Pediatric Oral Health Initiative

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Abstract

Oral health in the pediatric population is an overlooked topic in primary care, yet it is vital to their overall health. Dental caries, otherwise known as cavities, are a significant problem among the pediatric population. Dental caries is the most common non-transmittable disease across the globe. Dental caries can have painful effects that can lead to serious health implications and reduce the quality of life. Prevention is key when addressing dental caries and oral health care. Oral health prevention and education should begin early on in life and continue throughout the lifetime. Pediatricians and primary care practitioners play a vital role in the prevention identification, and treatment of dental caries. Individuals in these care roles must become familiar with dental caries and the best evidence-based practices. Furthermore, these health care providers can have an active role in policy creation and change within the community to address the issue. In a north valley pediatric office in Phoenix, Arizona, a project was conducted to help improve oral health in the pediatric population. The project consisted of a well-child template modification at the 9-month well-child visit that would prompt providers to encourage a dental visit by the 12-month appointment. The results were limited, and the outcomes were not statistically significant. A recommendation for future studies will be to verbalize the recommendation and provide a handout or recommend a specific pediatric dentist.

Keywords: pediatrics, oral health, dental caries, primary care

Project Report: Pediatric Oral Health Initiative

Background and Significance

The most common chronic disorder in the pediatric population is tooth decay and dental cavities (WHO, 2017). Many parents are unaware of the importance of maintaining healthy primary teeth and the consequences cavities may have on their child's future. There is a high prevalence of cavities in the pediatric population and a need for intervention.

The purpose of this project was to educate providers regarding the recommended oral health guidelines and to implement a template change to guide providers when they present oral health anticipatory guidance. The American Academy of Pediatrics (2018) and the American Academy of Pediatric Dentistry (2016) recommend parents establish a dental home for their children by the child's first birthday. The project changed the practice from making the recommendation at the 18-month well-child visit, to making the recommendation at the 9-month well-child visit. The overall aim of the project was to identify if provider education in conjunction with modifying the 9-month well-child template to incorporate national guidelines would increase the prevalence of children being taken to the dentist by their 12-month well-child visit.

It is important to address this problem because it is affecting children locally, nationally, and globally. Over one-quarter of children between the ages of 2 and 8 years of age, and more than one-half of all adolescents over the age of 12 years of age, will have a minimum of one cavity (Clark & Clark, 2018; Nelson, Slusar, Albert & Riedy, 2017). Similar to the findings by the World Health Organization, dental decay is the most common disease among children in Arizona (Arizona Department of Health Services, 2015). Furthermore, in 2015 it was reported that over 60% of third graders in Arizona suffered from dental caries (ADHS, 2015).

The pediatric office that hosted the change project did not have the hard data to support this claim. However, providers reported a pervasiveness of poor oral health among their pediatric population and support for the project.

After examining the evidence and listening to the reports made by the pediatric providers at a local pediatric primary care office, a clinically relevant PICOT question was developed. The PICOT question asked: "Does provider education regarding oral health anticipatory guidelines and template changes increase the number of children that see the dentist by their 12-month well-child visit?"

Evidence Synthesis

Before beginning the search for information regarding oral health in the pediatric population, certain search criteria were established. The search criteria included: the article should be written in the English language, published within the past five years, and peer-reviewed. The most pertinent information was found on the Arizona State University online journal databases, CINAHL Plus with Full Text, Cochrane Library, and PubMed. Several searches were made in CINAHL Plus, and the more terms that were searched, the more results were yielded. For example, a search for "pediatric" OR "children" AND "dental caries" OR "cavities" AND "primary care" AND "parents" OR "guardians" yielded over 20,000 results. The final search was comprised of a search for "pediatric" AND "dental caries" AND "primary care," which yielded 13 results.

Cochrane is a database that has systematic reviews. The most successful search on Cochrane consisted of a search for "pediatric dentistry" AND "primary care" AND "dental caries" OR "cavities." This search generated 27 results that were published within the past five years. When searching on PubMed, it was identified that the more terms led to more specific

results. A search for "pediatric" AND "dental caries" OR "oral health" had a return of over

26,000 results. The final search included a search for "pediatric" AND "dental caries" AND

"oral health" AND "children" AND "primary care" AND "teeth" AND "cavities." This search

produced 32 results. There was no grey literature used for this paper; however, some of the

information used was obtained from organizational, local, government, and international

websites. The criteria remained the same; although there was guaranteed evidence to the peer-

reviewed status of a website, all information came from reputable government or educational

sources.

Ten studies were used for this evidence-based project. The studies were established as

high quality and evidence-based material through the Fineout-Overholt and Melnyk's rapid

critical appraisal (2011). All the articles varied in their strength of evidence. There were three

cross-sectional studies, one randomized control trial and a study that compared two randomized

control studies. One of the articles was qualitative, another study was descriptive, and another

was an evaluation study (Appendix A). One article used previous data that was obtained through

an electronic medical record. Interestingly the last study assessed a mandated law that reviewed

the outcomes of the required intervention. Approximately one-half of the studies did not use a

model or conceptual framework. Typically, nursing journals incorporated a model or framework.

There were no repeats of frameworks or models. One article used the Common Sense Model of

Self-Regulation (CSM) another used the Plan-Do-Study-Act model, and another used Bandura's

Social Cognitive Theory (Appendix A). The studies had similar characteristics regarding

demographics, with the exception of one. The participants comprised of male and female

children ranging in age from infancy to adolescence (Appendix A). In some of the studies, the

parents, or at least the mother were included as a co-participant.

All studies aimed to address the issue of poor oral hygiene and the development of dental caries in the pediatric population. However, the assessment tools, and the results, were heterogeneous. While several researchers focused on patient and parental perception of oral health, other researchers identified solutions to improve oral health in children (Appendix A & B). One study was a bit of an outlier in comparison to the others because the aim was to improve provider knowledge through the use of interdisciplinary education. The authors of these works denied any bias and reported where they obtained funding and for their company or organization affiliation. Most authors provided evidence of validity and reliability by providing a confidence interval, power, and effect size.

The surmounting evidence from the World Health Organization, Arizona Department of Health Services, and the American Academy of Pediatric Dentistry laid the foundation for the project. The information gathered from these organizations supported the need for an intervention to address dental caries in the pediatric population. The evidence gathered from the 10 studies helped guide this project with the selection of a target population and the intervention. Many of the studies focused on educating parents while one focused on educating providers. With this information, it was decided that providers would be making recommendations to parents based on national guidelines and education they have received, with the modification of a well-child template.

Theoretical Framework and Implementation Framework

The evidence-based practice model chosen for this project was the Stetler Model. The Stetler Model is considered a "prescriptive" model that takes current evidence-based research and incorporates it into practice to address a problem, issue, or gap (Stetler, 2001). The model has five phases: preparation, validation, evaluation/decision-making, translation/application, and

evaluation (Stetler, 2001). This model guided the application of evidence-based practices in the

practice. An exhaustive search for the literature was performed, and evidence to support a change

project was collected. A problem was recognized, and desirable outcomes were identified. The

literature and providers at the pediatric practice supported the need for an intervention. A chart

audit was used and validated by using information from charts transcribed by two different

providers. The intervention included implementing national guidelines through provider

education and template modification. The change project change was measured for effectiveness.

