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WILEY
A Pilot Study Assessing Clinic Value in Pediatric Pharyngeal Dysphagia: The OPPS/Cost Method

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Objectives/Hypothesis: Given the costs of healthcare, capitation, and desires for quality improvement (QI), there is a need to better assess healthcare value. Time-driven activity-based costing and the Quadruple Aim have evaluated value by assessing health outcomes and provider experiences relative to costs. The proposed OPPS/Cost method expands on this to examine value for aerodigestive clinic treatment of pediatric persistent pharyngeal dysphagia: $O + P_1 + P_2 + S/Cost$ ($O =$ objective health [video-fluoroscopic swallow study results], $P_1 =$ patient/family experience [Consumer Assessment of Healthcare Providers and Systems], $P_2 =$ provider experience [Copenhagen Burnout Inventory (CBI)], $S =$ subjective health [Feeding/Swallowing-Impact Survey], $C =$ cost [time-driven activity-based costing]).

Study Design: Use of QI time data, surveys, and retrospective chart review for 56 patient encounters.

Methods: Staff interviews were used to develop process maps, and monetary values were assigned to activities. OPPS/Cost outcomes were normalized amongst variables, and composite values were calculated. Comparisons were made using a Student t test for pre- and post-clinic relocation over a 14-month period.

Results: Time reductions were check-in (13 minutes/patient), rooming (21 minutes/patient), and providers (4 minutes/patient). Patient in-room wait time increased (4 minutes/patient). The CBI identified burnout as an area for improvement. OPPS/Cost composite values increased by 14%, with a 1.7% cost reduction, improvement in objective and subjective health outcomes of 47.4% ($P < .05$) and 7.3%, respectively, and stable patient/family experience.

Conclusions: OPPS/Cost is feasible in an interdisciplinary clinic and helped evaluate value during a clinic relocation. The QI opportunities identified are indicative of the potential of OPPS/Cost.

Key Words: Value, quality improvement, time-driven activity-based costing, aerodigestive, pharyngeal dysphagia.

Level of Evidence: NA

INTRODUCTION

Value-based care is more important than ever before given rising costs of healthcare and variability in healthcare delivery and outcomes. To improve the quality of care delivery and outcomes, the US healthcare system is transitioning away from volume-based care to value-based care through the implementation of accountable care organizations, merit-based incentive payments, and bundled payment models. Limited methods exist to assess the quality improvement that comes along with these changes. This study aimed to address the lack of a standardized process.

Given constraints of time and funding, there are inherent trade-offs in healthcare delivery. With a value-based focus, both outcomes and costs are evaluated. In 2008, the Triple Aim initiative focused on improving healthcare by evaluating the patient’s health and experience of care outcomes with cost. In 2014, providers’ experience was also examined as another important component to improving healthcare, resulting in the Quadruple Aim. Separately, Kaplan proposed time-driven activity-based costing (TDABC) as a patient-centered method for assessing cost and value. In 2016, Lee et al., applied tools based on TDABC concepts in a hospital where they demonstrated that raising providers’ awareness of costs and quality was enough to reduce cost and improve quality.

This study examined an approach to value-based evaluation of a quality improvement initiative in the

Additional Supporting Information may be found in the online version of this article.

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Coppess et al.: Clinic Value in Pediatric Pharyngeal Dysphagia
Seattle Children’s Hospital (SCH) Aerodigestive Program for the treatment of persistent pharyngeal dysphagia (PPD). PPD is a complex disease, with implications for various subspecialties and treatment generally extending over a prolonged time course with multiple visits/procedures. The Aerodigestive Program is interdisciplinary, with otolaryngology, pulmonology, gastroenterology, speech language pathology (SLP), and nutrition. Providers from traditionally separate clinics can evaluate and propose care plans concurrently. Clinic and operating room procedural efficiency is difficult given the complexity of these patients and their subspecialty needs, making the assessment of value important. Changes in care delivery, such as a move of an aerodigestive clinic from within a large hospital to an ambulatory care facility (ACF) to accommodate growth in patient volume, can be difficult to measure from the perspective of the value of care. Prior to this study, there was not a comprehensive set of criteria available to measure the evolution of this program and how changes may impact it or the delivery of care.

The OPPS/Cost method (OPPS/Cost), based on principles of the Quadruple Aim and TDABC, was developed to evaluate the value of clinical care across the treatment of PPD. We examined the impact of moving an aerodigestive clinic from a hospital to an ACF while assessing feasibility/sustainability of implementing the OPPS/Cost method. The hypothesis was that OPPS/Cost can be used for value-based evaluations of healthcare delivery for PPD, and the methods’ principles are potentially applicable to value-based evaluation of healthcare delivery for other disease states and clinics.

