



An Effective Psychoeducational Intervention for Early Childhood Caries Prevention: Part I

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Abstract: Purpose: The purpose was to compare whether mothers exposed to an autonomy-supportive psychoeducational videotaped message, informed by the self-determination theory (SDT), demonstrated greater changes in oral health knowledge and behavioral intentions as a preventive means for early childhood caries (ECC) than mothers exposed to a neutral message delivered by brochure. **Methods:** Data were collected at baseline, one-, and six-month follow-ups from 415 12- to 49-month-old WIC-enrolled children and their mothers: 283 in the video intervention group and 132 in the brochure control group. Mothers completed questionnaires on maternal knowledge and behavioral intentions for oral health care. Chi-square, Wilcoxon rank-sum, and Mann-Whitney tests were used to analyze data ($P < .05$). **Results:** Relative to their baseline scores, the intervention group showed a greater increase in knowledge than the control group, both at one-month ($P = .002$) and six-month follow-ups ($P < .001$). The video group also demonstrated a greater increase in behavioral intentions than controls, both at one-month ($P < .05$) and six-month follow-ups ($P < .001$). Knowledge and behavioral intention levels at six-month follow-up did not differ significantly from those at one-month follow-up, indicating that intervention-based increases in these measures were maintained over time. **Conclusions:** Data provided evidence of the effectiveness of the autonomy-supportive psychoeducational intervention for ECC prevention relative to a neutral brochure. (*Pediatr Dent* 2013;35:241-6) Received January 27, 2012 | Last Revision July 30, 2012 | Accepted August 6, 2012

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Early childhood caries (ECC) is a potentially painful, serious, and debilitating disease that may result in a significant public health impact.¹ There are profound disparities in ECC experiences such that children from minority and low-income families not only suffer a disproportionate share of the disease burden, but also may receive their primary health care in public health settings. Consequently, there is a need to evaluate dental health educational interventions targeted to ECC prevention for use in public health settings attended by high-caries risk groups. Many authors recommend the implementation of educational interventions as a means of preventing ECC.^{2,3} A major issue discussed in the oral health promotion literature, however, involves the lack of high quality educational interventions and preventive approaches using psychological/behavioral strategies.^{4,5} One psychological theory that may be particularly useful in promoting behavior change is the self-determination theory (SDT) of motivation.^{6,7}

SDT is a theory of human motivation that uses traditional empirical methods to explain when people learn how to autonomously self-regulate their behavior in a healthy, productive, and responsible way, even during uninteresting activities such as homework, smoking cessation, and dieting to lose weight.⁸⁻¹¹ When behaviors are uninteresting or require effort, motivational problems often occur. To regulate their behavior, people can engage in these behaviors autonomously or through control or coercion. According to SDT, when behavior is regulated autonomously people function well, but when behavior is regulated through coercion

people function poorly.^{8,12} The key to changing a behavior such as brushing one's teeth or resisting the consumption of cariogenic foods/drinks is whether the person comes to accept, internalize, and feel a sense of ownership over the uninteresting, effortful behavior. To accept, internalize, and feel a sense of ownership, people need to perceive the uninteresting activity as something that is truly important, worthwhile, or valuable to their well-being or the well-being of their children. SDT explains the conditions under which one person can help others come to accept, internalize, and gain a sense of ownership over the uninteresting, but important, way of behaving.

SDT is based on two key propositions. First, different types of motivation exist. Autonomous motivation (engaging in a behavior out of a sense of ownership and choice) leads to more positive functioning (more weight loss, better oral health care) than neutral motivation, which leads to more positive functioning than controlled motivation (engaging in a behavior out of a sense of obligation and pressure).¹³ To be autonomous means that one behaves out of a sense of choice, volition, and "wanting to"; to be controlled means that one behaves out of a sense of pressure, obligation, and "having to." Thus, when motivating others, supporting their autonomy produces more positive functioning than does controlling their behavior.