Bandura's theory of self – efficacy is the conceptual framework that was used for the

project. According to Bandura (1977, 1986) the theory "…conceptualizes person- behavior –

environment interaction as a triadic reciprocality, the foundation for reciprocal determinism" (as

cited in Resnick, 2014). Bandura (1977, 1986) proposes that an individual's self-perception is

shaped by the outcomes of their actions, through the observation of other people's experiences,

through the opinions of others, and through deductions they have made from current knowledge

(as cited in Resnick, 2014). Many of the studies used for this review had one or two populations

of interest, and that included the child and or the parent. The self-efficacy theory can be applied

to the provider and or parent. This theory was used to empower providers to promote

preventative health. The providers can also use it for the parents. Parents may feel overwhelmed,

but with the use of this theory, providers assisted parents by building upon current ideas parents

may have about oral health and advocating for early dental visits.

The project was also supported by Kurt Lewin's change theory, which describes the

three phases that occur in a change: unfreezing, change, and refreezing (Nursing Theory, 2016).

This project required the DNP student and the staff at the pediatric office to stop, evaluate the

current practice, implement a new evidence-based practice change, and then continue with the

practice change, if it does not pose harm. In some cases, change is a slow process consisting of

people at various stages of support for the change. The innovation theory suggested that there

would be some people that would be eager to support the change, while others would need more

time before supporting a change (LaMorte,2019). Many of the providers were supportive of the

practice change; however, there was concern that the parents would be resistant to the

recommendation.

Methods

Before implementation, a project, the project must be reviewed to ensure the safety and

well-being of all parties involved. The project must be deemed ethical and must not cause harm

or withhold benefits from individuals. Before the implementation of this project, Arizona State

University's Institutional Review Board (IRB) examined the project details. In early October, the

project was approved by the IRB. The project was implemented at a local pediatric primary care

clinic in Glendale, Arizona and aimed to educate providers about the American Academy of

Pediatrics and the American Academy of Pediatric Dentistry clinical guideline recommendations

regarding oral health anticipatory guidelines. The guidelines state, a child should have their first

dental visit by their first birthday (AAP 2018; AAPD, 2016). The current practice at this local

pediatric office was to recommend a dental visit at an 18-month well-child visit. In addition to

educating the providers, a template modification was made on the 9-month well-child template.

The modification reminds providers to encourage parents to take their child to the dentist by the

12-month well-child visit. It was hypothesized that the education and template modifications

would lead to more recommendations to the dentist and an increase in visits to the dentist before

the child's 12-month well-child visit. The project aim was to benefit pediatric providers, parents,

and the health of infants and children. Also, it was anticipated that pediatric providers would

have more knowledge regarding oral health recommendations, and parents would be empowered with the knowledge obtained from the pediatric providers. The hope was that with the increase in early dental visits, there would be fewer dental caries for pediatric patients in the future. The project did not require any funding. No additional provider time was required. Provider education and project execution were performed during regular business hours. No additional materials were needed for the implementation of this project.

To measure the effectiveness of the change project; dental visit status was recorded before the project change and after the project change. The change project was implemented on Monday, October 7th across the four different pediatric practice locations. Two nurse practitioners were recruited for the project, and both agreed to have their charts audited. The nurse practitioners agreed to ask about dental visit status at the 12-month visit and recommend visiting a dentist at the 9-month well-child visit. Three months after the intervention was implemented, the nurse practitioners began asking parents at the 12-month visit if they had taken the child to the dentist. These parents had received the recommendation at the 9-month well-child visit. The pre-intervention group consisted twenty-two 12-month old infants whose parents did not receive the recommendation at the 9-month well-child visit. The post-intervention group consisted of twelve 12-month old infants whose parents received the recommendation at the 9-month well-child visit. The DNP student recorded parent responses in a chart audit form. The chart audit recorded the nurse practitioner's ID number, the patient's ID number, age, and dental visit status. The two groups were then compared. The project methods are listed step-by-step with a timeline below:

A. Providers educated about national guidelines via email on October 4th, 2019.

1. Guidelines explained: children should be established at a dental home by their first birthday.

2. Discussed modifications made on a 9-month well child template.

3. Encouraged providers to update parents regarding the national guidelines and recommend the patient see a dentist before their next well-child exam at 12 months.

B. Change the template – DNP student and site champion made changes to the template on October 4th, 2019.

1. Anticipatory guidance added to the 9-month well-child template.

2. The anticipatory guidance reminds/notifies the provider to encourage the parent to find a dentist that takes pediatric patients and establish care with a dentist they feel comfortable with.

C. Action – Project Launch October 7th, 2019

1. Participating providers asked parents of patients arriving for their child's 12-month well-child visit if their child has had their first dental visit.

2. Providers advise parents at the 9-month well-child visit that the child visits the dentist before their next well-child visit at 12-months.

3. The parents of children at the 9-month well-child visit were asked at the 12-month well-child visit if the child had seen a dentist.

D. Recording

1. The providers documented the dental appointment status of 12-month old infants whose parents did not receive the recommendation at the 9-month well-child visit; the pre-intervention group.

2. The providers documented the dental status of 12-month old infants whose parents

received the recommendation at the 9-month well-child visit; the post-intervention group.

3. The responses were recorded in the chart audit, and all anonymity was maintained.

4. Dental home status responses of the pre-intervention group were recorded between

mid-October of 2019 to late December 2019.

5. Dental home status responses of the post-intervention group were recorded between

January 2020 and March of 2020.

E. Comparison

1. The results were compared between the two different 12-month old groups. One group

comprised of patients that were seen before the template change and the other group

comprised of patients that were seen after the template change.

2. Measuring these two groups determined the efficacy of provider education in

conjunction with a template modification.

3. The providers were the subjects of the study. The study aimed to identify if

implementing national guidelines into practice, along with provider education would

result in more children seeing the dentist before their first birthday.

Results

The pre-intervention group comprised of twenty-two responses from 12-month well-child

visits; six of the twenty-two charts had stated that the patient had visited the dentist before the

well-exam. The post-intervention group comprised of twelve responses from 12-month well-

child visits; one of the twelve charts had stated that the patient visited the dentist before the well-

exam. A two-tailed Mann-Whitney two-sample rank-sum test was conducted to examine whether

there were significant differences in dental status between the pre and post-intervention groups.

The two-tailed Mann-Whitney two-sample rank-sum test is an alternative to the independent

samples *t*-test but does not share the same assumptions (Conover & Iman, 1981). The result of

the two-tailed Mann-Whitney *U* test was not significant based on an alpha value of 0.05, $U =$

157, z = -1.29, p = .198. The mean rank for pre-intervention group was 18.64 and the mean rank

for the post-intervention group was 15.42. This suggests that the distribution of confirmed dental

appointment status was not significantly different between the pre-intervention group (*Mdn* =

1.00) and the post-intervention group (*Mdn* = 1.00). Table 1 presents the result of the two-tailed

Mann-Whitney *U* test. Figure 1 presents a boxplot of the dental appointment status for the pre

and post-intervention groups.

