

FIRST-TIME MOTHERS' INTENDED VERSUS ACTUALIZED CHILD ORAL HEALTH-RELATED BEHAVIORS

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ABSTRACT

Jenna Bridger Alvey: First-Time Mothers' Intended *versus* Actualized Child Oral Health-Related Behaviors
(Under the direction of Jessica Lee)

We examined the relationship between first-time mothers' intended (baseline) versus actualized (at follow-up) child oral health behaviors (COHB) in the context of oral health knowledge, oral health literacy, self-efficacy and dental neglect. Baseline data was collected from a group (White 44%, African American 40%, Native American 17%) of first-time pregnant clients (N=119) at Women, Infants and Children Clinics in NC. Follow-up data was collected from 48 of these individuals at least one year after their child's birth. Mothers were highly likely to realize their intentions to reduce juice consumption, nighttime bottle-feeding and regular tooth brushing. However, 75% did not realize their intention to limit sweet snacks for their child. Implementation of positive COHB was not correlated with oral health knowledge, oral health literacy, dental neglect, self-efficacy and sociodemographics. Our research suggests that first-time mothers are likely to implement some but not all positive behaviors they intended to adopt during pregnancy.

To my husband, Brett, thank you for your unwavering support and love. To Aaron and Abigail, thank you for bringing joy into my life every day. To my extended family, thank you for all of your continued help and encouragement. And to the faculty, staff and amazing residents of the Department of Pediatric Dentistry, thank you for being incredible in your efforts to change the lives of children everyday.

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LIST OF ABBREVIATIONS

ABI	Actualized Behavior Index
COHL	Carolina Oral Health Literacy Project
DN	Dental Neglect
ECC	Early Childhood Caries
NHANES	National Health and Nutritional Examination Survey
OHL	Oral Health Literacy
OHK	Oral Health Knowledge
SEF	General Self Efficacy
WIC	Special Supplemental Nutrition Program for Women, Infants and Children

INTRODUCTION

Dental Disease in Children

Although efforts to prevent early childhood caries (ECC) have been a national priority over the past decade, ECC continues to be a vexing challenge to both the dental and medical professions. The most recent National Health and Nutrition Examination Survey (NHANES) data revealed an **increase** in caries prevalence among children ages 2-11 (NIDCR, 2014). This is a total reversal of the decrease seen in this age group from 1970-90 (NIDCR, 2014). Although dental caries is considered a preventable condition, it remains the most prevalent childhood disease (US Department of Health and Human Services, 2000). Moreover, a disproportionate number of children in populations from lower socioeconomic backgrounds are experiencing ECC. Many of these children, along with their families, participate in programs such as Head Start and Special Supplemental Nutrition Program for Women, Infants and Children (WIC).

A more detailed evaluation of the most recent NHANES Survey reveals that 42% of the U.S. children have caries in their primary dentition (NIDCR, 2014), a phenomenon with many potential negative health effects. ECC can have a significant impact on the daily lives of children and their families. Children with ECC often have difficulty eating, trouble sleeping, and behavioral problems (Low *et al.*, 1999; Jackson *et al.*, 2011). Approximately half of children with severe-ECC report symptoms of pain (Low *et al.*, 1999). A correlation between the disease and failure to thrive in young children has also been demonstrated (Acs *et al.*, 1999).

Anticipatory Guidance and Prevention

The concept of tailoring and targeting preventative health messages specifically to high caries risk groups has recently become an area of interest. Effective anticipatory guidance may lead to increased knowledge, adoption of positive behaviors and ultimately decrease the number of children affected by ECC and the morbidity associated with it. Preliminary evidence suggests that primary prevention focused on mothers can lead to an improvement of the child's oral health and general health (Meyer *et al.*, 2013). Federally funded programs, such as Head Start, are taking initiatives to educate caregivers on the importance of oral health earlier in the child's life (Administration for Children and Families, 2008). Emphasis is being concentrated on educating pregnant women on the importance of their oral and overall health as well as the oral and general health of their child (NY State Department of Health, 2006). There is emerging evidence that, for prevention to be maximally effective, it should start earlier. This suggests that focusing on educating pregnant women before undesirable child oral health-related habits are formed may be a promising strategy (California Dental Association, 2010).

Nearly seven million women become pregnant each year (Ventura *et al.*, 2012; Ventura *et al.*, 2012), with a significant proportion being first-time mothers. First-time pregnant women are more likely to seek health information (Shieh *et al.*, 2009b), which makes this an opportune time to provide helpful information on the importance of oral health for their child. To make these messages effective, pregnant women must be receptive to the information and the messages must be presented in a manner that is understandable, as well as culturally and linguistically appropriate (National Culturally and Linguistically Appropriate Services, 2013). Clifford and colleagues (Clifford *et al.*, 2012) examined the attitudes of pregnant women on this question and found that pregnant mothers thought that the later stage of pregnancy was a good time to receive

oral health education. Many women suggested that a time after birth would be appropriate as well, such as when ‘baby teeth’ start to erupt.

Health Knowledge, Literacy, and Behaviors

Pregnant women with low health literacy are less likely to have the knowledge required to perform optimal health practices (Shieh *et al.*, 2009a), both for themselves and for their child. Rothnie and colleagues (Rothnie *et al.*, 2012) noted that first-time mothers, younger women, and lower socioeconomic groups may exhibit less knowledge of child oral health knowledge issues. They concluded that a majority of this group may not have the appropriate knowledge to provide suitable oral health care for their children. In a recent study conducted by our research group, we found that oral health literacy among low-income first-time pregnant mothers correlated with their oral health knowledge (Hom *et al.*, 2012). Research thus far has been inconclusive in demonstrating a relationship between oral health knowledge and oral health status or behaviors (de Silva-Sanigorski *et al.*, 2013).