Second, the quality of one's motivation (autonomous, neutral, controlled) depends, rather meaningfully, on the other person's motivating style. When people use an autonomy-supportive motivating style, they: (1) nurture the other's inner motivational resources (promote the other's interest, valuing, sense of autonomy); (2) use informational, noncontrolling language by communicating value in and rationales for uninteresting activities and requested behaviors; (3) display patience to allow time for learning and internalization to occur vs pushing hard for compliance; and (4) take the other's perspective and acknowledge and accept his/her expressions of negative affect and resistance.¹²

The opposite of an autonomy-supportive motivating style is a controlling style in which the person neglects the other's inner motivational resources, uses controlling language to pressure the

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other into compliance, and unilaterally tells the other what to do without considering his/her perspective or feelings. Research consistently shows that people who have their autonomy supported function better than do people who have their behavior controlled, as evidenced by their greater autonomy, perceived competence, learning, well-being, and capacity for effective long-term behavioral self-regulation.^{12,14-16}

The self-determination model proposed for this study suggests that, when an oral health message supports the mother's autonomy, she will be significantly more likely to identify with that message, internalize it, and accept its recommendations as her own. According to SDT, the more the autonomy-supportive oral health care message allows mothers to experience enhanced autonomous motivation and volitional internalization, the more positive will be the mother's post-message oral health care knowledge, behavioral intentions, and behavioral care for their children, as well as the mothers' capacity for long-term retention of this improved knowledge, intentions, and behavior.

The overall purpose of this study was to assess the effectiveness of an autonomy-supportive psychoeducational videotaped oral health message informed by the SDT as a means of preventing ECC to be used in public health settings attended by high-caries risk groups.

The current article discusses the first part of this study (Part I), which describes the SDT, reports study demographics, and assesses the efficacy of the SDT-based psychoeducational intervention. We predicted that: (1) the intervention would enhance mothers' oral health care knowledge (hypothesis 1) and behavioral intentions (hypothesis 2), relative to a neutral message delivered by brochure that represented standard practice; and (2) these hypothesized benefits applied to both short-term (1-month) and long-term (6-month) effects.

The second part of this study (Part II)¹⁷ is presented as a companion article in this same publication and compares self-reported oral health behavioral changes between mothers from the two study groups.

Methods

This study was approved by the Institutional Review Board of the University of Iowa, Iowa City, Iowa, and consisted of a convenience sample of mother-child dyads recruited from two Special Supplemental Food Programs for Women, Infants, and Children (WIC) in Iowa. Mothers/legal guardians were required to be at least 18 years old and have children between the ages of 12 and 49 months old. No other inclusion/exclusion criteria were employed in this study.

At the initial appointment, following consent procedures, mother-child dyads were randomly assigned, using a randomization table, into one of two groups: (1) a video intervention group; and (2) a brochure control group. After randomization, all mothers completed a series of baseline questionnaires, prior to the respective intervention, on demographic information and preintervention mothers' self-reported knowledge and behavioral intentions concerning their child's oral health. Cronbach's alpha coefficients, measuring the internal consistency of the scales, were 0.72 for knowledge and 0.64 for behavior intentions. These calculations were done during the development of these scales on a separate sample.¹⁴

Upon completion of baseline/preintervention questionnaires, mothers assigned to the intervention group were exposed to an educational component consisting of a 15-minute videotaped oral health message informed by the SDT, which covered a variety of oral health topics: process of tooth decay, oral hygiene practices, dietary habits that affect caries susceptibility, checking the child's teeth for early signs of cavities (white spot lesions), and bacterial

transmission from mother to child. Throughout the video, motivation messages addressed the harm of inappropriate oral hygiene and dietary habits, challenges mothers face in caring for their child's oral health, and tips for positive oral health practices. What made the videotaped message unique from the brochure was that these messages were communicated in an autonomy-supportive way—by taking the mother's perspective, acknowledging resistance and negative feelings that might arise, providing explanatory rationales for the recommended behaviors, and vitalizing personal goals and aspirations for positive oral health practices.

The oral health message was delivered by a pediatric dentist who acted as the "dentist" in the video and was fluent in English and Spanish. Other video actors included caregivers of children attending the University of Iowa pediatric dentistry clinic, as well as the study's principal investigator and her children.

The video was produced by the University of Iowa media department and designed using images, music, and scenes of realistic practical life situations during the delivery of oral care for young children. A videotape format was chosen for the message informed by the SDT, because the investigators wanted to create a product that would both provide the necessary information on a consistent basis and also be practical for use in busy WIC clinics.

