ORIGINAL REPORT: DECISION ANALYSIS RESEARCH

Understanding Pediatric Dentists' Dental Caries Management Treatment Decisions: A Conjoint Experiment

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Abstract: *When traditional ranking and rating surveys are used to assess dentists' treatment decisions, the patient's source of payment appears to be of little importance. Therefore, this study used the marketing research tool conjoint analysis to investigate the relative impact of source of payment along with the child's age and cooperativeness on pediatric dentists' willingness to use Atraumatic Restorative Treatment (ART) to restore posterior primary teeth. A conjoint survey was completed by 707 pediatric dentists. Three factors (age of the child, cooperativeness, type of insurance) were varied across 3 levels to create 9 patient scenarios. The relative weights that dentists placed on these factors in the restorative treatment decision process were determined by conjoint analysis. "Cooperativeness" (52%) was the most important factor, "age of the child" (26%) the second-most important factor, followed by "insurance status of the child" (22%). For the third factor, insurance, pediatric dentists were least willing to use ART with publicly insured children (–0.082), and this was significantly different from their willingness to use ART with uninsured children (0.010) but not significantly different than their willingness to use ART for children with private insurance (0.073). Unlike traditional ranking and rating tools, conjoint analysis found that the insurance status of the patient appeared to be an important factor in dentists' decisions about different restorative treatment options. When pediatric dentists were forced to make tradeoffs among different patients' factors, they were most willing to use ART technique with young, uncooperative patients when they had no insurance.*

Knowledge Transfer Statement: *The present study suggests the feasibility of using techniques borrowed from marketing research, such as conjoint analysis, to understand dentists' restorative treatment decisions. Results of this study demonstrate pediatric dentists' willingness to use a particular restorative treatment option (Atraumatic Restorative Treatment in this application) when forced to make tradeoffs in a "conjoined," or holistic, context among different factors presented in real-life patient scenarios. A deeper understanding of dentists' treatment decisions is vital to develop valid practice guidelines and interventions that encourage the use of appropriate restorative treatment modalities.*

Keywords: dental atraumatic restorative treatment, decision making, conjoint analysis, pediatric dentistry, access to health care, therapy

Introduction

The dental literature documents substantial variation in factors influencing dentists' decisions to initiate a particular caries management treatment for their patients (Bader and Shugars 1992, 1997; Brennan and Spencer 2005). One source of this variation is when professionals feel compelled to make correct decisions in the absence of clear, objective, evidence-based standards or guidelines, otherwise labeled *professional uncertainty* (Kress 1980; Bailit et al. 1983; Elderton 1985). Based on findings in medicine, when professional uncertainty is strong, the probability of receiving a service often depends on the provider or practice characteristics rather than the nature and severity of illness (Wennberg

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et al. 1980; Wennberg et al. 1982; Wolff 1989).

In 1992, Bader and Shugars proposed a model of how dentists make caries management treatment decisions, and they discussed 2 main sources of variations: dentists' factors, such as their personal characteristics and practice-related characteristics, and patients' factors, such as the specific clinical presentation of the case along with patient behavior, preferences, and socioeconomic status.

In studies that used traditional ranking and rating surveys, the patient's ability to pay appears to be of little importance (Bader and Shugars 1992, 1997; Brennan and Spencer 2005). However, in studies that employed different techniques, such as life scenario portraits of dentists' decision making, the results differ. Marcus and colleagues (1983) asked 20 dentists to evaluate 62 simulated patient cases, finding that they were more likely to modify preferred plans if patients had limited ability to pay or had no insurance.

This would be expected since alternative treatments usually exist for most dental problems, varying in effectiveness, appearance, and cost (Eisenberg 1986). Thus, when faced with financial constraints, dentists were able to select alternative treatment options that did not necessarily result in poorer health outcomes.

Therefore, within the decision process, literature supports the idea that dentists are responsive to technical and patient factors in formulating prescriptions of therapy (Conrad et al. 1984; Hazelkorn 1985). However, little has been done to assess the relative weights of those factors in dentists' decision making, through advanced survey tools that mimic real patients' life situations (Hazelkorn 1985).

