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April 27, 2022

RE: *JAMA Open Network* submission titled: **Association of Children’s Hospital Status on Value for Common Surgical Conditions**

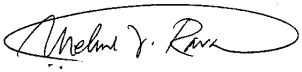
Dear Dr. Morris and Editors Staff of *JAMA Open Network*,

On behalf of my co-authors we respectfully submit the attached revised manuscript for consideration for publication in *JAMA Open Network*. As requested, we have provided detailed response to the each of the reviewers’ thoughtful comments in the attached letter. Our responses are in **bold** and associated line references highlighted in yellow. Further, we have provided a “tracked changes” version and “clean” version of the manuscript.

The incorporated changes, as suggested by reviewers, now strengthen this AHRQ R01 funded research. We feel that the readership of *JAMA Open Network* will find our timely results fascinating. To our knowledge, this is the first publication of its type to address the value proposition for children’s hospitals in the United States.

All authors are responsible for reported research and have participated in the concept and design, analysis and interpretation of data, drafting or revising, and have approved this manuscript as submitted. This work is not under consideration for publication in any other venues. We appreciate your review and consideration for publication in *JAMA Open Network.*

Yours in service,

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Mehul V. Raval, MD, MS

EDITOR'S SPECIFIC COMMENTS:  
  
E1: Key Points, Findings: Include the study design (eg, clinical trial, cohort study, case-control study, meta-analysis, etc). Focus on primary outcome(s) and finding(s). Do not emphasize secondary outcomes. Report basic numbers only but state if results are statistically significant or not significant; do not include results of statistical tests or measures of variance. Limit to no more than 1-2 sentences.

**E1: Key Points, Findings section has been updated to state: “In this cohort study, negotiated payments for commonly performed surgical procedures in children were significantly higher at children’s hospitals than non-children’s hospitals. Inpatient procedures were 39% higher and outpatient were 34% higher.” page 2, lines 23-25**

E2: Abstract, Design and Methods: State the years of the study and the duration of follow-up. For older studies (eg, those completed >3 years ago), add the date of the analysis being reported.

**E2: Abstract, Design and methods section has been updated to state: “This was a retrospective cohort study of pediatric patients undergoing one of 13 commonly performed surgical procedures between 2010 and 2015 with 90-day follow-up using administrative data from the Health Care Cost Institute (HCCI). Data analysis took place from July 2019 to December 2021.” page 3, lines 37-40**

E3: Abstract, Results: The number of patients and summary demographic information (eg, baseline characteristics of study participants) should be reported in the first line of the Results section.

**E3: Abstract, Results section has been updated to state: “There were 368,220 pediatric patients who underwent one of the surgical procedures of interest. 220,899 (60.0%) of the patients were male. 118,977 (32.3%) had their procedure at freestanding CH (CH-A), 75,256 (20.4%) at CH attached to an adult hospital (CH-B), and 173,987 (47.3%) at NCH.” page 3, lines 46-50**

**Of note, the only patient-level demographics we have available to us are gender.**

E4: Abstract, Conclusions: Begin with “In this cohort study,…” and report findings in past tense.

**E4: Abstract, Conclusions section has been updated to state: “In this cohort study, children who underwent common surgical procedures had equivalent clinical outcomes at CH and NCH but the procedures were associated with higher payments and, thus, overall lower value care. To ensure delivery of optimal value to patients and payers, further research is needed to evaluate mechanisms to ensure access, decrease costs, and improve value at both CH and NCH.”** **page 4, lines 58-63**

E5: Methods: please indicate how this report follows the STROBE reporting guideline for cohort studies. See <http://www.equator-network.org/reporting-guidelines/strobe/>

**E5: Methods section updated to state: “This study follows Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines for cohort studies.” page 6, lines 109-111**

**We have also added a sentence to the limitations section explicitly addressing bias and generalizability of our findings: “Our results may be biased and thus have limited generalizability to publicly insured populations.” page 15, line 303**

E6: Table 3: Statistical significance cannot be indicated via asterisks, formatting, or footnotes. If you would like to add P values to the tables, please add additional columns and include all P values, including those that are nonsignificant. Express P values to 3 decimals if less than .01 or to 2 decimals if greater than or equal to .01.

**E6: Table 3 has been reformatted to include p-values, see page 25**

E7: SUPPLEMENTAL MATERIAL  
Please put all online-only elements into a separate combined file. Supplemental content is published online without editing and formatting by JAMA Network staff, so please be sure all elements are readable and fit on the page. These materials should be self-explanatory (able to stand on their own) and carefully prepared for accuracy, clarity (including expansion of all abbreviations), and legibility.  
Each element (eg, each eTable) must be cited in the main paper.