Mothers from the intervention group completed two additional questionnaires at baseline immediately after viewing the videotaped message to assess their perceptions of the degree of autonomy support of the videotaped oral health presentation informed by the SDT. One assessed mothers' perceived feelings of autonomy, relatedness, and competence ("health care climate questionnaire"), and the other assessed mother's internalization of the videotaped oral health presentation [ie, the degree to which mothers understood, agreed with, and perceived the oral health message as helpful and useful to them ("internalization questionnaire")]. These are important manipulation checks to be assessed in order to confirm the intended effects of the videotaped message on mothers' internalization and feelings of supported autonomy. Cronbach's alpha coefficients for the "health care climate questionnaire" and "internalization questionnaire" scales were 0.90 and 0.80. Again, these calculations were performed during the development of these scales on a separate sample.¹⁴

Mothers assigned to the control group received the educational component using a neutral style via a paper brochure that contained the same dental content covered in the videotaped message. The reason our research team opted for a paper brochure was because most of the standard dental education delivery methods in many busy dental and WIC clinics rely on educational brochures; additionally, it would be unethical to fail to provide information to the control group mothers. Since SDT proposes that if the mother has internalized the message the changes should be evident within a short period of time,⁶ all mothers from both groups were sent a questionnaire, via mail at the 1-month follow-up, designed to assess mothers' changes in self-reported knowledge and behavioral intentions from baseline.

Approximately five months after the initial appointment, mothers were again contacted to schedule a six-month follow-up visit to collect postintervention information. All study instruments were available in English and Spanish. An overall composite score for each individual questionnaire was created by totaling the individual's scale scores for questionnaires using 5-point Likert-type scales. These included questionnaires on self-reported knowledge (ranging from "strongly disagree" to "strongly agree"), behavioral intentions (ranging from "not at all likely" to "very likely"), health care climate (ranging from "strongly disagree" to "strongly agree") and internalization (ranging from "not at all true" to "very true"). As maternal knowledge and behavioral intention scores were not normally distributed, nonparametric tests were used for all analyses.

Wilcoxon signed rank tests were used to evaluate changes in the quantitative measures, and group comparisons were made via chi-square and Mann-Whitney tests. A 0.05 level of statistical significance was used.

Results

Randomization. This study recruited 415 mother-child dyads at baseline: 283 randomly assigned to the intervention group and 132 to the control group. The reason the video and control groups have unequal numbers of participants assigned to each is because originally this study was funded by a National Institutes of Health grant (no. 5 R21 DE016483-02) to test the effectiveness of an autonomy-supportive psychoeducational videotaped oral health message facilitated by SDT as a preventive means of ECC. This particular grant was exploratory in nature and did not provide for a control group. To test our study intervention against the standard care in dental education through brochures, we obtained modest internal funding, which limited the number of control group participants recruited.

Among the 415 mother-child dyads, there were no significant differences between the intervention and control groups regarding: maternal age and education; marital status; household income; proportion of mothers with previous awareness of ECC; or the child's age, sex, or race/ethnicity ($P>.05$). There appeared to be some difference concerning dental insurance ($P<.03$), with a slightly higher proportion of mothers receiving brochures reporting private dental insurance (17 percent vs eight percent) and slightly fewer reporting uninsured status (four percent vs 10 percent) vs mothers randomized to the intervention group; corresponding levels of enrollment in the Medicaid program were 75 percent vs 78 percent, and enrollment in the Hawk-I insurance plan was five percent vs three percent for the brochure and video groups, respectively.

Participation levels. Among the 283 mother-child dyads in the intervention group, 155 (55 percent) returned the one-month follow-up questionnaires and 181 (64 percent) returned for the six-month follow-up visit. Among the 132 in the control group, 78 (59 percent) returned the one-month follow-up questionnaires and 86 (65 percent) returned for the six-month follow-up visit. There was no difference in levels of attrition between both groups ($P=.45$). Mothers from both groups who participated at baseline but failed to complete both follow-ups were more likely to be younger, single, and less educated and have lower household income ($P<.05$) than 319 mothers who completed both follow-ups. Among these 319 participants, there was no evidence that subjects in the intervention and control groups differed regarding any of the demographic characteristics considered in the previous section, with the single exception of participation in dental insurance ($P<.02$), where patterns similar to those described among all 415 baseline participants were observed. These findings indicate that both groups remained quite comparable after attrition. Lastly, both groups were also similar at baseline regarding maternal knowledge ($P=.53$) and behavioral intentions ($P=.50$).

