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Aceituno Bráulio Simpriano, Denise Cristina; Moreira São-João, Thaís; Mialhe, Fábio Luiz
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Original Article

Use of the Theory of Planned Behavior and Implementation Intentions in Dentistry: Evidence of Literature

Denise Cristina Aceituno Bráulio Simpriano¹, Thaís Moreira São-João², Fábio Luiz Mialhe³

¹MSc in Public Health, Piracicaba Dental School, State University of Campinas, Piracicaba, SP, Brazil.

²School of Nursing, State University of Campinas, Campinas, SP, Brazil.

³Department of Community Dentistry, Piracicaba Dental School, State University of Campinas, Piracicaba, SP, Brazil.

Author to whom correspondence should be addressed: nise Cristina Aceituno Bráulio Simpriano, Rua Raja Gebara 1-55, apto 53 B, Bauru, SP, Brasil. 17018550. E-mail: denisebraulio@hotmail.com.

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Abstract

Objective: To identify and discuss the evidence on the use of two psychological theories in preventive oral health behaviors: the Theory of Planned Behavior (TPB) and the theory of Implementation Intentions (II). **Material and Methods:** We conducted a literature review from the keywords 'theory of planned behavior', 'oral health' and 'implementation intentions' and their equivalents in Portuguese, referring to the databases Bireme (BVS), PubMed (Medline version) and Scielo, from January 1991 to July 2015. After the selection of studies, they were divided into three groups according to their use in the field of oral health: a) use of TPB, b) use of II and c) those which used an association of both theories. **Results:** We recovered 159 articles on the topic. After analysis, 25 articles met the inclusion criteria. Of these, 21 used the TPB in oral health, three the theory of Intent Implementation in oral health and one used the two together (TPB and II) in oral health. We found that the TPB and II showed promising results both in terms of prediction of preventive behaviors and in the promotion of changes in preventive oral health behaviors. **Conclusion:** The evidence raised in this study showed that the TPB and II are theories that can help researchers / health professionals to predict and to change preventive oral health behaviors. However, additional research is needed to test their effectiveness in other oral health behaviors, age groups and longer follow-up times.

Keywords: Psychological Adaptation; Behavior and behavior mechanisms; Motivation; Intention; Dentistry.

Introduction

Health education can provide the cognitive and affective resources to individuals so that they can achieve better health. When properly informed and motivated, individuals may become more willing and able to change, actively assuming the search for their well-being [1].

Several models have investigated the variables underlying the human motivations to keep or change health habits, and one of the most widely used to support the planning of interventions in health is the Theory of Planned Behavior (TPB) [2], which considers the intention to act the main predictor of future behavior. Other authors, however, consider that the intervention in only the intention to act is not enough to turn it into the desired behavior. For that end, the individual must also establish an objective plan of action to act or implement the desired behavior. Therefore, a theory was developed in which the implementation of the desired behavior is a function of two determinations: the pre-planning of the behaviors that individuals perform to achieve their goals and the choice of the most favorable situations to perform them (when, where and how), which has the name of "implementation intentions" [3].

The Theory of Planned Behavior (TPB) and the Theory of Implementation Intentions (II)

The Theory of Planned Behavior (TPB) is an extension of the Theory of Rational Action and postulates that "behavioral intentions" are the proximal determinants for the realization of the actual behavior [2]. According to the TPB, the behavior is a function of the "intention" of individuals to act (that is, perform the desired behavior) and their perception of control over the behavior. The intention, in turn, is determined by three constructs: the attitude, subjective standard (social pressure) and the perceived behavioral control (Figure 1). The attitudes represent the overall assessment of a behavior and the subjective standards represent the perceived pressure from significant persons for the performance of the behavior, such as parents, friends and also the influence of culture, beliefs or public opinion. The perceived behavioral control represents the degree to which the behavior can be performed through will, but limited by difficulties in the execution of the behavior. These three constructs interact with each other to form the behavioral intention, which in turn, will influence the beginning or not of a determining behavior [2]. Figure 1 shows a schematic of the psychological constructs involved in the development of the intention and final behavior in health, according to the TPB.

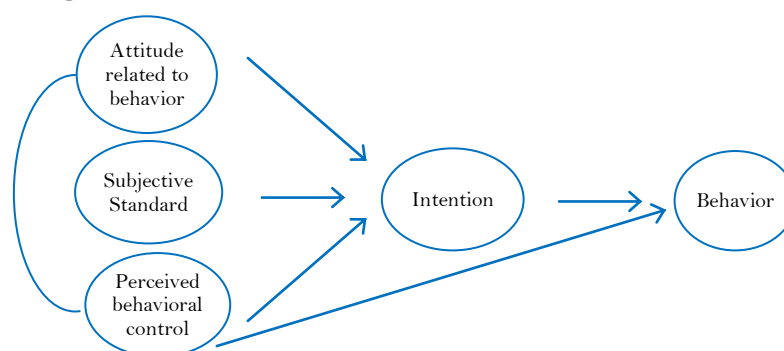


Figure 1. Structural diagram of the Theory of Planned Behavior.

