ORIGINAL RESEARCH-GENERAL OTOLARYNGOLOGY

Comparing quality at an ambulatory surgery center and a hospital-based facility: Preliminary findings

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ABSTRACT

OBJECTIVE: To measure the quality of outpatient surgery in an ambulatory surgery center (ASC) compared to a hospital-based facility (HBF) in a multidimensional manner.

STUDY DESIGN: Cross-sectional survey based on chart review. **SETTING:** Pediatric academic health center.

SUBJECTS AND METHODS: A total of 486 cases were reviewed. Procedures were performed at either an ASC (n=275) or an HBF (n=211). Cases comprised four procedure types: ventilation tube insertion (ASC, n=126; HBF, n=108), dental rehabilitation (ASC, n=89; HBF, n=58), adenotonsillectomy (ASC, n=37; HBF, n=34), and ventilation tube insertion/ adenoidectomy (ASC, n=23; HBF, n=11). Measures were developed for five categories: safety, patient-centeredness, timeliness, efficiency, and equitability. Performance was compared between facilities.

RESULTS: The ASC had no unexpected safety events (0/275) compared to nine events (9/211) at the HBF. Tonsil bleed rates were 0 percent (0/37) at the ASC compared to 5.9 percent (2/34) at the HBF. Patient satisfaction was similar between facilities (ASC, n=64; HBF, n=35). Differences in timeliness approached 30 percent. A total of 77 percent of ASC cases finished within the scheduled time compared to 38 percent at the HBF. Total charges were 12 to 23 percent less at the ASC. Patients treated at the ASC generally lived in wealthier neighborhoods.

CONCLUSION: Performance at the ASC generally exceeded that at the HBF. Future research should investigate how perioperative processes result in these quality differences. Health policy implications are discussed.

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Today's healthcare environment continues to be plagued by "layers of processes and handoffs that patients and families find bewildering and clinicians view as wasteful." As the healthcare industry responds to public demand for higher quality while facing scarce resources, innovative delivery models that provide high-quality, low-cost care are increasingly needed. Ambulatory surgery centers (ASC),

which take advantage of economies of scale and low-cost organizational structures, have been described as such a model.²

One explanation for the quality advantage of ASCs is their bias toward being high-volume centers. A well documented relationship exists between quality and surgical volume.3 In rotator cuff surgery, for example, higher volume has been linked to decreased length of stay, higher rates of routine patient discharges, and shorter mean operating room times.⁴ ASCs are also cost effective. Plastic surgery cases performed at an ASC resulted in higher contribution margin per case minute compared with those performed at a hospital-based facility (HBF).2 This quality advantage has resulted in more procedures being shifted to ASCs. For example, ambulatory cases represented four to 13 percent of lumbar spine surgery from 1994 to 1996, whereas that percentage increased to nine to 17 percent from 1997 to 2000.5 According to the American Association for Accreditation of Ambulatory Surgery Facilities (AAAASF), 23 unanticipated deaths occurred out of 1,414,418 outpatient procedures performed.⁶ A recent review of pediatric otolaryngology outpatient procedures performed at an ASC revealed an unexpected outcome rate of 0.2 percent, with no deaths.7

Current quality studies typically investigate one aspect of quality (eg, safety) while ignoring others. In 2001, the Institute of Medicine defined quality as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes, and are consistent with current professional knowledge". Quality was further described as being multidimensional. These dimensions include care that is safe, effective, patient-centered, timely, efficient, and equitable. Quality studies should address each of these dimensions to avoid dangerous tradeoffs. For instance, a service that is timely and efficient because it cuts corners may not be safe.

The purpose of this study was to measure the quality of outpatient surgery in an ASC compared to an HBF. By measuring quality in a multidimensional manner, a more complete understanding can be developed of how organizational structure affects quality.