Table 1

Two-Tailed Mann-Whitney Test for Dental_Appointment by Type_Pre_Post

| | Mean Rank | | | | |
Variable	Pre	Post	*U*	*z*	*p*
Dental_Appointment	18.64	15.42	157.00	-1.29	.198

Figure 1

Ranks of Dental_Appointment by Type_Pre_Post
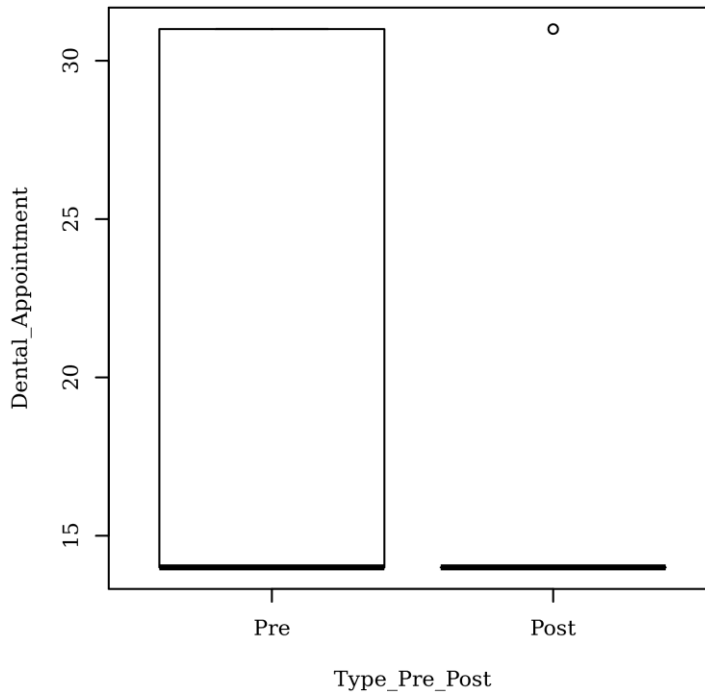
Furthermore, the result of the two-tailed Mann-Whitney U test was not significant based on an alpha value of 0.05, $U = 107$, $z = -1.29$, $p = .198$. The mean rank for pre-intervention group was 16.36 and the mean rank for the post-intervention group was 19.58. This suggests that the distribution of "no confirmed dental appointment status" was not significantly different between the pre-intervention group ($Mdn = 2.00$) and the post-intervention group ($Mdn = 2.00$). Table 2 presents the result of the two-tailed Mann-Whitney U test. Figure 2 presents a boxplot of dental appointment status for the pre and post intervention groups.

Table 2

Two-Tailed Mann-Whitney Test for No_Dental_Appointment by Type_Pre_Post

	Mean Rank				
Variable	Pre	Post	U	z	p
No_Dental_Appointment	16.36	19.58	107.00	-1.29	.198

Figure 2

Ranks of No_Dental_Appointment by Type_Pre_Post
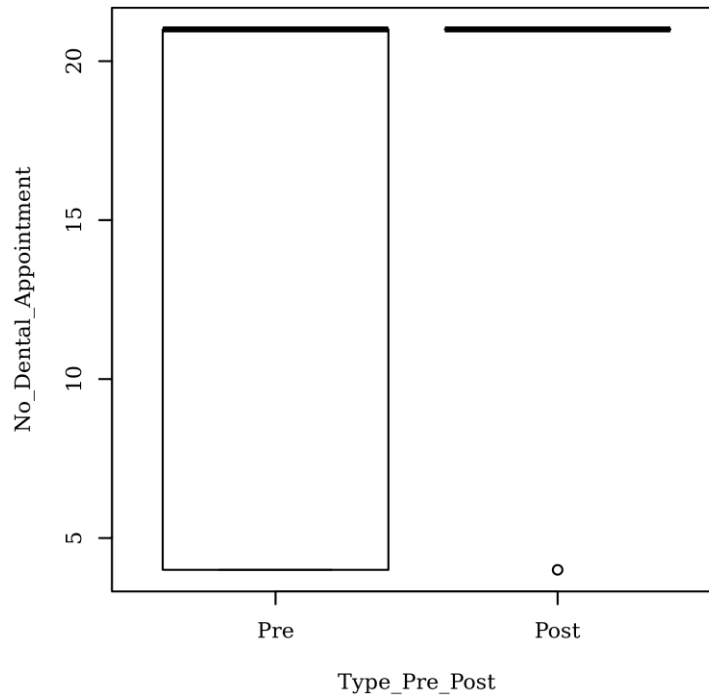
Although the project did not have significant results, the providers at the project site were

updated on the guidelines set by the American Academy of Pediatrics and the American

Academy of Pediatric Dentistry. Also, the 9-monthwell-child templates are updated and in

accordance with the national guidelines. Lastly, now that the project is complete, there is no

further work that needs to be completed by the practice or their staff. The practice will be able to

sustain the practice change without any funding or efforts made by employees.

Discussion

While the project aimed to implement national guidelines, it appears that provider education

and the delivery of oral health anticipatory guidance were not enough to increase the number of

dental visits among infants. A limitation of the study was the disproportionate group sizes. This

difference in sizes can be attributed to one of the practitioners forgetting to document responses in

the last half of the project. The lack of data in the last part of the project is attributed to the

COVID-19 pandemic that began in late 2019 and early 2020. The pandemic ultimately led to a

government mandate for people to remain in their homes unless a person needed to leave the house for essentials. During this time many people did not want to go to medical appointments unless absolutely necessary, for fear of contracting the virus.

It is recommended that this project be implemented again. If the project is implemented again, future project designers may consider using additional interventions. For example, future project designers can suggest providers write a "prescription" for the dentist. Or the provider could recommend a specific dentist and have office staff assist parents with making an appointment. Overall, there is still a need for improvement of the issue. It is hoped that future studies will identify a solution that will empower providers, and parents, to tackle poor oral health in infants and children.

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Appendix A

Table 1

Evaluation Table

Citation	Conceptual Framework	Design/Method	Sample/Setting	Variables & Definitions	Measurement	Data Analysis	Results	Level of Evidence
Alsadat et al, 2018 Dental fear in primary school children and its relation to dental caries **Funding:** None **Country:** Saudi Arabia	**Framework**: None mentioned Health Belief Model (1950) could be inferred.	**Method/Design:** Cross-sectional, analytical study Used the guidelines for Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) **Purpose:** "to detect the prevalence of dental fear among primary school children and test its relationship with dental caries experience."	N = 1525 elementary school boys and girls between the ages of 6 and 12 years old. Native language needed to be Arabic	**DV1:** Decay or caries in primary teeth **DV2:** Decay or caries in permanent teeth **IV1:** Dental fear	Children's Fear Survey Schedule – Dental Subscale (CFSS-DS) – Five-point Likert type scale Parent Questionnaire Dental Exam: Decayed, Missed, and Filled Teeth (DMFT) for primary and permanent teeth	Statistical Package for Social Sciences version 18 (SPSSS, Inc., Chicago, IL, USA) Analysis of variance (ANOVA)	Severe cavities found in permanent teeth of participants with higher mean scores of fear (p = 0.035) Higher scores of fear correlated with higher incidents of untreated caries in permanent teeth (p = 0.001) **Confidence:** 95% **Significance:** 0.005 **Power:** 85%	**LOE:** Level III **Strengths:** None mentioned; but the study is feasible to recreate. **Weaknesses:** Variety of cultures, some have less access to health care; some children had never been to the dentist, while others had which would affect the score. **Conclusion:** Information from this article is useful in identifying potential barriers promoting oral