Although the TPB can be used to help the development of interventions that influence behavioral intentions, it is not considered as effective for the translation of intentions into actions, only for the development of intentions. This is because the adoption of health behaviors, according to some authors, involves two phases: one motivational and another volitional [3].

The TPB can explain well the first stage (motivational), since it involves the personal development of a behavioral intention based on attitude, subjective standard and perceived behavioral control. However, so that the intention can become a behavior, it is critical the development of the second step (volitional). In it, the person plans the act (when, where and how) and develops strategies to develop the planned behavior. Thus, this plan to change the behavior is known as the formation of an "implementation intention" [3].

Figure 2 shows a schematic of the determinations involved in the action planning leading to behavior change, according to the strategy of Implementation Intentions (II).

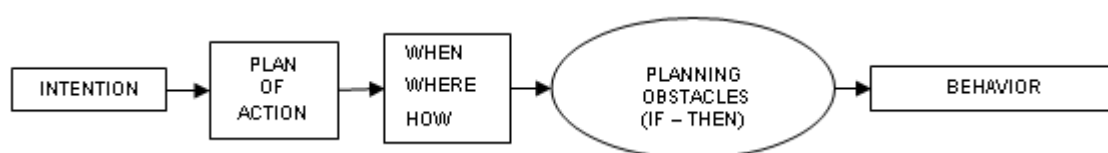


Figure 2. Structural Diagram of the strategy of Implementation Intentions. Based on Gollwitzer [3].

Various studies in the scientific literature that have used the TPB and II in the field of health have addressed, mostly, issues related to physical activity, communicable diseases, tobacco and diet [4,5]. However, little is known about the effectiveness of these interventions in the field of oral health, which therefore requires evidence that might bring to the reader an overview of the 'State of the art' of the scientific production in oral health using these theories [6-8].

Within this context, the objective of this study was to investigate the scientific production related to the application of the TPB and II in dentistry in order to provide to the professionals aids and evidence for the improvement of their strategies for oral health education and promotion for various age groups and health outcomes.

Material and Methods

We performed a literature review of scientific articles published in the databases Bireme (BVS), Pubmed (Medline version) and Scielo from January 1991 to July 2015. We started the search 1991, the year in which the Theory of Planned Behavior was published by its author [2]. For the location of the articles, initially we used the following keywords in English: theory of planned behavior, implementation intentions and oral health and their translations into Portuguese (teoria do comportamento planejado, implementação das intenções, saúde bucal), which are not available as keywords in the DeCs of the Virtual Health Library - BVS/BIREME. After the selection of the studies on the subject, they were separated into three groups focused on the field of oral health: a)

use of the TPB, b) use of the Implementation Intentions and c) studies that used both theories in oral health.

Inclusion criteria were articles that used such theories in the field of oral health, to assess both their predictive ability in preventive behaviors and their effectiveness to promote better preventive oral health outcomes in relation to the control group in interventional studies. Exclusion criteria were articles that were not aligned with the object searched, those that addressed these theories without a specific focus in the field of oral health, reviews of literature that indirectly used the assumptions of the theories in the planning and/or analysis of studies, articles without full text and articles that did not use the psychological theories selected. The flowchart of the selection of articles is summarized in Figure 3.