Previous studies usually used simple ranking and rating questions to assess the importance of different factors influencing dentists' treatment plan decisions (Ryan, Scott, et al. 2001). This common measure of professionals' stated decisions, evaluating 1 factor at a time, is susceptible to social desirability bias (Koele and Hoogstraten 1999), and it fails to incorporate any concept of opportunity cost or measure preference strength (Ryan, Scott, et al. 2001). Therefore, in this study, we used a marketing research tool that has been shown to be a valid predictor of real-world decisions (Koele and Hoogstraten 1999): conjoint analysis.

Conjoint analysis is based on the premise that decision options can be described by sets of attributes or factors, each made of different levels. The relative value that professionals attach to those factors can be statistically estimated (conjoint utility) by constructing a series of hypothetical scenarios made of each factor at different levels and by asking professionals to rate, rank, or make choices within a set of hypothetical options (Ryan, Scott, et al. 2001).

Conjoint analysis can model actual decision making more efficiently because it requires respondents to make trade-offs in a "conjoined," or holistic, context, as opposed to traditional methods, which do not impose a resource constraint. For example, in traditional surveys, respondents can rate all attributes as "extremely important" without having to evaluate trade-offs (Chakraborty et al. 1993; Cunningham et al. 1999; Koele and Hoogstraten 1999).

Conjoint analysis has been successfully used as an instrument for establishing treatment preferences among clinicians in many health care applications (Ryan and Farrar 2000; Derek et al. 2010; Bridges et al. 2012; Landfeldt et al. 2015). In the dental literature, the use of conjoint analysis is rare; however, the few applications that used conjoint analysis in investigating dentists' and patients' decision-making process have demonstrated encouraging results for its stability, rationality, and ability to avoid social bias (Chakraborty et al. 1993; Cunningham et al. 1999; Koele and Hoogstraten 1999; Kateeb et al. 2014; Kateeb et al. 2015).

The specific goal of this study was to use conjoint design to investigate the relative impact of patients' source of payment among other factors, such as child's age and level of cooperation, on pediatric dentists' willingness to use Atraumatic Restorative Treatment (ART) to restore posterior primary teeth. ART is a dental caries management procedure that can be carried out in nontraditional dental settings at low costs and does not need extensive operator training or special skills (Frencken et al. 1996; Frencken and Coelho 2010). It is based on removing carious tooth tissues with hand instruments alone and restoring the cavity with an adhesive restorative material (Frencken et al. 1996). Despite the well-documented advantages of this procedure (Carvalho et al. 2009; Frencken 2010), the practice of ART is not believed to be widely used in the United States. Factors related to the use of ART in the United States among pediatric dentists are still unknown.