Key: **ANOVA:** Analysis of Variance; **CFSS –DS:** Children's Fear Survey Schedule – Dental Subscale; **CI**: Confidence Interval; **CPQ:** Child Perception Questionnaire; **CSM:** Common Sense Model; **DV:** Dependent Variable; **DMFT:** Decayed, Missed, and Filled Teeth; **ECC:** Early Childhood Caries; **EMR:** Electronic Medical Record; **FV:** Fluoride Varnish; **ICDAS:** International Caries Detection and Assessment System; **IPE:** Interprofessional Practice and Education; **IPQ-RD:** Illness Perception Questionnaire Revised for Dental; **IV:** Independent Variable; **OHRA:** Oral Health Risk Assessment; **OHRQoL:** Oral Health-Related Quality of Life; **PDSA:** Plan-Do-Study-Act; **Q&A:** Questions and Answers; **RCT:** Randomized Control Trial; **RR**: Relative Risk; **SPSS:** Statistical Package for Social Sciences; **STROBE:** Strengthening the Reporting of Observational Studies in Epidemiology

								health in pediatrics.
Citation	**Conceptual Framework**	**Design/Method**	**Sample/Setting**	**Variables & Definitions**	**Measurement**	**Data Analysis**	**Results**	**Level of Evidence**
Alves, et al. 2018. Efficacy of a public promotion program on children's oral health. **Funding**: None noted **Country**: Brazil **Bias**: The authors report no conflict of interest.	**Framework**: None mentioned. Theory of Planned Behavior (1980) can be inferred. Or Health Promotion Model	**Design:** Cross-sectional cohort study **Purpose:** "Assess the efficacy of the Baby's Mouth early dental prevention and promotion program in preventing oral diseases in children attended in in 2010.	**Sample**: 252 boys and girls between the ages 36 – 60 months. However, the children were enrolled in the program at birth. N1= 84 Effective participants of the program from birth N2 = 84 Children that have stopped participating for more than 24 months. N3 = 84 Children who have never attended a prevention program. **Setting**: One of 10 primary care	**IV**: Oral health prevention program **DV1**: Dental caries **DV2**: Gingivitis **DV3**: Malocclusions **DV4**: Hygiene habits	Maternal perception of oral health care questionnaire given to mothers. And an interview with mothers of the children Pediatric dental exam measuring the occurrence of caries, gingivitis, and malocclusions. Examiner used: The DEFT (decayed, extracted, and filled teeth) index. The modified GI (gingival index) Measuring the overjet, overbite, and	Chi-squared test with a significance level of $p < 0.05$ Fisher's Exact test with a significance level of $p < 0.05$	Children that participated in the Baby's Mouth oral health program had significantly fewer incidences of caries, gingivitis, and occlusions. They also had better oral health habits in comparison to children that did not participate or that stopped participating. N1 had <0.001 in all categories (caries, gingivitis, habits, and hygiene) but had <0.004 for malocclusions.	**LOE**: IV **Strength**: Positive results with improving oral health among children 3 – 5 years old. **Weakness**: None mentioned.

Key: ANOVA: Analysis of Variance; **CFSS –DS:** Children's Fear Survey Schedule – Dental Subscale; **CI**: Confidence Interval; **CPQ:** Child Perception Questionnaire; **CSM:** Common Sense Model; **DV:** Dependent Variable; **DMFT:** Decayed, Missed, and Filled Teeth; **ECC:** Early Childhood Caries; **EMR:** Electronic Medical Record; **FV:** Fluoride Varnish; **ICDAS:** International Caries Detection and Assessment System; **IPE:** Interprofessional Practice and Education; **IPQ-RD:** Illness Perception Questionnaire Revised for Dental; **IV:** Independent Variable; **OHRA:** Oral Health Risk Assessment; **OHRQoL:** Oral Health-Related Quality of Life; **PDSA:** Plan-Do-Study-Act; **Q&A:** Questions and Answers; **RCT:** Randomized Control Trial; **RR**: Relative Risk; **SPSS:** Statistical Package for Social Sciences; **STROBE:** Strengthening the Reporting of Observational Studies in Epidemiology

			units in the Legal Amazon region		crossbite identified malocclusions.			
Citation	**Conceptual Framework**	**Design/Method**	**Sample/Setting**	**Variables & Definitions**	**Measurement**	**Data Analysis**	**Results**	**Level of Evidence**
Basir et al, (2017) Four-level evaluation of health promotion intervention for preventing early childhood caries: a randomized controlled trial **Funding:** No financial support **Country:** Iran	Nutbeam (1998) Four Levels of Health Promotion Interventions Multi-Level Behaviors Framework Health Promotion Model	**Method:** Randomized control trial: Pre/Post questionnaire 6 months apart **Design:** Parallel-Group Experimental – received standard care with education (lecture, Q&A, discussion) Control – received standard care **Purpose:** To answer the question, "Could health promotion intervention improve children's oral health and could oral health education consequently reduce ECC?"	**N** = 104 women with children 12-36 months without caries Experimental Group **N** = 52 Control Group **N** = 52 **Setting:** Maternal- Child Health ward in Iran **Attrition Rate:** 36 women	**IV:** Oral health education **DV1:** Oral health and dental caries **DV2:** Health Literacy	Oral Health Behaviors Questionnaire: (Perceived threat, oral health literacy, oral health behaviors) Dental Exam after 6 months Intra-examiner **reliability** measured by Kappa coefficient (K=0.8), which is "satisfactory." Content **Validity** Ration = 1 **Reliability** of Questionnaire: Perceived threat (087), health	Questionnaire using a five-point Likert Scale Data Analysis through SPSS 15 Proportions compared utilizing chi-square analysis Spearman test for correlation T-test/paired t-test to compare the groups	$P < 0.05$ considered statistically significant Perceived Threat: ($p = 0.01$) Oral Health Behavior = ($p = 0.01$) Decayed teeth = significantly less in the experiment group = ($p < 0.05$) **Significance:** $p < 0.05$ **Power:** 90%	**LOE:** Level II **Strengths:** primary care intervention, intervention affordable **Weaknesses:** Did not assess various aspects of health literacy Did not asses feeding methods Didn't check surface of teeth Limited to children without caries