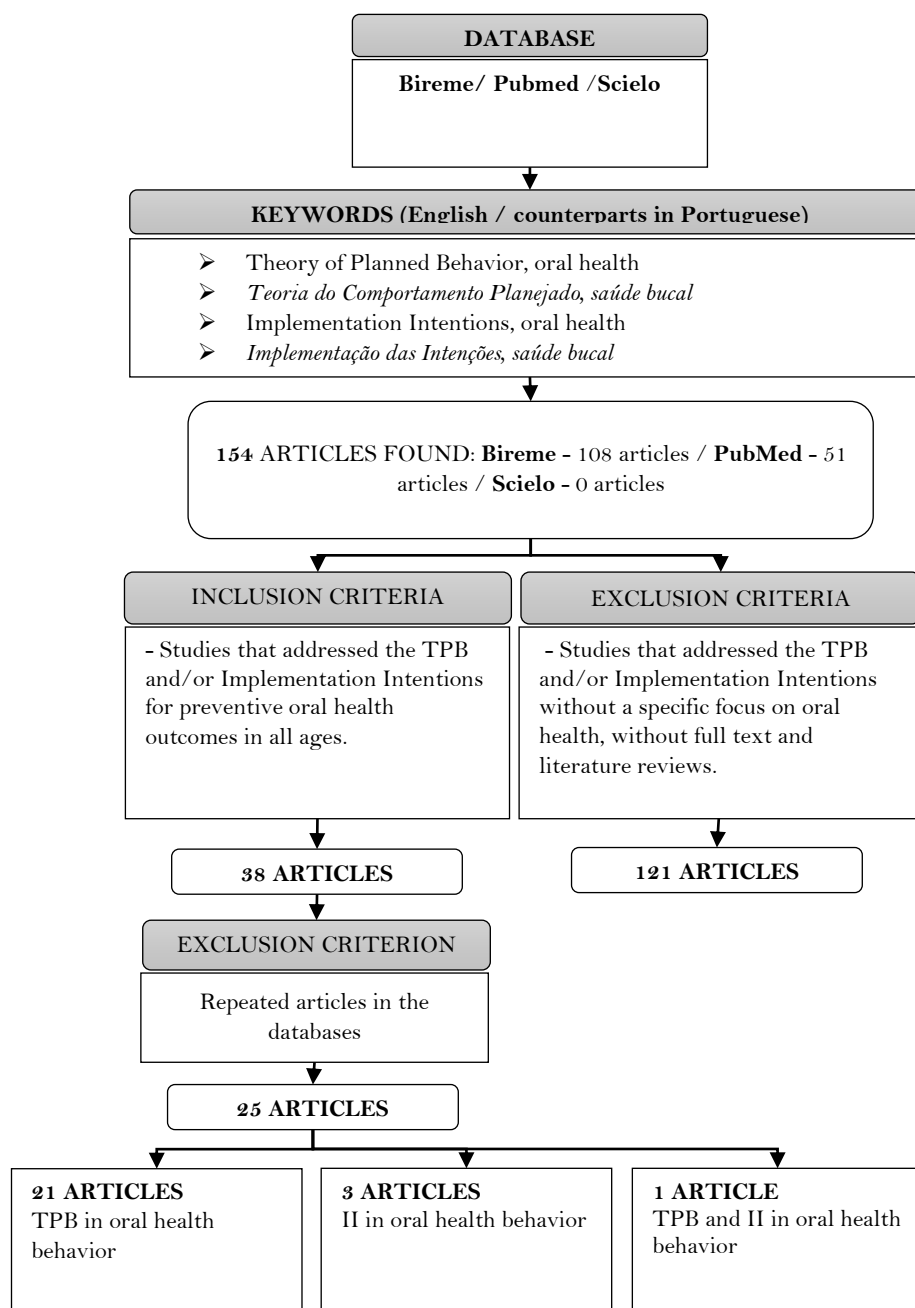


Figure 3. Flowchart of the selection of articles.

Results

The initial search retrieved 159 articles on the topic. After reading the abstracts, 121 articles were excluded as they did not address behaviors in the field of oral health and 12 others as they were repeated in the databases. After further analysis, 25 articles met the inclusion criteria. Of these, 21 used the TPB in oral health, three the theory of Implementation Intentions in oral health and one used the two theories together (TPB and II) in oral health, as presented in Charts 1 to 3. All the intervention studies found in this review had a relatively short follow-up, ranging from two weeks to two months.

Several studies were excluded because they addressed the impact of treatments with drugs taken orally (e.g., oral contraceptives), using the above mentioned theories for various systemic diseases and conditions. Some studies described the 'implementation' of other courses of action/activities not related to the theory of implementation intentions.

Chart 1. Articles retrieved from the databases using the theory of planned behavior (TPB) in oral health.

Reference	Sample	Type of study / data collection	Objective	Main results and conclusions
Sniehotta FF et al., 2007 [10]	239 Scottish university students	Intervention / educational lecture and TPB questionnaire, in the United Kingdom*	To assess an intervention to increase the frequency of flossing.	Changes were found in the behavior of flossing two weeks and two months after intervention. The individuals of the intervention group showed an increase in flossing in comparison with the control group, thus showing the effect of simple action plans on oral self-care behavior. According to the authors, this was the first study to provide evidence that a simple one-minute intervention, based on a theory, can favor changes in self-care behavior.
Buunk-Werkhoven YA et al., 2009 [26]	216 Dutch army recruits.	Cross-sectional / TPB questionnaire, in 2007 in the Netherlands.	To identify the relevant predictors for a proper oral hygiene behavior.	The authors found that the recruits had favorable attitudes in relation to their oral hygiene behavior and generally felt in control to perform this behavior, but the results may not be completely generalizable to the population of recruits to the army as a whole, because the sample was basically composed of male, single individuals with low/medium schooling, being recommended the replication of the study in different military groups and various contexts.
Vanagas G et al., 2009 [18]	550 parents of children of 3 and 4 years of age in Lithuania.	Cross-sectional / TPB questionnaire, in Lithuania.*	To assess the association between the skills and attitudes of the parents for positive behavior in the oral health of their children.	The attitudes of the parents in relation to the oral health of their children were significantly associated with their own oral hygiene behavior and their understanding of the importance of the development of the oral hygiene of their children. Oral diseases are clearly related to this behavior, and it is expected that the prevalence of caries and periodontal disease in children will decrease with improvement in the attitudes of the parents and their oral hygiene skills.