**MATERIALS AND METHODS**

**Developing the Model**

Previously validated measures were incorporated while utilizing existing survey instruments and available clinical data to improve implementation and sustainability. The factors evaluated by OPPS/Cost are as follows: (O) objective health, (P₁) patient/family experience, (P₂) provider experience, (S) subjective health, and Cost. Each variable required standardization to a positive linear-correlated 100-point scale due to varying units of measurement, and TDABC cost was multiplied by the number of variables utilized in the numerator for the respective composite scoring (Table I).

(O) OBJECTIVE HEALTH. Objective health measures providers’ assessment of the patient’s disease and helps track treatment progress. Given that the videofluoroscopic swallow study (VFSS) is one of the cornerstones of PPD assessment and is generally performed multiple times through the care of this disease, the SLP’s consistency recommendation from the VFSS was selected. A numerical score of 1 to 7 was assigned to consistency (1 = thin, 2 = half-nectar, 3 = nectar, 4 = slightly less thick than honey, 5 = honey, 6 = puree, and 7 = solids). The objective health calculation is as follows:

\[ O = 100 - \left( \frac{\text{VFSS score}}{7} \right)^*100. \]

(P₁) PATIENT/FAMILY EXPERIENCE. Patient/family experience is a measure of satisfaction with the patient/guardian/provider interaction. SCH uses a modified version of the validated Consumer Assessment of Healthcare Providers and Systems (CAHPS). The unvalidated subscales utilize Likert scales ranging from 3 to 11 points that were identified iteratively by the National Research Corporation (modified-CAHPS). The survey is performed via email and phone within 3 days after a patient’s visit and scored utilizing an structured query language script as standard practice for the institution independent of this study. The patient/family experience calculation is as follows:

\[ P_1 = \frac{100}{n} - \left( \sum_{i=1}^{n} \frac{x_2}{2} + \frac{x_3}{3} + \frac{x_{10}}{10} \right), \quad n = \#\text{questions}, \]
\[ x_2 = 2 \text{point scale value}(s), \quad x_3 = 3 \text{point scale value}(s), \]
\[ x_{10} = 10 \text{point scale value}(s). \]

(P₂) PROVIDER EXPERIENCE. Provider experience measures the impact to the provider. Although burnout does not measure the providers’ full experience, it is an important and well-validated measure of work-related wellness. The Copenhagen Burnout Inventory (CBI) is validated for the evaluation of provider burnout. The full 19-question CBI was initially utilized, but after feedback, “that [providers] were getting burnt out from the burn-out survey,” the validated seven-question work-related burnout subscale was emailed after each clinic and generally completed within a few days. A comment box was included so that providers could anonymously provide feedback. Normative data are available for the CBI, and provider burnout can be assessed and compared, with a CBI normative mean of 33 for all healthcare workers. The provider experience calculation is as follows:

\[ P_2 = 100 - (\text{CBI composite}). \]

(S) SUBJECTIVE HEALTH. Subjective health measures the patients’ perspective of their disease state. The validated pediatric Feeding/Swallowing Impact Survey (FSIS), an 18-question survey, was administered to the parents of the patient on a tablet device while they waited to meet their providers at each appointment. The subjective health calculation is as follows:

\[ S = 100 - \left( \frac{100}{n} - \left( \sum_{i=1}^{n} \frac{x_i}{5} \right) \right), \quad n = \#\text{questions}, \quad x_i = \text{FSIS values}. \]

COST. TDABC was used to measure cost because it provides transparency when individual costs of a clinic can easily get lost in the financials of the larger hospital system. Additionally, the process of implementing TDABC is important in identifying the way care is currently being assessed by creation of process maps. Process maps are detailed flowcharts of each step in the care of a typical patient with measurement of the time it takes for each activity. TDABC data are obtained by identifying the time spent by each resource and multiplying that time it takes for each activity. TDABC cost was multiplied by the number of variables utilized in the numerator for the respective composite scoring (Table I).
took place in real time in the clinic by a research assistant. The TDABC calculation is as follows:

\[
\text{Cost} = \frac{\text{TDABC value}}{10}
\]

The OPPS/Cost composite/value was calculated using the following equation:

\[
O + P_1 + P_2 + S, n = \#\text{variables}.
\]

Specific variables can be isolated, for example, isolating the health aspects over cost:

\[
O + S, n = 2,
\]

to focus specifically on health measures. A perfect score for each of the OPPS/Cost elements would be 100, indicating no diet modification for VFSS, 100% patient/guardian satisfaction for modified-CAHPS, no provider burnout for CBI, and no problems for FSIS. OPPS/Cost composite scoring of 1 indicates a theoretical perfect balance of outcomes to average cost of care. It can be inferred that the closer the ratio is to 1, the better the clinic value of treatment of PPD, but the individual elements need to be viewed, as there are tradeoffs in outcomes and cost.

