

A Value-based Health Care Rating System: Comparing Providers of Children's Oral Health Treatment



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INTRODUCTION

- Early Childhood Caries (ECC), defined by the American Dental Association as widespread tooth decay among youth less than 6 years of age, with 23% of U.S. children experiencing disease and costing \$892 million in total U.S. dental expenditures in 2012. ECC disproportionately affects ethnic minorities and the poor.
- The Affordable Care Act (ACA) intends to move health care providers and institutions to improve the health for the population under the "Triple Aim" objectives advocated by the Institute for Healthcare Improvement and the National Academy of Medicine for "better care, better health, at lower cost."
- Reimbursement mechanisms for dental care in the United States are driven by volume of procedures or visits, but the ACA mandates the movement from volume to value.
- The Porter-Teisberg model of Value-Based Health Care supports the "Triple Aim" objectives and defines value as the quotient of patient-perceived quality of care and the direct cost of care delivered ($V=Q/C$).
- There have been many attempts to rate hospitals and providers, but national rating systems are variable due to the difference in focus to its ratings and are primarily based solely on outcomes, not value.
- Examples: Centers for Medicare and Medicaid Services [i.e., Hospital Compare and Care Compare (for physicians)], The Leapfrog Group, Healthgrades, Consumer Reports, Vitals.com, Yelp, Google, Facebook, ZocDoc, and Propublica.

PURPOSE

- The purpose of this study is to validate with statistical cluster analysis, a value-based rating system of providers by geographic region, treatment facility, and individual provider.
- By creating a value-based rating mechanism:
 - Patients can better compare and select providers
 - Third-party payers, such as insurance companies and government programs can better compare outcomes and costs for provider systems, clinic facilities, and individual providers

METHOD

- Cross sectional cohort design
- Quality was measured with a 26-question Parental-Reported Symptom and Service Quality questionnaire (PRSSQ), a post-treatment survey administered to the parents of the children treated for ECC approximately one month after the treatment visit.
- The PRSSQ was adapted from the validated 13-question Early Child Oral Health Impact Scale (ECHOIS), 4-question Child-Oral Impacts on Daily Performance (C-OIDP), and 9-question Dental Consumer Assessments of Healthcare Providers and Systems (D-CAHPS) tools.
- ECHOIS assesses the effects of the child's oral health problems on not only the child, but also on the child's parent or caregiver.
- C-OIDP assesses oral impacts on the following daily performances: eating, speaking, cleaning teeth, smiling, emotional stability, relaxing, doing schoolwork, and social contact.
- D-CAHPS assesses the dental care experiences and satisfaction level of consumer-caregivers.
- Direct labor costs were used as a proxy for total direct cost and adjusted by relative value units.
- Value, the quotient between quality and adjusted costs, was used to rate providers by geographic region and clinic facility.
- Data was collected from 487 subjects treated between December 2015 and October 2016 at federally qualified health centers (FQHC) and hospitals located in seven U.S. states: Arizona, Florida, Hawaii, Maryland, Massachusetts, New York, and Tennessee.
- Subjects were registered as patients at one of twelve FQHCs and hospitals in the seven states, which serve communities with underserved and multi-ethnic compositions.
- Inclusion Criteria: 1) Subjects were age 6 or younger, 2) Diagnosed with early childhood caries, 3) Presented with a full complement of 20 primary teeth, 4) Parents were able to expressly consent for treatment in Spanish or English, 5) Treatment with either surgical treatment with general anesthesia (GA), surgical treatment without (GA), or non-surgical disease management treatment.
- Means and standard deviations were calculated for continuous variables. Counts and percentages were calculated for categorical variables.
- Descriptive statistics were presented both overall and by treatment modalities. Comparisons of distributions by treatment modalities were conducted by the Chi-square test (or the Fisher's exact test, as appropriate) for categorical variables and by the one-way ANOVA test (or the Kruskal-Wallis test, as appropriate) for continuous variables.
- To compare the value score by states and by facilities in which patients received their first treatment, Tukey's multiple comparison test was used.
- The comparisons of the value score by states and by facilities were conducted within each category of treatment modality.
- Natural logarithm transformation was applied to the value score in order to approximate a normal distribution. States, facilities, or individual providers with less than 10 observations were excluded from the multiple comparison (Note: All individual providers had less than 10 observations).
- To assess the robustness of results based on the Tukey's multiple comparison test to potential heterogeneity of variances of the In-transformed value score across states and facilities, a sensitivity analysis using the non-parametric Dunn's Kruskal-Wallis multiple comparison test was conducted.