Dumitrescu AL et al., 2011 [9]	153 freshmen students of the School of Medicine of Romania.	Cross-sectional / TPB questionnaire, in late 2009 and early 2010 in Romania.	To test the efficiency of a TPB model in predicting the intention to improve oral health behaviors.	The attitudes and perceived behavioral control in relation to the oral health behavior contributed as predictors of intention, while the subjective standards did not. Knowledge in oral health significantly affected the affective and cognitive attitudes, while the current behavior was not a significant predictor of intention to improve oral hygiene.
Buunk-Werkhoven YA et al., 2011 [24]	92 adults of the Dominican Republic.	Cross-sectional / TPB questionnaire and clinical examination, in the Dominican Republic.*	To assess the significant predictors of intention to carry out a proper oral hygiene behavior	Attitude, subjective standards and perceived behavioral control emerged as predictors of intention of oral hygiene behavior. Knowledge in oral health and social expectation of having healthy teeth were not significantly related to this intention of proper oral hygiene behavior. The theory of planned behavior can be used as a basis for the design of appropriate interventions for persons in developing and underdeveloped countries, and oral hygiene interventions aimed at improving behaviors must be specifically adjusted to the target population.
Buunk-Werkhoven YA et al., 2011 [6]	487 Dutch adults.	Cross-sectional / on-line questionnaire, in 2005 in the Netherlands.	To measure the behavior and knowledge in oral hygiene and the expectation of social relations when the individual has healthy teeth.	The authors suggest that to enhance individual motivation to perform a proper oral hygiene behavior, the perceived behavioral control seems to be the most important factor of influence, followed by attitudes, knowledge in oral hygiene and social expectation. They have concluded that there is a relationship between the predictive power of the TPB and two other variables, social expectation and knowledge in oral health, in relation to oral hygiene behavior, but there is the need for replication in other samples to assess the generalizability of the results.
Buunk-Werkhoven YA et al., 2011 [25]	221 individuals with dental needs in two different cultural regions: 113 in the Caribbean - Aruba/Bonaire and 108 in Nepal.	Cross-sectional / questionnaire and clinical examination, in the Caribbean and Nepal.*	To identify factors that predict oral hygiene behaviors based on TPB.	The Theory of Planned Behavior (TPB) performed quite differently in the two socio-cultural contexts of this study. In the Caribbean, attitude and subjective standards were significant determinants of the oral hygiene behavior. In Nepal, the perceived behavioral control had more influence in the behavior. These differences in the psychological determinants between the two cultural groups were related to cultural and environmental differences. This study showed that there are substantial differences between the two regions in the way individuals perceive and experience different aspects of oral health and their oral hygiene behavior, which suggests the importance of different TPB constructions depending on the context in which they are inserted.
Pakpour AH et al.,	721 Iranian high	Prospective cohort /	To assess the index of	There was relative stability in

