss prevention in older adults (Sakurai, 2003). Although family members may have different oral health goals, they can make efforts to improve oral self-care by participating in intergenerational and family educational activities in the community and by learning about and reinforcing oral self-care behavior together. In this way, family members can more positively perceive oral self-care, thus supporting and urging family members to maintain good oral self-care (Dumitrescu, et. al., 2011).

The efficacy of oral self-care can also affect self-care intentions and behavior. Several health behavioral theories such as the Health Belief Model discuss self-efficacy, intention and behavior. A previous review conducted a meta-analysis to analyze whether self-efficacy is a key determinant of intention and behavior. The findings support health behavior theories and indicate that higher self-efficacy is effective in promoting behavior change (French, Olander, Chisholm, & Mc Sharry, 2014). The relationship found in our study between self-efficacy and behavioral intentions was also previously established (Fishbein, 2000). The work of Bandura (1977) suggests that self-efficacy is related to direct experiences, alternative experiences, persuasion, and other factors. Therefore, PHNs should consider discussing with middle and older age community-dwelling individuals their current and previous experiences of preferred brushing or flossing techniques, which may improve their oral self-care efficacy. Prior bad experiences, such as whether they consider oral self-care difficult and not easy to perform may contribute to poor performance (Bandura, 1986; Zhou, Sun, Knoll, Hamilton, & Schwarzer, 2015). This issue also reveals the importance of public health nurses collaborating with local oral healthcare professionals. Together, nurses and other professionals can use feedback from community-dwelling adults via community health educational activities or regular home visits to implement tailored educational approaches to foster more positive oral self-care behaviors.

Correlations among model variables

Our study identified that oral self-care attitudes, perception of significant others' beliefs, and oral self-care self-efficacy have direct effects on oral self-care intention, as well as indirectly, but significantly, impacting oral self-care behavior. Perception of environmental restrictions also directly and significantly affected oral self-care behavior, which aligns with the assumptions of the Intergrated Behavioral Model (Fishbein, 2000) and results from other

research (Brein, Fleenor Jr., Kim, & Krupat, 2015; Zhou, Sun, Knoll, Hamilton, & Schwarzer, 2015).

To improve oral self-care activities, public health nurses need to also consider theoretical underpinnings and individual characteristics, including attitudes, perceptions of the opinions of others, self-efficacy, and environmental constraints to oral self-care behavior when designing relevant intervention programs to promote and enhance oral self-care behavior in middle-aged and older people. In sum, public health nurses may have to move beyond just educational interventions to affect oral health behaviors, to include oral health literacy, intention of oral self-care, and perception of environmental constraints as well as to consider, for example, the use of media to demonstrate and provide reminders to floss.

Study Limitations

The limitations of the study were the reliability of the instruments used was low (perceptions of environmental constraints, oral self-care attitudes and behavior). Future research should increase number of items in the instruments, also should enlarge the sample size to evaluate these newly developed instruments. The data were collected in Taiwan and the sample was skewed toward well-educated respondents. As a result, these findings may not be generalizable to other cultures or populations. Future research requires more diverse samples especially reflecting different literacy levels, because this variable influences design and success of educational interventions and makes the relationships found with oral health literacy less conclusive.

Recommendations and Implications for Public Health Nursing

Awareness of oral health problems and risk level of disease among middle-aged and older adults is an important consideration in the practice and research of public health nurses, as well as the role of self-care in the prevention of oral diseases in this population. With

regard to the oral health education of older adults, materials should be designed in ways that are easy to understand (level of language) and readability (large font) and interesting, including multimedia oral health care education such as videos (Mullen, 2013; Pei et al., 2017). Local public health centers and clinics can collaborate with public health nurses and provide oral health self-care activities within the community. To improve self-efficacy, motivation, performance and to build positive self-care attitudes, these activities should be offered together with family or friends to make it interesting, fun and more supportive. Future studies should employ observational methods to examine oral self-care behavior and design intervention projects to improve oral self-care behavior.

CONCLUSIONS

Our findings revealed that the Integrated Behavioral Model can assist in understanding the important determinants of oral self-care behavior. Oral health literacy and environmental constraints have negative direct effects on oral self-care behavior. Oral self-care intention has positive direct and significant effect on oral health self-care behavior. Also, oral self-care attitude, self-efficacy, and perception of significant others' beliefs have significant direct effects on oral self-care intention and indirect effects on oral self-care behavior. Both indirect and direct effects on oral self-care in middle-aged and older people can be explored by the Integrated Behavioral Model. Application of the Integrated Behavioral Model to oral self-care behavior among middle-aged and older people can assist public health nurses to identify the self-care behaviors of this population. There are a number of ways which nurses may intervene to improve oral health care: a) by enhancing oral health knowledge, b) maintaining positive attitudes, c) assisting with acceptance of recognition and support from others, d) belief in ability for oral self-care, and e) reducing environmental constraints to enhance oral self-care awareness.