**Data Sources**

Waiver of patient consent was obtained from the SCH Institutional Review Board for this quality improvement study. Ten providers (otolaryngology/pulmonology MDs, SLPs, nurses, nutritionists, and MAs), and 56 patient encounters of the SCH Aerodigestive Program with a diagnosis of PPD and/or aspiration were studied.

**Setting**

The OPPS/Cost study was initiated in April 2016 in the otolaryngology clinic space at the free-standing children’s hospital in Seattle, Washington. Five months into the study, the clinic moved to an ACF in Bellevue, Washington. Process changes made during this move included an increase in the number of exam rooms from three to five, reorganization of clinic space (see Supporting Figure 1 in the online version of this article), transitioning from half-day to full-day clinics, and a revised clinic huddle strategy.

### Applying the Model

Process maps illustrating the current state of evaluation and treatment of PPD (see Supporting Figure 2 in the online version of this article) were created and reviewed for accuracy by the aerodigestive team. The average cost to the hospital for each step in the cycle of care for a typical patient visit was determined using information obtained from the financial department for personnel, nondisposable equipment, and space. The amount of time spent by healthcare workers on patients throughout patient clinic visits and diagnostic procedures was tracked in real time. TDABC costs per patient, per clinic visit were calculated with costs for nondisposable equipment and space allocated to activities where they were utilized based on remaining useful life and percentage of capacity time. An average value of time spent was

![Clinical Value in Pediatric Pharyngeal Dysphagia](image-url)
RESULTS

A total of 56 patient encounters were collected, of which 69.6% (39) were male. The average age at the first visit was 3.9 years (standard deviation = 2.6 years). A 1.7% reduction in cost, improvement in objective and subjective outcomes of 47.4% (P < .05) and 7.3%, respectively, and stable (−0.03%, P > .05) patient experience was seen with the clinic location change (Fig. 1). Although CBI scores were not available for the sample at the hospital location prior to the move to ACF, comparing a mean CBI of 47.5 to the normative mean of 33 indicated burnout (P < .05). The composite scoring indicated a 14.0% increase in OPPS/Cost and 26.2% increase in OS/Cost (P < .05) (Fig. 2).

Generally, the move from the hospital to the ACF saved time in rooming patients by reducing check-in time, vitals time, and getting patients closer to their appointed schedule, all while decreasing facility costs. A decrease of 13 minutes/patient was noted in patient check-in time, and 21 minutes/patient were saved in rooming times. A decrease of 3 minutes/patient was seen during vitals assessment, which was attributed to taking vitals in the patient room as opposed to a vitals room where bottlenecks was often observed. Change from hand-completed quality of life surveys to tablet devices saved the MA an average of 4.5 minutes/patient and provided real-time access to the data. An increased wait time of 4 minutes/patient between being roomed and seeing the first provider was noted, whereas the amount of time spent with providers decreased by an average of 4 minutes/patient. Having the MA mix SLP swallowing supplies saved the SLP 7.6 minutes/patient. Initially, an increase of 15 minutes/patient of waiting for discharge was noted at the new location; however, once at steady state in the new location, the time waiting for discharge adjusted to an increase of only 8 minutes/patient more than the previous location.

With respect to cost, $2.50/patient was saved by performing vitals in the patient’s room. Transitioning SLP tasks to the MA saved $7.00/patient. Automating surveys on tablet devices saved $3.30/patient. TDABC allocation of facilities costs decreased by $7.70/patient and the overall decreased time spent with providers marked a decreased average cost of $10.30/patient.

DISCUSSION

The strongest benefit of OPPS/Cost is in comparing pre- and postintervention, highlighting potential areas for improvement, and monitoring changes over time. Our intervention was the move from the hospital to the ACF and its associated process changes, with the hypothesis that it would result in improved provider and patient experience, decreased cost, and increased value. With the application of OPPS/Cost, it was shown that the transition to the ACF identified an increase in value of 14%, but with the only result we expected being a statistically significant cost reduction of 1.7%. In analyzing the cost reduction, we found a 4 minute/patient decrease in average time with providers was the largest driver. TDABC showed patients got to their rooms faster and were more often on time for appointments in the ACF than the hospital. However, patients spent more time in their room waiting for the first provider at the ACF, likely because more exam rooms were available in the ACF, shifting some of the patients’ waiting time from lobby to exam room. This could be viewed as positive or negative depending on one’s perspective. Interestingly, patient satisfaction was stable in spite of less time spent with providers. These are exactly the types of tradeoffs that OPPS/Cost intends to further investigate as the clinic continues to evolve.