2012 [29]	school students.	TPB questionnaire and clinical examination, in 2009 in Iran.	plaque and tooth brushing behavior in the period of one month.	the moments of tooth brushing (low prevalence) in moments 1 and 2 of the study, which can be explained by the low educational level of the parents of the participants of the study. The female adolescents brushed their teeth more often than the male adolescents. The authors concluded that, despite the limitations of the study, the results showed the importance of implementing planning strategies for changes in brushing behaviors in adolescents.
Van den Branden S et al., 2012 [19]	Parents of 1,057 children at birth, at the age of 3 and 5 years, in Belgium.	Prospective cohort / questionnaire, from 2003 to 2009 in Belgium.	To assess the influence of the oral health behavior of parents on the health behaviors of their children.	The authors observed that positive attitudes of parents regarding oral health behaviors increased between birth and 3 years of age, while the subjective standards and intentions decreased. Mothers with higher education had significantly higher scores for attitudes, perceived behavioral control and intentions than less educated mothers. Health promotion campaigns should focus on these inequalities on dental beliefs in the development and assessment of procedures.
Van den Branden S et al., 2013 [20]	Parents of 1,157 children of five years of age of public and private kindergartens, of four distinct geographical areas in Belgium.	Cross-sectional / TPB questionnaire, in 2003 in Belgium.	To test the validity of a new questionnaire based on the TPB for the measurement of three important behaviors related to eating habits and oral hygiene of children and dental care standard.	The results demonstrated the applicability of the TPB on the prediction of oral health behavior of parents of preschoolers, as well as the production of a valid and reliable questionnaire to measure cognitive concepts related to this theory. The authors have concluded that the questionnaire can define important determinants of the behavior of parents on the oral health of their children and, therefore, preventive actions can also be directed to them.
Anderson CN et al., 2013 [23]	907 American university students.	Cross-sectional / questionnaire with behavioral messages in the dental context, in 2008 and 2010 in the United States.	To determine the predictors of regular dental examinations of young adults, using for this end two behavioral theories: the Theory of Rational Action and the TPB.	The results indicated that the use of the TPB, along with behavioral messages in the dental context, was more effective for the understanding and adherence to routine dental examination. According to the authors, this study may inspire oral health campaigns and designs, because, by using principles and strategies of communication in health, young adults can be encouraged to regularly visit the dentist and have positive behaviors in their oral health.
Astrom AN, Okullo I, 2004 [13]	1146 high school students.	Prospective cohort / structured TPB questionnaire and clinical examination, in 2001 in Uganda.	To assess the predictive validity of the TPB in the intention of consumption of sugar and self-perception of adolescents.	Approximately 1146 students replied to the TPB questionnaire (Moment I) and after 90 days an oral clinical examination was conducted in 372 students of this same sample and the TPB questionnaire was applied again. There was a decrease in the consumption of sugar in students with great experience with cavities (self-perception of consumption). The average

				sugar consumption among the adolescents remained stable, increased and decreased respectively in accordance with their intentions over the course of the study, thus the authors could conclude that the TPB has predictive validity in self-perception and consumption of sugar. They also suggested that the TPB, in addition to its predictive validity, can be a model for changing behaviors.
Astrom AN, Kiwanuka SN, 2006 [12]	Parents/ caregivers of 589 children of 3-5 years of age.	Cross-sectional/ TPB structured questionnaire, administered individually to the parents, and oral clinical examination in children, in Uganda.*	To investigate the intention of parents to control the consumption of sugary snacks by their children and if this behavior can occur between 3-5 years old (preschool children) and if they are in accordance with sociodemographic characteristics and behavioral factors derived from the TPB.	The family seems to play a key role in the food choices of children in preschool age and should be aware of the potential of their influence in this respect. On average, parents showed attitude and perceived behavioral control favorable to control the sugar intake of the children, therefore a strong intention to perform such behavior. They realized the risk of dental caries and suffering that the children were subjected to. To continue the behavior, parents need to be motivated and feel confident in the control of sugar. This study indicates that the TPB is able to predict the intention of parents in the control of the intake of sugary snacks by their children. Moreover, the attitudes of the parents and the reported level of sugar consumption by the children varied among the various socioeconomic family groups. Parents with higher education had a more favorable attitude and intention to control sugar intake compared with those with less education. Prevention programs should pay attention to family behavior, their socioeconomic status and the attitudes of parents towards the restriction of sugar consumption.
Weatherwax JA et al., 2015 [21]	Parents/ guardians of 181 children of 3-5 years of age.	Cross-sectional / structured questionnaire for TPB and oral health knowledge, in 2011 in the United States.	To investigate the relationship between sociodemographic conditions, intent and knowledge of the parent/guardian in relation to the oral health conditions of the children.	The race/ethnicity and education level of the parents were significantly related to the DMFT of the children. The higher rates of dental caries in early childhood were found in children whose parent/guardian were Latino American and parents/guardians with education below high school. The multiple regression analysis revealed that a higher level of education of parents/guardians was significantly associated with lower dmft in this sample. The results of this study were consistent with research in which race/ethnicity and education level of the parents/guardians serve as predictors of the oral health conditions of their children. Parental knowledge was not, in this study, a determinant of the oral health condition of the child.