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					literacy (080), and behavior (0.70).			
Citation	**Conceptual Framework**	**Design/Method**	**Sample/Setting**	**Variables & Definitions**	**Measurement**	**Data Analysis**	**Results**	**Level of Evidence**
Cooper et al, 2017. Interprofessional oral health education improves knowledge, confidence, and practice for pediatric healthcare providers. **Funding**: United States Human Resource and Health Administration **Country**: U. S. A	**Framework**: No framework identified The Adult Learning Theory could be inferred.	**Design**: Evaluation Study Qualitative study **Purpose**: to "evaluate changes in knowledge, confidence, attitude, and clinical practice in children's oral health of the students completed the course" The IPE course.	**Sample**: N = 31 students that took the pre and post-test. N = 25 Dental students N = 3 nursing students N = 3 Osteopathic Medicine students **Attrition**: 10 students **Setting**: University of California, San Francisco	**IV**: Interprofessional Practice and Education (IPE) **DV1**: Knowledge **DV2**: Confidence **DV3**: Attitude **DV4**: Clinical Practice	Four questionnaires were given to the students before and after the course: Course Content Questionnaire Confidence Questionnaire Attitudes Questionnaire Clinical Practice Questionnaire Course content exam was multiple choice, and graded as correct or incorrect. A 3-level Likert scale measured confidence. Attitude was measured on a	Wilcoxon ranked test to compare responses for the pre and post - test for average scores not normally distributed. The exact McNemar's test was calculated to evaluate differences in individual questions from the pre and post-test; statistically significant = <0.001 Non-parametric and crosstabs were calculated with chi-	Knowledge: Statistically significant results included the knowledge of when to apply fluoride and when to perform infant frenectomy p < 0.001 Confidence: Statistically significant more confidence p < 0.001 Attitude increased, but not significantly Clinical practice improved in total and was statistically significant with a moderate effect size; p = 0.005	**LOE**: VI **Strengths**: positive results and encouraging interdisciplinary courses **Weaknesses**: No control or comparison groups, many of the students were already in a dental program, and there was a small sample size.

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Citation	Conceptual Framework	Design/Method	Sample/Setting	Variables & Definitions	Measurement	Data Analysis	Results	Level of Evidence
					4-level Likert scale. Clinical practice was measured on a 4-level Likert scale.	square analyses. Statistically significant = <0.05		
Daly et al, 2016. Factors associated with parents' perceptions of their infants' oral health care. **Funding**: National Institutes of Health (NIH) and NIH Grants. **Country**: U. S. A.	Multivariable prediction model	**Method**: Qualitative; Longitudinal, retrospective study **Purpose**: "The objectives of this study are to (*a*) compare parents' perceptions of how well they do in taking care of the infants' teeth and/or gums versus how well they do in taking care of the infants' medical health and (*b*) determine factors associated with parental perceptions of how well they do in taking care of the infants' teeth and/or gums."	**Sample**: (pairs) / participants comprised of 1323 parents/legal guardians and one infant between the ages of 9 – 15 months at the initiation of the study. N = 1238 parents **Setting**: Three different clinical sites: Duke University in Durham, NC, Indiana University in Indianapolis, IN, and the University of	Parents/Legal guardian will be used interchangeably. **DV**: Parents' perception **IV1**: Tooth brushing status **IV2**: Quality and technique of brushing **IV3**: Baby's sugar intake **IV4**: Insurance coverage	Parent Questionnaire: Risk Assessment tool from longitudinal study	Wilcoxon signed-rank test used to compare parents' view on "(a) teeth and/or gums and (b) medical health." Spearman correlations evaluated the association between the views of the parents (perception variable). One-way ANOVA compared uninterrupted variable responses	"Although the 2 perception variables correlated significantly at $r_{(s)} = 0.35$ ($P <$ .0001), there was a statistically significant difference with parents' perceptions of care for their infants' medical health better than their perceptions of care for the infants' teeth and/or gums ($P <$ .0001). "	**LOE**: VI **Strengths**: Three different sites. Data management and recording was done at site separate from the 3 clinics New insight on infant oral health care and parents' perception of how well they manage medical and dental care for their children. **Weaknesses**: Education level was not asked.

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			Iowa in Iowa City, IA	**IV5**: If the baby regularly sees the pediatrician and the dentist **IV6**: Income **IV7**: Family race		among the three sites. The Pearson chi-square test compared distinct variable responses among the three sites.		Data was self-reported
Citation	**Conceptual Framework**	**Design/Method**	**Sample/Setting**	**Variables & Definitions**	**Measurement**	**Data Analysis**	**Results**	**Level of Evidence**
Mahat & Brown, 2017. Parental knowledge about urban preschool children's oral health risk. **Funding**: None noted **Country**: U. S. A.	Theory: Bandura's Social Cognitive Theory was briefly mentioned.	**Design**: Descriptive design Power analysis for Pearson correlation was used to establish a sample size. Medium effect size (r = 0.30) Alpha of 0.05 Power of 0.80 The sample size must be at least 67. **Purpose**: "explore parent's knowledge of preschool	**Sample**: N = 87 parents and children between the ages of 2 – 5 years old. **Setting**: Daycare and preschool in Newark, NJ	**DV**: Parental knowledge on oral health risks. **IV1**: Ethnicity **IV2**: Income **IV3**: Parental education **IV4**: parent's perception of child's dental health **IV5**: Parents' report of importance of regular	17-item questionnaire separated into two different sections. First section comprised of demographics and the second section evaluated the parent's understanding of oral health risk factors. Questions were rated: 1) agree, 2) disagree, 3) don't know.	SPSS 21.0 used to analyze data. Descriptive statistics was used for parental knowledge and demographic material. Associations between variables were assessed by correlation coefficients. Differences in oral health	There is no correlation between demographics and oral health knowledge. Negative relationship of parental age and oral health knowledge; the older the parent, the less knowledgeable they tended to be (r = -0.231, p = 0.05). Overall group had a relative understanding on	**LOE**: V **Strengths**: Identified oral health information deficits among parents Anticipatory guidance and education can be useful in the prevention of caries during well-visits, school and community settings **Weaknesses**:

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					Questions regarding parental knowledge scored as 1) correct or 0) incorrect Questionnaire reviewed by 2 pediatric nurse practitioners Reliability of the instrument was 0.70 based on Cronbach's alpha.	awareness among ethnicities was appraised the independent t-test.	the importance of oral health, with a mean score of 11.94 77% of parents believe the pediatrician should check for cavities 95.4% of parents believe children should have regular visits to the dentist.	Small sample size. Sample was mostly minorities in urban area. Self-reporting from the parents.
Citation	**Conceptual Framework**	**Design/Method**	**Sample/Setting**	**Variables & Definitions**	**Measurement**	**Data Analysis**	**Results**	**Level of Evidence**
Nelson et al, 2017 Do baby teeth really matter? Changing parent perception and increasing dental care utilization for young children **Funding:** National Institute of Dental and Craniofacial Research, the	Common Sense Model of Self-Regulation (CSM)	**Method:** Comparison of two randomized control trials **Purpose:** "test a new referral letter and dental information guide (DIG), compared to a standard letter, to improve caregivers' illness perception of their child's	N = 736 caregivers of children ages 5-10 years old with dental caries that need restorative care in Ohio and Washington N = 903 Medicaid-enrolled children attending well-child visits;	**DV1:** Presence of dental caries **DV2:** Seen by a dentist **IV1:** Caregiver Illness Perception (IPQ-RD) **IV2:** Caregiver behavioral intention	Illness Perception Questionnaire Revised for Dental (IPQ-RD) that used a five-point Likert Scale Behavioral Intention Caregiver Questionnaire Presence of	Chi-square, Wilcoxon Mann-Whitney, Stratified Analysis, T-Test Analysis, two-sided 0.05 alpha level Z test	Caregivers that believe baby teeth don't matter are statistically more likely (p <0.05) to have children with caries and have not seen a dentist. In addition, those caregivers have less intention to take the children to the dentist, in comparison to caregivers that believed primary	**LOE:** Level I **Strength:** None mentioned; Two randomized control trials. **Weakness:** None mentioned; Not clear about the validity and reliability. Although they report no bias, the study was supported by organizations