Demographics. Baseline demographic data showed that the mean age for mothers was 27.6 years old. Most mothers were single ($N=160$; 39 percent), had a high school diploma ($N=255$; 62 percent), and reported having previous awareness of ECC ($N=299$; 75 percent). Twenty-five percent had an annual household income ranging from \$0 to \$5,000 ($N=92$; Table 1). The mean age of children was 26.8 months old. Although most children (77 percent) were reported to have Medicaid (Title XIX) as their primary dental insurance, 79 percent had never been to a dentist. At baseline, 11 percent of children had untreated cavitated lesions, and 52 percent were found to have either cavitated or noncavitated lesions. Forty-three percent of the children were from minority families (Table 1).

Mothers' perceived feelings of autonomy, relatedness, and competence and internalization of the videotaped oral health message in the video intervention group. As seen in Table 2, mothers from the intervention group reported high total scores on both "health care climate questionnaire" and "internalization questionnaire." This means that most mothers experienced a feeling

Table 1. DEMOGRAPHIC CHARACTERISTICS OF FULL SAMPLE*

	N	Mean (±SD)	Median	Range
Mother's age (ys)	411	27.6±5.9	26.2	18, 52
Child's age (mos)	415	26.8±10.9	26.0	12, 49
			Frequency	%
<i>Mothers' marital status</i>				
Married			145	35
Separated			18	4
Divorced			26	6
Single, never married			160	39
Live with significant other			60	15
Widowed			2	1
<i>Household income</i>				
\$0-\$5,000			92	25
\$5,001-\$10,000			46	13
\$10,001-\$15,000			40	11
\$15,001-\$20,000			82	22
\$20,001-\$25,000			41	11
\$25,001-\$30,000			25	7
\$30,001-\$35,000			24	6
\$35,001+			18	5
<i>Mother's highest level of education</i>				
≤8 th grade			13	3
Some high school, but did not graduate			61	15
High school diploma or GED			255	62
2-year college degree			46	11
4-year college degree			20	5
Graduate degree			14	4
<i>Maternal previous awareness of early childhood caries</i>				
Yes			299	75
No			98	25
<i>Child's sex</i>				
Male			205	49
Female			208	51
<i>Dental insurance</i>				
Medicaid			302	77
S-CHIP			15	4
Private			43	11
No dental insurance			31	8
<i>Has the child ever been to a dentist?</i>				
Yes			83	21
No			319	79
<i>Child's race/ethnicity</i>				
Caucasian			237	57
African American			67	16
Latino			51	12
<i>Other race/ethnicity (including multiracial/ethnic)</i>				
Asian			3	1
American Indian/Alaska Native			1	0.5
Native Hawaiian/other Pacific Islander			1	0.5

* Due to missing data, not all variables add up to the total sample size population of 415.

Table 2. MOTHERS' PERCEIVED FEELINGS OF AUTONOMY, RELATEDNESS, AND COMPETENCE AND INTERNALIZATION OF THE VIDEOTAPED ORAL HEALTH MESSAGE IN THE VIDEO INTERVENTION GROUP

	n	Mean (±SD)	Median	Range
Health care climate total questionnaire score	249	128.2 (13.9)	130	46-145
Perceived autonomy score	265	61.3 (7.0)	62	15-70
Perceived competence score	270	31.2 (3.4)	32	14-35
Perceived relatedness score	267	35.7 (4.8)	37	8-40
Internalization questionnaire total score	280	55.1 (5.3)	57	26-59
Mother understood videotaped message	280	18.1 (1.9)	19	10-19
Mother agreed with videotaped message	282	13.2 (1.4)	14	5-14
Mother perceived message as helpful	281	23.8 (3.1)	25	11-26

of autonomy, competence, and relatedness after viewing the videotaped oral health presentation and understood, agreed with, and felt that the message was helpful and useful to them. As previously stated, mothers in the control group did not complete these questionnaires.

Comparison of video intervention and brochure control groups. The intervention and control groups were similar at baseline for levels of knowledge ($P=.19$) and behavioral intentions ($P=.32$). The mean knowledge score at baseline was 24.96 (± 3.68 SD) in the intervention group and 24.44 (± 3.90) in the control group. The mean intention score at baseline was 28.22 (± 3.75) in the intervention group and 28.05 (± 3.59) in the control group (data not shown in Table 3).