SPECIFIC AIMS

To be successful in reducing dental disease in children, prevention efforts must start early. Understanding the association between oral health knowledge and infant oral health behaviors among pregnant women is an important question from a practical and clinical perspective. Anticipatory guidance and oral health education programs have begun to target pregnant women with an expectation to improve child oral health-related behaviors in the *post-partum* period and ultimately the oral health status of the child. Little is known about the effectiveness of these programs and, more specifically, about what pregnant women know at the time of pregnancy, and how this translates to their child-directed oral health behaviors after birth. To address this gap in current knowledge, we undertook this study aiming to:

1. Compare first-time mothers' **intended** *versus* **actualized** child oral health-related behaviors;
2. Examine **changes** in oral health literacy (OHL), oral health knowledge (OHK), general self-efficacy (SEF), and dental neglect (DN) among the above, between pregnancy and after the birth of the child.

METHODS

Study Design, Population, and Procedures

This study relied upon interview data from the Carolina Oral Health Literacy (COHL) project, a prospective cohort study designed to examine OHL and oral health outcomes among caregivers and their children (Lee *et al.*, 2011). This investigation utilized a nested cohort of 119 English-speaking first-time pregnant women who met the study's eligibility criteria and were enrolled in COHL in 2007-2009 (Hom *et al.*, 2012). The overarching goal of COHL was to examine the association of OHL with oral health-related knowledge, behaviors, quality of life, dental visits, and expenditures among caregivers and their infants or children. Participants were clients of Women, Infants and Children clinics in seven counties of NC. Eligibility criteria for participation in COHL included: a) being the primary caregiver of a healthy (ASA I or II) and Medicaid-eligible infant/child 60 months old or younger, or expecting a newborn within the next 8 months, b) 18 years or older and c) English speaking. Caregivers or pregnant women that met these criteria and agreed to participate were accompanied to a private area for a 30-minute in-person interview with one of the two trained study interviewers. If they experienced any difficulty reading the consent or HIPAA forms, the interviewer read them aloud. After the completion of the interview, an incentive (a \$20 gift card) was given to the caregiver. This was designated as the baseline interview (Time 1, T1). For the cohort of first-time pregnant women, a follow-up interview (Time 2, T2) was conducted after the birth of their child, for which a \$30 incentive was provided. Detailed descriptions of the sampling procedures, survey instruments, sample characteristics, and outcomes have been previously reported (Vann *et al.*, 2012; Lee *et*

al., 2011; Divaris *et al.*, 2011; Lee *et al.*, 2012; Hom *et al.*, 2012; Vann *et al.*, 2013; Divaris *et al.*, 2014).

Data Sources

At Time 1, concurrent with study enrollment, a survey covering a wide range of informational domains was administered using an in-person interview to all participants. Interview data were collected for socio-demographic characteristics, self and child oral health-related knowledge and behaviors, health literacy, self and child oral health-related quality of life, SEF, DN, and self-reported oral health status (Lee *et al.*, 2011). At Time 2, participants were contacted and invited for a follow-up interview after their child's first birthday. The interval between the two interviews ranged between 15 and 66 months (Vann *et al.*, under preparation). By March 2015, a follow-up rate of over 40% (48/119) had been achieved for the cohort of pregnant women.

Variable Definition and Measurement

The primary outcome of interest for this study was the mothers' child oral health-related (COHR) behaviors. These potentially beneficial or deleterious oral health practices were reported at the time of pregnancy and after the birth of the child. They were assessed with six questions (Douglass *et al.*, 2001) presented according to the phase of the study (Appendix A, Part I). At Time 1, mothers were asked about their *intended* (prospective) health behaviors, whereas after the birth of the child, Time 2, they were asked about their *actual* child oral health-related behaviors. For example, at Time 1 they were asked: "How often do you think you will give your child fruit juices to drink (any kind)?" At Time 2 they were asked: "How often does your child drink fruit juices (any kind)?" Other questions pertained to primary source of the child's drinking water (i.e., city water system, well water system, bottled water), nighttime bottle-feeding, and the

timing of the first dental visit where possible responses included “before the first tooth erupts,” “at age one,” “at age three,” and “only when they have a problem.”

Several additional variables were examined for changes between T1 and T2. The first was mothers’ child oral health-related knowledge (OHK). This was measured using a six-item scale (Shick *et al.*, 2005; Mathu-Muju *et al.*, 2008), wherein they were asked to answer “agree,” “disagree,” or “don’t know” to questions such as “cleaning baby teeth is not important because they fall out anyway” and “tooth decay in baby teeth can cause infections that can spread to the face and other parts of the body” (Appendix A, Part II). A summary score ranging between 0-6 was derived from this knowledge quiz, with 0 indicating the lowest OHK and 6 the highest.

Oral health literacy (OHL) was measured using a validated word-recognition test, the Rapid Estimate of Adult Literacy in Dentistry-30, or REALD-30 (Lee *et al.*, 2007). REALD-30 contains 30 dentistry-related words arranged in order of increasing difficulty, which the interviewee is asked to pronounce, with 1 point given for every word pronounced correctly (Appendix A, Part III). The OHL score ranges from 0 (lowest literacy) to 30 (highest literacy). Although a threshold of what constitutes “low OHL” has not been established, previous investigations have used the <13 REALD-30 score threshold to denote low OHL (Vann *et al.*, 2010; Divaris *et al.*, 2012; Vann *et al.*, 2013).