Methods

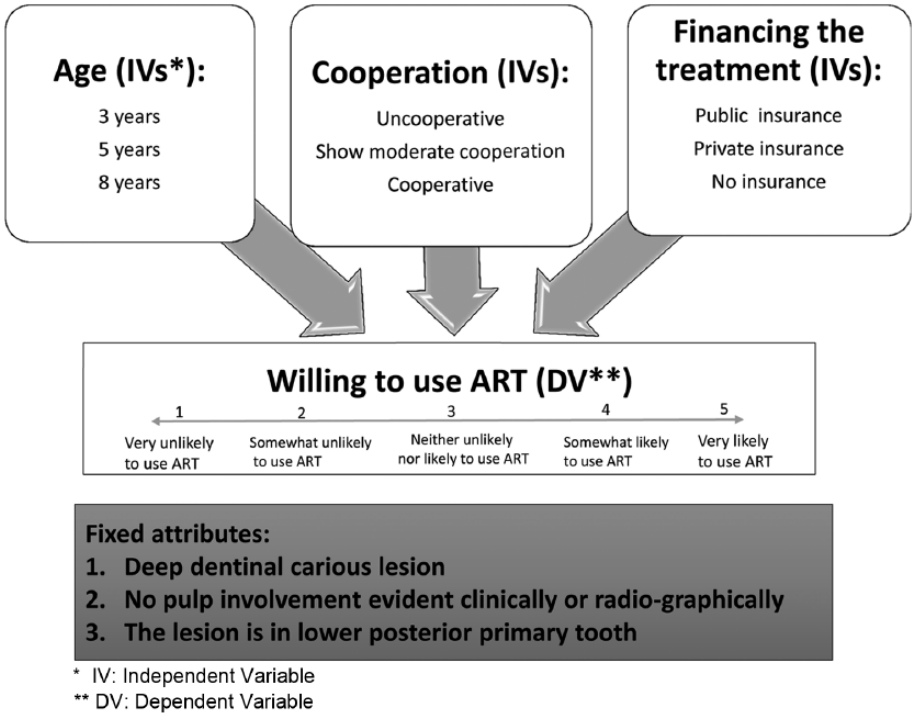
Conjoint Experiment Design

This survey was part of 2 surveys sent to 2 national random samples of pediatric dentists: one asked about the use of ART in primary anterior teeth (Kateeb et al. 2014), and the one described below investigated the use of ART in primary posterior teeth. The design of the conjoint experiment followed the recommended steps (Reed Johnson et al. 2013) and has been described in detail (Kateeb et al. 2014), so only a brief description is presented here.

First, we defined the decision problem for the study as the effects of patients' factors on willingness of pediatric dentists to use ART as a restorative treatment option. We opted to use a metric conjoint analysis design whereby respondents rated the strength to which they were willing to use ART on a 5-point scale (5 = very likely to use ART, 1 = very unlikely to use ART), and we used this response as our dependent variable.

The second step involved the choice of factors. To keep the balance between information overload and statistical efficiency (Cunningham et al. 2009), we used a limited number of factors (child age, cooperativeness, and insurance coverage) to produce the most relevant and efficient parsimonious design. After selecting the main factors, we assigned 3 levels for each factor, and those levels were our independent variables. The methodology that was used in factor

Figure 1. The conceptual model of our conjoint study, including the 3 factors and their levels. ART, Atraumatic Restorative Treatment; DV, dependent variable; IV, independent variable.



selection and level assignment has been described in detail (Kateeb et al. 2014). The conceptual model that underlies this study is shown in Figure 1.

In the next step, the experimental design was constructed. An orthogonal fractional factorial design (Johnson and Lievense 2000) of 9 conjoint scenarios was produced with SPSS Conjoint (SPSS Inc. 2009). This design allowed for estimations of the main effect of the utility (relative weights) for each level of the presented factors on the willingness to use ART. The clinical presentation of the dental caries case in the 9 hypothetical patient scenarios was identical so that all scenarios included the same carious lesion deep into the dentin but with no pulpal involvement evident clinically or radiographically in a posterior primary tooth.

Finally, pilot testing to improve readability of the questions was carried out by 2 pediatric dentistry senior residents and 2 dental public health senior residents. Examples of conjoint hypothetical patient scenarios are given in column 2 of Table 1.

The questionnaire also included nonconjoint questions that asked about the use of ART in general. An important nonconjoint question asked if the respondents considered ART in the given scenarios to be definitive or interim treatment and why. ART was defined in the introduction of the survey as "a procedure based on removing carious tooth tissues using hand instruments alone and restoring the cavity with an adhesive restorative material" (Frencken et al. 1996). In addition, demographic and practice characteristics questions were added to capture information on key individual characteristics. Those questions were modeled on previous American Academy of Pediatric Dentistry (AAPD) surveys to its members (Weil and Inglehart 2010; Tellez et al. 2011) where validity and reliability of the questions had already been tested.

Table 1.
Examples of Patient Scenarios and Their Logit Values.