As predicted by SDT, both outcomes showed significant changes at the one-month follow-up (Table 3). Both groups showed a significant increase in knowledge and behavioral intention scores relative to baseline ($P<.001$ in all instances). The intervention group, however, showed a greater increase in knowledge and behavior intentions scores than the control group at the one-month follow-up ($P=.002$ and $P<.05$, respectively). Similarly, at the six-month follow-up, both groups showed a significant increase in knowledge and behavioral intention scores relative to the baseline ($P<.009$ in all instances, Table 3). Again, however, the mean increase in knowledge and behavior intention scores relative to the baseline were greater for the video group vs brochure control group ($P<.001$ in both instances).

Levels of knowledge at the six-month follow-up did not differ significantly from those at the one-month follow-up in either the intervention group ($P=.66$) or control group ($P=.74$), indicating maintenance of the increases in oral health care knowledge (Table 3). Following the same trend, levels of behavioral intentions at the six-month follow-up also did not differ significantly from those at the one-month follow-up in either group ($P>.86$ in both instances), further indicating maintenance of the increases in oral health care behavioral intentions (Table 3). In a supplemental analysis, these comparisons were repeated, confining the analyses only to those subjects who participated in all three waves of data collection ($N=181$); results and conclusions were essentially unchanged from those reported above.

Discussion

SDT has been successfully applied as the motivational basis to productive changes in people's behavior in several different fields, including medicine, business, religion, parenting, sports, education, and psychotherapy.^{8-13,15,16,18-22} Study results showed the videotaped oral health message informed by SDT to be significantly better than a brochure message in terms of overall improvement in maternal self-reported oral health care knowledge and behavioral intentions.

Everyone has the right to receive the most appropriate information to care for his/her own oral health and, in the case of this study, to care for their children's oral health. In addition, it is an ethical and professional responsibility to disseminate sound dental knowledge for the public, regardless of what people do with the dental information received. A significant improvement in knowledge was observed in this study, mirroring similar knowledge gains reported from different educational modalities.²³⁻²⁵ Dental health education can improve an individual's knowledge concerning dental health issues. However, although knowledge dissemination is an important key of oral health educational interventions, in most cases oral health care behavior change does not occur, despite increases in knowledge.^{4,5}

The significant positive changes in behavioral intentions observed among those in the intervention group is very encouraging and promising, since accumulated evidence suggests that intentions are reliable predictors of behavior.^{26,27} Intentions are viewed as an individual's stated orientation toward a behavior and, according to the theory of reasoned action (TRA),²⁶ are the immediate determinants of behavior. In the TRA, behavioral intentions are determined by: (1) the individual's attitude toward the behavior (eg, putting a child to bed with a bottle with juice is: healthy or unhealthy); and (2) normative social forces, such as social norms and social pressure to perform the behavior (eg, most people I know think I should not put my child to bed with a bottle of juice: agree or disagree). Accumulated evidence suggests that attitudes and subjective norms are good predictors of intentions and that intentions are reliable predictors of behavior.^{28,29}

When people internalize a requested behavior and consider it as their own, greater autonomy is experienced in the quality of their internalized motivation, and changes should be evident within a short period of time.⁶ Another encouraging finding in our study is the fact that, as predicted by SDT, the intervention group

Table 3. CHANGES IN MATERNAL KNOWLEDGE AND BEHAVIORAL INTENTION RELATIVE TO BASELINE AT 1- AND 6-MONTH FOLLOW-UPS: COMPARISON OF BROCHURE CONTROL VIDEO AND INTERVENTION GROUPS

	Knowledge		Behavioral intention	
	Control	Video	Control	Video
<i>1-month follow-up</i>				
Mean increase score (±SD) relative to baseline	3.89±3.94	5.31±5.30	1.71±3.40	2.71±3.72
<i>P</i> -value*		.002		<.05
<i>6-month follow-up</i>				
Mean increase score (±SD) relative to baseline	3.11±4.25	5.17±3.90	1.24±3.70	2.93±3.18
<i>P</i> -value*		<.001		<.001

* Significance probability associated with the Mann-Whitney test of the null hypothesis that the distribution of change relative to the baseline was the same for the video intervention group and the control brochure group. *P*-values associated with changes over time within groups are given in the text.

demonstrated significantly greater increases in both knowledge and behavioral intentions as early as one month after the intervention. These increases in the intervention group were not only significantly greater than the increase observed for the control group at one-month follow-up, but the intervention-based increases in knowledge and intentions were maintained at the six-month follow-up.