Dental Neglect (DN) was measured using a modified version (Lee *et al.*, 2012) of the Dental Neglect Scale (DNS) and pertains to the personal dental neglect of the caregiver (Thomson and Locker, 2000; Jamieson and Thomson, 2002b). In DNS, participants are asked to indicate their agreement or disagreement with 6 statements related to their own oral health with possible responses ranging from “definitely not” to “definitely yes” (Appendix A, Part IV). These statements include topics such as “I keep up with my dental care at home” and “I receive

the dental care I should.” The calculated cumulative DNS score ranges between 6 (least dental neglect) and 24 (most dental neglect).

General self-efficacy (SEF) is a construct developed to assess a “general sense of perceived self-efficacy with the aim in mind to predict coping with daily hassles as well as adaptation after experiencing all kinds of stressful life events” and was measured using the general self-efficacy scale (Schwarzer and Jerusalem, 1995). The scale includes 10 items which the respondent is asked to rate as “not at all true” (1 point), “hardly true” (2 points), “moderately true” (3 points), or “exactly true” (4 points), resulting to 10-40 overall score range (Appendix A, Part V). An example of the scale’s items is: “I can always manage to solve difficult problems if I try hard enough.”

Demographic information was collected for race (self-reported as white, African American, or American Indian), county of residence, education level (less than high school, high school or general educational development, some college, and college or more), age (measured in years), and marital status (measured as single, married, divorced/separated/widowed). For exploratory purposes, we used data from the NHANES question “How long has it been since you last visited a dentist or dental clinic for any reason?” and dichotomized responses to “within the past year” versus not.

Analytical Strategy

A conceptual model depicting the hypothesized associations between possible differences in intended versus actualized child oral health-related behaviors and oral health literacy and knowledge, dental neglect and self-efficacy is presented in the Figure. Due to the small sample size of our follow-up cohort we aimed to study changes in the hypothesized mediators between T1 and T2 instead of conducting formal mediation or moderation analyses.

Analytical approach for Aim 1

We used descriptive statistics including frequencies and proportions to examine the distribution of COHR behaviors during (intended) and after pregnancy (actualized). We examined the entire spectrum of reported frequencies (*i.e.*, for frequency of juice consumption: never/once in a while/occasionally/once a day/more than once a day) as well as dichotomous arbitrary definitions of ‘favorable’ versus ‘deleterious’ behaviors (*i.e.*, occasionally or less frequent versus daily or more frequent). Determination of these thresholds was guided by the distribution of responses - merging strata with small numbers -, as well as substantive assessments of favorable versus unfavorable behaviors. Initially, we inspected counts and frequencies of intended *versus* actualized COHR behaviors using contingency tables (Appendix B, Table B1). Subsequently, we specifically examined the proportion of actualized behaviors, e.g., the proportion of participants who performed an intended behavior [$B / (B + D)$, in Table B1].

To summarize participants’ actualized behaviors we created an index enumerating their reports of positive actualized behaviors (Actualized Behavior Index, ABI). The index had a theoretical range from 0 (no actualized behaviors) to 5 (maximum number of actualized intended behaviors). We examined the association of this index’s score with participants’ demographic characteristics using X^2 tests as well as with oral health literacy and knowledge, dental neglect and self-efficacy using analyses of variance (ANOVA) and a conventional $p < 0.05$ statistical significance criterion.

Analytical approach for Aim 2

Distributions of oral health literacy, oral health knowledge, dental neglect and self-efficacy were examined initially means and standard deviations. Changes in these measures were

classified based on their direction (numbers and proportions of positive change, no change and negative change) and were stratified by dental attendance (timing of last dental visit). We formally tested for changes between T1 and T2 using paired t-tests and a conventional $p < 0.05$ statistical significance criterion.

RESULTS

The demographic characteristics of our study sample are presented in Table 1. Of the 119 individuals interviewed at T1, 48 were available for a follow-up interview at T2, a follow-up rate of approximately 40%. The sample was diverse with 44% White, 40% African American and 17% American Indian women, who were predominantly (83%) single. With the exception of education, no other important differences were noted between participants who were successfully followed and those who were lost to follow-up. As expected, participants with higher education were more likely to remain in the cohort. Nevertheless, approximately half of the respondents in T2 had a high school level education or less.

Table 2 presents the correspondence between intended and actualized child oral health-related behaviors for individuals who remained in the follow-up cohort and thus were interviewed at T2. Two-thirds of caregivers who intended to limit the number of times their child would consume fruit juices to one per day or less realized that intention (12/36). A smaller proportion realized positive behaviors regarding sweet snacks (11/43). Nighttime bottle use, daily brushing and use of fluoridated toothpaste were realized at higher rates: 76% (35/46), 90% (37/41) and 58% (15/26), respectively.

Noteworthy, the actualized behavior index score ranged between 1 and 4, indicating that all women realized at least one behavior, none realized all 5 possible and most realizing 2 or 3 intended behaviors. We found no important association between sociodemographic characteristics and realized behaviors (Table 3). Although we found no statistically significant association between the index and oral health literacy, knowledge, dental neglect and self-

efficacy, we noted that women with only 1 (lowest) actualized behavior had the lowest scores in oral health literacy and knowledge and the highest dental neglect.