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METHODS

Case Selection

An institution-owned database was retrospectively reviewed from October 1, 2008, to October 31, 2008. This database consisted of all surgical procedures performed at a pediatric academic health center for that time period. Procedures were either performed at an HBF or an ASC; both facilities are owned by the same institution. The four most common procedures performed at the ASC were compared to the same procedures at the HBF. These procedures were myringotomy with insertion of pressure equalizing tubes (PET), dental rehabilitation (Dental Rehab), adenotonsillectomy (T&A), and adenoidectomy/myringotomy with insertion of pressure equalizing tubes (PET/Ad). Only outpatient procedures were included. Procedures that were scheduled as inpatient, outpatient-admit, or 23-hour observation were excluded. Combination procedures were also excluded. The study was approved by the Institutional Review Board at Cincinnati Children's Hospital Medical Center.

Facility Description

The HBF is a full-service, not-for-profit, pediatric academic medical center. In 2007, the HBF performed 23,069 outpatient surgical procedures and 5892 inpatient procedures. Twenty-three operating rooms are available. The HBF is located in an urban setting and is a worldwide tertiary referral center for complex conditions.

The ASC is located at a pediatric medical facility consisting of a 24-hour pediatric emergency room, outpatient specialty clinics, imaging and laboratory services, and eight operating rooms. The ASC performs only outpatient surgical procedures and a small number of overnight procedures.

Quality Measures

Using the Institute of Medicine's multidimensional definition of quality, a variety of measures was developed. Table 1 provides the definition, measurement tool, and measure for each dimension of quality. These measures were selected based on existing institutional resources that facilitated data collection and analysis. Although additional measures for each dimension would have certainly yielded a more robust comparison, it was felt that the selected measures provided enough information to make valuable inferences about quality differences between facilities. Safety was measured by extracting data from the surgical safety database, an institution-owned database. Safety measures included unplanned trips to the operating room, unplanned admissions, and unplanned visits to the emergency room. Results were reviewed by senior faculty for appropriateness before inclusion. Effectiveness was not measured in this study. Because the same surgeons operated at each facility, it was felt that any deficiencies in effectiveness would be equally distributed between facilities. Patient-centeredness was measured using the Children's Hospital Ambulatory Surgery Questionnaire, a 17-question survey addressing specific aspects of the patient's experience. Patients were interviewed via telephone by a contracted agency. Questionnaire data were collected from July 1, 2008, to October 31, 2008. Only surveys for included cases (PET, Dental Rehab, T&A, PET/Ad) were used. Timeliness was measured using an electronic operating room management system (Epic, Madison, WI) that records specific time points during the patient's surgery experience. These time points were used to construct clinically relevant time periods. Additional timeliness measures included percentage of cases starting within five minutes of scheduled start time (when scheduled as first case of the day), percentage of cases where the actual case duration did not exceed scheduled duration, and percentage of cases where the recovery room nurse was available at the patient's bedside upon arrival in the post operative care unit (PACU). The same management system (Epic) was used to measure efficiency. The institution's accounting system measures efficiency in terms of supplies, implants, and operational items. Supplies include items used directly for the case (suture, gauze, etc). No implants were used. Operational items are allocated in time increments (eg, charge/15 minutes in operating room [OR]) and are used to recover labor and overhead costs (OR equipment, maintenance, etc). Finally, equitability was evaluated by measuring the median household income by census tract (2000 census data) and geographic proximity to the delivery facility.9

RESULTS

Table 2 provides a description of cases performed at the ASC and the HBF. While the four most common procedures at the ASC comprised 48 percent of all cases performed there, these same procedures accounted for only 11 percent of cases at the HBF. Outpatient surgery comprised 99 percent of cases at the ASC compared to 68 percent of cases at the HBF. These results underscore the different environments present at the two facilities. Table 2 also reports the American Society of Anesthesiologists (ASA) classification by procedure. In general, the majority of patients were ASA 1 or ASA 2 at both facilities. The ASC had a slight bias toward ASA 1 patients compared to the HBF. This effect was statistically significant for PET and Dental Rehab (P =0.0003 and 0.01, respectively). Dental Rehab represented the largest discrepancy (73% were ASA 1 at the ASC; 48% were ASA 1 at the HBF). ASA 3 procedures were rare at both facilities.