**E7: Both supplemental tables have been put into a separate singular combined file and deleted from the manuscript document.**

REVIEWER COMMENTS:

Reviewer #1 (Remarks to the Author):  
  
This was a well conducted study of the relationship between children’s hospital status and the cost and outcomes of numerous common pediatric surgical procedures. However, there are a number of issues that require addressing.  
  
1) Given that claims from Q1 2010 to Q4 2015 were used, ICD-10-CM/PCS codes should have been used, in addition to ICD-9-CM and CPT codes, to identify the study cohort and to identify postoperative complications.

**R1.1: Our analyses spanned January 2010 to September 2015 (Q3 2015) before the transition to ICD-10.**

**We clarified this in our methods section: “We analyzed claims data from January 2010 to September 2015 from HCCI.” page 7, line 113**

2) Many postoperative complications are addressed in the emergency department or in observation status encounters. These types of encounters should be included in the identification of relevant complications.

**R1.2: Our outpatient claims include emergency department claims as long as they are part of a hospital facility, a critical access hospital, or a surgery center. Stand along emergency facilities would not be counted in our case, but those are very rare in our data. Our data captures over 99% of all ED visits.**

**We clarified this in our methods section: “These occurrences include emergency department claims that were the part of a hospital facility, critical access hospital, or surgery center.” page 8, lines 145-146**

3) It is not clear why the specific hospital-level variables included in the multivariable models were selected. For example, it seems that the proportion of admissions covered by Medicaid would be preferable to the total number of Medicaid discharges, particularly since the total number of discharges is also controlled for and is presumably highly collinear with the payer-specific numbers of discharges.

**R1.3: We selected our other covariates based on institutional knowledge and data availability. Essentially, we used variables that are both observable and thought to affect hospital prices, but which are not themselves clearly outcomes of prices. In cases where variables are thought to also be an outcome of prices, we present results with and without such covariates. This is the case for quality measures. In the case highlighted by Reviewer 1, the more flexible specification is to include each variable separately. Collinearity across those variables is not a problem since we are not attempting to interpret any of those coefficients individually.**

4) It is not clear how hospital markets were defined. It seems that either zip codes or counties were used, neither of which would be appropriate.

**R1.4: We do not define hospital markets in this paper, but we do include zip codes “fixed effects” in our regression analysis. These fixed effects adjust for any time-invariant, unobservable factors specific to that zip code that may affect our outcomes of interest. Any measure of a market that can be constructed from zip codes is therefore controlled for in our regression since the unobservable market fixed effect can be written as a linear combination of zip code level effects.**

5) Given that the complication outcomes are binary, the investigators should conduct secondary analyses utilizing marginal logistic regression models fit using GEE.

**R1.5: As the reviewer notes, we did not consider complications/readmissions in our regression analysis. Therefore, we conducted additional analyses as follows. First, there were very few complications among the outpatient procedures, therefore we focused on inpatient procedures. The below table demonstrates regression coefficients on the CH-A and CH-B indicator variables (again with NCH as the reference), alongside standard errors and p-values. This data was added to Table 3 in the manuscript, see page 25)**

**As can be seen, the coefficient estimates are small and standard errors are large. Thus, we fail to reject the null of different readmission/complication rates across hospital types.**

**Our results section was updated to state: “Adjusting for observable characteristics, we similarly see no significant difference in readmissions or complications among CH-A or CH-B compared to NCH. For example, a coefficient estimate of 0.23 implies an estimated 1.26 increase in the odds of a complication, or a 26% increase in complication rates, for CH-A compared to NCH. However, given the low rates of complications overall, these percentage increases reflect relatively small changes in the occurrence of complications (Table 3).” pages 11-12, lines 223-228**

**Additionally, we added clarification to our methods section and it now states: “In cases where the outcomes were binary, such as for 90-day readmissions or complications, we estimated the same specification using a generalized linear model with a binomial family and a logit link function.” page 9, lines 173-175**

**“For prices, there are 26 regressions total, but not all results are available for these individual analyses due to small sample sizes. Similarly, for regressions involving quality outcomes, we focused on the full inpatient sample due to low counts of readmissions or complications for individual procedures or outpatient-only procedures.” pages 9-10, lines 180-184**

6) It would be helpful to see 1) a sensitivity analysis that includes only hospital markets where both CH-A and NCH are located 2) a sensitivity analysis that includes only hospital markets where both CH-B and NCH are located and 3) a sensitivity analysis that includes only hospital markets where one CH-A has a monopoly on pediatric tertiary care.

