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Does common-sense communication and the interpersonal relationship predict oral health self-management?

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DOES COMMON-SENSE COMMUNICATION AND THE INTERPERSONAL RELATIONSHIP PREDICT ORAL HEALTH SELF-MANAGEMENT?

by

Kieran J. Maestro

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Abstract

This study sought to understand how patients’ perceptions of the nature and manner of communication with dental health professionals may impact their health self-management quality and habits in the context of preventable illness. Specifically, this study investigated the distinct and overlapping impacts of (a) communication based in the Common Sense Self-Regulation Model (CSM; Leventhal et al., 1980), and (b) the interpersonal relationship between the patient and the dental health professional provider on patients’ oral hygiene quality and habits. It was hypothesized that the interpersonal relationship would positively moderate a positive relation between CSM-based communication and patients' oral health self-management and strength of oral health self-management habits.

A sample (N = 471) of participants were recruited via Amazon’s Mechanical Turk (MTurk) to answer questions about their most recent dental appointment. Participants were largely suburban-dwelling, Caucasian women with a mean age of 35.27 (SD = 11.47) and mean individual income of over $50,000. The findings suggest that dental professionals are regularly having CSM-based communication with their patients, and patients are regularly enacting oral health self-management. Interestingly, contrary to predictions, regression analyses indicated that whereas better dental professional-patient interpersonal relationships predicted better oral health self-management quality, more CSM-based communication at their appointment did not. Future research should focus on populations with less consistently practiced oral health self-management.
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Introduction

Preventable oral illnesses are a burden on the American public. Approximately 9% of American adults have periodontal disease, 91% have dental caries (at least one cavity), and by age 60, one in four adults are completely edentulous (Centers for Disease Control, 2017; Harris et al., 2014; National Institute of Dental and Craniofacial Research [NIDCR], 2018). If left untreated, these oral illnesses can worsen with time, require more serious and expensive treatment (Wall & Vujicic, 2015), and lead to significant social, emotional, and physical health consequences such as difficulty with verbal articulation, self-consciousness, and oral infection (Gift et al., 1992; Haumschild & Haumschild, 2009; Inglehart & Bagramian, 2002; Jackson et al., 2011; Kim et al., 2013; Touger-Decker & Mobley, 2007).

Even with access to dental services, supplies, and basic knowledge of oral hygiene techniques, patients infrequently enact oral health self-management (e.g., toothbrushing, flossing, etc.) to prevent oral illness. Surveys have shown that only about 70% of patients brush twice or more a day, 23% routinely go two or more days without brushing, 20% do not floss at all, and 60% have reported putting off attending dental services in the past year (American Dental Association, 2020; Centers for Disease Control, 2017; Delta Dental, 2014; NIDCR, 2018). There is a clear need to improve oral health self-management and ensure that these behaviors become habits.

Dental professionals (e.g., dentists and dental hygienists) routinely communicate with their patients about establishing, correcting and maintaining oral health self-management to aid in the amelioration and prevention of dental caries, periodontal disease, and their associated consequences (Chestnutt et al., 1998; Harris et al., 2014; König & Navia, 1995). Routine preventative dental care practice includes communicating with the patient about the quality of
their oral health self-management (e.g., use and effectiveness of toothbrushing and flossing, attendance to dental appointments, etc.) and strength of their oral health self-management habits (i.e., routinely, automatically, and consistently performed, toothbrushing, flossing, and oral rinsing, at least twice a day), especially when patients present with poor oral health (Harris et al., 2014).

Research on best communication practices between dental professionals and their patients has explored the relationship of motivational interviewing (Jönsson et al., 2010), goal setting (Newton & Asimakopoulou, 2015), and the use of external cueing (Wind et al., 2005) with outcomes, including patients’ intentions to enact oral health self-management (Orbell & Verplanken, 2010), and oral health self-efficacy (Clarkson et al., 2009; Stewart et al., 1997). This research suggests that communication between dental professionals and their patients can improve patient’s preventative self-management. However, among these studies, effect sizes are small or inconsistently reported, and patients continue to have difficulty with their oral health self-management, suggesting opportunities to improve communication further.

Communication about Patients’ Personal Understandings of Oral Illness

One way to improve communication between dental professionals and their patients would be to use a theoretically guided approach. The Common Sense Self-Regulation Model (CSM; Leventhal et al., 1980) suggests that how patients manage their health conditions is guided by their understanding of their health conditions (Croyle & Barger, 1993; Leventhal et al., 1998). According to CSM theorists, patients construct personal understandings of their health conditions, termed illness representations. Illness representations include five domains: identity, cause, consequence, timeline, and control. Identity-based representations refer to the patient’s understanding of the label of a health problem (for example, a patient may decide that tooth
sensitivity and persistent pain is a cavity). *Cause* representations are defined by the patient’s explanation of environmental, lifestyle, or biological factors that they believe have influenced the onset of their health problem (e.g., eating too many sugary foods or “bad genes”). The *consequence* refers to the side effect or potential costs of the health problem (e.g., tooth loss). *Timeline* refers to the duration or trajectory of the health problem (e.g., a general sense of how long the tooth pain may last). Finally, *control* refers to the overall sense of being in control of the symptoms of their health problem (e.g., “Despite the pain, I feel able to cope the pain with medication”).

Applied to oral illnesses, the CSM theorists might suggest that when patients have more adaptive (i.e., accurate, complete, and functional) oral illness representations (e.g., “My tooth pain is caused by a cavity”) and act accordingly (e.g., strengthen their oral health self-management, oral health habits, follow their dental provider’s recommendations, etc.), they are likely to achieve better health outcomes (e.g., prevent or reverse tooth decay).

There is growing evidence in the medical field that the CSM may be helpful for understanding how patients manage their health conditions. Systematic reviews consistently support the associations between illness representations and management behavior across a range of medical and psychological outcomes in several health conditions (Hagger & Orbell, 2003), including diabetes (Breland et al., 2013), asthma, liver, heart disease, and cancers (Horne & Weinman, 1999; Parfeni et al., 2013). However, what is not yet known is if the CSM operates similarly in the context of diseases primarily managed through preventative, habitual methods, such as oral illnesses.

Based on the CSM theoretical framework, patients may fail to enact high quality and habitual oral health self-management may be due to a lack of accurate, complete, developed, or
functional oral illness representations (Bress, 2013; DeWalt et al., 2004; DeWalt & Hink, 2009). Several reasons for this lack of developed oral illness representations have been suggested in the theoretical literature. First, patients may overlook the potential consequences of inconsistent oral health self-management, especially in the context of competing health challenges (Bress, 2013). Second, in the absence of a salient, somatic, symptomatic experience of disease (common in the early stages of oral illness development), patients may not be fully aware of the potential consequences of the oral illness (Harris et al., 2014). Finally, in the context of more recognizable markers of compromised oral health (e.g., toothache, observable decay, or gingivitis), patients may nonetheless report good, overall oral health (Chen, 2018; Lugo et al., 2014; Saxer et al., 1998). Communication guided by the CSM may help to uncover patients’ oral illness representations and shape them to be consistent with recommended oral health self-management.