With regard to other longitudinal changes, health literacy improved substantially, by 3.5 points between T1 and T2 ($p < 0.0005$) and 83% of women improving their score (Table 4). Virtually no changes were noted for the 3 other measures. When we explored all pairwise correlations between all 4 measures and the actualized behavior index, we found that only dental neglect and oral health knowledge were significantly inversely associated ($r = -0.36$) (Supplemental Table S1). We found no important associations between dental attendance and changes in oral health literacy and knowledge. Nevertheless, dental neglect ($P = 0.1$) and self-efficacy scores ($P = 0.04$) were more favorable among women who reported a visit within the last year (40%) versus those who reported a visit 2 years ago or more (60%) (Table 5).

DISCUSSION

This investigation is the first to juxtapose and contrast intended versus actualized child oral health-related behaviors in a cohort of first-time pregnant mothers. Our findings indicate that there can be modest expectations of first-time pregnant women actualizing intended positive child oral health behaviors. Tooth brushing/cleaning and use of fluoride toothpaste appeared as feasible goals for the participating women, while only about a quarter of them were able to realize their intentions regarding their children's sweet snacking frequency. While the reasons and influences underlying these behaviors need to be investigated systematically, some implications for prevention are apparent: for preventative messages during the pre-partum period to be useful, caregivers must be able to both recollect and implement the recommendations given to them during that time. It is difficult to predict how much of the preventative information individuals are able to retain and, even more importantly, act upon.

Once the demands of daily living begin to influence the decisions of our participants it is reasonable to expect that not all of the intended child oral health-related behaviors would be actualized. Individuals from lower socioeconomic backgrounds, like ones in this study, have to overcome daily barriers related to poverty, poor health, unstable work conditions and increased stress (American Psychological Association, 2015). These factors, along with values and attitudes related to perceptions of the importance of oral health, can lead to poor oral health outcomes for children from lower socioeconomic backgrounds (Kelly *et al.*, 2005; Mofidi *et al.*, 2002). Despite all of these mentioned obstacles, our study suggests that overall there is a strong

relationship between caregivers' intentions and implementation for most positive child oral health-related behaviors examined.

Caregivers were highly likely to realize their intentions with regards to decreased juice consumption, nighttime bottle-feeding and regular tooth brushing with their children. These particular behaviors appear to be less challenging for caregivers to incorporate in their daily lives. As such, these topics remain good areas of focus during prenatal preventative discussions because the chance of a caregiver performing the ideal child oral health-related behavior is high.

Despite the American Academy of Pediatric Dentistry's recommendation for all children to use fluoridated toothpaste twice daily (American Academy of Pediatric Dentistry Committee on Scientific Affairs, 2014-15a), the attitudes about fluoride exposure among the cohort appears to be varied. When asked about fluoride exposure, a higher percentage of caregivers did not realize this intended behavior when compared to the previously mentioned categories (33% realized the intention compared to 25% that did not). It should be mentioned that with this particular behavior 30% of individuals never had the intention of using fluoridated toothpaste and never implemented the behavior of using fluoridated toothpaste. Because of the wide array of understanding, this particular topic should be an important area of focus during preventative messages delivered during the prenatal period.

With regard to feeding practices, specifically the likelihood that they would give their child sweet snacks, caregivers were far more likely not to actualize their intended behavior. Sixty-seven percent of participants did not actualize their intention to limit sweet snacks compared to 23% of those who did actualize their intention to limit this behavior. This area was the only area of focus in which the intention was not a good predictor of actualized behavior. Along with the deleterious effects that increases in sugar and carbohydrate consumption can

have on the dentition, consumption of these types of foods also play an important role in the obesity epidemic that our nation is currently facing. Thorough education on the importance of maintaining a healthy diet low in sugary foods and carbohydrates should be discussed not only during the prenatal interventions but should continue throughout the lifetime of the child (American Academy of Pediatric Dentistry Committee on Scientific Affairs, 2014-15b).

The distribution of the ABI was roughly normal. Every individual that was interviewed at T2 actualized at least one intended behavior, with a majority of individuals actualizing two or three behaviors. Seventeen percent of individuals actualized 4 of the 5 behaviors and there were no participants that implemented all of the behaviors. No correlation was noted between age, level of education, race or marital status and an individual's ability to implement an intended behavior. However, it was noted that women with only 1 actualized behavior had the lowest scores in OHL and OHK as well as the highest scores of DN. Dental neglect and OHK were significantly inversely associated when evaluating pairwise correlations and the ABI; therefore if someone had increased OHK they were less likely to have increased DN.

There was a statistically significant improvement in OHL scores, with 83% of caregivers improving their score. This can be explained by the likely intervention that individuals received when they participated in programs such as Early Head Start and WIC. Improvement in OHL is also likely explained by the fact that it is merely a word-recognition test and not application of a concept.

Examination of changes in OHL and OH did not reveal any relationship with the caregiver's own dental attendance. However, DN and SEF were more favorable among those caregivers that visited the dentist within the past year when compared to caregivers that reported a visit to the dentist 2 or more years ago. The improved DN score with more recent dental care

among caregivers is to be expected. It must be mentioned that during the survey instrument we did not designate whether or not these dental visits were of emergency origin or for recall visits and regular care, which could further influence the relationship between OHL, OHK, DN and SEF with type and regularity of dental visits.