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Figure Captions

Figure 1. Path Analysis of Oral Self-Care Behavior Based on the Integrated Behavioral Model.

Note: OSC = Oral Self-Care. * $p < .05$; ** $p < .01$; *** $p < .001$.

^a Dependent: OSC Attitude, adjusted $R^2 = .056$, $Se = .972$.

^b Dependent: Perception of Environmental Constraints, adjusted $R^2 = .017$, $Se = .991$.

^c Dependent: OSC Intention, adjusted $R^2 = .551$, $Se = .671$.

^d Dependent: OSC Behavior, adjusted $R^2 = .169$, $Se = .912$.

Figure 2. Modified Model of Oral Self-Care Behavior.

Note: OSC = Oral Self-Care. * $p < .05$; ** $p < .01$; *** $p < .001$.

^a Dependent: OSC Attitude, adjusted $R^2 = .056$, $se = .972$.

^b Dependent: Perception of Environmental Constraints, adjusted $R^2 = .017$, $Se = .991$.

^c Dependent: OSC Intention, adjusted $R^2 = .550$, $Se = .670$.

^d Dependent: OSC Behavior, adjusted $R^2 = .169$, $Se = .912$.

Table 1. Descriptive Statistics of Variables ($N=263$)

| Variable | n (%) | Mean \pm SD |
|---|------------|------------------|
| Gender | | |
| Male | 115 (43.7) | |
| Female | 148 (56.3) | |
| Age (years) | | 61.0 \pm 10.7 |
| Educational level ($N=262$) | | |
| Informal education | 4 (1.5) | |
| Elementary | 34 (13.0) | |
| Junior high | 27 (10.3) | |
| Senior high | 88 (33.6) | |
| College or above | 109 (41.5) | |
| Oral Health Literacy | | 11.3 \pm 3.4 |
| Oral Self-Care Attitude | | 24.9 \pm 2.8 |
| Perception of Significant Other Beliefs | | 160.8 \pm 40.6 |
| Oral Self-Care Self-efficacy | | 72.5 \pm 22.4 |
| Perception of Environmental Constraints | | 13.8 \pm 2.5 |
| Oral Self-Care Intention | | 82.3 \pm 17.9 |
| Oral Self-Care Behavior | | 6.8 \pm 2.2 |

Table 2. Direct, Indirect, and Total Effects of a Path Analysis of the Original Model ($N=263$)

| Dependent | Independent | Effects | | |
|----------------------------------|----------------------|---------------|-----------------|--------------|
| | | Direct effect | Indirect effect | Total effect |
| OSC Attitude ($R^2=0.056$) | Oral Health Literacy | .245*** | - | .245 |
| PEC ($R^2=0.017$) | OSC Self-efficacy | -.144* | - | -.144 |
| OSC Intention ($R^2=0.551$) | Oral Health Literacy | -.007 | .035 | .028 |
| | OSC Attitude | .144** | - | .144 |
| | PSOB | .378*** | - | .378 |
| | OSC Self-efficacy | .483*** | .001 | .484 |
| | PEC | -.067 | - | -.067 |
| OSC Behavior ($R^2=0.169$) | Oral Health Literacy | -.255*** | .010 | -.245 |
| | OSC Attitude | - | .047 | .047 |
| | PSOB | - | .124 | .124 |
| | OSC Self-efficacy | - | .182 | .182 |
| | PEC | -.148* | -.022 | -.170 |
| | OSC Intention | .327*** | - | .327 |

Note. OSC = Oral Self-care; PEC = Perception of environmental constraints; PSOB =

Perception of significant other beliefs. * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

Table 3. Direct, Indirect, and Total Effects of a Path Analysis of the Modified Model ($N=263$)

| Dependent | Independent | Effects | | |
|---------------------------------|----------------------|---------------|-----------------|--------------|
| | | Direct effect | Indirect effect | Total effect |
| OSC Attitude ($R^2=.056$) | Oral Health Literacy | .245*** | - | .245 |
| PEC ($R^2=.017$) | OSC Self-efficacy | -.144* | - | -.144 |
| OSC Intention ($R^2=.550$) | Oral Health Literacy | - | .022 | .022 |
| | OSC Attitude | .131** | - | .131 |
| | PSOB | .391*** | - | .391 |
| | OSC Self-efficacy | .484*** | - | .484 |
| OSC Behavior ($R^2=.169$) | Oral Health Literacy | -.255*** | .032 | -.223 |
| | OSC Attitude | - | .043 | .043 |
| | PSOB | - | .128 | .128 |
| | OSC Self-efficacy | - | .179 | .179 |
| | PEC | -.148* | - | -.148 |
| | OSC Intention | .327*** | - | .327 |