Only one empirical study to date has examined the potential link between how patients think about their oral health (i.e., representations) and oral health self-management. Judah et al. (2013) examined the relation between consequence-type oral illness representations and flossing habit formation. More positive consequence-type representations (e.g., “Flossing will make my teeth feel cleaner or nicer” or “Flossing is good for my oral health”) predicted stronger flossing habits four weeks later, supporting the link between oral illness representations and habitual oral health-promoting self-management.

While no studies have examined the potential impact of increased communication about oral illness representations between dental professionals and their patients, a few studies have examined illness-representation-related communication in medical care. Petrie et al. (2002), for example, used an experimental design to study the effect of an illness-representations-intervention among myocardial infarction survivors. Patients who were randomized to receive
the intervention learned to distinguish between symptoms related versus not related to myocardial infarction. In CSM terms, the patients discussed identity-type representations with their physicians. Patients who discussed these representations reported later feeling more prepared when leaving the hospital, returned to work sooner, and reported fewer myocardial infarction-related symptoms three months after discharge than wait-list controls.

Phillips et al. (2012) examined the relationship of CSM-based communication and outcomes among primary care patients with chronic illnesses. Findings indicated that patients’ report of greater CSM-based communication with their physicians was associated with patients’ reporting a greater understanding of their illnesses, more satisfaction with treatment, greater adherence to prescribed treatment one month after the consultation, and ratings of their problems as “better” or “completely gone” at a one-month follow-up. Further, compared to the patients’ ratings of doctors’ interpersonal skills during the encounter, recall of CSM-based communication was a stronger predictor of adherence and problem resolution at one-month follow-up.

Correspondingly, Phillips et al. (2017) evaluated CSM-based communication among veterans with medically unexplained symptoms (MUS) and their physicians in a post-deployment health clinic. Veterans who reported more communication about their illness representations and treatment expectations with their physicians were more likely to report greater adherence to treatment recommendations and greater overall satisfaction with treatment.

As CSM-based communication has been linked with patients’ adherence to treatment recommendations across a variety of illnesses (Leventhal et al., 2016), it seems likely that dental professional-patient communication that targets patients’ oral illness representations may also be related to the quality and routinization of patients’ oral health self-management. This study aimed to build on the extant theoretical and empirical literature in health-based communication.
by evaluating the impact of CSM-based communication on patients’ self-management quality and habit formation in the context of preventable, dental illness.

**Quality of the Interpersonal Relationship**

Beyond the content of dental professional-patient communication, the context of the interpersonal relationship between the dental professional and patient may play an important role in how CSM-based communication affects patients’ preventative oral health self-management. In dentistry, the interpersonal relationship has been called the dental professional’s “chair-side” manner, defined as the patient’s felt sense that the dental professional is caring for them and is respectful and sensitive to their needs (Church et al., 1980; Zimmerman, 1988). Patients commonly believe that their relationships with dental professionals should be comfortable, welcoming, and warm (Mayerson, 1990; Moawad, 1988). A failure to meet these expectations may lead to missed appointments and patient non-adherence to treatment recommendations (Becker & Maiman, 1975; Davis, 1971; Laskin, 1979).

Reviews of doctor-patient communication theory and research in medical literature frequently identified the interpersonal relationship as a facilitator of successful communication (as rated by both doctors and their patients) and as a predictor of patient health self-management, health outcomes, and treatment satisfaction (Arora, 2003; Epstein et al., 2005; Ha & Longnecker, 2010; Hall et al., 1988; Ong et al., 1995; Zolnierek & DiMatteo, 2009). A systematic review of qualitative data (Di Blasi et al., 2001) found that patients often described greater treatment satisfaction, less pain, and faster overall recovery when working with doctors who provided clear information about their health and treatment processes in a “warm,” “friendly,” or “reassuring” manner.
Similar conclusions about the provider’s interpersonal manner have been found in the dental literature, where research has linked better quality dental professional-patient interpersonal relationships to several dental outcomes. For example, in longitudinal studies of patients receiving dental treatment in outpatient clinics, greater duration of dentist-patient discussion (Camner et al., 1994) and patients’ reports of liking of and familiarity with their dentist (Sandell et al., 1994) predicted attendance to future appointments and better oral health (e.g., less dental plaque and inflammation of the gums) at 6-month follow-up appointments. In a study of patients receiving orthodontic care, patients who identified their orthodontist as polite, friendly, empathic and communicative also reported less anxiety, greater compliance with treatment recommendations, and greater treatment satisfaction eight to twelve months into treatment (Sinha et al., 1996). Among patients with marked dental anxiety or fear, several systematic reviews have found that perceptions of dentists’ concern for their patients’ comfort and stronger dentist-patient rapport were associated with reductions in anxiety and patient-rated, successful outcomes of treatment (Abrahamsson et al., 2003; Bernson et al., 2011).

However, despite the links between the interpersonal relationship and several subjective and objective treatment outcomes, strong interpersonal relationships alone are likely insufficient for improving the self-management of physical health conditions. Kinmonth et al. (1998) assessed the impact of an interpersonal communication training for doctors and nurses treating patients newly diagnosed with type 2 diabetes versus a treatment-as-usual control group. Their findings suggested that patients who received care from the interpersonally-trained medical providers reported better communication with their treatment team and were more satisfied with treatment. However, at one-year follow-up, the same patients’ body mass indices were significantly higher and diabetes-related knowledge scores were significantly lower than that of
the control group. While the enhanced communication led to improved treatment satisfaction, it did not seem to improve physical outcomes. The authors hypothesized that the enhanced relational process deemphasized the self-management of the disease itself (Kinmonth et al., 1998). Similarly, in Phillips’ et al. (2012; reviewed above) study on primary care patients with chronic illnesses, patient adherence to their doctors’ recommendations and patient-reported health improvements were more strongly influenced by CSM-based communication (i.e., discussion about the patients’ understandings of the disease) than the patients’ reports of their doctors’ interpersonal skills. Overall, it seems that better interpersonal relationships alone are likely not sufficient for helping patients improve their health.

Although theory and research in medicine and dentistry has routinely linked the interpersonal relationship with the patient as an important factor in several objective and subjective health and treatment outcomes, some research seems to suggest otherwise. The reasons for the mixed findings are unknown. Interestingly, in the medical and dental literature (e.g. Arora, 2003; Epstein et al., 2005; Ha & Longnecker, 2010; Hall et al., 1988; Ong et al., 1995; Zolnierek & DiMatteo, 2009), the interpersonal relationship with the patient is referred to as facilitating the impact of communication on patient health and behavior; in other words, the variation in patient behavior after a consultation may be due to an interaction between the actual content of doctor-patient communication and their interpersonal relationship. However, no medical nor dental research to date has explicitly tested the interpersonal relationship with the patient as a contributing factor to patient health behavior. The present study aimed to fill this gap in literature by testing the hypothesis that a strong interpersonal relationship between a doctor and patient facilitates the relation between the content of doctor-patient communication, as understood through the CSM, and patient health self-management in the context of oral health.
Research Aims and Hypotheses

This study was designed to build on previous theoretical and empirical literature in health-based communication by examining the relation between CSM-based communication and the quality and consistency of oral health self-management (i.e., toothbrushing and flossing). Moreover, the study examined the degree to which the dental professional’s interpersonal relationship with the patient might contribute to the association between CSM-based communication and oral health self-management. The first hypothesis was that more CSM-based communication would be associated with better quality health self-management and habits, as reported by dental patients. The second hypothesis was that stronger interpersonal relationships between dental professionals and their patients would strengthen this association, increasing patients’ quality and routinization of oral health self-management. Because health self-management is known to be associated with patient trait-conscientiousness, a construct that refers to a stable, personal characteristic of being careful or vigilant (Bogg & Roberts, 2004), trait-conscientiousness was measured as a covariate.