While this study is novel in its exploration of child oral health-related behaviors, similar research has been conducted with regards to first-time mothers' intentions to breastfeed. Studies have shown a correlation with ability to implement or continue breastfeeding and education and race, with individuals from lower educational attainment and minority backgrounds being less likely to continue with breastfeeding (Buxton *et al.*, 1991). However, our study did not find similar correlations. This can be explained by the difference in feasibility of implementing child oral health-related behaviors compared with the feasibility of breastfeeding for a period of time.

Much of the literature regarding breastfeeding practices recommends increased support and education during the prenatal period to increase successful implementation of optimal child health-related behaviors. Similar strategies should be utilized to support continued and improved rates of implementation of child oral health-related behaviors. Based on our findings, preventative messages should be focused not only on the benefits of ideal oral health behaviors but also the benefits of living an overall healthy lifestyle. First-time mothers could benefit from specific strategies to overcome the demands of having a newborn or small child and ways in which to incorporate favorable behaviors into their daily lives. For example, providers could discuss the importance of establishing bedtime routines early in the lifetime of the child and practical ways in which to accomplish that behavior along with incorporation of positive child oral health-related behaviors nightly.

The findings of our study should be considered with the limitations in mind. Our sample size of the follow-up cohort was small, representing a follow-up rate of 40%. The population that we were examining presented specific challenges with follow-up, namely individuals from low socioeconomic groups tend to be more likely to have a change in address, phone number and other pertinent contact information. Frequently participants from T1 did not respond to requests for a second interview. If a second interview was scheduled the individual often did not show for the visit. The literature demonstrates a higher no-show rate for this population, with transportation, child-care and attitudes towards the importance of such appointments as notable barriers to follow-up (Kelly *et al.*, 2005; Mofidi *et al.*, 2002). Also, it should be noted that some mothers had a miscarriage or lost primary custody of the child. Despite these issues, analysis of the T1 and T2 groups demonstrate that, with the exception of education, they are very similar in their demographic characteristics.

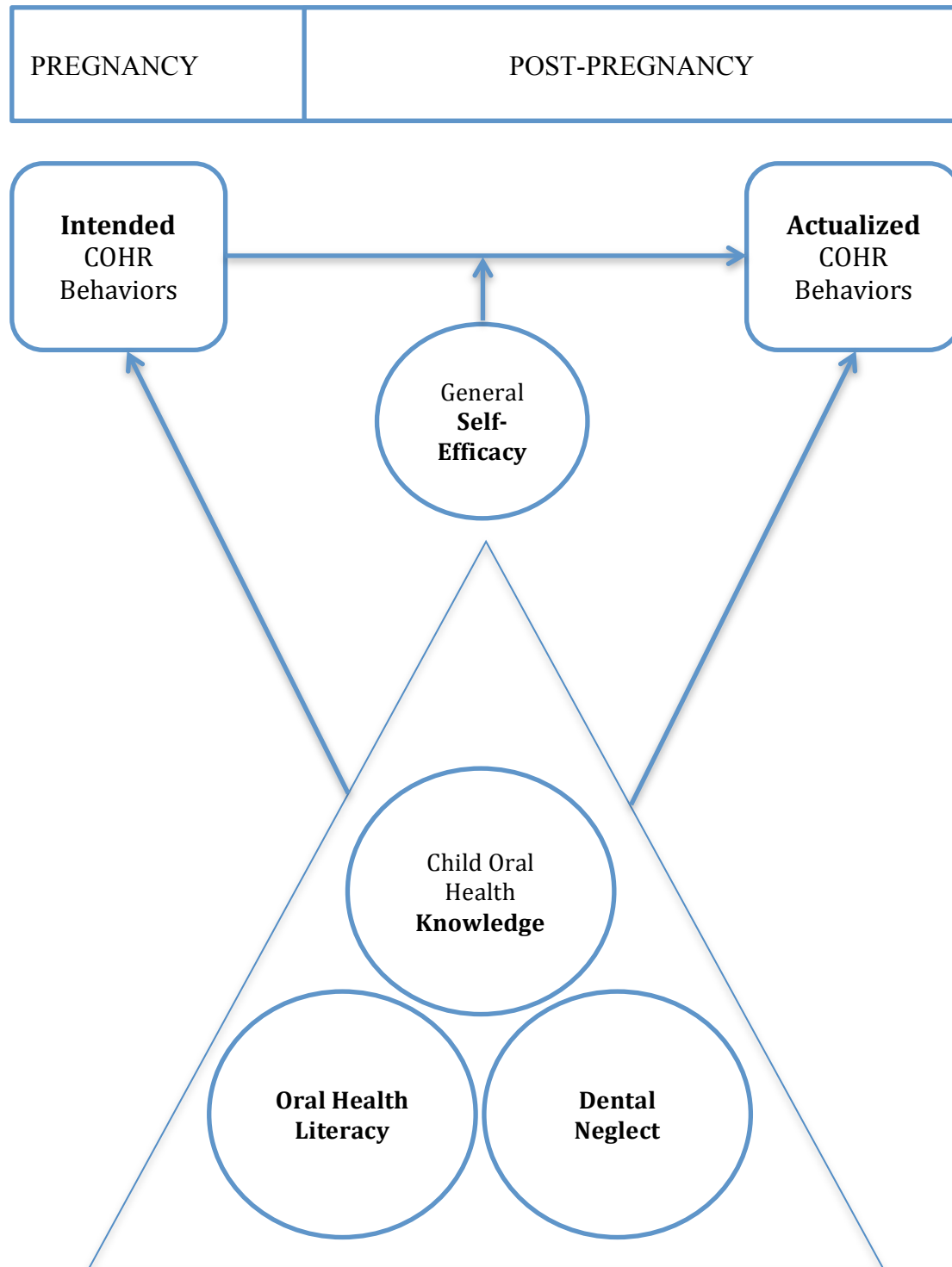
Our subjects were recruited from a nonprobability convenience sample from seven WIC sites across the state of North Carolina. WIC was established by the USDA Food and Nutrition Service as a supplemental nutrition service, as well as a source of health care referrals and education about the importance of healthy eating for qualifying individuals from low-income backgrounds (US Department of Agriculture, Food and Nutrition Services, 2015). The demographics of the WIC population and its large audience, serving over 53% of infants born in the United States (US Department of Agriculture, Food and Nutrition Services, 2015), make it a very important group to study. The findings are not generalizable beyond the population of participants at the particular WIC sites that were surveyed. However, we do know that populations of participants at WIC sites both across the state of North Carolina and across the United States tend to have similar characteristics. Furthermore, this specific population