Safety

The overall unexpected event rate was 4.2 percent (9/211) at the HBF. Five of these events were visits to the emergency room for dehydration and sore throat. Two patients were admitted for observation after treatment of postoperative tonsillar hemorrhage. One patient was admitted for observation with postoperative vomiting, and one patient with diabetes mellitus was admitted for blood glucose monitor-

Dimension	Definition (IOM)	Measurement tool	Measures
Safe	Avoiding injury to patients from care that is intended to help them	Surgical safety database	Unplanned trips to the operating room Unplanned admissions Unplanned visits to the emergency room
Effective	Providing services based on scientific knowledge to all who could benefit and refraining from providing services to those not likely to benefit	Not measured	Not measured
Patient-centered	Providing care that is respectful of and responsive to individual patient preferences, needs, and values, and ensuring that patient values guide all clinical decisions	Children's Hospital Ambulatory Questionnaire	17 Questions Addressing: Physical comfort Respect for patients' values, needs, and preferences Emotional support Access to care Information and education Transition and continuity Coordination and integration of care Overall and confidence in care
Timely	Reducing waits and sometimes harmful delays for both those who receive and those who give care	Electronic operating room management system	Clinically relevant time periods Enter time Registration time Wait for SDS SDS time Wait for OR Anesthesia time before OR OR time Transfer to PACU Nurse-to-bedside time Anesthesia time after OR Family wait to see child Recovery time Discharge time Total PACU time Leaving time Total time Percentage of cases starting on time Percentage of cases with actual case length not exceeding scheduled length Percentage of patients with zero wait for PACU nurse
Efficient	Avoiding waste, in particular, waste of equipment, supplies, ideas, and energy	Electronic operating room management system	Supply quantity Supply cost Supply charges Operational items Operational item charges Total charges
Equitable	Providing care that does not vary in quality because of personal characteristics such as sex, ethnicity, geographic location, and socioeconomic status	U.S. Census Bureau 2000 Census Data Mapping Software	Median household income by census tract Geographic proximity to delivery site

IOM, Institute of Medicine; SDS, same day surgery; OR, operating room; PACU, post operative care unit. Measures were developed using the Institute of Medicine's definition of quality.

Table 2		
Case description	by	facility

Procedure	ASC	HBF	Total	
PET*	126	108	234	
ASA 1	96 (76%)	60 (56%)		
ASA 2	28 (22%)	47 (43%)		
ASA 3	2 (2%)	1 (1%)		
Dental rehab†	89	58	147	
ASA 1	65 (73%)	28 (48%)		
ASA 2	23 (26%)	23 (40%)		
ASA 3	1 (1%)	7 (12%)		
T&A‡	37	34	71	
ASA 1	23 (62%)	16 (47%)		
ASA 2	14 (38%)	18 (53%)		
ASA 3	0 (0%)	0 (0%)		
PET/Ad§	23	11	34	
ASA 1	12 (52%)	8 (73%)		
ASA 2	11 (48%)	3 (27%)		
ASA 3	0 (0%)	0 (0%)		
Subtotal	275 (48% of total)	211 (11% of total)	486	
Total (OP/OP4H)	563	1274	1837	
Total cases (all types)	569	1861	2430	

ASC, ambulatory surgery center; HBF, hospital-based facility; PET, insertion pressure equalizing tubes; Dental rehab, dental rehabilitation; T&A, adenotonsillectomy; PET/Ad, insertion pressure equalizing tubes/adenoidectomy; OP, outpatient procedures; OP4H, 4 hour observation; ASA, American Society of Anesthesiologists.