Method

Participants

An a priori power analysis was conducted using G*Power software (version 3.1) to estimate the appropriate number of participants to achieve a power level of .90. Family-wise alpha was adjusted 0.05. Due to the lack of research on dental professional-patient communication about oral illness representations, the estimated effect size was based on research in medical health settings. In two relevant studies, a small to medium effect size was reported between discussion of medical illness representations and patients’ adherence to prescribed treatment, i.e., \( R^2 = .06 \) (Phillips et al., 2012) \( R^2 = .17 \) (Phillips et al., 2017). Based on an
estimated small effect size of .06, the results of the power analysis indicated a sample size of 241 participants to achieve statistical power = 90. To account for the possibility of missing data, the sample size was increased by 10%, resulting in a target sample of at least 265 participants.

Eligible participants, recruited through Amazon’s Mechanical Turk for a web-based study, were at least 18 years old and had a dental appointment in the past six months in the United States during which they reportedly received a diagnosis of either tooth decay (dental caries) or periodontal disease. In addition, to be eligible, volunteers needed to indicate that they recalled the nature of their conversation and interaction with their dental provider. Volunteers were excluded from participation if they reported having had a full mouth denture treatment, since these patients’ oral self-management is considered substantially different and therefore not relevant to this study of habitual self-management of oral hygiene.

A total of 2,148 individuals who began the survey on psychdata.com. Of those, 1,565 either (a) did not meet eligibility requirements, or (b) consented to participate but did not complete any of the measures. There were 29 participants who incorrectly responded to a random response check question and were subsequently removed. Participants who reported having a dental appointment more than six months ago were also removed. Finally, duplicate submissions, identified by an anonymous code generated when participants entered the questionnaire from the recruitment website, were removed, resulting in a final sample of 471 participants, which exceeded the minimum size of 265 indicated by the power analysis.

**Instruments**

*Identification of Oral Health Practitioner*

Participants responded to a single item to identify whether the oral health provider about whom they based their subsequent responses was a dentist or registered dental hygienist (“Which
type of dental professional did you see in the past six months (if you saw more than one of the following professionals, please select the professional that you spoke to the most)?”

**Common Sense Self-Regulation Model Communication Behavior**

The 7-item Common Sense Self-Regulation Model Communication Behavior Scale (CBS; Phillips et al., 2012, 2017; see Appendix A) asked participants to indicate whether their most recent communication with their dental professional(s) addressed each of five aspects of their oral illness representations (e.g., cause, identity, timeline, control, and consequences) with yes/no responses. For example, the item “My dental professional told me what s/he was looking for during the physical exam” assessed identity representation. Total scores could range from 0 to 7, with 7 indicating more communication in which the professional provided the patient with an understanding of their presenting oral illness and the associated, prescribed treatment.

The scale was designed to have strong face and external validity in order to be used in a variety of healthcare settings. The measure was created using input from primary care physicians, three health psychologists, and a sociologist (Phillips et al., 2012). Psychometrically, a single factor was supported by confirmatory factor analysis (Phillips et al., 2012), and in a sample of patients with medically unexplained symptoms, the internal consistency was demonstrated to be .92 (Kuder Richardson-20; Phillips et al., 2017). There is some evidence for convergent validity in that Phillips et al. (2012) reported a positive association ($r = .49$) between patients’ perceptions of communication about health representations and a better general understanding of their health condition. In the present study, Cronbach’s alpha was .71, which is considered to be acceptable (DeVellis, 2017; Kline, 2000).
Patients’ perceptions of the interpersonal relationship with their dental professional was measured by the Interpersonal Treatment scale in the Primary Care Assessment Survey (PCAS-ITS; see Appendix B; Safran, Kosinski, et al., 1998). The full 49-item measure includes 11 scales that measure 7 dimensions of patients’ healthcare experiences, including interpersonal treatment. All scales are measured within the context of patients’ relationships with their personal healthcare providers.

The Interpersonal Treatment Scale within the Primary Care Assessment Survey is a 5-item measure that was developed to capture the emotional and relational aspects of patients’ perceptions of the interpersonal relationship with their physician. Items assess perceptions of their doctor’s caring for, patience with, friendliness toward, respect for, and time spent with them. Participants used a Likert-type scale from 1 = very poor to 6 = excellent. The summed scores range from 5 to 30. Higher scores indicate a higher quality interpersonal relationship as perceived by patients. The language of the items was adjusted to reflect the dental context in this study. That is, the word ‘doctor’ was changed to ‘dental professional.’

The Interpersonal Treatment Scale has demonstrated several aspects of validity, including face, external, item-convergent, and item-discriminant (Safran, Taira, et al., 1998). Cronbach’s alpha was .95 in the original development study (Safran, Kosinski, et al., 1998). In the present study, Cronbach’s alpha was .93. (DeVellis, 2017; Kline, 2000).

Quality of Oral Health Self-Management

The quality of patients’ oral health self-management was measured by the 5-item Dental Neglect Scale (DNS; see Appendix C; Thomson et al., 1996). The DNS was originally created to assess oral health recommendations (e.g., toothbrushing, seeking dental care, etc.; Thomson et
Items are scored on a six-point Likert-type scale from 1 = *definitely no* to 6 = *definitely yes*. Total summed scores range from five to 30 (one item is reverse coded). Higher scores indicate greater quality oral self-management behavior (i.e., lack of oral health neglect).

The Dental Neglect Scale has been used to study adolescent and adult oral self-management (Coolidge et al., 2009; Jamieson & Thomson, 2002b; Skaret, Astrom, et al., 2007; Thomson et al., 1996; Thomson & Locker, 2000). Patients with lower scores (i.e., less quality oral health self-management) tend to report worse oral health (Jamieson & Thomson, 2002a; Thomson & Locker, 2000), less consistent use of dental services (Jamieson & Thomson, 2002a; Skaret, Berg, et al., 2007; Thomson & Locker, 2000), a greater impact of poor oral health on their daily lives (Jamieson & Thomson, 2002a), fewer than 20 teeth, and more sugary soft drink consumption on a daily basis (Skaret, Berg, et al., 2007).

Psychometrically, the Dental Neglect Scale is moderately correlated with the Dental Indifference Scale, $r = .58, p < .01$ (Jamieson & Thomson, 2002b), a theoretically similar measure. Reliability findings have been inconsistent across studies. Cronbach’s alpha has ranged between .57 (Skaret, Astrom, et al., 2007) and .60 (Coolidge et al., 2009), and intraclass correlation for test-retest was .81 (Coolidge et al., 2009). In this study, Cronbach’s Alpha was found to be .70, considered to be acceptable (DeVellis, 2017; Kline, 2000).

**Strength of Toothbrushing and Flossing Habits**

To measure patients’ strength of oral health self-management habits (i.e., degree of routinization), the 4-item Self Report Behavioral Automaticity Index (SRBAI; see Appendix D; Gardner et al., 2012) was administered to measure participants’ toothbrushing and flossing habits. Items included “Brushing/flossing is something I automatically do” and “Brushing/flossing is something I do without thinking.” Items are scored on a 5-point Likert
scale from 1=\textit{strongly disagree} to 5=\textit{strongly agree}. Total scores range from 4 to 20, where higher scores indicate greater habit strength (i.e., routinization) of oral health self-management.