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Clinical and Translational Sciences Collaborative of Cleveland, and by the National Center for Advancing Translational Sciences of the NIH. **Country:** U. S. A.		dental caries and increase utilization for children (5 to 10 years old) with caries-related restorative needs" **Purpose 2:** "assess the extent to which the effect of the new vs. standard intervention on dental utilization is mediated through changes in illness perception (as measured by the IPQ-RD) and behavioral intention." **Purpose 3:** "improve dental care access and reduce cavities among Medicaid-enrolled children 3 to 6 year old attending well-	ages 3 – 6.		Cavities: International Caries Detection and Assessment System (ICDAS)		teeth are important. **Significance:** $p < 0.05$ **Effect Size**: 86% and 80% The article states measurements tested for validity and reliability, but does not provide results.	that may benefit from certain results.

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child visits."								

Citation	Conceptual Framework	Design/Method	Sample/Setting	Variables & Definitions	Measurement	Data Analysis	Results	Level of Evidence
Okah et al, 2018. Promoting oral health in childhood: a quality improvement project. **Funding**: Authors state there was no external funding. **Country**: U. S. A.	**Framework**: Plan-Do-Study-Act	**Design**: Quantitative Retrospective Study Systematic Evidence-Based Design **Purpose**: "incorporate OHRAs, including documentation of the oral screening examination, into well-child visits for patients aged 12 – 47 months to drive (1) improved rates of preventative fluoride varnish (FV) application and (2) improved dental referrals for children at high risk for caries."	**Sample**: All patients 12 – 47 months old, being seen for well child visits. N = 6100 (over the course of a year) **Setting**: Pediatric Care Clinic within an urban, academic children's hospital.	**IV**: Implement OHRA in electronic medical record (EMR). **DV1**: Amount of oral health assessments. **DV2**: FV application **DV3**: Dental referrals	Documentation in the Cerner Electronic Medical Record (EMR). For example: Oral Health Screenings FV application Referral to dentist	Process and outcome measure data retrieved from EMR every month. P – charts on Excel QI were used to analyze pre and post intervention information. Patients at high risk for cavities were monitored every 3 months. Control charts were revised when the statistics indicated a unique change.	OHRA documentation increased from 2% to 17% soon after OHRA tool incorporated into EMR. After many cycles of PDSA it went up to 48% Oral screening documentation increased from 0% - 10%. After many PDSA cycles, it went up to 73% FV application increased from 42% to 79% Dental referrals went up from 8.6% in mid to late 2013 to 54% at the start of 2017.	**LOE**: II **Strengths**: children at risk for caries were identified and given appropriate care. New clinic flow and EMR upgrades led to better processes and outcomes. More dental referrals. Tackled obstacles, such as varying FV application. **Weaknesses**: FV application may have been underreported due to the reliance on provider documentation.

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Citation	Conceptual Framework	Design/Method	Sample/Setting	Variables & Definitions	Measurement	Data Analysis	Results	Level of Evidence
Schuch et al, 2015. Oral health-related quality of life (OHRQoL) of schoolchildren: impact of clinical and psychosocial variables. **Funding**: Brazilian Government Agency for Science Development for the research-funding grant. **Country**: Brazil	**Framework:** No framework identified. Health Related Quality of Life Model could be inferred.	**Design:** School-based cross-sectional study **Purpose:** "to investigate the impact of clinical and psychological variables on the OHRQoL of Brazilian schoolchildren."	**Sample**: Public and private school children between the ages of 8 – 10 years old. N = 749 **Setting**: Private and Public schools	**DV**: OHRQoL or CPQ **IV1:** Sex **IV2:** Age **IV3:** Family income **IV4:** Decayed teeth **IV5:** Dental Trauma **IV6:** Dental Fear **IV7:** Dental pain	Questionnaires for parents in order to obtain socioeconomic and sociocultural information. Interviews with the children. Child Perceptions Questionnaire (CPQ) 8 – 10. 95% CI Dental exams, which cover periodontal condition, dental caries, dental trauma, and malocclusion evaluation. Measurement included: Dental Plaque Index, Gingival Bleeding Index, DMFT, The O'Brien Index (trauma	T-tests One-way ANOVA These were used to identify the relationships among CPQ scores and independent variables.	CPQ scores were higher (p < 0.001) among non-white children and among mothers with less education. CPQ scores were also higher (p < 0.001) among children that experience dental anxiety or had painful encounter within the past 6 months. Family instability (p = 0.003) and overcrowding in the home (p = 0.007) was associated with higher CPQ score. OHRQoL is affected by oral disorders and social vulnerability.	**LOE**: IV **Strengths:** The study reiterates the significance of oral health prevention and treatment. External validity of sample analyzed Validated instruments used **Weaknesses:** dental trauma may have been under reported because information was collected retrospectively.

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					assessment), and the Dental Aesthetic Index (malocclusion assessment). Fluorosis was measured using Index of Dean and the Index of FDI assisted with the identification of enamel weakness.			
Citation	**Conceptual Framework**	**Design/Method**	**Sample/Setting**	**Variables & Definitions**	**Measurement**	**Data Analysis**	**Results**	**Level of Evidence**
Wigen & Wang, 2016. Referral of young children to dental personnel by primary care nurses. **Funding:** Norwegian Directorate of Health **Country**: Norway	**Framework**: None noted. Health Promotion Model could be inferred.	**Design**: A design that is a quality assurance system already in place and mandated by law in the public dental services. **Purpose**: "evaluate routines for referring children from well-baby clinics to the dental services" in addition "… to study whether referred children younger than 3 year required	**Sample**: N = 181 children (ages 4 months to 16.6 years); 53% of the participants were under the age of 3. **Setting**: Twenty-one well-baby clinics refer to sixteen public dental clinics	**DV**: Referral to the dentist from primary care. **IV1**: Visible plaque or caries **IV2**: Non-Western background **IV3**: Disease or need for medication. **IV4**: Unfavorable diet	Parental Questionnaire, which included the parent's background and education level, and the family status (one or two parent home). 95% CI Significance level = 5%	SPSS 22 Anonymized data Chi-Square statistics was used to assess the relationships between referral indications and oral exam findings.	P < 0.01: 52% of children referred to dentist for visible signs of plaque and or caries. All children did not have a Western background 92% of children had oral disease or needed medication at the dental visit. All children referred to the	**LOE:** I **Strengths:** None noted **Weaknesses:** None noted

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		contact with dental personnel."		IV5: Not examined			dentist from a well-child visit had more than one risk factor of obtaining dental caries. Only 2% of children 3 years old and younger were referred to the dentist, and of those children, only 6% had cavities.	