ID No.	Scenario as Presented for Pediatric Dentists	Logit Value, %
1	A 3-y-old patient who is uncooperative and has public insurance	8.4
2	A 3-y-old patient who is uncooperative and has private insurance	9.2
3	**A 3-y-old patient who is uncooperative and has no insurance**	9.8
9	A 3-y-old patient who is cooperative and has no insurance	2.0
10	A 5-y-old patient who is uncooperative and has public insurance	5.8
12	A 5-y-old patient who is uncooperative and has no insurance	6.8
19	An 8-y-old patient who is uncooperative and has public insurance	5.4
25	**An 8-y-old patient who is cooperative and has public insurance**	1.1
27	An 8-y-old patient who is cooperative and has no insurance	1.3

Questionnaire Administration and Sampling Strategy

A national random sample of 2,247 pediatric dentists registered at the AAPD as active members was invited to participate

in this survey in May 2011. An invitation e-mail and 3 reminder e-mails after 2, 4, and 6 wk were sent to the entire study sample, which included a link to the web survey. Formal written consent was not required; submitting a completed questionnaire constituted the subject's consent. The University of Iowa Institutional Review Board approved all aspects of this study.

Analysis Framework

We considered 300 to be our minimum sample size based on previous studies using conjoint analysis; this number assumed a margin of error of 3% around conjoint utility estimates and a confidence interval of 95% (Ryan, Bate, et al. 2001; Orme 2010). Response bias was checked by comparing 1) the original sample with the AAPD active specialist email list and 2) the demographic data for respondents who were included in the analysis with both the original sample and the whole email list.

The conjoint analysis was performed with the "conjoint" procedure in SPSS. Through a series of linear regressions, SPSS conjoint uses each dentist's rating of patient scenarios (dependent variable) to generate the conjoint utility scores (the β values in a regression model) for each factor level (independent variable). Utility scores represent the participant's preferences for that factor's level, with higher utility scores indicating greater preference. To calculate these utilities, dummy variables were used in which 1 level of each factor was arbitrarily assigned to zero. That is, within a factor, the utility of the other levels reflected the relative utility of a level versus the base level that has been set to zero, which implicates the possibility of comparing levels within the same factor but not across the 3 factors.

The relative importance of each factor as a whole was also calculated in percentage terms based on the beta weights. SPSS computed the importance score by taking the range of utility scores for any attribute level (highest minus lowest), dividing by the sum of all the utility ranges, and multiplying by 100 (SPSS Inc. 2009).

In addition, a logit preference probability was estimated at the profile level for all possible scenarios, including the 9 scenarios presented in the survey and the simulation scenarios. Conjoint utility values were calculated from pediatric dentists' ratings of the 9 conjoint scenarios used in the current survey. Those values were used to calculate the total utility of the previous 9 scenarios in addition to the simulation scenarios. Simulation scenarios were not rated by the respondents but can be produced from all possible combinations of the current study's 3 factors and 9 levels (3 levels for each factor), yielding a total of 27 possible hypothetical scenarios. One way to estimate and compare the utility of those scenarios is to use the logit model, which uses the probability as the ratio of a scenario's natural log utility to that for all simulation scenarios, averaged across all respondents (SPSS Inc. 2009). The logit is then a measure of how likely a particular patient scenario is to receive ART.

Finally, we used conjoint utility values to group pediatric dentists sharing similar prefrence values (i.e., clusters). First, a hierarchical method to define the number of clusters was used; then, a *k*-means procedure was preformed to actually form the clusters and agree on the most appropriate solution according to interpretability and discrimination of clusters. We also assessed if cluster membership of pediatric dentists differed by demographic and practice characteristics, and a stepwise discriminant function analysis model was created to assess which demographic and practice characteristics variables predicted cluster membership.

Results

Thirty-one percent of the subjects (n = 707) completed the online questionnaire. For nonconjoint questions, data from all 707 respondents were used; however, for conjoint questions, 479 cases were included in the conjoint analysis. Metric conjoint analyses require that ratings for all scenarios be complete and varied. Thus, data were excluded from analyses if there was no variation in how respondents addressed each scenario (e.g., rating all 9 scenarios as 1, "extremely unwilling to use ART," or 5, "extremely willing to use ART") or if respondents skipped ≥1 scenario.

To assess nonresponse bias, we compared the distributions of the demographic variables for respondents included in our analysis (n = 479) with both the original sample (n = 707) and the entire AAPD email list, and no significant statistical differences were detected.