The Self Report Behavioral Automaticity Index was originally created as a subscale of the 12-item Self Report Habit Index (SRHI; Verplanken & Orbell, 2003). Convergent validity was supported in an association between the SRHI and measures of response frequency (i.e., the degree to which choices are frequent and consistent across environments), $r = .58, p < .01$. Additionally, the Self Report Habit Index differentiated between daily versus weekly performed health behaviors (Verplanken & Orbell, 2003). The briefer Self Report Behavioral Automaticity Index (SRBAI) used in this study has been demonstrated to be a more parsimonious measure of habitual behavior patterns than the original full index, $r = .92$ (Gardner et al., 2012). A meta-analysis that examined the psychometric properties of the subscale across a variety of health behaviors found that 89% of the included studies reported internal consistencies ranging between .80 to .97 (Gardner, 2015). In the presents study, Cronbach’s alpha was .88 for the toothbrushing-SRBAI, and .95 for flossing-SRBAI, considered to be good and excellent, respectively (DeVellis, 2017; Kline, 2000).

\textit{Trait-Conscientiousness}

To measure self-rated, trait-conscientiousness, the 10-item International Personality Item Pool of the Big Five Conscientious Scale (Goldberg et al., 2006) was used. Items include “I am always prepared” and “I do just enough work to get by.” Items are measured on a 5-point scale from 1 = \textit{very inaccurate} to 5 = \textit{very accurate}. Five items are reverse coded. Summed scores range from 10 to 50. Higher scores suggest greater trait-conscientiousness.

The International Personality Item Pool (IPIP) of the NEO Conscientious Scale is an open-source version of the widely used Neuroticism Extraversion Openness (NEO) Personality
Inventory (Costa & McCrae, 1992). It has evidence of convergent validity with measures of anxiety ($r = -.28$), impulse expression ($r = -.36$) and ratings from participants’ spouses ($r = .43$; Costa & McCrae, 1992). IPIP was found to have an internal consistency reliability = .81 (Goldberg et al., 2006). In the present study, Cronbach’s alpha was .84, considered to be good (DeVellis, 2017; Kline, 2000).

**Demographic Questionnaire**

A demographic questionnaire (see Appendix F) was administered to characterize the sample. Questions assessed age, race/ethnicity, gender identity, markers of socio-economic status (e.g., education level, income), history of oral illness(s), date of last dental appointment, number of dental appointments in the past year, and use of dental insurance. To assess general markers of oral health, questions also assessed frequency of smoking, brushing and flossing frequency, and the number of decayed, missing, or filled teeth.

**Procedure**

Participants were recruited through Amazon’s Mechanical Turk (MTurk), an online recruitment database to obtain a broad, general sample, not restricted by geographic region. From MTurk, potential participants were automatically redirected to Psychdata.com, where the survey was based. Participants who completed the questionnaire received $0.25, an amount commensurate with other studies advertised on MTurk.

After accessing the Psychdata.com website, volunteers completed a series of screener questions to assess their eligibility for participation (over 18 years of age, diagnosed with an oral health condition, and having attended a dentistry appointment in the past six months). Volunteers who did not meet eligibility were thanked for their interest in participation and directed out of the questionnaire.
Individuals who met the eligibility criteria were directed to review the informed consent document, where they were provided information about the study (inclusion criteria, incentive and procedural information), informed of the minimal risks to their participation, and reminded of the voluntary nature of their participation. Participants were informed that they had the right to withdraw from the study at any time by closing their browser. The contact information for the researcher, faculty supervisor, and Institutional Review Board at the University at Albany, SUNY were provided. At the bottom of the page, participants were required to indicate that they fully read, understood, and agree to participation by selecting the corresponding options.

Participants who provided informed consent were randomly assigned to one of six orders of administration of the study measures. In all cases, the demographic questionnaire was presented last. To require participants to answer all study measures (other than the demographic questionnaire), participants were cued to respond to overlooked items at the bottom of each page of the survey.

A single item was used to assess for random responding (e.g., “Please answer disagree to this question”). If respondents did not provide the requested answer, it was assumed that they were likely responding randomly. The data associated 29 respondents was excluded from analysis for this reason.

Results

Demographic Characteristics

As shown in Table 1, most participants self-identified as women (62.2%), with a mean age of 35.27 years ($SD = 11.5$). Participants identified as Caucasian (65.8%), Asian American (16.1%), Black/ African American (11.5%), Hispanic/ Latino/a (6.6%), Indigenous American (3.0%), and other (0.4%). Their mean individual income was over $50,000, and mean number of
financial dependents was 1.14 (SD = 1.5). Regarding educational background, most participants reported having earned a Bachelor’s (42.3%) or master’s degree (12.7%), or some undergraduate college education (18.9%). A majority of participants lived in suburban (46.5%) or urban communities (33.5%), with a mean commute time of 24.1 minutes (SD = 24.0) to their dentist’s office.

Participants reported that they primarily visit with only a dentist (55.2%), or both a dental hygienist and a dentist (28.2%). Most participants reported using dental insurance (75.2%). Regarding oral health self-management, participants attended $M = 2.79$ appointments ($SD = 2.23$) in the last year, brush their teeth a $M = 1.92$ times per day ($SD = 0.74$), floss $M = 1.1$ times per day ($SD = 1.1$), and use tobacco 1.9 times per day ($SD = 4.5$).

On average, participants reported having 4.0 decayed, missing, or filled teeth (DMFT; $SD = 4.7$). The most common procedures that participants reported having had in the past were dental cleanings (86.8%; see Table 2), fillings (72.0%), tooth extraction (36.7%), root canal (29.7%), and crowns (28.9%). Of the participants who reported having been diagnosed with dental caries in the past, 87.3% reported receiving treatment for the condition, while 47.6% did not complete treatment. Among participants with previously diagnosed periodontal disease, 30.6% received treatment, and 25.5% did not complete treatment. Of participants who reported a diagnosis of ware (e.g., bruxism), 7.9% had treatment, whereas 8.1% did not complete treatment. Among participants with oral cancer, 1.5% reported having treatment, and 0.6% reported not completing treatment.

Regarding the dental professional at their last appointment, a majority of participants identified their dentist (81.7%) or dental hygienist (17.0%). Finally, participants reported a mean of 69.9 days ($SD = 57.2$) since their last dental appointment.
Preliminary Analyses

Preliminary analysis were carried out to examine the linearity, normality, and homoscedasticity (Cohen, 1988). Independence of observations was assumed because duplicate submissions were screened out and the data were not paired or nested. In addition, counterbalancing was used to ensure this assumption would not be violated (analysis described below).

Scatterplots of the residuals of the independent and dependent variables in three univariate multiple regression analyses revealed that residuals corresponded to the horizontal line (y = 0), suggesting that the assumption of linearity was met. Inspection of the frequency distributions and P-P plots of dental neglect (i.e., quality of oral health self-management), toothbrushing habit strength, and flossing habit strength approximated normal distributions.