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Appendix B

Table 2

Synthesis Table

Author	Alsadat et al	Alves et al	Basir et al.	Cooper et al.	Daly et al.	Mahat & Brown	Nelson et al.	Okah et al.	Schuch et al.	WIgen & Wang
Year	2018	2018	2017	2017	2016	2017	2017	2018	2015	2016
Design/ Level of Evidence	Cross - Sectional Analytical Study Level III	Cross – Sectional Cohort Study Level IV	RCT Pre/Post Questions Level III	Evaluation Qualitative Level VI	Qualitative Longitude Retrospect Study Level VI	Descriptive Design Level V	Comparison of two RCT Level I	Electronic Data Collection Level II	School – Based Cross Sectional Level IV	Quality Assurance System - Law Level I
Study Characteristics										
Participant Demographics										
% Female Child	48%	48%	50%	N/A	49.1%	Not available	Not available	N/A	53.9%	41.4%
% Female Parent	44%	100%	100%	N/A	94%	Not available	Not available	Not available	Not available	Not available
Age Range of Child	6 – 12 years old	3 – 5 years old	1 – 3 years old	N/A	9 – 15 months old	2 – 5 years old	5 – 10 years old 3 – 6 years old	12 – 47 months old	8 – 10 years old	4 months – 16.6 years old
Region of Study	Middle East	Brazil	Iran	United States	United States	United States	United States	United States	Brazil	Norway
Setting										
Health Care Clinic		X	X		X		X	X		X
School	X			X		X			X	
Sample Size/# Studies Included	N = 1525	N = 252	N = 104	N = 31	N = 1238	N = 87	N = 736 N = 903	N = 6100	N = 749	N = 181
Measurement Tools	CFSS – DS Parent Questions	Maternal Question DEFT	Questions Dental Exam	Pre and Post Course Questions	Risk Assessment Tool for Parents	Demographic Questions	IPQ – RD Behavioral Intention	EMR Document Dental Exam	Demographic Questions	Demographic Questions

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	DMFT	GI Dental Exam		Course Content Exam		Oral Health Knowledge Questions	Caregiver Questions ICDAS		Interview with children Child Perception Questions Dental Exam DMFT/GI	
Intervention	Identify correlation between dental fear and dental caries.	Education Prevention Program Vs. Some Education Vs. Control (no education)	Education with standard well-baby care Vs. Control (standard well-baby care)	IPE Course	Parent perception of their role in oral care vs. medical care. Compared to actual dental care in children.	Assessment of oral health knowledge and risk assessment. Provided with kit (tooth brush and toothpaste for parent and child)	Questionnaire: 1. Illness perception 2. Behavioral Intention Then provider provides oral health facts	Retrospective data collection Modify HER Change oral health education Change work process standards	Questionnaire to evaluate the effects of psychosocial characteristics and OHRQoL CPQ	Referral to dentist based on certain criteria
Duration of Intervention	8 months	13 months	6 months	10 weeks	17 months	10 – 15 minute Questionnaire	5 years	4 years	Not available	1 year
Outcomes	⬆ Dental Fear = ⬆ Dental Caries = ⬇ Restored Permanent teeth	Education Program vs. Control Caries < 0.001 Gingivitis <0.001 Malocclusions < 0.004 Habits < 0.001 Hygiene < 0.001	Perceived threat P = 0.001 Health literacy P = 0.001 Health behavior P = 0.001 Incidence of ECC P = 0.001	IPE Course Pre vs. Post Knowledge ⬆ P = 0.005 Confidence ⬆ P < 0.001 Attitude Not stat. sig. Clinical Practice	Parent believes they take good care of child's teeth = Actually, taking good care of child's teeth =	Moderate knowledge of oral health risks among all demographics. Except for age: ⬆ parental age = the ⬇ oral health knowledge; p = 0.05	Caregivers that do not believe "baby teeth" matter had: ⬆ proportion of children with cavities p < 0.05 ⬇ # of children that have seen dentist ⬇ intention of taking child to dentist	Pre-Intervention OHRA <2% of patients FV: 42% of patients Dental referrals before age 3: "uncommon" Post-Intervention	Skin color (Caucasian) & Maternal education (> 8 years) = ⬆ Higher OHRQoL and CPQ scores P < 0.001 Children in non-nuclear families (p = 0.003	52% of children referred had visible plaque and caries (p < 0.01) 31% of children referred reported a sugary diet; parents offer sugary drinks at night p > 0.05 44% of children referred due to

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				↑ p < 0.001	Parents take care of own dental health		↓ accurate perception In comparison to caregivers that believe "baby teeth" matter.	OHRA: ↑ 45% and then 73% FV: ↑ 86% Referral of high risk patients: ↑ 54%	Household crowding (p = 0.007) = ↓ OHRQoL Dental pain = ↑ CPQ scores	diet had at least one cavity. 92% of children referred had chronic disease and or weakness p < 0.01 Referred due to Non- Western background p < 0.01
Independent Variable										
Child's Age									X	
Child's Sex									X	
Dental Fear	X								X	
Oral Health Program/ Education		X	X	X		X				
Current Oral Hygiene Status					X				X	X
Sugar Intake / Diet					X					X
Insurance Coverage					X					
Income					X	X			X	
Family Ethnicity					X	X				X
Regular Pediatric (Medical or Dental) Visits					X					
Parental Dental Health Perception							X	X		
Parent's Reports of										