Demographics and Practice Characteristics

The sample consisted of 57% men and 43% women. The mean ± SD age of our sample was 47 ± 12 y. Eighty-four percent were in private practice, and 43% of them practiced in the suburbs. More than 53% reported being moderately busy, "provided care to all who requested appointment but was not overworked."

Patient Population Characteristics

Respondents reported that a mean 48% of their patients were considered at high caries risk. They mainly were between 3 and 12 y of age; however, 21% were <3 y old, and 17% were >12 y. On average, 35% of our respondents' patient populations were covered by public insurance, 52% by private insurance, and 15% had no insurance.

Use of ART as Definitive or Interim Treatment

Sixty-two percent of our sample cited "depth of lesion" and 55% cited "number of surfaces involved" as important factors in the decision to use ART as definitive or interim treatment (format: check all that apply). However, nonclinical factors, such as patient's cooperation and age, were more important in the treatment decision (78% and 68%, respectively). Insurance status of the patient was cited by 6% of the sample as an important factor in willingness to use ART with pediatric patients.

Conjoint Results

In the conjoint model, data from 479 pediatric dentists were analyzed individually to build the final model.

The results of the conjoint analysis are shown in Table 2.

Relative Importance of the 3 Factors

Factor importance measured the impact of the factor as a whole on the decision process (Fig. 2). "Cooperation of the child" (52%) was the most important factor, "age of the child" (26%) the second-most important factor, then "insurance status of the child" (22%).

Utility of the Different Levels within Each Factor

The conjoint utility of each level reflects the amount of variation in the dependent variable (rating of the scenarios) accounted for by each factor level. Thus, the utilities for the 9 levels provided further insights into pediatric dentists' restorative treatment trade-offs. For example, for the most important factor, cooperation of the child, the relative utilities for the first 2 levels were 0.870 and –0.170. Both these utilities were significantly different from each other and the third level (–0.700), suggesting that pediatric dentists were more willing to use ART as a restorative treatment option with uncooperative children than moderately cooperative children or cooperative children. Similarly, for the second-most important factor, age, pediatric dentists were most willing to use ART with children 3 y old (0.265); however, there was little difference with regard to children who were 5 and 8 y old (–0.097 and –0.167 units, respectively). Interestingly, for the third factor, insurance, pediatric dentists were least willing to use ART with publicly insured children (–0.082), and this was significantly different than their willingness to use ART with uninsured children (0.010) but not significantly different with private insured children (0.073). The magnitude and significance of the differences among the levels of the 3 factors are shown in Figure 3.

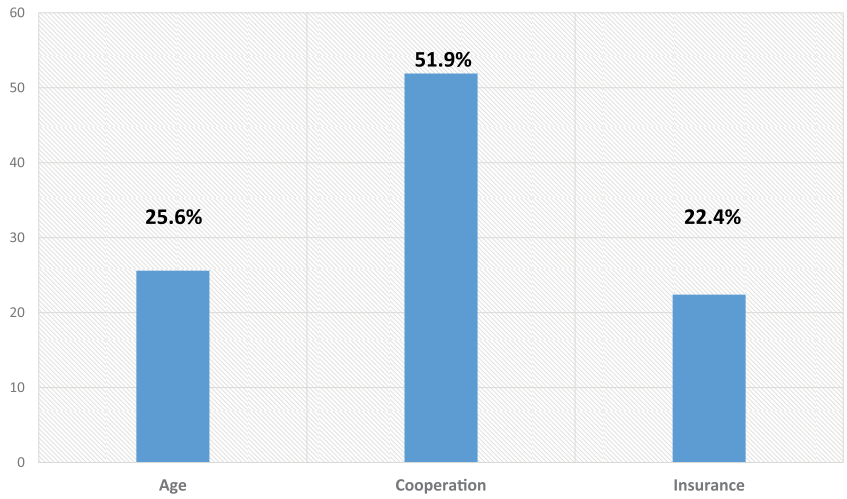
Simulation Scenarios

Level utility was used to calculate the logit preference probability, not only for the 9 patient scenarios presented in the survey, but also for all possible combinations of factor levels used in this specific conjoint design (27 scenarios). As an example, pediatric dentists were likely to use ART with 3-y-old uncooperative children with no insurance (logit value of 9.8) almost 9 times more than for an 8-y-old cooperative child with public insurance (logit value of 1.1), given that the 27 scenarios were real and the factors selected in this study represent all the factors that may influence such a decision. Table 1 shows selected patients' scenarios and their logit values.