To assess for homoscedasticity, standardized residuals were plotted against standardized predicted values for dental neglect, toothbrushing habit strength, and flossing habit strength. The data were evenly splayed around the line, where y = 0 for dental neglect and toothbrushing habit strength, evidence for homoscedasticity, whereas the trend appeared relatively more curved, but acceptable for flossing habit strength.

Multicollinearity was assessed by inspecting Tolerance (criteria ≤ .50) and variance inflation factor (VIF; criteria ≥ 5.00; Myers & Myers, 1990). No violations were noted across the independent variables (Tolerance = .87; VIF = 1.14).

Outlying data points were assessed through DFBETA (criteria = ± 1.0), Cook’s distance (criteria = ≥ 1.0), leverage values (criteria = > 2(k+1)/n = 0.01699), Mahalanobis distances (criteria = chi-square p ≤ .001), and Studentized deleted residuals (Belsley et al., 2005; Fox, 1991; Hoaglin & Welsch, 1978; Tabachnick & Fidell, 2013). No cases violated the DFBETA
criterion, suggesting that omitting cases would not change the relative predictive influence of the independent variables. No cases were identified as influential based on Cook’s distance. There were 48 cases that exceeded the criterion for leverage, which evaluates the influence of the observed value on the outcome variable of the predicted values. For Mahalanobis distances, measures of the distance of the case to the means of the predictor values, 9 cases exceeded the criterion both when dental neglect and toothbrushing habit strength were used as outcomes. Finally, using Studentized deleted residuals to identify atypical cases (criteria = $t \geq t_\alpha, n-k-2$), 23 cases exceeded 2.0 and four cases exceeded 3.0 when dental neglect was used as the outcome. When toothbrushing habit strength was used as an outcome, 21 cases exceed 2.0 and three cases exceeded 3.0.

Overall, across both models, 51 cases exceeded one measure of influence. Nine cases violated two more than one measure of influence. All cases were inspected; none appeared to be contaminated. Therefore, all cases were retained for the main analyses.

**Counterbalancing Effects**

Participants were randomly assigned to six orders of questionnaire administrations to prevent potential priming effects. The demographic questionnaire was always presented last. Examination of cell sizes indicated that the number of participants was approximately equivalent (i.e., 77, 72, 91, 76, 77, 78). To examine for order effects, a one-way MANOVA was conducted with the order of administration (1-6) as the independent variable and the scores on the measures as the DVs. Box’s M’s multivariate test for homogeneity of covariances was nonsignificant, $M = 74.0$, $F(75, 352416.83) = 0.96$, suggesting that assumptions for MANOVA testing were met. For MANOVA testing, a per comparison error rate of 0.05 was used to maintain statistical power.
The results from this analysis suggested no significant ordering effects, Pillai’s Trace = 0.06, $F(25, 2325) = 1.19$.

**Descriptive Statistics**

As shown in Table 3, participants’ scores on the CSM Communication Behavior Scale suggested that a majority of participants identified having had CSM-based communication with their dental professional at their last dental appointment ($M = 5.5, SD = 1.7$). Participants most frequently endorsed communication about the appropriate treatment for their oral illness and how long treatment may take (i.e., control illness representation and treatment-timeline representation; 87%; see Table 3), and the potential causes (i.e., cause illness representation; 84%). Participants least frequently endorsed communication about the timeline, that is, how long they could expect to have their oral illness (i.e., illness-timeline representation; 70.1%).

Intercorrelations among the study variables (Table 5) indicated that CSM-based communication was positively related to the quality of patients’ oral health self-management (i.e., less neglect of their dental health), $r = .28, p < .01$, but not to the reported strength of toothbrushing, $r = .08, p > .05$, or flossing habits, $r = .08, p > .05$. The interpersonal relationship was positively related to patients’ self-reported quality of oral health self-management, $r = .34, p < .01$, toothbrushing habit strength, $r = .22, p < .01$, and flossing habit strength, $r = .10, p < .05$.

**Tests of Hypotheses**

Three univariate multiple regression equations tested the potential main and interacting effects of CSM-based communication and the dental professional-patient interpersonal relationship on the quality of patients’ oral health self-management, toothbrushing habit strength and flossing habit strength. Participant trait-conscientiousness, as measured by the International Personality Item Pool of the Big Five Conscientious Scale (Goldberg et al., 2006), was added to
the model as a covariate. In SPSS, PROCESS (Hayes, 2018) model number one was used to test the fit of the overall models and the strength and significance of the interactions in each model. Experiment-wise Type 1 error was set at 0.05, and split to test three univariate models using a Bonferroni correction, such that $\alpha_{pc} = 0.02$, to protect against potential inflation of Type 1 error when performing multiple tests.

**Quality of Oral Health Self-Management**

The first regression analysis tested the hypothesis that Interpersonal Relationship would moderate the association between CSM-based Communication and Quality of Oral Health Self-Management, while controlling for Trait-Conscientiousness. As shown in Table 6, the overall model accounted for a significant amount of variance in the Quality of Oral Health Self-Management, $R^2 = .20$, $F(4, 466) = 25.34, p < .001$. Inspection of the contribution of the covariate revealed that it was uniquely significant, $b = 0.19$, 95% CI [0.13, 0.24], $t = 6.69, p < .001$, in that greater self-reported Trait-Conscientiousness predicted better Quality of Oral Health Self-Management.

In terms of the major predictors, however, CSM-based Communication did not uniquely contribute to the prediction of the Quality of Oral Health Self-Management, $b = 0.04$, 95% CI [-0.20, 0.27], $t = 0.30, p = .77$, whereas the Interpersonal Relationship had a positive association, $b = 0.22$, 95% CI [0.14, 0.31], $t = 5.33, p < .001$, such that a stronger Interpersonal Relationship predicted greater Quality of Oral Health Self-Management. The interaction of CSM-based Communication and Interpersonal Relationship was not significant, $b = -0.01$, 95% CI [-0.05, 0.03], $t = -0.70$. In sum, the first and second hypotheses were not supported in terms of the Quality of Oral Health Self-Management.
Toothbrushing and Flossing Habit Strength

The second regression analysis tested the statistical hypothesis that an interaction between CSM-based Communication and Interpersonal Relationship would explain a significant amount of variance in Toothbrushing Habit Strength while controlling for Trait-Conscientiousness. The overall model was statistically significant, $R^2 = .12, F(4, 466) = 14.88, p < .001$. As in the analysis of Quality of Oral Health Self-Management, Trait-Conscientiousness was a uniquely significant covariate, $b = 0.16, 95\% \text{ CI} [0.10, 0.22], t = 5.54, p < .001$, in the prediction of Toothbrushing Habit Strength; greater self-reported Trait-Conscientiousness predicted greater Toothbrushing Habit Strength.

In terms of the major predictors, CSM-based Communication did not uniquely contribute to the prediction of Toothbrushing Habit Strength, $b = -0.12, 95\% \text{ CI} [-0.36, 0.12], t = -0.98, p = .328$, but Interpersonal Relationship did, $b = 0.12, 95\% \text{ CI} [0.04, 0.21], t = 2.94, p = .003$. Using the Bonferroni-corrected Type I error rate of 0.02, the addition of the interaction to the model indicated a nonsignificant, marginal change, $\Delta R^2 = 0.01, F(1, 466) = 4.82, p = .029, b = -0.04, 95\% \text{ CI} [-0.08, -0.01], t = -2.37, p = .029$.