This study was subject to the inherent limitations of survey studies that rely on self-reported data collection. In addition, most motivational interventions, including those informed by SDT, are done on a one-to-one basis, which is generally considered the gold standard in delivering a message. Our research study, however, faced the challenge of motivating mothers to adopt positive behaviors for ECC prevention through a videotaped oral health message. Such an approach was necessary, since the primary goal of this research study was the development of an effective, easily delivered modality that could get the message of caries prevention to a wide audience in a variety of circumstances with minimal manpower utilization.

It is also important to note that possible differences between groups could have been solely due to the methods of the videotaped presentation vs the standard brochure. As mentioned previously, our research team opted for a paper brochure to be the study control group. This is because most of the standard dental education delivery relies on educational brochures and, furthermore, it would be unethical to fail to provide information to the control group mothers. The limited funding available for the control group, however, would have also prevented us from covering the costs involved in the production of a neutral videotaped oral health message.

One important strength of this study is the fact that our sample population consisted of very young, high-caries risk children from low-income families attending a WIC program. It is known that a great amount of dental disease occurs among the program's participants. Indeed, caries prevalences for WIC-enrolled children three years old and younger have been reported to be 35 percent to 56 percent.^{30,31}

Knowing that intentions are reliable predictors of behavior,^{25,26} clinicians can easily identify areas where motivation may be low by simply asking parents how likely they are to engage in specific oral hygiene/dietary practices regarding their children (ie, "how likely are you to decrease the daily amount of juice your child usually drinks?"). Once motivation problems are identified, SDT can be a valuable and useful tool for any dental or medical professional while educating their patients to adopt suggested health recommendations.

When motivating patients to adopt healthier behaviors, it is important to:

1. promote the patients' interest and curiosity in, appreciation for, and value of the message by relating the message to the individual's personal goals and by providing rationales for requested behaviors, especially those perceived to be uninteresting or particularly effortful;
2. use informational and noncontrolling language by supporting requests with explanatory rationales rather than with pressuring directives ("you should", "you have to"); and
3. acknowledge the patient's perspective on the challenges of health care and accept their expressions of negative affect and resistance to the health message being delivered.

Health care professionals should be sensitive to how they can more effectively communicate their recommendations, so that patients and/or caregivers can perceive these requests as things worth doing.

Conclusions

Based on this study's results, the following conclusions can be made:

1. An autonomy-supportive psychoeducational intervention, informed by the self-determination theory, enabled mothers to increase their oral health care knowledge and behavioral intentions relative to the baseline and significantly more than did usual practice (informational brochure used in the control group).
2. The positive effects of the psychoeducational intervention were observed as early as one month and maintained at six months.

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References

1. Vargas CM, Monajemy N, Khurana P, Tinanoff N. Oral health status of preschool children attending Head Start in Maryland, 2000. *Pediatr Dent* 2002;24:257-63.
2. Horowitz HS. Research issues in early childhood caries. *Community Dent Oral Epidemiol* 1998;26(suppl 1):67-81.
3. Ismail AI. Prevention of early childhood caries. *Community Dent Oral Epidemiol* 1998;26(suppl 1):49-61.
4. Schou L, Locker D. Oral Health: A review of the effectiveness of health education and health promotion. Amsterdam: Dutch Centre for Health Promotion and Health Education. Amsterdam, Netherlands; 1994.
5. Kay E, Locker D. Effectiveness of Oral Health Promotion: A Review. Health Education Authority. London, Great Britain; 1997.
6. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well being. *J Amer Psychol* 2000;55:68-78.
7. Deci EL, Eghari H, Patrick BC, Leone DR. Facilitating internalization: The self-determination theory perspective. *J Personal* 1994;62:119-42.
8. Williams GC, Saizow R, Ross L, Deci EL. Motivation underlying career choice for internal medicine and surgery. *Soc Science Med* 1997;45:1705-13.
9. Williams GC, McGregor H, Sharp D, et al. Testing a self-determination theory intervention for motivating tobacco cessation: Supporting autonomy and competence in a clinical trial. *Health Psychol* 2006;25:91-101.
10. Guay F, Ratelle CF, Chantal J. Optimal learning in optimal contexts: The role of self-determination in education. *Can Psychol* 2008;49:233-40.
11. Vansteenkiste M, Ryan RM, Deci EL. Self-determination theory and the explanatory role of psychological needs in human well-being. In Bruni L, Comin F, Pugno M, eds. *Capabilities and Happiness*. Oxford, UK: Oxford University Press. In press.
12. Reeve J. Why teachers adopt a controlling motivating style toward students and how they can become more autonomy supportive. *Educ Psychol* 2009;44:159-75.
13. Reeve J, Jang H, Hardre P, Omura M. Providing a rationale in an autonomy-supportive way as a motivational strategy to motivate others during an uninteresting activity. *Motiv Emot* 2002;26:183-207.