**R1.6: We agree that the suggested market-level analysis would be interesting and informative; however, as highlighted in reviewer’s point (4), such an analysis would require that we first propose an appropriate measure of hospital markets for the procedures and population in question. Common market definitions such as counties or Hospital Referral Regions (HRRs) are inappropriate, particularly HRRs which are derived from the Medicare population. Other distance-based definitions of markets may be more appropriate but are beyond the scope of our paper, the analysis of which is at the procedure level. Nonetheless, we did re-estimate regressions when limiting to HRRs based on two conditions: 1) HRRs with nonzero counts of CH-A and NCH hospitals; and 2) HRRs with non-zero counts of CH-B and NCH hospitals. From the results, we again find evidence of significantly larger prices among CH-A relative to NCH.**



7) Is it the case that the models for hospital payments included 5-digit patient residential zip codes as indicator variables? The authors should clarify how and which (hospital vs. patient) zip codes were incorporated into these models.

**R1.7: We used hospital 5-digit zip codes as fixed effects. They are incorporated conceptually as a set of indicator variables, one for each hospital zip code reflected in the data. However, due to computational barriers, we do not estimate the regression with those indicator variables. We instead employ estimators that first de-mean the data at the zip code level, so that the fixed effect is "removed" from the estimation. This is sometimes referred to as a "within" estimator. The results are the same in either case but with significantly less of a computational burden.**

8) A substantial proportion of patients were excluded because their procedures lacked a non-missing consolidated NPI in the claims data. How did these patients differ from those patients who were included in the study?

**R.1.8: We observe some information from other sources (such as the hospital cost reports or the American Community Survey), and based on that information, the excluded hospitals tend to be much smaller and operate in smaller markets. The bed size from the excluded hospitals range from 25 to 39, with a mean of 27. Meanwhile, the mean bed size among the included hospitals is 400. The mean population size from the census data among counties for observations with missing NPIs is 33,000, versus a mean population of 1 million among counties where hospitals have non-missing, consolidated NPIs. Hospitals without consolidated NPIs in the HCCI data tend to be much smaller and exist in less populated areas.**

9) The authors should clarify how hospital teaching status was defined.

**R1.9: We define a teaching hospital as any hospital that reports being a member of the Council of Teaching Hospitals of the Association of American Medical Colleges, as captured in the American Hospital Association survey.**

**We have added this to our methods section and it now states: “Further, hospitals were classified as teaching or non-teaching if they reported being a member of the Council of Teaching Hospital of the Association of American Medical Colleges on the AHA survey.” page 8, lines 137-139**

10) Confidence intervals should be added to Table 3.

**R1.10: We have updated Table 3 as per E.6 and have added p-values.**

11) The authors should clarify that they used the version 1 HCCI data, which differs substantially from the currently available version 2 dataset.

**R1.11: We did use version 1 of the dataset in our analysis. We have updated our methods section to state: “This investigation was a retrospective cohort study using version one of the Health Care Cost Institute (HCCI) dataset.” page 6, lines 97-98**

12) Given that most lower SES children and adults are not commercially insured, it is not clear how the HCCI data can possibly be representative of the U.S. population of persons younger than 65 years of age, even if weights are applied, as stated in the methods. Furthermore, it is not clear if weights were applied for this analysis.

**R1.12: We did not use any weights in this analysis as the claims weren’t sampled. We agree that this data may not be generalizable to the publicly insured population as the claims only encompass privately insured patients.**

**We discussed this as a limitation in our study: “This study has several limitations. First, HCCI data reflect payments and care delivery for employer based/privately insured patient populations. Depending on the specific state, Medicaid (including Medical Assistance, Children's Health Insurance Plan (CHIP) or other government-assistance plan coverage) ranges from 17% (Utah) to 56% (New Mexico).35 Our results may be biased and thus have limited generalizability to publicly insured populations. Nevertheless, the large sample sizes included in our study and variable private insurance plans (with high and low deductible plans included) may increase the generalizability of our findings.”** **page 15, lines 299-306**

Reviewer #2 (Remarks to the Author):  
  
I have reviewed the study by Dr. Raval and colleagues that examines the reimbursement differences for common pediatric surgical procedures between children's hospitals and general acute care hospitals. The question is interesting and the data are more detailed than the typical claims data available for this type of analysis (which usually only has charges rather than reimbursed amounts). The actual and potential limitations are well explained.  
  
1) The only question I have is about the selection of procedures. The way it is explained in the manuscript gives the impression that it was an ad hoc selection. Instead of a literature review and clinical discretion, why not just start by examining the top 10 or top 20 procedures in terms of volume? And if this was considered as a strategy maybe a short appendix explaining which of those top volume procedures were excluded and for what reason, and present something like figure 2 for reach procedure in the appendix.

**R2.1: Our selection of cases was a purposeful sampling. We wanted to represent a wide variety of surgical specialties across multiple surgical subspecialties and intentionally included several lower volume procedures.**

**Our methods section states: "Final procedure inclusion was determined through a combination of literature review and clinical judgement to purposefully capture inpatient and outpatient populations and to represent the full spectrum of children’s surgical procedures performed at most hospitals." page 7, lines 121-124**