The third regression analysis tested the hypothesis that the Interpersonal Relationship would moderate the relation between CSM-based Communication and Flossing Habit Strength, beyond the contribution of Trait-Conscientiousness (covariate). The overall model was not significant, $R^2 = 0.02, F(4, 466) = 1.85, p = .119$, therefore no additional tests were conducted.

Discussion

The present study was designed to fill a gap in clinical communication research by examining the relations between CSM-based communication, doctor-patient relationships, health behavior, and habit formation in the context of oral illness prevention. Specifically, it was
hypothesized that CSM-based communication would be positively associated with patients’ oral self-management quality and strength of oral health self-management habits (i.e., toothbrushing and flossing), and that a stronger dental professional-patient interpersonal relationship would positively moderate the relation between CSM-based communication and patients’ oral self-management quality and strength of oral health self-management habits.

Most patients recalled having had CSM-based communication with their dental professional, including the cause, identity, timeline, control, and consequence-type representations of oral illness, suggesting that, in this sample, CSM-based communication is consistent with the kind of communication already occurring between dental professionals and their patients. In particular, participants recalled communication about the causes of their oral health condition and ways to manage it (i.e., control and treatment timeline representations). These findings seemingly make sense; dental professionals and their patients likely prioritize communication about control representations the most as these discussions are consistent with preventative dental care practice guidelines (Harris et al., 2014) and likely lead to discussions about patients’ oral health self-management.

The primary hypothesis was that CSM-based communication would be related to better oral health self-management. In regression analyses that controlled for trait-conscientiousness, CSM-based communication was not related to any of the hypothesized oral health self-management practices. These findings are inconsistent with previous studies of patients managing chronic disease in which CSM-based communication was a strong predictor of patients’ health behavior and health outcomes, including adherence to doctor’s recommendations, problem resolution, and satisfaction with treatment (Phillips et al., 2012,
2017). In fact, Phillips et al. (2012) found that CSM-based communication was more strongly associated with these behaviors than was the strength of the physician-patient relationship.

One explanation for these results may be that CSM-based communication is not associated with oral health self-management (quality and strength of toothbrushing habits). Perhaps patients have little drive or willingness to change their typical toothbrushing habits to prevent an oral illness (e.g., gum disease, tooth decay, etc.) that may not yet be a salient threat. Related research in medicine examined the impact of CSM-based communication on health behavior in patients in primary care with chronic illness (Phillips et al., 2012) and chronic medically unexplained symptoms (Phillips et al., 2017) – conditions that, when compared to oral illnesses, arguably carry more potent and clearly-understood consequences, such as disability or death.

Another explanation for the inconsistency with previous findings is a lack of variability in participants’ reports of CSM-based communication with their dental professional. Since all participants reported some degree of CSM-based communication with their dental professional, variations in oral health self-management may be due to other factors. Therefore, to understand if CSM-communication improves oral health self-management, we may need to understand the relationship between these variables in a sample with greater variability in report of CSM-communication with their dentist.

The almost universal report of dental professionals using CSM-based communication may have several explanations. First, the most likely of these explanations is that dental professional-patient communication may inherently be CSM-based. Participant report of CSM-communication was higher than found in studies of physician-patient communication (Phillips et al., 2012; 2017). In fact, the rates were so high that even if they were inflated due to a potential,
participant recall bias (i.e., favorable reporting), it seems likely that dental professional-patient communication likely includes discussion of patients’ illness representations (e.g., control, timeline, causes, etc.) – essential features of CSM theory.

Second, the lack of variability in levels of CSM-based communication may be due to recall bias. The most recent appointment was on average two months prior to study participation. Studies on adherence to health professionals’ recommendations have routinely found that approximately 30% to 60% of information patients discuss with their health professionals is forgotten within an hour, and 50% of the health recommendations provided are not followed (DiMatteo et al., 2002). Considering that approximately 20% of dental patients experience significant anxiety during their dental appointment (White et al., 2017) and the well-documented impact of anxiety on memory (Airaksinen et al., 2005; Vytal et al., 2012), the present participants may be have had faulty recall of the communication with their dental professional.

Finally, our sample was predominantly Caucasian, college-educated, suburban women who were already connected to dental care and reported relatively good brushing and flossing behaviors, in line with recommendations from the American Dental Association (2020). It may be that this group’s oral health self-management is less affected by CSM-based communication because their oral illness representations are already relatively accurate and solidified. Additionally, it may be that this group is inherently, relatively high in conscientiousness, effectively shielding the potential associations between CSM-based communication and oral health self-management, as discussed above. Findings should be interpreted as reflective of these groups and generalized to other groups with caution.

Our second hypothesis was that greater quality interpersonal relationships between the dental professional and patient would magnify the relation between CSM-based communication
and patients’ oral health self-management such that patients’ quality and routinization of oral health behaviors would be even better and more routine, respectively. The results did not support this hypothesis. While not hypothesized, it was found that the quality of interpersonal relationship between the dental professional and the patient was significantly and uniquely associated with the quality of participants’ oral self-management, in general, and toothbrushing habits, in particular. These findings are consistent with previous literature in medicine and dentistry (Bogg & Roberts, 2004; Dewi et al., 2011; Sandell et al., 1994; Sinha et al., 1996). Research has consistently supported the impact of a high-quality doctor-patient interpersonal relationship on several treatment- and health-related outcomes, including patient satisfaction, attendance at follow-up appointments, and adherence to treatment recommendations (Dewi et al., 2011; Sandell et al., 1994; Sinha et al., 1996). Moreover, a good interpersonal relationship, defined by trust and honesty, is viewed as a critical aspect of shared decision making between providers and patients (Ford et al., 2000), and is the hallmark of patient-centered care (Eide et al., 2004; Roter, 2000).

While not a primary hypothesis of this study, we also found that patients' trait-conscientiousness was a more powerful predictor of patients' oral health self-management practices than factors of the doctor-patient interaction (i.e., communication and interpersonal relationship). Research has consistently documented the health benefits of trait-conscientiousness: those high on the trait tend to avoid unhealthy behaviors (e.g., substance use, dietary overconsumption, risky sex, unsafe driving, etc.; Bogg & Roberts, 2004), and likely as a result live longer than others (Deary, Weiss, & Batty, 2010). In other words, persons high on trait-conscientiousness are likely strong health self-regulators; they likely have more accurate pre-existing understandings of their health statuses and can implement healthful behaviors more
successfully than others. As the participants of this study were generally higher on trait-conscientiousness, it may be that they stood to benefit less from CSM-based communication than patients low on trait-conscientiousness.

The present findings suggest that to change toothbrushing behaviors for patients demographically similar to those sampled in this study, it is advisable for dental professionals to prioritize patient’s trait-conscientiousness and their relationship with patients, above discussions about the patients’ illness representations, as grounded in the CSM. These findings suggest that (a) perhaps measuring and adapting interventions to patients’ levels of conscientiousness and, (b) better, perhaps more intentional, focus on developing interpersonal interactions with patients characterized by friendliness, caring, and concern may facilitate patients’ oral health self-management.

This was the first study to examine the presence and potential contribution of CSM-based communication in the contexts of prevention, dental treatment, and oral health. Limitations include the previously discussed recall bias and relatively homogeneous sample. Other limitations include the cross-sectional design and exclusive use of self-report. Prospective and intervention designs would be better situated to uncover potential causal relations between CSM-based communication and the resulting health self-management. Future studies should also use objective measures of CSM-based communication.