represents the demographic with the highest proportion of early childhood caries. This population would benefit most from targeted preventative efforts aim at reducing the disease burden within the population. More insight into how they understand information regarding oral health behaviors and implement those specific behaviors would help to understand how to effectively construct preventative messages targeting this group.

To date, no studies have explored the realization of child oral health-related behaviors in a cohort of first-time pregnant mothers. Our research suggests that prenatal preventative messages do have merit and that first-time mothers are likely to implement some but not all positive behaviors if they have the intent to do so during pregnancy. Future research should focus on interventions examining specific messages to help mothers increase their knowledge and develop the coping skills necessary to carry out optimal oral health behaviors for their children.

FIGURE 1

Conceptual model depicting possible associations of intended and actualized child oral health-related (COHR) behaviors with mothers' general child oral health-related knowledge, oral health literacy, dental neglect, and general self-efficacy.



TABLES

Table 1. Demographic Information. Descriptive demographic information of the first-time pregnant women cohort in the Carolina Oral Health Literacy study at the baseline interview.				
		Entire cohort* (n = 119)	Followed-up (n = 48)	P [†]
		n (%) or mean (SD)	n (%) or mean (SD)	
Age (years; at baseline)		22.2 (3.9)	22.0 (4.1)	0.7
Race				
	White	52 (44)	21 (44)	1.0
	African American	47 (40)	19 (40)	
	American Indian	20 (17)	8 (17)	
Education				0.02
	Less than high school	30 (25)	10 (21)	
	High school or general education degree	36 (30)	13 (27)	
	Some college	47 (40)	19 (40)	
	College or more	6 (5)	6 (13)	
Marital status				0.4
	Single	96 (81)	40 (83)	
	Married	16 (13)	6 (12)	
	Divorced/ separated/ other	6 (5)	1 (2)	
	No response	1 (1)	1 (2)	
County of Residence				0.8
	Buncombe	8 (7)	2 (4)	
	Burke	3 (3)	1 (2)	
	New Hanover	12 (10)	5 (10)	
	Orange	12 (10)	7 (15)	
	Robeson	31 (26)	13 (27)	
	Wake	53 (45)	20 (42)	
Oral health knowledge		4.8 (1.0)	4.7 (1.0)	0.7
Oral health literacy		16.4 (5.0)	16.7 (4.3)	0.6
Dental neglect		11.9 (3.3)	12.0 (3.4)	0.9
General self-efficacy		33.3 (3.8)	33.2 (4.2)	0.8
*after exclusions; cohort description reported in Hom <i>et al.</i> , 2012				
†derived from t-test for age and X ² tests for categorical variables comparing participants followed-up with those lost to follow up				

Table 2. Correspondence between intended and actualized child oral health-related behaviors. These values were among the cohort of 48 first-time pregnant women in Carolina Oral Health Literacy study.		
	Actualized behavior (T2), n (%)	
Intended behavior (T1)	“How often does your child drink fruit juices (any kind)?”	
“How often do you think your child will drink fruit juices (any kind)?”	Once a day or less	More than once a day
Once a day or less	24 (50)	12 (25)
More than once a day	5 (10)	7 (15)
	“How often does your child receive sweet snacks?”	
“How often do you think your child will receive sweet snacks?”	Occasionally or less frequently	Daily or more frequently
Occasionally or less frequently	11 (23)	32 (67)
Daily or more frequently	0 (0)	5 (10)
	“Do you put your child to bed with a bottle?”	
“Do you think you will put your child to bed with a bottle?”	Never/sometimes	Usually
Never/sometimes	35 (73)	11 (23)
Usually	1 (2)	1 (2)
	“Do you brush or clean your child’s teeth or gums every day?”	
“Do you think you will brush or clean your child’s teeth or gums every day?”	Yes	No
Yes	37 (77)	4 (8)
No	4 (8)	3 (6)
	“Do you use fluoridated toothpaste when brushing your child’s teeth?”	
“Do you think you will use fluoridated toothpaste when brushing your child’s teeth?”	Yes	No
Yes	15 (33)	11 (24)
No	6 (13)	14 (30)

Table 3. Actualized Behaviors Index (ABI). The distribution of the ABI and its association with demographic information, oral health knowledge, health literacy, dental neglect and self-efficacy measured at baseline, among the cohort of 48 first-time pregnant women in Carolina Oral Health Literacy study