TABLE 1: Summary of sample characteristics and comparisons by treatment modalities

	Overall	Surgical with GA	Surgical without GA	Non-Surgical	p
n	487	260	156	71	
age (mean (sd))	3.99 (1.22)	3.94 (1.18)	4.55 (1.08)	2.94 (0.90)	<0.001
Gender = male (%)	243 (49.9)	137 (52.7)	68 (43.6)	38 (53.5)	0.16
Ethnicity = Hispanic (%)	272 (56.2)	119 (45.8)	104 (68.0)	49 (69.0)	<0.001
Race (%)					<0.001
White	135 (27.7)	74 (28.5)	54 (34.6)	7 (9.9)	
Black	80 (16.4)	47 (18.1)	26 (16.7)	7 (9.9)	
Asian	21 (4.3)	10 (3.8)	5 (3.2)	6 (8.5)	
Native Hawaiian/Other Pacific Islander	31 (6.4)	31 (11.9)	0 (0.0)	0 (0.0)	
American Indian/Alaskan Native	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Other	220 (45.2)	98 (37.7)	71 (45.5)	51 (71.8)	
Payer source (%)					<0.001
Federal Medicaid	462 (94.9)	254 (97.7)	137 (87.8)	71 (100.0)	
CHIP [§]	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Employer paid commercial insurance	1 (0.2)	1 (0.4)	0 (0.0)	0 (0.0)	
Individually paid commercial insurance	1 (0.2)	0 (0.0)	1 (0.6)	0 (0.0)	
Self-pay	22 (4.5)	4 (1.5)	18 (11.5)	0 (0.0)	
Other	1 (0.2)	1 (0.4)	0 (0.0)	0 (0.0)	
Sum ECHOIS [¶] (mean (sd))	57.45 (7.61)	55.59 (7.10)	58.19 (8.57)	62.66 (3.25)	<0.001
Average ECHOIS [¶] (mean (sd))	4.42 (0.58)	4.28 (0.55)	4.48 (0.66)	4.82 (0.25)	<0.001
Sum D-CAHPS [‡] (mean (sd))	40.30 (4.52)	40.07 (3.92)	39.13 (5.24)	43.68 (3.09)	<0.001
Average D-CAHPS [‡] (mean (sd))	4.48 (0.50)	4.45 (0.44)	4.35 (0.58)	4.85 (0.34)	<0.001
Sum C-OIDP [‡] (mean (sd))	19.30 (2.31)	19.63 (1.62)	18.53 (3.32)	19.79 (1.01)	<0.001
Average C-OIDP [‡] (mean (sd))	4.83 (0.58)	4.91 (0.40)	4.63 (0.83)	4.95 (0.25)	<0.001
Quality					
Total PRSSQ [†] (mean (sd))	117.05 (10.48)	115.28 (8.22)	115.85 (13.21)	126.13 (5.20)	<0.001
** Average PRSSQ [†] (mean (sd))	4.57 (0.37)	4.55 (0.28)	4.49 (0.49)	4.87 (0.20)	<0.001
Cost					
Total cost care (mean (sd))	381.91 (343.57)	635.61 (275.75)	110.80 (99.58)	48.59 (26.33)	<0.001
RVUs (mean (sd))	29.77 (21.06)	46.15 (13.02)	12.49 (11.36)	7.76 (3.59)	<0.001
† Cost per RVU [†] (mean (sd))	12.66 (9.60)	14.23 (6.22)	12.71 (14.09)	6.82 (3.68)	<0.001
Value					
‡ Value score (mean (sd))	58.19 (56.92)	40.82 (30.08)	70.45 (70.61)	94.83 (72.76)	<0.001*
Ln-value score (mean (sd))	3.79 (0.69)	3.57 (0.49)	3.90 (0.84)	4.40 (0.52)	<0.001

Means (standard deviations) are presented for continuous variables; frequencies (%) are presented for categorical variables.
* p < 0.001 by the Kruskal-Wallis test.
** Quality = Average PRSSQ, with higher score indicating higher quality.
† Cost = Cost per RVU, with lower score indicating lower cost.
‡ Value = Value score = 100 times Quality (**) divided by Cost (†), with higher score indicating higher value.
§ CHIP: Children's Health Insurance Program.
¶ ECHOIS: Early Childhood Oral Health Impact Scale.
‡ D-CAHPS: Dental Consumer Assessments of Healthcare Providers and Systems.
‡ C-OIDP: Child-Oral Impacts on Daily Performance.
‡ PRSSQ: Parental-Reported Symptom and Service Quality questionnaire.
‡ RVL: Relative Value Unit.
§ CHIP: Children's Health Insurance Program.
‡ ASA: American Society of Anesthesiologists Physical Status Classification System.