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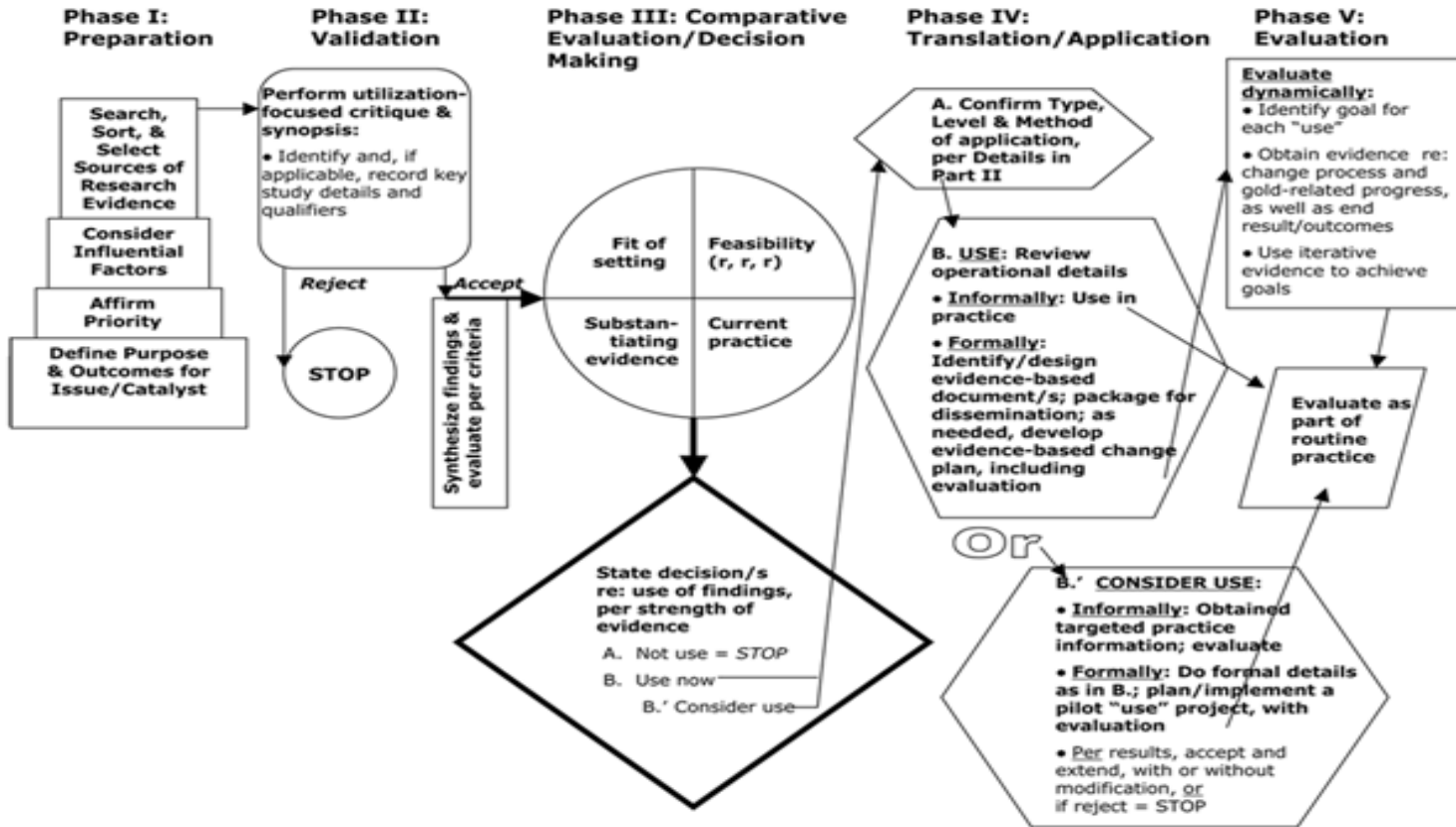|												
Oral Health Importance						X						
Caregiver Behavioral Intention								X				
Implement EMR Document									X			
Dependent Variable												
Caries in Primary Teeth	X	X	X					X				
Caries in Permanent Teeth	X							X				
Health Literacy			X									
Gingivitis		X										
Hygiene Habits		X										
Malocclusion		X										
Perception				X	X							
Knowledge				X		X						
Visit to Dentist								X				
Number of Dental Screens									X			
Fluoride Varnish Application									X			
Dental Referrals									X		X	
Oral Health Quality of Life										X		
Dental Care Confidence				X								
Clinical Practice				X								

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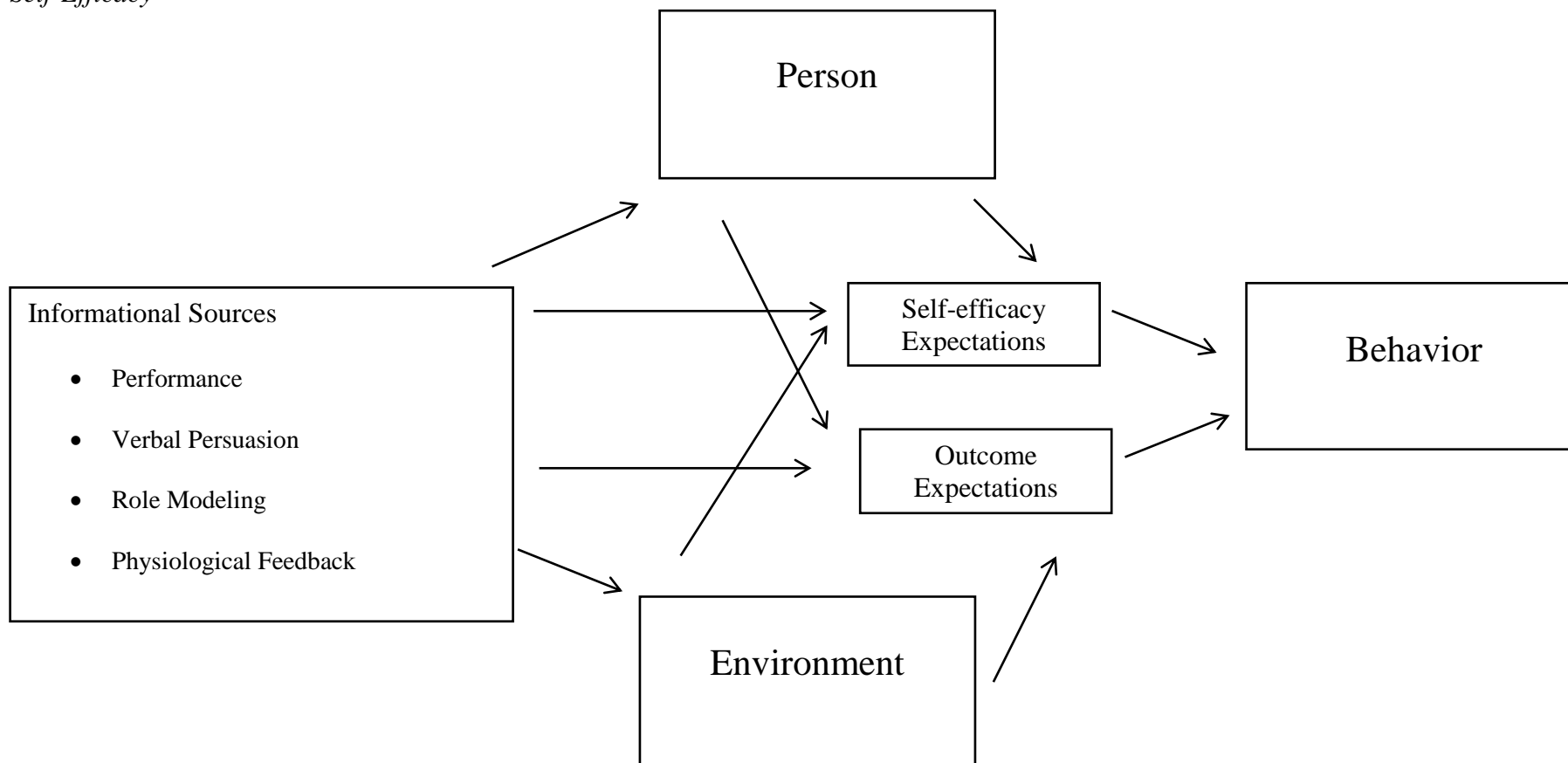Appendix C

Figure 1

Stetler Model

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Appendix D

Figure 2

Self-Efficacy

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