Freeman T et al., 2012 [16]	273 dental hygienists	Prospective cohort / structured TPB questionnaire in Australia.*	To find out the barriers perceived by dental hygienists to perform activities to assist their patients to stop smoking and the predictors associated with this behavior.	After the hygienists filled TPB-based questionnaires on the potential predictors that make them ask their patients about smoking, as well as to help them quit smoking, and the analysis through structural equation modeling, the authors found that 90% of the hygienists intended to identify patients who smoked. The four most frequently beliefs associated with helping the patient to quit smoking were improved oral health (91%), general health and quality of life (90%), the result of dental treatment (86%) and the aesthetics of the patient-pigmentation (76%). The analysis of the structural equations showed that the level of self-efficacy of the hygienists was an important variable to translate their intentions of helping patients quit smoking into actual behaviors. Organizational variables, such as the perception of the legitimacy and appropriateness of their role, and the support of colleagues to perform the role of asking and helping patients to quit smoking were also identified as factors that predicted the self-efficiency for those tasks. The authors concluded that the use of the theory provides more detailed guidelines about which factors can be better targeted to support the desired behaviors and that, in this case, the best ways to help hygienists improve their role is to increase their skills and confidence to prepare question on smoking habits, to build relationships with individuals and to help them quit smoking.
Dumitrescu AL et al., 2014 [28]	172 university students.	Cross-sectional/ structured questionnaire containing all the constructs of five psychological models, in 2010 in Romania.	To test the usefulness and effectiveness of five social-cognitive models in the prediction of individual oral health behaviors, so that researchers can be guided in the choice of models on which to base their interventions.	The constructs of attitude, subjective standard, perceived behavioral control, susceptibility, severity, benefits, barrier, self-efficacy and expectations of the results were measured for three oral behavioral intentions of improved brushing, flossing and frequency of mouthwash. The results of this study suggest that the Theory of Planned Behavior and the Health Action Process Approach were the best predictors of intentions of the three health behaviors. The Theory of Planned Behavior is a better model than the Health Belief Model for the prediction of intent to improve oral health behaviors. In both theories, the results were good especially in relation to intention to improve the flossing and mouthwash behaviors. The authors have concluded that all theoretical models were able to predict a substantial percentage of the variance in oral health

				behaviors in relation to intent to improve them.
Koyio LN et al., 2012 [17]	216 clinical staff and nurses.	Cross-sectional / structured TPB questionnaire in 2010 in Kenya.	To assess attitudes, subjective standards, perceived behavioral control and intentions of clinical staff and nurses regarding the performance of routine oral exams for oropharyngeal candidiasis in patients with HIV.	Attitudes, subjective standards and intentions of nurses for the oral examination in outpatient consultations were highly positive, regardless of the socio-demographic characteristics. The constructs of attitude and subjective standard were the ones that stood out as predictors of intention. The perceived behavioral control showed very low internal validity and was removed from the analysis in this study. The nurses showed willingness to give oral hygiene orientation and expressed their conviction that the routine oral examination was beneficial for patients. Being able to obtain the support from politicians, supervisors, experts and their colleagues seems to be important in the motivation of the clinical staff to perform routine oral exams for oropharyngeal candidiasis in their workplaces.
Dumitrescu AL et al., 2013 [27]	179 university students.	Cross-sectional / structured TPB questionnaire in 2010 in Romania.	To test the constructs of the extended TPB, including the self-identity; to predict the intentions of young adults in improving their oral hygiene behavior.	Significant differences were observed for self-identity (interest of individuals in their oral health) regarding the brushing behavior and the reason for the visit to the dentist. Students who brushed their teeth more than twice a day scored significantly higher in comparison with those who brushed their teeth once per day or less. Those who visited the dentist only when they had pain reported lower levels of self-identity compared to those who visited the dentist for routine treatments. As expected, the level of self-identity of young adults in relation to oral health was associated with better oral health behaviors. The cognitive attitudes and subjective standards of the TPB emerged as the strongest predictors of intentions to improve oral health behaviors. The understanding of the roles of self-identity in the lives of young students can improve the relationship of dentists with their patients.
Wade J et al., 2010 [15]	10 general practitioners/ focus group (Phase 1) and 499 general practitioners (Phase 2).	Qualitative/ structured TPB questionnaire (Phase 1) and postal questionnaire and open questions (Phase 2), in 2008 in the United Kingdom.	To identify potential barriers to screening by general practitioners of oral cancer in the United Kingdom, aiming to provide recommendations for a theory-based intervention.	The constructs of subjective standard (family pressure) and perceived behavioral control (proper equipment, time limitations) were identified as significant predictors of intention to perform the oral cancer screening in general practice. The authors have concluded that there is considerable potential to improve the intention to perform the oral cancer screening in general practice. Theory-based interventions could include additional training to reinforce confidence,

				experience, test knowledge and easiness, the provision of appropriate equipment in surgery and increased motivation to join the opportunistic screening.
Bonetti D et al., 2009 [14]	133 dental surgeons in Scotland.	Cross-sectional/ questionnaire using multiple theoretical approaches simultaneously: TPB, TSP, SCT, Common-Sense Model of Self-regulation, Active Learning Theory, II and the Precaution Adoption Process, in 2002 in Scotland.	To predict the behavior of professionals in the number of uses of fissure sealants in permanent second molars of children of 7-14 years of age to prevent dental caries.	The results of this study provide additional evidence that psychological models can be applied to predict behavior based on clinical evidence as a preventive treatment. The authors have concluded that this study provides evidence that psychological models can be useful for predicting clinical practices that require a change in the behavior of oral surgeons, and they suggest that an intervention can motivate these professionals in the development of the intention to use fissure sealants, as well as allow them to develop a clear action planning on when and how they will use the fissure sealants as part of the treatment of their patients, thus increasing the implementation of this evidence-based practice.