Table 2.
Factor Levels and Conjoint Utility Values.

Factor Level	Utility Estimate	SE
Age, y		
3	0.265	0.044
5	–0.097	0.057
8	–0.167	0.047
Child		
Uncooperative	0.870	0.047
Moderate cooperative	–0.170	0.044
Cooperative	–0.700	0.044
Insurance coverage		
Public	–0.082	0.044
Private	0.010	0.047
None	0.073	0.044
Constant	2.423	0.032

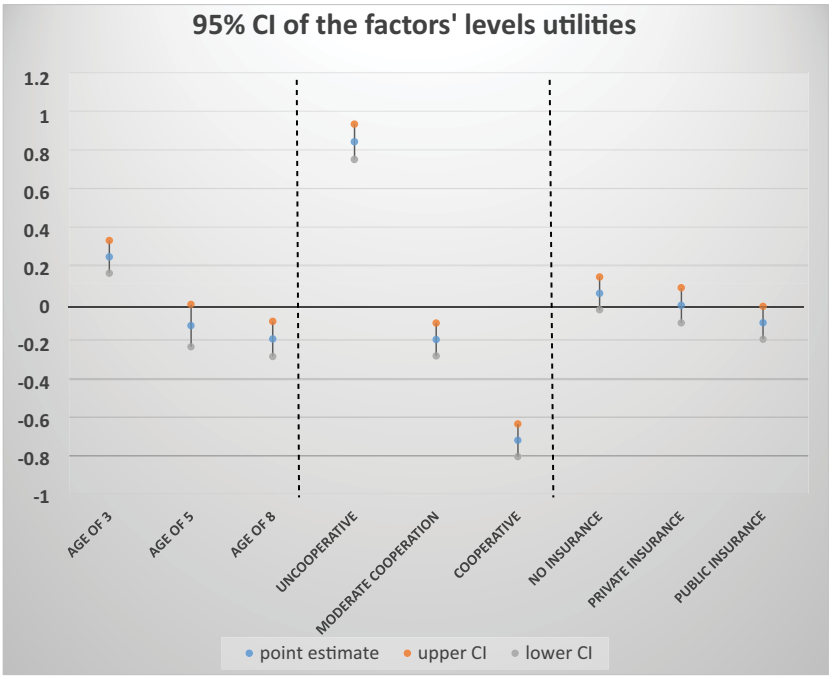
Figure 2. Factor importance values calculated from individual utility, then averaged.



Cluster Analysis of Dentists According to Their Preference Values

Although the aggregate conjoint model provided a good estimate of the willingness of pediatric dentists to use ART with their patients, more specific insights were obtained by clustering those pediatric dentists into relatively homogeneous groups according to preferences (conjoint utility values) and then exploring how those clusters varied relative to the dentists' demographic and practice characteristics.

Figure 3. The mean utilities for each factor and their associated 95% confidence intervals (95% CIs).



In our case, 5 distinct clusters were formed of pediatric dentists who shared similar conjoint utility. Cluster 1, the smallest (n = 18), included pediatric dentists who were most willing to use ART with cooperative children. Pediatric dentists in cluster 2 (n = 94) were most willing to use ART with children without insurance. Cluster 3, the largest (n = 172), was more willing to use ART with very young and uncooperative children. Pediatric dentists in cluster 4 (n = 147) were most willing to use ART with uncooperative children. Finally, cluster 5 (n = 48) members were more willing to use ART with older children.