14. Weber K. A Comparison of the Effectiveness of Three Educational Interventions in the Prevention of "Early Childhood Caries." Iowa City, Iowa: University of Iowa; 2003.
15. Vallerand RJ, Deci EL, Ryan RM. Intrinsic motivation in sport. *Exerc Sport Sci Rev* 1987;15:389-425.
16. Grolnick WS, Ryan RM. Parent styles associated with children's self-regulation and competence in school. *J Educ Psychol* 1989;81:143-54.
17. Weber-Gasparoni K, et al. An Effective Psychoeducational Intervention for Early Childhood Caries Prevention: Part II. *Pediatr Dent* 2013;35(3):247-51.
18. Grolnick WS, Ryan RM, Deci EL. Inner resources for school achievement: Motivational mediators of children's perceptions of their parents. *J Educ Psychol* 1991;83:508-17.
19. Baard PP, Deci EL, Ryan RM. Intrinsic need satisfaction: A Motivational Basis of Performance and Well-being in Work Settings (unpublished manuscript). New York, NY: Fordham University; 1998.
20. Adie J, Duda JL, Ntoumanis N. Autonomy support, basic need satisfaction, and the optimal functioning of adult male and female sport participants: A test of basic needs theory. *Motiv Emot* 2008;32:189-99.
21. Ryan RM, Rigby S, King K. Two types of religious internalization and their relations to religious orientations and mental health. *J Pers Soc Psychol* 1993;65:586-96.
22. Georgiadis MM, Biddle SJH, Stavrou NA. Motivation for weight-loss diets: A clustering, longitudinal field study using self-esteem and self-determination theory perspectives. *J Health Educ* 2006;65:53-72.
23. Craft M, Croucher R, Blinkhorn A. "Natural Nashers" dental health education programme: The result of a field trial in Scotland. *Br Dent J* 1984;156:103-5.
24. ter Horst G., Hoogstraten J. Immediate and delayed effects of a dental health education film on periodontal knowledge, attitudes, and reported behavior of Dutch adolescents. *Community Dent Oral Epidemiol* 1989;17:123-6.
25. Eckman A, Persson B. Effect of early dental health education for Finnish immigrant families. *Swed Dent J* 1990;14:143-51.
26. Ajzen I, Fishbein M. *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, NJ: Prentice Hall; 1980.
27. Ajzen I. From intentions to actions: A theory of planned behavior. In: Kuhl J, Beckmann J, eds. *Action-control: From Cognition Behaviour*. Heidelberg, Germany: Springer; 1985: 11-39.
28. Sheppard BH, Hartwick J, Warshaw PR. The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *J Consum Res* 1988;15:325-43.
29. Tedesco LA, Keffer MA, Fleck-Kandath C. Self-efficacy, reasoned action, and oral health behavior reports: A social cognitive approach to compliance. *J Behav Med* 1990;14: 341-55.
30. Lee C, Rezaiaimira N, Jeffcott E, Oberg D, et al. Teaching parents at WIC clinics to examine their high caries risk babies. *J Dent Child* 1994;61:347-9.
31. O'Sullivan DM, Douglass JM, Champany R, et al. Dental caries prevalence and treatment among Navajo preschool children. *J Public Health Dent* 1994;54:139-44.