Since there are few studies that examined the impact of CSM-based communication on patient outcomes, additional research is needed. Ideally, future research should consider testing the impact of a CSM-based intervention using a prospective, randomized, and controlled research design to allow for causal inferences and limit the potential impact of recall bias.
Additionally, previous research has largely documented the impact of communication about illness representations on self-management and disease outcomes in illnesses after their onset. While the present study was one of the first to examine CSM-based communication and the interpersonal treatment of the patient in the context a preventable illness, future research should be directed at studying these variables in the context of other preventable diseases or health conditions before their onset (e.g., diabetes mellitus type two).

Finally, future research should focus on populations who are at greater risk of oral illnesses, presumably those from lower socio-economic statuses who tend to have less access to oral health information and resources (Baskaradoss, 2018), as these groups may be more variable in their oral health self-management. Research in these populations may be better situated to assess the relations among CSM-based communication, the dental professional-patient relationship, and oral health self-management.

Conclusion

This study sought to expand on previous research on the provider-patient communication characterized by the Common Sense Self-Regulation Model (Phillips et al., 2012, 2017) by investigating (a) the extent to which CSM-based communication impacted the quality and consistency of patients’ health self-management and habits, and (b) the extent to which the interpersonal relationship of the patient facilitated that hypothesized effect in the context of prevention, oral illness, and dental treatment. The findings suggest that dental professionals are routinely engaging in CSM-based communication with patients, and that patients generally report enacting recommended oral health self-management. However, greater CSM-based communication was not related to oral health self-management after controlling for conscientiousness. This finding may be due to a ceiling effect with patients reporting high levels
of CSM-based communication. Additional research, particularly with more at-risk populations, is needed to better assess how CSM-based communication and the dental professional-patient relationship impact patients’ oral health self-management.
Table 1

Demographic Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>35.27</td>
<td>11.47</td>
<td>470</td>
</tr>
<tr>
<td>Yearly Income</td>
<td>51386.27</td>
<td>97327.18</td>
<td>470</td>
</tr>
<tr>
<td>Number of Dependents</td>
<td>1.14</td>
<td>1.46</td>
<td>468</td>
</tr>
<tr>
<td>Decayed, Missing, and Filled Teeth</td>
<td>3.99</td>
<td>4.66</td>
<td>469</td>
</tr>
<tr>
<td>Days Since Last Dental Appointment</td>
<td>69.91</td>
<td>57.21</td>
<td>471</td>
</tr>
<tr>
<td>Number of Dental Appointments in Last Year</td>
<td>2.79</td>
<td>2.23</td>
<td>468</td>
</tr>
<tr>
<td>Tobacco Use per Day</td>
<td>1.93</td>
<td>4.54</td>
<td>468</td>
</tr>
<tr>
<td>Brush Teeth per Day</td>
<td>1.92</td>
<td>0.74</td>
<td>468</td>
</tr>
<tr>
<td>Floss per Day</td>
<td>1.14</td>
<td>1.12</td>
<td>470</td>
</tr>
<tr>
<td>Minutes to Travel to Dental Office</td>
<td>24.11</td>
<td>24.00</td>
<td>469</td>
</tr>
</tbody>
</table>
Table 2

Percentages of Participants’ Dental Diagnoses and Treatment Completion

<table>
<thead>
<tr>
<th>Variable</th>
<th>Completed Treatment</th>
<th>Did Not Complete Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caries</td>
<td>87.3</td>
<td>47.6</td>
</tr>
<tr>
<td>Periodontal disease</td>
<td>30.6</td>
<td>25.5</td>
</tr>
<tr>
<td>Ware (e.g., Bruxism)</td>
<td>7.9</td>
<td>8.1</td>
</tr>
<tr>
<td>Oral Cancer</td>
<td>1.5</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Note. N = 457.
Table 3

Descriptive Statistics of the Study Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSM-based Communication</td>
<td>5.52</td>
<td>1.71</td>
</tr>
<tr>
<td>Interpersonal Relationship</td>
<td>23.15</td>
<td>4.98</td>
</tr>
<tr>
<td>Trait-Conscientiousness</td>
<td>37.19</td>
<td>6.96</td>
</tr>
<tr>
<td>Quality of Oral Health Self-Management</td>
<td>21.76</td>
<td>4.35</td>
</tr>
<tr>
<td>Toothbrushing Habit Strength</td>
<td>14.46</td>
<td>4.13</td>
</tr>
<tr>
<td>Flossing Habit Strength</td>
<td>11.00</td>
<td>5.09</td>
</tr>
</tbody>
</table>

*Note. N = 471.*
### Table 4

**Common Sense Self-Regulation Model (CSM) Communication Behavior Scale Responses**

<table>
<thead>
<tr>
<th>My dental professional…</th>
<th>CSM Illness Representation</th>
<th>Percentage of Affirmative Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. …discussed with me what might be the cause of my oral health condition(s).</td>
<td>Cause</td>
<td>83.7</td>
</tr>
<tr>
<td>2. …told me what s/he was looking for during the exam.</td>
<td>Identity</td>
<td>77.9</td>
</tr>
<tr>
<td>3. …told me how long I could expect to have this (these) oral health condition(s).</td>
<td>Timeline</td>
<td>70.1</td>
</tr>
<tr>
<td>4. …gave me clear instructions about my treatment: what to do, when, how often, and for how long.</td>
<td>Control/timeline</td>
<td>86.8</td>
</tr>
<tr>
<td>5. …told me what I might expect across treatment.</td>
<td>Consequence/identity</td>
<td>81.5</td>
</tr>
<tr>
<td>6. …gave me some tips to help me work my treatment into my daily routine.</td>
<td>Control/consequence</td>
<td>76.9</td>
</tr>
<tr>
<td>7. …told me how to monitor my oral health condition(s) to see if the treatment is working.</td>
<td>Identity/control</td>
<td>74.7</td>
</tr>
</tbody>
</table>
### Table 5

*Bivariate Correlations*

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CSM-based Communication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Interpersonal Relationship</td>
<td>.278**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Trait-Conscientiousness</td>
<td>.176**</td>
<td>.241**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Oral Health Self-Management Quality</td>
<td>.148**</td>
<td>.338**</td>
<td>.365**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Toothbrushing Habit Strength</td>
<td>.075</td>
<td>.223**</td>
<td>.295**</td>
<td>.496**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Flossing Habit Strength</td>
<td>.084</td>
<td>.098*</td>
<td>.068</td>
<td>.390**</td>
<td>.481**</td>
<td></td>
</tr>
</tbody>
</table>

* * p < .05.