* In this article, the year of study was not specified by the authors.

Chart 2. Articles retrieved from the databases using the theory of implementation intentions in oral health.

Reference	Sample	Type of study / data collection	Objective	Main results and conclusions of the authors
Schüz B et al., 2006 [11]	157 students of psychology and pedagogy, in Berlin.	Intervention / TSC questionnaire and implementation of flossing, in Germany.*	To verify whether the measures of the Social Cognitive Theory (SCT), that is, the perception of risk, the expectations of results and self-efficiency, along with the action planning and obstacles of the implementation intentions, were correlated with the flossing behavior.	Participants who accepted the recommendation to floss daily for a period of six weeks differed from those who did not do it, regarding the planning of when, where and how they would perform such behavior, in addition to the planning of the obstacles that could occur. The authors found that psychosocial interventions can be useful to improve the periodontal status, especially in younger persons. However, they emphasize that this period of weeks may have been too short for definitive conclusions, and longer future studies are needed to assess the effects of flossing planning.
Schüz B et al., 2009 [8]	194 individuals, either university students or the general public, over 18 years of age in Berlin.	Intervention / behavioral questionnaire and implementation of flossing, in Germany.*	To test the effects of a planning of short intervention for a flossing behavior, and how this intervention is accepted by individuals with different ways of thinking.	The authors found that the encouragement of the individuals to form a detailed plan about when, where and how they would floss significantly improved the performance of the behavior both in two and eight weeks of follow-up, compared to the control group that received only dental floss and instructions. The authors concluded that the formulation of plans is an economical and effective intervention to facilitate the oral hygiene, and they can be easily implemented in the practice of dental clinic.
Clarkson JE et al., 2009 [7]	87 dentists and 778 adult patients, in Scotland.	Intervention / oral hygiene guidance, implementation of dental hygiene behavior and clinical examination, in Scotland.*	To compare the effectiveness of two interventions – SCT and II – to help dentists to influence the oral hygiene behavior of their patients.	Patients who have undergone the intervention based on the psychological theories had significantly higher self-efficiency and better action planning compared to those who received only oral hygiene instructions. Better behaviors and clinical results were also associated with higher self-efficiency and better action planning for the intervention group. The authors concluded that cognitive variables and psychological models can be effectively applied to change oral hygiene behaviors. A simple intervention, based on theory and within the limitations of a doctor's office, was more effective in cognitively influencing the oral hygiene behavior of

				patients than just the routine care with instructions for oral hygiene.
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* In this article, the year of study was not specified by the authors.

Chart 3. Article retrieved from the databases using both theories of planned behavior and implementation intentions in oral health.

Reference	Sample	Type of study / data collection	Objective	Main results and conclusions
Lavin D & Groarke A, 2005 [22]	119 Irish university students.	Intervention / TPB questionnaire and implementation of flossing, in Ireland.*	To test the predictive validity of the TPB and the effects of the implementation intentions regarding the flossing behavior.	Participants in the intervention and control groups had similar motivation and showed no differences in the frequency of flossing for a period of 3 weeks, which indicates that the implementation intentions is not an effective intervention to motivate flossing. The authors comment on some limitations of the study, such as the short three weeks of follow-up, which may not be sufficient for the consolidation of an implementation intention, and also the self-report measures that have the disadvantage of the answers being vulnerable to the trend of interviewees of wanting to provide socially desirable answers. Future studies are necessary with follow-up of over three weeks so that significant differences between the groups may arise.

* In this article, the year of study was not specified by the authors.

Discussion

This study aimed to investigate the scientific production related to the application of the TPB and II in dentistry in order to provide to the professionals aids and evidence for the improvement of their strategies for oral health education and promotion for various age groups and health outcomes.

To achieve this, a review was conducted to identify the existing evidence in the scientific literature on the impact of interventions using two psychological theories, specifically the TPB and the strategy of Implementation Intentions in the adherence to better oral health behaviors. We selected 25 studies that met the inclusion criteria. After analysis, the employability of the models and their psychological constructs were evident in the prediction of oral health behaviors, as well as the importance of the design of the interventions and the way in which they were led to the success of the results.

Despite the importance and the wide applicability of the strategy of Implementation Intentions in the studies concerning the field of health, the results of current experiences have been counterbalanced by some limitations. One of these limitations is related to outcomes being based on self-report measures, limited especially regarding the social desirability bias, memory and the imprecision of the answers [22]. On the other hand, the self-report measures have high applicability, low cost and allow the collect of precise information on the type of activities and the context in which they occur, in addition to being able to compare current and past behaviors.