Note. OSC = Oral Self-care; PEC = Perception of environmental constraints; PSOB =

Perception of significant other beliefs. * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

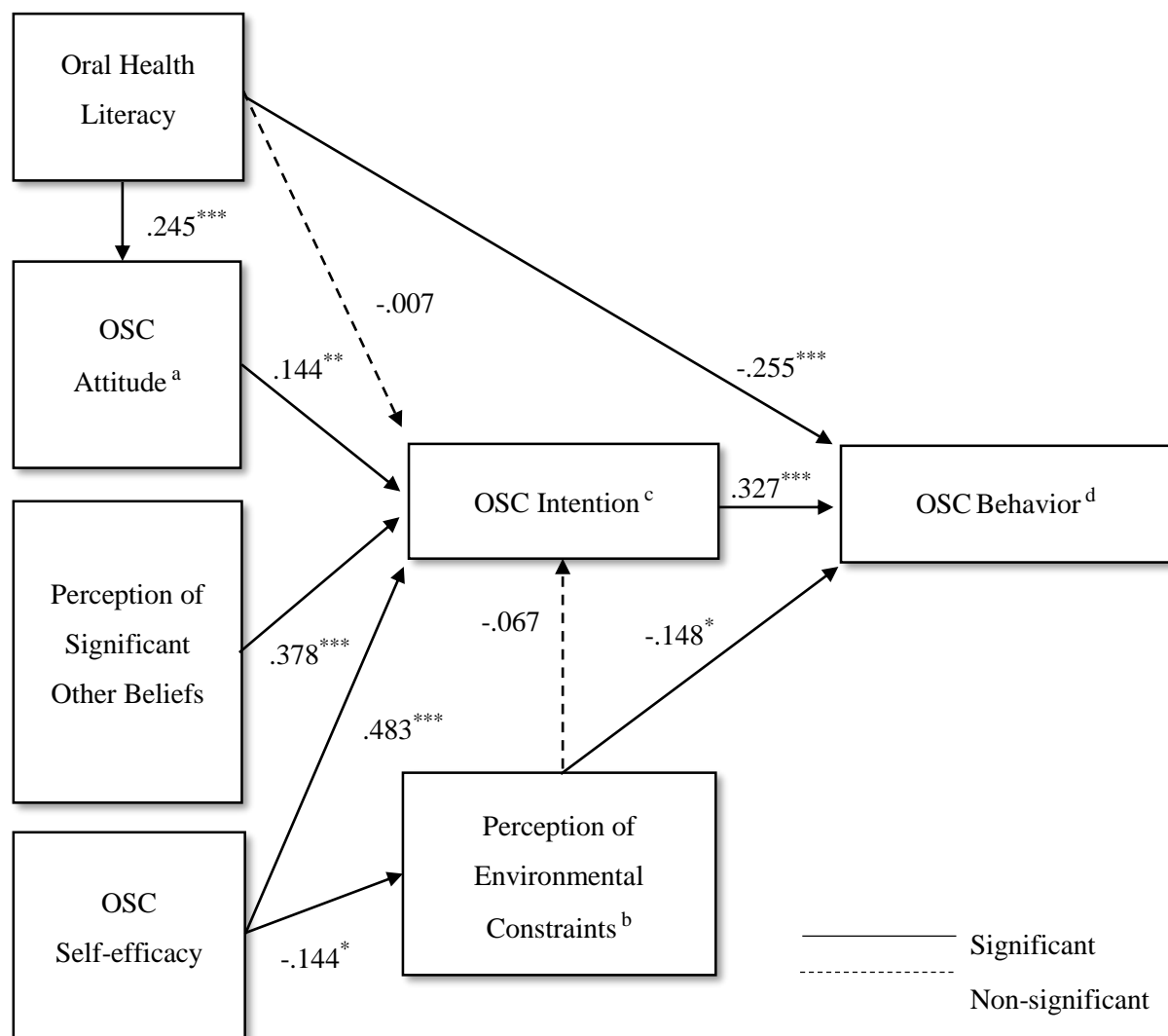


Figure 1. Path Analysis of Oral Self-Care Behavior Based on the Integrated Behavioral Model.

Note: OSC = Oral Self-Care. * $p < .05$; ** $p < .01$; *** $p < .001$.

^a Dependent: OSC Attitude, adjusted $R^2 = .056$, $Se = .972$.