	Actualized behaviors				P [†]
	1	2	3	4	
	n (col.%) or mean (SD)	n (col.%) or mean (SD)	n (col.%) or mean (SD)	n (col.%) or mean (SD)	
Entire sample	8 (17) [*]	14 (29) [*]	18 (37) [*]	8 (17) [*]	
Age (years; at baseline)	22.0 (3.6)	21.0 (2.4)	22.9 (5.1)	21.9 (4.7)	0.6
Race					
White	2 (25)	6 (43)	9 (50)	4 (50)	0.9
African American	4 (50)	6 (43)	6 (33)	3 (28)	
American Indian	2 (25)	2 (14)	3 (17)	1 (12)	
Education					0.6
Less than high school	1 (12)	3 (21)	4 (22)	2 (25)	
High school or general education degree	3 (38)	5 (36)	3 (17)	2 (25)	
Some college	2 (25)	6 (43)	7 (39)	4 (50)	
College or more	2 (25)	0 (0)	4 (22)	0 (0)	
Marital status					0.4
Single	7 (87)	10 (71)	16 (89)	7 (87)	
Married	1 (13)	3 (21)	2 (11)	0 (1)	
Divorced/ separated/ other	0 (0)	0 (0)	0 (0)	1 (12)	
No response					
County of Residence					0.7
Buncombe	0 (0)	1 (7)	0 (0)	1 (12)	
Burke	0 (0)	0 (0)	0 (0)	1 (12)	
New Hanover	1 (12)	2 (14)	2 (11)	0 (0)	
Orange	1 (12)	2 (14)	3 (17)	1 (12)	
Robeson	3 (38)	5 (36)	4 (22)	1 (12)	
Wake	3 (38)	4 (29)	9 (50)	4 (50)	
Oral health knowledge	4.6 (0.9)	4.8 (1.3)	4.7 (1.0)	4.8 (0.9)	0.9
Oral health literacy	15.5 (2.1)	17.2 (4.8)	16.7 (4.4)	16.9 (5.2)	0.8
Dental neglect	13.2 (4.4)	12.6 (2.3)	10.9 (3.6)	11.9 (3.1)	0.3
General self-efficacy	32.5 (5.6)	32.4 (3.1)	34.3 (4.3)	33.1 (4.3)	0.6
*row percentage					
†derived from ANOVA for continuous variables and X ² tests for categorical variables					

Table 4. Changes in Variables. Changes in oral health knowledge, literacy, dental neglect and self-efficacy among the 48 first-time pregnant women in the Carolina Oral Health Literacy study, between the baseline (T1) and the follow-up (T2) interviews.

	T1 mean, SD	T2 mean, SD	P [†]		improved (n, %)	no change (n, %)	worsened (n, %)
OH Knowledge*	4.7 (1.0)	5.1 (1.0)	0.08		17 (36)	20 (43)	10 (21)
OH Literacy	16.7 (4.3)	20.3 (5.5)	<0.0005		40 (83)	3 (6)	5 (10)
Dental Neglect*	12.0 (3.4)	11.6 (2.7)	0.5		21 (45)	6 (13)	20 (43)
General Self-Efficacy	33.2 (4.4)	33.9 (3.5)	0.2		19 (40)	9 (19)	20 (42)
*derived from paired t-tests							
†one participant with missing data at follow-up							
SD, standard deviation							

Table 5. Correlation with last dental visit. Changes in oral health literacy, oral health knowledge, dental neglect and general self-efficacy stratified by time since last dental visit as assessed at follow-up.

		How long has it been since you last visited a dentist or dental clinic for any reason? Within the past:		
		1 year	2 years or more	P*
		n (col. %) or mean, SD	n (col. %) or mean, SD	
T2 sample		29 (60) [†]	19 (40) [†]	
Change in OHL				0.2
Improved		24 (83)	16 (84)	
Stable		3 (10)	0 (0)	
Worsened		2 (7)	3 (16)	
Mean baseline OHL		16.7 (4.5)	16.7 (4.1)	0.1
Change in OHK				0.9
Improved		11 (38)	6 (33)	
Stable		12 (41)	8 (44)	
Worsened		6 (21)	4 (22)	
Mean baseline OHK		4.8 (1.0)	4.6 (1.0)	0.4
Change in DN				0.8
Improved		12 (41)	7 (39)	
Stable		4 (14)	2 (11)	
Worsened		13 (45)	9 (50)	
Mean baseline DN		11.3 (3.5)	12.9 (3.0)	0.1
Change in SEF				0.9
Improved		11 (38)	8 (42)	
Stable		6 (21)	3 (16)	
Worsened		12 (41)	8 (42)	
Mean baseline SEF		34.2 (3.7)	31.7 (4.5)	0.04
*corresponding to X^2 tests for categorical variables and t test for continuous ones †row percentage SD, standard deviation OHL, oral health literacy OHK, knowledge score DN, dental neglect score SEF, general self-efficacy				

APPENDIX A: SURVEY INSTRUMENTS

Part I. Child oral health behavior items (Douglass *et al.*, 2001). (The italicized question reflects the intended behavior question and the non-italicized question reflects the actualized behavior.)