** ** p < .01.
### Table 6

*Model Fit and Parameter Estimation Using PROCESS Model One per Outcome Variable*

<table>
<thead>
<tr>
<th>Parameter Estimation</th>
<th>Oral Health Self-Management Quality</th>
<th>Toothbrushing Habit Strength</th>
<th>Flossing Habit Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trait-conscientiousness</td>
<td>0.19 [0.13, 0.24]*</td>
<td>0.16 [0.10, 0.22]*</td>
<td></td>
</tr>
<tr>
<td>CSM-based Communication</td>
<td>0.04 [-0.20, 0.27]</td>
<td>-0.12 [-0.36, 0.12]</td>
<td></td>
</tr>
<tr>
<td>Interpersonal Relationship</td>
<td>0.22 [0.14, 0.31]*</td>
<td>0.12 [0.04, 0.21]**</td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>-0.01 [-0.05, 0.03]</td>
<td>-0.04 [-0.08, -0.01]***</td>
<td></td>
</tr>
</tbody>
</table>

**Model Fit**

<table>
<thead>
<tr>
<th>Model Fit</th>
<th>Oral Health Self-Management Quality</th>
<th>Toothbrushing Habit Strength</th>
<th>Flossing Habit Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R^2$</td>
<td>.20</td>
<td>.12</td>
<td>.02</td>
</tr>
<tr>
<td>$F$</td>
<td>25.34*</td>
<td>14.88*</td>
<td>1.85</td>
</tr>
<tr>
<td>$\Delta R^2$ with Interaction</td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Delta F$ with Interaction</td>
<td>4.82***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. N = 471.*

* $p < .001$

** $p = .003$

*** $p = .029$
Figure 1.

*Hypothesized Models*
References


https://doi.org/10.1111/j.1600-0528.1998.tb01979.x


https://ada.org/en/publications/jada


https://doi.org/10.1177/0022034509345627


https://doi.org/10.1037/1040-3590.4.1.5


https://doi.org/10.2190/kmpk-19ta-gek8-bftm

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https://doi.org/10.1037/a0019596


Appendix A

**Common Sense-Self Regulation Model Communication Behavior** (Phillips et al., 2012)

<table>
<thead>
<tr>
<th>My dental professional…</th>
<th>Yes (1)</th>
<th>No (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. …discussed with me what might be the cause of my oral health condition(s).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. …told me what s/he was looking for during the exam.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. …told me how long I could expect to have this (these) oral health condition(s).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. …gave me clear instructions about my treatment: what to do, when, how often, and for how long.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. …told me what I might expect across treatment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. …gave me some tips to help me work my treatment into my daily routine.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. …told me how to monitor my oral health condition(s) to see if the treatment is working.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total score range 0 – 7.
Appendix B

Primary Care Assessment Survey - Interpersonal Treatment Scale (Safran, Kosinski, et al., 1998)

<table>
<thead>
<tr>
<th>Thinking about the personal aspects of the care you receive from your dental professional (either the dentist or registered dental hygienist you indicated). How would you rate the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>1. Amount of time your dental professional spends with you</td>
</tr>
<tr>
<td>2. Dental professional’s patience with your questions or worries</td>
</tr>
<tr>
<td>3. Dental professional’s friendliness and warmth toward you</td>
</tr>
<tr>
<td>4. Dental professional’s caring and concern for you</td>
</tr>
<tr>
<td>5. Dental professional’s respect for you</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Very Poor</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Total score ranging from 5 – 30.
Appendix C

**Dental Neglect Scale** (Thomson et al., 1996)

<table>
<thead>
<tr>
<th></th>
<th>Definitely No</th>
<th></th>
<th>Definitely Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1. I keep up my dental care at home.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I receive the dental care I should.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I need dental care, but I put it off.*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I brush as well as I should.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I control snacking between meals as well as I should.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I consider my dental health to be important.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Indicates reverse coding

Total score ranging 6 – 30.

Follow-up Questions:
1. In the past 7 days, how many days did you brush your teeth at least two times?
2. In the past 7 days, how many days did you floss at least one time?
Appendix D

**Self-Report Behavioral Automaticity Index** (SRBAI; Gardner et al., 2012)

<table>
<thead>
<tr>
<th>Brushing is something…</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither disagree nor agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>1. … I do automatically.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. … I do without having to consciously remember.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. … I do without thinking.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. … I start doing before I realize I’m doing it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flossing is something…</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither disagree nor agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>1. … I do automatically.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. … I do without having to consciously remember.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. … I do without thinking.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. … I start doing before I realize I’m doing it.</td>
<td></td>
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</tr>
</tbody>
</table>

Total scores range from 4 – 20 for each measure
### Appendix E

**IPIP Representation of the NEO Conscientiousness Scale** (Goldberg et al., 2006)

<table>
<thead>
<tr>
<th></th>
<th>Very Inaccurate</th>
<th>Moderately Inaccurate</th>
<th>Neither Inaccurate nor Accurate</th>
<th>Moderately Accurate</th>
<th>Very Accurate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
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<tr>
<td>4</td>
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<tr>
<td>5</td>
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<td>7</td>
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<td>8</td>
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<tr>
<td>9</td>
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<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total scores range from 10 to 50. Higher scores indicate greater conscientiousness.

* Reverse coded
Appendix F

Demographic Questionnaire

1. What is your age?

2. What is your gender?

3. Race: Choose all that apply
   Asian
   Black/African American
   Hispanic/Latin American
   Native American/American Indian/First Nation
   Native Hawaiian/Pacific Islander
   White/Caucasian, not Hispanic/ Latin
   Other (please specify)

4. What is your relationship status?
   Single, never married, not living with a partner
   Married
   Separated
   Living together
   Divorced
   Widowed

5. What is your Education level?
   Some high school
   High school diploma or GED
   Some college education
   Associate’s Degree
   Bachelor’s Degree
   Master’s Degree
   Doctoral Degree

6. What is your best estimate of your yearly income?

7. What is your job/ occupation? _______________

8. What language do you primarily speak?

9. How many dependents do you have (children or adults for whom you are financially responsible)?

10. How would you describe the area where you live?
    Rural
    Suburban
11. In what state do you currently reside?

12. What oral health condition(s) have you been diagnosed with in the past?
   - Dental caries (cavities), approximately how many?___________
   - Periodontal (gum) disease
   - Bruxism or another disease of ware (worn down teeth)
   - Oral cancer

13. What oral health condition(s) have you been diagnosed with and currently still have?
   - Dental caries (cavities), approximately how many?___________
   - Periodontal (gum) disease
   - Bruxism or another disease of ware (worn down teeth)
   - Oral cancer

14. Approximately how many decayed, missing, of filled teeth do you have?

15. What was the date of your last dental appointment?

16. How many dental appointments have you had in the last year?

17. What types of dental treatments have you had in the past? (check all that apply)
   a. Cleanings at the dental office
   b. Sealants
   c. Fillings
   d. Crowns
   e. Root canals
   f. Tooth extraction (tooth pulled)
   g. Periodontal (gum) treatment
   h. Dentures
   i. Night guards/ bite guards
   j. Braces/ retainer
   k. Teeth whitening at the dental office

18. Do you use dental insurance?

19. Approximately how many times do you smoke tobacco (e.g., cigarettes, cigars, pipe, etc.) per day?

20. Approximately how many times do you brush your teeth per day?

21. Approximately how many times do you floss your teeth per day?

22. Who do you primarily meet with at the dentist’s office?
   - Dentist (has doctoral degree)
Registered dental hygienist
Both

23. What is your dentist’s specialty?
   General dentistry
   Cosmetic dentistry
   Preventative dentistry
   Orthodontics
   Periodontics
   Endodontics

24. Approximately how long does it take for you to travel to your dental office?

25. Do you have a routine for brushing and/or flossing your teeth? (Please describe your routine and include when, where, how often you do these behaviors, as applicable). If you do not have a daily routine, enter N/A".