In a second step, we explored whether cluster membership differed according to dentists' demographics and practice characteristics. Our results show that clusters were similar in composition of demographic and practice characteristics, except for 2 variables: "age of the pediatric dentist" and the "busyness of the dentist's practice." These differences were distinct between clusters 1 and 3. Cluster 1 was mainly composed of older pediatric dentists as compared with cluster 3 ($F(4,473) = 3.1$, $P = .016$). Pediatric dentists in cluster 1 reported the least busy practices versus other clusters and were significantly different from cluster 3 ($F(4,469) = 2.9$, $P = 0.021$).

In addition, we created a stepwise discriminant function analysis model to assess which demographic data and practice characteristic variables were predictive of cluster membership. The discriminate functions were in agreement with our preliminary results and revealed a significant association between cluster membership and the following predictor variables: busyness of the practice ($F = 3.17$, $P < 0.015$) and age ($F = 3.0$, $P < 0.002$).

Discussion

The results of the conjoint analysis in this study indicate that pediatric dentists go through a complex multiattribute decision-making process by trading off among different factors to decide on the treatment option that they would use with their patients. According to economic theory, this selection usually maximizes dentists' satisfaction and utility (Phillips et al. 2002).

Previous research assessing 1 factor at a time without incorporating any opportunity cost or placing influencing factors in context have produced inaccurate importance weights. Therefore, in this application, a different but well-established methodology, conjoint analysis, was used to get a better understanding of pediatric dentists' hidden drivers to select a restorative treatment option in real-life patient scenarios.

In the current application, 21% of the pediatric dentists (n = 151) were not willing to use ART in any of the scenarios presented. This agrees with our previous work suggesting that the use of ART in the United States is contentious and not widely accepted (Kateeb et al. 2013a, 2013b; Kateeb et al. 2014).

Those cases (n = 151) were not included in the conjoint analysis, which limits our results to pediatric dentists willing to consider ART as an option to manage dental caries. In general, pediatric dentists in the United States are taught to use traditional restorative treatment options, such as amalgam and stainless-steel crowns, more often than ART restorations (Kateeb et al. 2013a). When they were instructed to use ART, pediatric dentists and general dentists were taught to use ART in primary teeth more often than permanent teeth and in posterior teeth more often than anterior teeth (Kateeb et al. 2013a, 2013b).

According to our conjoint analysis results, cooperation of the child was the most important factor in pediatric dentists' willingness to use ART in primary posterior teeth. In a previous application, where dentists' willingness to use ART in anterior primary teeth was assessed, age was the most important factor, followed by cooperation of the child (Kateeb et al. 2014). This difference in the 2 applications is consistent with the idea that the chronologic stage of the teeth and their exfoliation time are more critical in selecting a restorative treatment modality in primary anterior teeth than in primary posterior teeth. For example, a cavity in a 2-y-old child's anterior tooth needs to be restored, but if it was in a 6-y-old child, there would be no urgent

need to restore it because the tooth would soon exfoliate. However, in a posterior tooth and within the age range that we provided in the scenarios (3 to 8 y), there is greater indication for restoring the tooth regardless of age because primary posterior teeth typically exfoliate between 9 and 11 y old. In addition, child cooperation in posterior teeth is more critical because of accessibility and moisture control issues.

In this study, conjoint utility estimates were reported for the 9 factor levels. These utility values provided additional information over and above the importance weights of the factors as a whole. For example, although the order of the impact of the factors as whole (age and cooperation) differed between the current application (primary posterior teeth) and the previous application of conjoint analysis (primary anterior teeth; Kateeb et al. 2014), pediatric dentists in both samples were most willing to use ART with younger and uncooperative children.

Similarly, conjoint utility provided us with extra details about the insurance factor. Conjoint analysis in this study found that dentists were more willing to use ART with uninsured patients, with an additional utility of 0.155, than patients with public insurance; however; there was no difference regarding whether patients had public or private insurance, as demonstrated in Figure 3. This agrees with the findings of the analysis of willingness of pediatric dentists to use ART in primary anterior teeth (Kateeb et al. 2014). ART costs less than conventional restorations and can be of a great value for patients who cannot afford more complex and costly treatment plans under sedation or general anesthesia.