P values represent the likelihood that the ASA class distribution occurred by chance.

ing. The tonsil bleed rate at the HBF was 5.9 percent (2/34) and 0 percent (0/37) at the ASC. No unexpected events occurred at the ASC.

Patient-centeredness

Results of the Children's Hospital Ambulatory Questionnaire demonstrated that patients generally had a positive experience at the ASC and HBF (Table 3). The overall experience was rated 9.6 at the ASC (scale from 0-10, 10 being the best) and 9.7 at the HBF. The scores were equally similar for all questions; they were generally positive and similar between facilities.

Timeliness

The time-period comparison revealed that procedures performed at the ASC were timelier than those performed at the HBF in nearly every measure for all procedure types (Fig 1). Additionally, the HBF generally had more variation than the ASC. For cases scheduled as the first case of the day, the ASC began on time in 89 percent of cases (n=45 at both facilities) compared to only 69 percent at the HBF. The percentage of cases with a recovery nurse available upon arrival in the PACU was essentially equal (98% at ASC, n=268; 94% at HBF, n=207). Finally, the percentage of cases where the actual duration did not exceed the sched-

uled duration was dramatically better at the ASC (77%) compared to the HBF (38%).

Efficiency

The two principle measures used to evaluate efficiency were the supply quantity and the operational charges. In a fixedfee reimbursement model, lower charges translate into increased profit margin for the institution. The ASC generally utilized fewer supplies and operational items for identical procedures (Table 4).

Equitability

In general, patients treated at the ASC came from wealthier census tracts than those treated at the HBF. The median household incomes by census tract for the ASC were \$55,930 (PET), \$44,388 (Dental Rehab), \$51,410 (T&A), and \$53,147 (PET/Ad), compared to \$43,577 (PET), \$42,039 (Dental Rehab), \$40,500 (T&A), and \$34,423 (PET/Ad) for the HBF. Figure 2 is a map showing the residence of all patients treated at the ASC (Fig 2A) and HBF (Fig 2B) in relation to the respective facility. At the HBF, a significant group of patients lived around the HBF, while no obvious geographical pattern was observed at the ASC.

^{*}P = 0.0003.

[†]P = 0.01.

[‡]P = 0.10.

 $[\]S P = 0.22.$

Table 3		
Children's Hospital Ambulatory	Questionnaire (al	I procedures combined)

Question	Best/worst score	ASC, n = 64	HBF, n = 35	% with best score ASC/HBF
On a scale of 0-10, where 0 is the worst care possible and 10 is the best care possible, what number would you use				
to rate your child's care during this visit? Did you have confidence and trust in the doctors treating	10/0	9.6	9.7	82/76
your child?	1/3	1.0	1.0	98/97
Did you have confidence and trust in the nurses treating your child?	1/3	1.0	1.0	98/98
Did the anesthesia staff in the induction room do everything they could to put your child at ease? How would you rate how well your child's pain was	1/3	1.3	1.3	92/95
managed in the recovery room after his or her procedure?	1/5	1.4	1.4	65/71
How would you rate how well your child's pain was managed after leaving the hospital? Would you say that your child's recovery room stay was, 1,	1/5	1.6	1.6	63/69
a lot shorter than needed; 2, a little shorter than needed; 3, about right; 4, a little longer than needed; or 5, a lot longer than needed?	3/1, 5	3.0	2.8	84/84
How would you rate the courtesy of your child's doctors?	3/1, 5 1/5	1.3	2.8 1.1	75/87
How would you rate the courtesy of your child's nurses? Did the staff introduce themselves and explain their role to	1/5	1.2	1.1	83/87
you and your child? If your child's procedure did not start on time, did someone give you a reason for the delay? 1, Yes; 2, No;	1/3	1.0	1.0	97/100
3, Procedure started on time When you had important questions to ask a nurse, did you	3/2	2.9	2.7	N/A
get answers you could understand? Before the procedure, did the surgeon answer your	1/3	1.1	1.2	98/95
questions in a way you could understand? Please rate how well the anesthesia staff helped you and	1/3	1.1	1.0	92/100
your child understand the anesthesia process. After your child's procedure, were the surgical results	1/4	1.1	1.4	94/92
explained to you in a way that you could understand? Did someone on the hospital staff teach you what you	1/3	1.0	1.1	98/100
needed to know to care for your child at home? Sometimes in the hospital, one doctor or nurse will say one thing and another will say something quite different.	1/3	1.0	1.1	97/95
Did this happen during your child's stay?	3/1	2.9	2.8	89/87