Questions	Responses
<i>“How often do you think your child will drink fruit juices (any kind)?”</i> “How often does your child drink fruit juices (any kind)?”	<ul style="list-style-type: none"> • Never • Once in a while (once a month or less) • Occasionally (once a week) • Once a day • More than once a day
<i>“How often do you think your child will receive sweet snacks?”</i> “How often does your child receive sweet snacks (candy, chocolate, raisins, etc.)?”	<ul style="list-style-type: none"> • Never • Once in a while (once a month or less) • Occasionally (once a week) • Once a day • More than once a day
<i>“Do you think you will put your child to bed with a bottle?”</i> “Do you put your child to bed with a bottle?”	<ul style="list-style-type: none"> • Never • Sometimes • Usually
<i>“Do you think you will brush or clean your child’s teeth or gums every day?”</i> “Do you brush or clean your child’s teeth or gums every day?”	<ul style="list-style-type: none"> • Yes • No
<i>“Do you think you will use fluoridated toothpaste when brushing your child’s teeth?”</i> “Do you use fluoridated toothpaste when brushing your child’s teeth?”	<ul style="list-style-type: none"> • Yes • No • Child has no natural teeth

Part II. Oral health knowledge items (Shick *et al.*, 2005; Mathu-Muju *et al.*, 2008)

Questions	Responses
Cleaning baby teeth is not important because they fall out anyway.	<ul style="list-style-type: none">• Agree• Disagree• Don't know
A child's overall health does not depend on whether (s)he has cavities in baby teeth.	
Fluoride disinfects water and makes it safe to drink.	
A cavity in a baby tooth should be filled only when it hurts.	
Fluoride helps prevent tooth decay.	
Tooth decay in baby teeth can cause infections that can spread to the face and other parts of the body.	

Part III. The REALD-30 instrument (Lee *et al.*, 2007)

Interviewers' script: "Now, I am going to show you some words that dentist use in giving instructions to their patients. I would like you to read the words out loud. Don't worry if you do not know the word. If you do not know the word, please just say, "don't know" or "Skip". Please don't guess. It is o.k. to skip. This will help us determine what words dentist should use when speaking with their patients."

1. Sugar	_____	11. Abscess	_____	21. Periodontal	_____
2. Smoking	_____	12. Extraction	_____	22. Sealant	_____
3. Floss	_____	13. Denture	_____	23. Hypoplasia	_____
4. Brush	_____	14. Enamel	_____	24. Halitosis	_____
5. Pulp	_____	15. Dentition	_____	25. Analgesia	_____
6. Fluoride	_____	16. Plaque	_____	26. Cellulitis	_____
7. Braces	_____	17. Gingiva	_____	27. Fistula	_____
8. Genetics	_____	18. Malocclusion	_____	28. Temporomandibular	_____
9. Restoration	_____	19. Incipient	_____	29. Hyperemia	_____
10. Bruxism	_____	20. Caries	_____	30. Apicoectomy	_____

Part IV. The Dental Neglect scale (Thomson and Locker, 2000; Jamieson and Thomson, 2002)

Questions	Responses
<p>Please answer the following questions about your own personal dental care:</p> <ul style="list-style-type: none">• I keep up with my dental care at home• I receive the dental care I should• I need dental care, but I put it off• I brush as well as I should• I control snacking between meals as well as I should• I consider my dental health to be important	<ul style="list-style-type: none">• Definitely not• Probably not• Probably yes• Definitely yes• Don't know

Part V. The General Self-Efficacy scale (Schwarzer and Jerusalem, 1995)

Questions	Responses
I can always manage to solve difficult problems if I try hard enough.	<ul style="list-style-type: none">• Not at all true• Hardly true• Moderately true• Exactly true
If someone opposes me, I can find the means and ways to get what I want.	
It is easy for me to stick to my aims and accomplish my goals.	
I am confident that I could deal efficiently with unexpected events.	
Thanks to my resourcefulness, I know how to handle unforeseen situations.	
I can solve most problems if I invest the necessary effort.	
I can remain calm when facing difficulties because I can rely on my coping abilities.	
When I am confronted with a problem, I can usually find several solutions.	
I am in trouble, I can usually think of a solution.	
I can usually handle whatever comes my way.	

Part VII. Mothers' self-reported dental health item (NHANES)

Question	Response
How long has it been since you last visited a dentist or dental clinic for any reason?	<ul style="list-style-type: none">• Within the past year (anytime less than 12 months ago)• Within the past 2 years (1 year but less than 2 years ago)• Within the past 5 years (2 years but less than 5 years ago)• 5 or more years ago• Don't know / not sure• Never• Refused

APPENDIX B: SAMPLE TABLE

Sample table for presenting and examining the correspondence between intended and actualized child oral health-related (COHR) behaviors.

Table B1.			
Actualized behavior	Intended behavior		
Do you brush or clean your child's teeth or gums every day?	No	Yes	Actualized behaviors proportion = $D / (B + D)$
No	A	B	
Yes	C	D	

APPENDIX C: SUPPLEMENTAL TABLE

Table SI. Pairwise correlations of changes in oral health knowledge, oral health literacy, dental neglect, general self-efficacy, and ‘actualized behaviors score’ among the cohort of 48 first-time pregnant women in Carolina Oral Health Literacy study				
	OH Knowledge	OH Literacy	Dental neglect	General Self-efficacy
Oral health literacy	-0.06	1.00		
Dental neglect	-0.36*	0.18	1.00	
General self-efficacy	0.06	0.12	-0.03	1.00
Actualized behaviors score	-0.16	-0.14	0.07	0.01
*denotes nominally statistically significant correlation; none was statistically significant after a Sidak correction for multiple testing				

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