Insurance as a whole was almost as important as the age factor in the current conjoint analysis. In contrast, when we asked about the importance of insurance status in pediatric dentists' decision to use ART as definitive or interim treatment but in another format (nonconjoint, check all that apply), insurance was 1/11 as important as age. This suggests that social desirability, which is a big concern in self-reported surveys, can be minimized when conjoint design is used.

The utility derived from the conjoint analysis also was used in this study to predict pediatric dentists' behavior for new patient scenarios. This was typically accomplished through the use of simulation scenarios that used results from conjoint analysis to make assumptions about the particular choice used by the pediatric dentists and that expressed those preferences by logit values. Market researchers have been using this approach to obtain a high degree of accuracy in predicting consumers' willingness to choose particular products and services (Wittink and Cattin 1989; Green and Srinivasan 1990), and this study suggests that dental researchers can do the same to predict patients' factors that make dentists most willing to use a particular restorative treatment option.

In the current study, simulation scenarios demonstrated that pediatric dentists were most willing to use ART with very young, uncooperative children who had no insurance and least willing to use ART with older, cooperative children with public insurance. This is consistent with the AAPD's (2012) professional guidelines encouraging pediatric dentists to use ART as an interim technique for very young and uncooperative children and for children with problematic access to dental care. In the United States, public insurance such as Medicaid provides excellent coverage for children receiving their restorative treatment in the operating room; thus, pediatric dentists may be more inclined toward operating room treatment for publically insured patients and less likely to use ART in an office setting for these patients.

Cluster analysis showed that dentists in cluster 1 (mainly composed of older dentists who had less busy practices) preferred to use ART with older children and that dentists in cluster 3 (mainly composed of younger dentists who had busier practices) preferred to use ART with younger children. This can be explained partially by the fact that the dentist's age in our sample correlated positively with treating a higher percentage of children in the 7- to 12-y age category ($r = 0.103$, $n = 683$, $P = 0.007$) and negatively with treating a higher percentage of children in <3-y and 3- to 6-y age categories ($r = –0.08$, $n = 682$, $P = 0.03$; $r = –0.19$, $n = 683$, $P < 0.0001$, respectively).

The generalizability of the results from our study to the national population of pediatric dentists is limited by the moderate response rate of 31% for the entire sample and the possibility of selection bias. However, our overall sample demographics compared favorably with the AAPD's list of pediatric dentists, and this response rate is within the normal range of response rates found in the recent literature of similar surveys of this population (Weil and Inglehart 2010; Tellez et al. 2011). Selection bias suggests that we need to consider the results of the current study with caution because it is possible that those who responded to our conjoint survey were more interested in the ART procedure than those who did not respond.

Other limitations related to the use of conjoint analysis as a design tool are described in detail in our previous work (Kateeb et al. 2014; Kateeb et al. 2015) and include information bias (i.e., framing in an overly "logical" way) and hypothetical bias (i.e., lack of realism). However, despite conjoint design limitations, conjoint analysis has been shown to be useful for predicting actual decisions when actual choices are compared (Whitehead 2005).

Unlike traditional ranking and rating tools used in previous studies, the conjoint analysis used in the present study found that insurance status of the patient appeared to be an important factor in dentists' decisions about different restorative treatment options. When pediatric dentists were forced to make tradeoffs among different patients' factors, they were most willing to use ART technique with young, uncooperative patients when they had no insurance. However, it did not make a difference in their decision making if the child had private or public insurance. This suggests that the use of a conjoint analysis tool to understand dentists'

decision making can provide deeper insights to understand the decision-making process.

Author Contributions

E.T. Kateeb, contributed to conception, design, and data acquisition, drafted and critically revised the manuscript; J.J. Warren, E.T. Momany, P.C. Damiano, contributed to conception and data interpretation, critically revised the manuscript; G.J. Gaeth, contributed to conception, design, data analysis, and interpretation, critically revised the manuscript. All authors gave final approval and agree to be accountable for all aspects of the work.

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