DISCUSSION

The purpose of this study was to use a multidimensional definition to measure the quality of outpatient surgery performed at an ASC compared to an HBF. While certain dimensions did not demonstrate significant differences (patient-centeredness), most of the dimensions revealed an advantage for the ASC over the HBF. The quality of outpatient surgery at the ASC was at least equal and in some cases superior to the HBF. These results confirm those found elsewhere. ^{2,4,7,10} This study was unique in the multidimensional manner in which quality was measured.

The results of the surgical safety database demonstrated differences between the two facilities. Nine unexpected events occurred at the HBF compared to none at the ASC. Upon further inspection, most of these events were visits to the emergency room for poor oral intake. Two tonsil bleeds occurred at the HBF (2/34, 5.9%), with zero (0/37, 0%) cases at the ASC. If the inclusion criteria were liberalized to include combination cases, two additional tonsil bleeds occurred at both the ASC and HBF. Therefore, the difference in tonsil bleed rates between facilities is likely not significant. Future data collections with larger sample sizes will elucidate these differences.

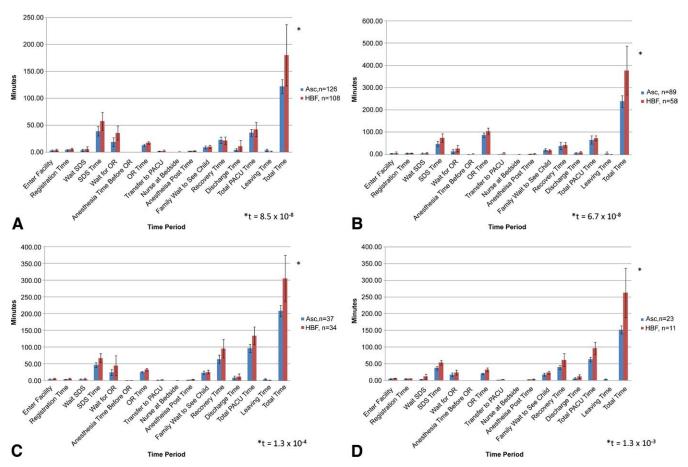


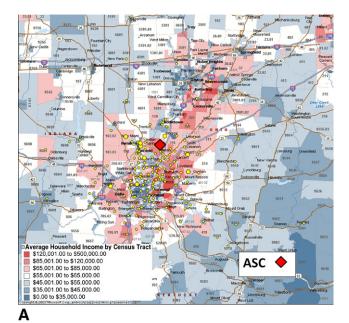
Figure 1 Time period comparison by location, ASC versus HBF: (A) PET; (B) dental rehab; (C) T&A; (D) PET/Ad. Student's t test applies to "total time."

Patient satisfaction surveys demonstrated that the experience was equally positive at both the ASC and the HBF. Gardner et al similarly found that, while patients at both types of facilities experienced significant preoperative anx-

iety, patients were generally satisfied with the care they received, regardless of location.¹¹ It is noteworthy that patients were equally pleased with each facility despite measurable differences in several quality dimensions. Literature