Despite the use of the TPB in oral health behaviors, this theoretical framework can present different performances in various sociocultural contexts. Thus, it is important to test its applicability in different countries and populations, with studies of distinct objectives, in order to strengthen its cross-validation and the theoretical veracity of the results [9].

Considerable portion of the selected articles on the TPB in the field of oral health presented a methodological design that was observational and transversal, and few intervention studies were found. Thus, few have investigated the impact of planned interventions based on TPB in oral health. On the other hand, the studies that employed the II associated with oral health used intervention methodologies and assessed the effect of this strategy on the changes in oral health behavior. We found that the longer intervention studies presented eight weeks of follow-up, thus demonstrating the need for interventions with extended monitoring, in order to allow the generation of more consistent evidence on the impact of interventions in the medium and long term.

We observed that behaviors related to oral hygiene, such as the use of fluoride toothpaste, techniques, frequency and time of brushing, were the most addressed subjects in the studies found using the selected theories, followed by studies that specifically assessed the impact of flossing on oral hygiene, especially those that used the strategy of Implementation Intentions. For the latter to be effective, the need for an action planning with the use of II is suggested [10,11].

Diet, related to consumption of sugar, was approached in two observational studies using the TPB, given that with the world economic development, growth of processed food products and unhealthy eating habits it is important to bring awareness to intentions and behavior changes related to general and oral health [12,13].

Another behavior studied was the intention of the performance of health care professionals in the education, prevention and promotion of oral health of patients, which was covered in four studies using the TPB. In one of these studies, several psychological theories were applied at the same time, being the sample composed of oral surgeons in order to predict and motivate the behavior of these professionals on the number of fissure sealants used in children for the prevention of dental caries [14]. The other investigated the predictors of intention related to oral diseases and also smoking, emphasizing the importance of motivating for the behavior through the barriers faced such as the lack of professional knowledge, skills, confidence, resistance of the patient and scarce resources [15-17].

Most of the studies investigated were composed of convenience samples and the most used data collection method was the structured questionnaire. In relation to age groups, most of the interventions that used both psychological theories studied were directed at young adults, such as university students. In one of these studies, the selection of this sample was justified because many are experiencing a phase of independence, self-care and self-affirmation, characteristics that would collaborate to support interventions and accept changes in health behaviors [11]. We also found studies directed toward health care professionals, such as doctors, oral surgeons, nurses and auxiliaries in the identification of predictive factors of their intention to work in the prevention and control of the oral health of their patients [14-17].

No studies were found investigating oral health behaviors and educational interventions that used the TPB and the strategy of II directly with children in the school age group, especially at the beginning of eruption of the permanent dentition, which is a period of great importance for the learning and fixing of healthy oral hygiene habits. We found five observational studies using the

TPB on the influence of the behavior of parents over their children until the age group of 5 years [12,18-21]. The behavior and oral health conditions of parents typify the importance and value that they grant to having a good oral health. When parents do not feel prepared and in control of the dental caries prevention and/or their own oral health, there is a lack of enough motivation to obtain and retain healthy habits in relation to the oral health of their children [21].

We have observed in this review that the two psychological theories assessed showed statistically significant associations with oral health behaviors. Interventions designed from volitional interventions, in which the person does the action planning (when, where and how), proved to be effective in promoting changes in oral health ($p < 0.05$), which facilitate the self-control of health/dental hygiene, in addition to being economically more affordable interventions. In one of interventional studies no significant differences were found between groups probably, according to the authors, because of some limitations of the study, such as the short three weeks of follow-up, which may not be sufficient for the consolidation of an implementation intention, and also the self-report measures that have the disadvantage of the answers being vulnerable to the trend of interviewees of wanting to provide socially desirable answers [22].

Regarding the TPB, 14 cross-sectional studies and 5 prospective cohort studies were found aiming to assess associations between the constructs of the TPB and oral hygiene behaviors [6,9,12-14,16-21,23-30]. We also found one intervention study assessing the impact of an intervention using the TPB on the flossing behavior [10] and one qualitative study using the TPB to identify the predictors of intention of clinical and general practitioners in conducting the screening and control of oral cancer [15]. In all of them, statistically significant differences were found between the groups, which demonstrate the effectiveness of interventions using the TPB.

In relation to the use of the strategy of II, we found three interventional studies, in which one assessed the oral hygiene behavior as a whole [7] and two the specific use of dental floss [8,11]. Finally, one study, which assessed the impact of an intervention using the TPB along the II in the flossing behavior, found no statistically significant differences between the control and intervention group [22].

Conclusion

We have observed that the TPB and II are theories that can help researchers / health professionals to predict and to change preventive oral health behaviors. However, additional research is needed to test their effectiveness in other oral health behaviors, age groups and longer follow-up times.

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