FIGURE 1: Boxplots of In-transformed value-rated letter score by provider-states and Comparisons of value scores (mean and (standard deviation)) by provider-states.

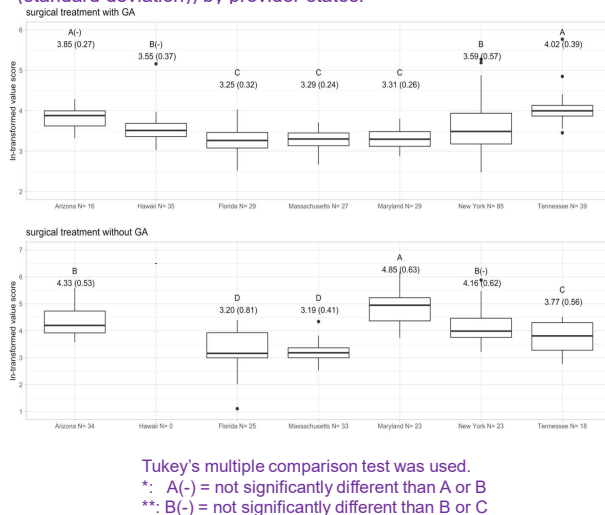
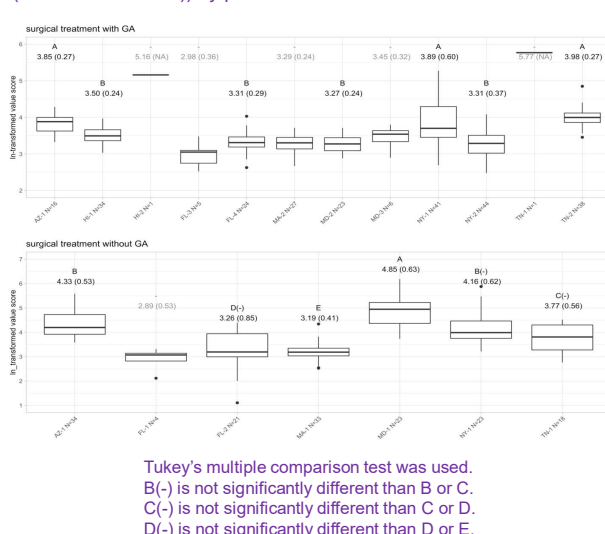


FIGURE 2: Boxplots of In-transformed value-rated letter score by provider-facilities and Comparisons of value scores (mean and (standard deviation)) by provider-facilities.



RESULTS

- Analytic sample included 487 patients. 53% of them received surgical treatment with GA, 32% received surgical treatment without GA and 15% received non-surgical treatment. Significant differences in the distributions of almost all demographic variables were observed among three treatment modalities. Significant differences were also observed in the quality, cost and value score. Specifically, non-surgical treatment had on average the highest quality score, lowest cost score and hence the highest value score among three treatment modalities. The rank of the value score was, surgical treatment with GA < surgical treatment without GA < non-surgical treatment. Comparisons of the value score by states and facilities were therefore carried out within each treatment modality (Table 1).
- The distributions of In-transformed value-based letter score by states were presented in Figure 1.
- For surgical treatment with GA, Tennessee had the highest average, followed by Arizona, Hawaii and New York. These four states also have on average significantly higher value scores than the other three states, namely, Florida, Massachusetts, and Maryland, whereas no significant differences were observed between these three states.
- For surgical treatment without GA, Maryland had significantly higher value score than the other states, followed by Arizona, New York and Tennessee. These four states' value score outnumbered that of Florida and Massachusetts.
- As for non-surgical treatment, patients were only seen in Maryland and New York. The value score in Maryland was significantly higher than that of New York. These findings were confirmed by the non-parametric Dunn's Kruskal-Wallis multiple comparison test.
- Figure 2 presents the comparisons by facilities. For surgical treatment with GA, there are two groups. AZ-1, NY-1, and TN-2, as a group, had significantly higher value score than HI-1, FL-4, MA-2, MD-2, and NY-2, as another group, as another group. However, no significant differences were observed within each of these two groups.
- For surgical treatment without GA, no clear grouping was observed, except that MD-1 had significantly higher value score than the other facility.
- The sensitivity analyses based on the Dunn's Kruskal-Wallis multiple comparison test confirmed the above results

CONCLUSIONS

- Rating methodologies can help patients in making health care decisions
- This paper demonstrates that value can be used as an objective methodology for rating hospitals
- Providers and Payors can use ratings in order to make treatment and purchase decisions based on value
- Because the healthcare industry is moving towards Value-Based Care, this model is in line with the overall industry's goals.
- Further studies will be required to identify whether this value metric is validated.

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