Applying OPPS/Cost also highlighted an area for potential improvement for our team in provider experience. Although data for provider experience were only obtained at the ACF, the mean CBI of 47.5 above normative means, with 47.1% of respondents reporting an individual CBI meeting criteria for burnout (CBI ≥ 50), indicated burnout risk. Assessing provider burnout is
important, as burnout is associated with increased risks for depression, reduction of work effort/hours, and early retirement, with costs of replacement at two to three times annual salary. Anecdotally, the providers expressed an increase in satisfaction relative to the hospital due to better flow. In the hospital, providers would physically run into each other or patients on their way in and out of rooms. With the additional rooms in the hub-and-spoke model, and rolling schedule of the ACF, providers were able to go into a patient’s room without waiting for the others to finish and come out to the central team location to discuss. When debriefing, providers believe there is improved communication in the new model that likely translated to better patient care. Times captured reflect that providers had more time outside of exam rooms available to communicate with other providers and for charting (+21 minutes/patient otolaryngology, +7.6 minutes/patient SLPs, and +7 minutes/patient pulmonology). An SLP stated, “Having my times tracked helped me realize I had inefficiencies and I changed my mixing process for swallow studies.” Overall, providers have described a more favorable schedule at the ACF (earlier end of the day) and less at home charting time, improving their satisfaction. The elevated provider burnout scores relative to normative data benchmarks are concerning, and even more concerning to consider what they might have indicated if these data had been gathered at the hospital and had the clinic remained there longer. Also, that the surveys were administered within a few days of clinical completion is to be considered, where providers’ sentiments could differ depending on the exact timing of their completion of the survey within the context of their clinic and charting experience. Regardless, this information sparked discussions to address provider burnout risk.

Lessons Learned

Implementation of OPPS/Cost required upfront investment to develop the process maps and obtain TDABC data, with most of the work performed by a volunteer research assistant, though time and attention were required of the aerodigestive team. A business administrator and clinical sponsor were critical, with the clinical sponsors of the project required to confirm the process maps and define outcomes. For health outcomes, utilizing data that were already tracked and implementing new survey measures that added value to the care of patients, while minimizing burden on the team, was well balanced. Ongoing collection of data is required for OPPS/Cost to be sustainable. Use of data already gathered helps limit the additional resources required. Modified CAHPS was already scored and required little work to obtain and analyze, whereas the VFSS required chart review. Recording the diet consistency recommendation by the SLP numerically when completing the VFSS in a database driven by note templates could help resolve this and is being explored. Additional avenues already being considered as part of quality improvement work irrespective of OPPS/Cost to implement data gathering via electronic means will help make data collection more sustainable, reduce the cost of administration, improve response rates, and improve temporal proximity to variables considered.

The largest challenge in implementing OPPS/Cost is ongoing time tracking during the clinic, which required a research assistant to manually record activity times. This is not sustainable long term. Automated tracking devices are being installed at SCH to perform this function in real time. A less expensive alternative solution would be to record clinic times less frequently. Once all of the data are obtained, there is a manual process to calculate OPPS/Cost. With the database setup and spreadsheet prepared for analysis, the time for this is limited, but further work is required to make this process more automatic, ideally making the data available on a real-time dashboard that can be discussed before and after each clinic. Others that are considering implementing OPPS/Cost should consider the costs of implementation in terms of times and resources of team members to setup processes and gather the data.

CONCLUSION

The benefits for defining value for a medical practice through measuring quality and costs include the direct benefits of reducing costs and improving quality, but also include being prepared for a shift toward value-based care as a future medical standard. The power of OPPS/Cost is not in the numbers generated, but in the collection of data and analysis of each individual factor when deviations are identified. It was feasible to implement and calculate for the SCH aerodigestive team. It currently appears useful for pre- and postintervention and analysis over time, but with further adoption could be useful as a benchmarking tool for the treatment of a disease state. As an application of established principles for assessing value of care (Quadruple Aim/TDABC), it appeared in this pilot study to be an effective tool for assessing value, including assessment of quality improvements and trade-offs, that warrants further investigation. Further research may attempt to apply OPPS/Cost to another pediatric aerodigestive program to validate the method for value analysis for treatment of PPD and to help provide a basis for comparison of institutions sharing best practices and quality improvement. Applying this method to understand other diseases would also be beneficial for a system as it moves toward value-based healthcare.

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