Procedure	Supply quantity	Supply cost (\$)	Supply charge (\$)	Operational items	Operational charges (\$)	Total charges (\$)
PET						
ASC	4.55	44.80	213.10	7.40	1457.25	1670.34
HBF	6.92	54.34	249.95	9.08	1672.78	1922.74
Dent rehab						
ASC	6.73	66.95	315.57	23.39	4029.68	4345.25
HBF	6.46	78.25	348.88	28.14	4708.84	5057.72
T&A						
ASC	4.89	72.25	341.76	13.78	2200.88	2542.64
HBF	7.32	82.79	391.59	18.00	2453.09	2844.68
PET/Ad						
ASC	8.91	102.39	484.30	10.57	1828.42	2312.72
HBF	10.73	126.45	574.09	14.91	2259.29	2833.38

ASC, ambulatory surgery center; HBF, hospital-based facility; PET, insertion pressure equalizing tubes; Dental rehab, dental rehabilitation; T&A, adenotonsillectomy; PET/Ad, insertion pressure equalizing tubes/adenoidectomy. Supplies include items used (eg, gauze, suture, etc) for each procedure.



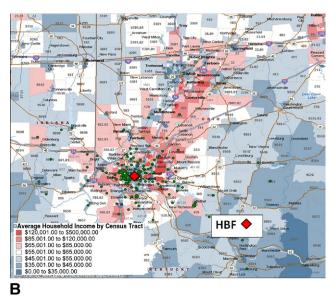


Figure 2 Proximity to facility by median household income: **(A)** ASC; **(B)** HBF. *Small circles*, 1 to 2 patients; *large circles*, 3 to 4 patients.

suggests that most patients lack the expertise to accurately judge the quality of healthcare services and therefore use surrogate markers (cleanliness, friendliness, etc) to make judgments about quality.¹²

The ASC appeared to outperform the HBF in timeliness. The ASC also demonstrated less variability than the HBF. The diverse and complicated nature of the HBF combines patients with diverse perioperative processes into one service location. This may adversely affect timeliness for low-complexity cases (PET, T&A) occurring in such an environment. Conversely, the ASC has a less diverse case mix, and thus perioperative processes are less varied. By geographically grouping cases with similar perioperative processes, the ASC efficiently utilizes human resources. Further

investigation is warranted to gain a deeper understanding of how perioperative processes differ between facilities.

Dramatic differences were also observed in the percentage of cases where the actual case length did not exceed the scheduled length (77% vs 38%). In cases where the actual case length did exceed the scheduled length, the HBF also tended to have longer delays. For example, PETs performed at the HBF exceeded the scheduled length in 70 percent of cases, with an average delay of 6.3 minutes, compared to 17 percent of cases, with an average delay of 5.2 minutes, at the ASC. One explanation for this difference may be the presence of residents at the HBF. At the HBF, surgical residents are involved in most of the procedures, and many rotating residents participate in the anesthesia care. Currently, the ASC has almost no resident participation. As pressure increases to improve timeliness, academic centers will have to balance quality improvement efforts with their mission to train physicians.

Efficiency is a measure of how well resources are utilized. In the current study, supply quantity and operational items were used as measures of resource utilization. For nearly all procedures, the ASC performed the same procedures more efficiently than the HBF. These differences in resource utilization represent cost savings for the ASC and support other findings.²

The maps in Figure 2 demonstrate that patients treated at the ASC generally resided in higher income neighborhoods (census tracts) and were not restricted by location. Conversely, patients at the HBF tended to live in lower income areas surrounding the HBF. More research is needed to understand this effect. If ASCs truly represent a quality advantage over HBFs, and ASCs are placed geographically in affluent areas, then the patients of lower socioeconomic status could have reduced access to this higher quality care.