^b Dependent: Perception of Environmental Constraints, adjusted $R^2 = .017$, $Se = .991$.

^c Dependent: OSC Intention, adjusted $R^2 = .551$, $Se = .671$.

^d Dependent: OSC Behavior, adjusted $R^2 = .169$, $Se = .912$.

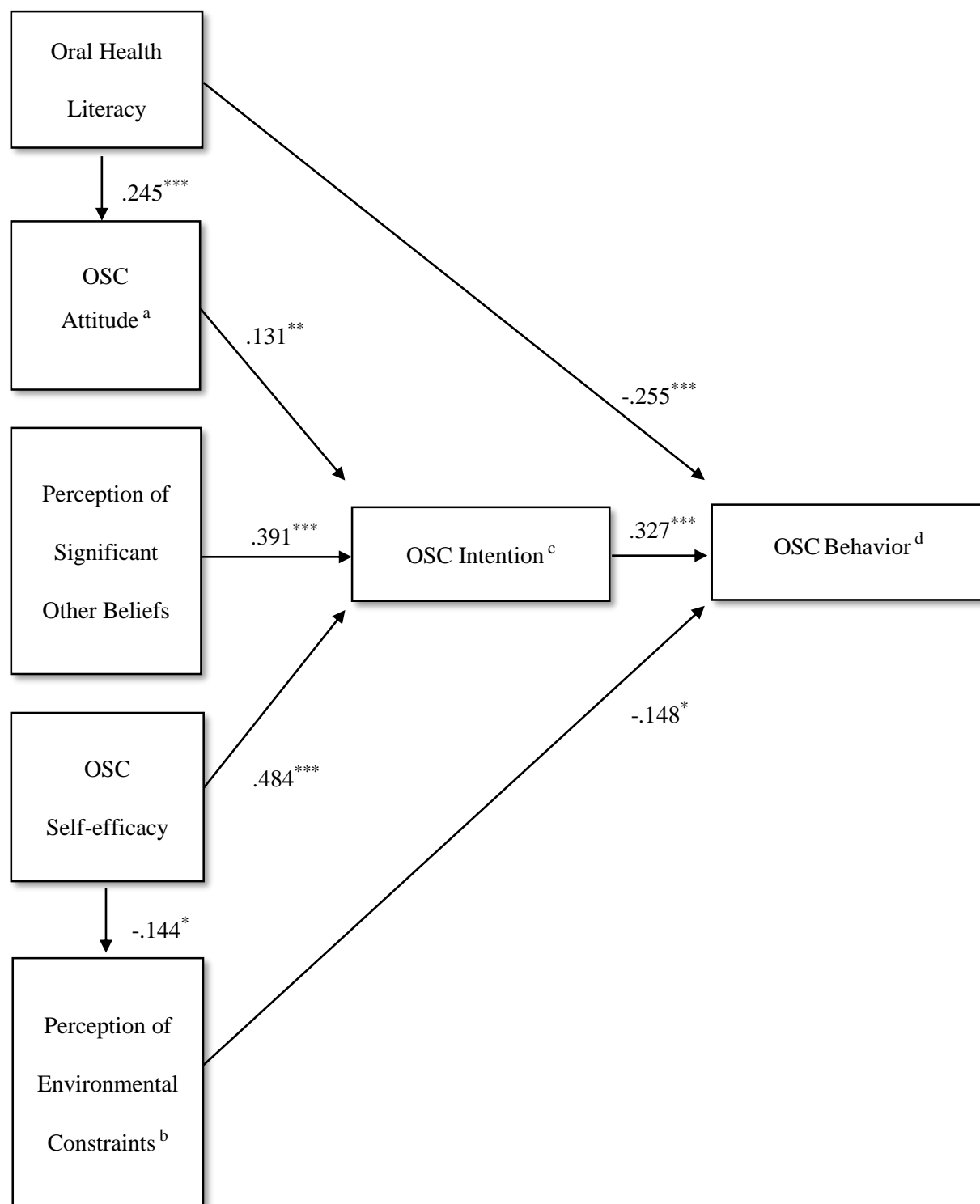


Figure 2. Modified Model of Oral Self-Care Behavior.

Note: OSC = Oral Self-Care. * $p < .05$; ** $p < .01$; *** $p < .001$.

^a Dependent: OSC Attitude, adjusted $R^2 = .056$, $s_e = .972$.

^b Dependent: Perception of Environmental Constraints, adjusted $R^2 = .017$, $Se = .991$.

Oral Self-Care Behavior

^c Dependent: OSC Intention, adjusted $R^2=.550$, $Se=.670$.

^d Dependent: OSC Behavior, adjusted $R^2=.169$, $Se=.912$.