Limitations

There are several limitations to this study. It is likely that increased ASA classification is associated with poorer outcomes in areas such as timeliness, efficiency, and adverse events. In the current study, ASA 1 cases were more common at the ASC than ASA 2 cases for two procedures (PET, P = 0.0003; Dental Rehab, P = 0.01). While statistically significant, both classifications meet institutional criteria to be performed at either location. The impact of an ASA 1 case compared to an ASA 2 case on outcomes is felt to be low for the types of procedures studied. Nevertheless, future data collections will help answer this question. On the other hand, ASA 3 patients are felt to have sufficient comorbid disease to adversely affect outcomes, even for low-complexity procedures. For this reason, ASA 3 cases are not performed at the ASC unless special approval is obtained. The number of ASA 3 cases performed was extremely low for PET (2% at the ASC, 1% at the HBF), T&A (0% at both facilities), and PET/Ad (0% at both facilities). Interestingly, a difference in ASA 3 cases did exist for Dental Rehab (1% at the ASC; 12% at the HBF), and yet the quality outcomes for this procedure followed the same trends as PET, T&A, and PET/Ad.

The sample size for this study is small, particularly for specific data subsets. While the small sample size may weaken the strength of the conclusions, the outcomes for procedures with small numbers (PET/Ad) did not differ from those with higher numbers (PET). As a preliminary study, sufficient data exist to suggest that true quality differences exist between facilities. Additionally, these results will help focus future data collections with larger numbers. Furthermore, the small sample size provided an opportunity to examine a larger, more inclusive number of measures in the quality comparison.

Another potential confounder in this study is the presence of residents at the HBF compared to the ASC. Figure 1 demonstrates, however, that the time during which residents participate in care (OR time) contributes insignificantly to overall differences in timeliness (total time). Therefore, at least some outcomes seem to be minimally affected by resident participation. From a practical standpoint, these results suggest that a very different quality experience characterizes these facilities, regardless of resident participation. This information is meaningful to providers, administrators, and patients when choosing a service facility. Finally, resident education may be limited if academic centers are held to the same quality standard as other institutions regarding value-based purchasing programs. Specifically, government programs that emphasize cost reduction and efficiency at the expense of resident training could undermine the quality of future generations of surgeons.

Health Policy Implications

Intense competition, increasing quality standards, and scarce resources have led many institutions to shift toward "service-line" strategies, allowing facilities to concentrate on what they do best. It makes sense, at least, for institutions to determine what types of organizational structure provide the best patient care. Aligning services with healthcare needs is not new. For example, Berry et al has stated that "when health care professionals consistently work below their level of expertise, scarce resources are wasted [and] care is more costly . . . Specialist physicians should do less of what generalist physicians can do, generalist physicians should do less of what nonphysician providers can do, and nonphysician providers should do less of what nonclinical staff can do."13 The current study suggests that performing low complexity cases at an ASC may represent a better utilization of resources.

As efforts increase to make improvements in the Institute of Medicine's dimensions of quality, it becomes clear that organizational technologies are necessary for progress. Before the implementation of an electronic operating room management system, this type of quality measurement would have been impossible. Thus, the success of improvement efforts relies on an institution's "ability to simultaneously build upon several organizational technologies:

clinical, social, information, and administrative technologies". 14

Ample evidence suggests that academic centers operate with significant financial risk. ¹⁵⁻¹⁷ Highly specialized procedures are increasingly shifted to teaching hospitals, ¹⁸ and complex patients tend to be poorly reimbursed. ¹⁶ Many expect these trends to continue. While reimbursement polices certainly need to be adjusted, investing in a free standing ASC is one method for academic health centers to remain financially competitive. ¹⁹⁻²⁰

While access to the ASC in this study was not limited to patients with commercial insurance (identical insurance policies governed both facilities), many private ASCs do not accept government-funded insurance plans because of poor reimbursement. This study suggests that government programs supporting ASCs may be a wise use of resources, which could facilitate the growth of these facilities in areas besides wealthy neighborhoods.

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AUTHOR CONTRIBUTIONS

Jedidiah Grisel, design, data collection, analysis, interpretation, and drafting of manuscript; **Ellis Arjmand,** design, data collection, oversight, analysis, interpretation and drafting of manuscript.

DISCLOSURES

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