INTRODUCTION
The COVID-19 pandemic has vividly exposed the weaknesses of our fragmented health system and demonstrated how the absence of robust centralized data limits our ability to quickly respond to public health crises and implement protocols that alter healthcare delivery.1 During the acute pandemic, shortages of personal protective equipment and uncertainties regarding equipment (eg, ventilators, intensive care beds) and staffing needs caused many health systems to rapidly implement protocols that diverted limited space, staff, and equipment to anticipated acute care needs.2,3 As part of this effort, millions of elective procedures that are required for treating other diseases and improving patient quality of life were canceled, resulting in delayed patient care and accumulated demand for elective procedures.4–12 Additionally, the loss of income from elective procedures caused financial strain on many health systems, resulting in cost-cutting layoffs and furloughs that...
may make it difficult to resume medical services after the pandemic is controlled. Concurrent with these changes among inpatient hospitals, many local governments also mandated closure of Ambulatory Surgery Centers (ASCs) that could have potentially assisted inpatient care and tempered financial strain on our healthcare sector.

ASCs represent a rapidly growing sector of healthcare delivery with unique potential to provide a smaller, highly specialized, discrete environment for specific types of elective procedures. On December 2, 2020, the Centers for Medicare and Medicaid Services (CMS) ruled to eliminate restrictions for certain procedures to the inpatient setting and expand coverage for procedures performed in ASCs. Although the ultimate goal of this policy is to increase patient choice and lower out-of-pocket expenses, the timing of its passage may also create an opportunity for local collaboration between inpatient facilities and ASCs to improve surge capacity for elective surgery during the COVID-19 pandemic.

However, little is known about the current volume and scope of surgical procedures performed in ASCs and the resources (eg, staff, equipment, space) that ASCs may provide to local health systems to assist with surge capacity during public health crises. The purpose of this study was to assess currently available administrative data for ASCs and elective surgery in the inpatient and outpatient ASC setting, and discuss practical ways these data may be improved upon to inform collaborative surge capacity protocols for elective surgery during the COVID-19 pandemic.

METHODS

Facility-Level Evaluation of ASCs

We performed a national retrospective analysis of ASCs in the United States using the December 2019 CMS Provider of Services (POS) file. We limited our analysis to Medicare-certified ASCs within the 50 United States, plus the District of Columbia. For each state, we obtained facility-level ASC data regarding hospital affiliation, number of operating rooms, physician specialty participation, availability of co-located medical services (radiology, pharmacy, laboratory), and ownership.

Procedure-Level Assessment of Elective Surgery in Inpatient Hospitals and ASCs

To estimate the monthly volume of elective surgery in inpatient hospitals, we performed a retrospective analysis of the 2016 Healthcare Cost and Utilization Project (HCUP) National Inpatient Sample. We excluded all admissions classified as non-elective and all admissions without at least 1 primary ICD-10 procedure. Discharge sampling weights were used to estimate national and regional inpatient surgical procedure volume. To estimate the monthly volume of elective surgery performed in ASCs, we used data from the 2018 California Health and Human Services Open Data Portal ambulatory surgery database, which includes encounter-level information from all hospital-based and freestanding ASCs licensed by the California Department of Public Health. Facility-level information was used to calculate the average annual volume of surgical procedures performed per California-licensed ASC. These data were then extrapolated to a national database of all Medicare-certified ASCs in 2019 to obtain national and regional estimates of procedure volume in ASCs.

To understand differences in the types of elective surgery currently performed in inpatient hospitals versus ASCs, procedure codes for encounters in each setting (ICD-10 for inpatient, CPT for ASC) were classified in 2 ways using available HCUP software tools: (1) major versus minor procedures and (2) clinical procedure categories. The distinction between major and minor procedures was defined using the HCUP procedure classes (inpatient setting) and HCUP surgery flag software (ASC setting). In the inpatient setting, minor procedures are defined as procedures that are not performed in operating rooms, and major procedures are operating room procedures as defined by the Medicare Severity Diagnosis Related Group (MS-DRG). In the ambulatory care setting, major procedures were defined under the “narrow” classification, which includes any invasive therapeutic surgical procedure involving incision, excision, manipulation or suturing of tissue that penetrates or breaks the skin, typically requires use of an operating room, and also requires regional/general anesthesia or sedation for pain control. Clinical procedure categories were defined using the HCUP Clinical Classification Software (CCS) for ICD-10-PCS procedure codes (inpatient setting) and the HCUP CCS for Services and Procedures (ASC setting). This coding scheme characterizes over 77,000 ICD-10 procedure codes and 9000 CPT/HCPCS codes into 244 single-level and 16 broad multilevel categories.

We also examined Elixhauser comorbidity profiles among patients undergoing elective procedures in inpatient hospitals using the ICD-10 method described by Quan et al. However, due to the absence of diagnostic codes in the 2018 California Health and Human Services Open Data Portal ambulatory surgery database, we were not able to examine comorbidity profiles among patients undergoing procedures in ASCs. Finally, we performed analyses of regional procedure volume and quantity of ASC facilities. All statistical analyses were performed using Stata version 15.1 (College Station, Tex.).

RESULTS

Facility-Level Evaluation of ASCs

In 2019, there were a total of 8540 Medicare-certified ASCs within the 50 United States and Washington D.C. These ASCs included 24,726 operating rooms, corresponding to an average of 2.9 operating rooms per ASC. Similar to our previous research, we found that the vast majority of ASCs were freestanding (99.5%) and privately owned (92.9%, Table 1). Compared with freestanding ASCs, hospital-based ASCs tended to be slightly larger (3.2 versus 2.9 ORs per ASC, \( P < 0.001 \)) and have additional ancillary service capabilities, such as radiology (44.4% versus 29.2%, \( P = 0.024 \)), pharmacy (46.7% versus 17.0%, \( P < 0.001 \)), and laboratory services (42.2% versus 17.8%, \( P < 0.001 \), Table 1). Similarly, we also found that hospital-based ASCs had a greater variety of physician specialty
participation (5.5 versus 3.0 specialties per ASC, \( P < 0.001 \)), which may correspond to more diverse operative equipment and supplies (Table 1). Finally, we observed a wide geographic variation in the number of ASCs and operating rooms available in each state (Fig. 1).

**Procedure-Level Assessment of Elective Surgery in Inpatient Hospitals and ASCs**

In the United States, approximately 4,297,850 elective procedures (surgical and non-surgical) are performed each month, and almost half (46.6%) are surgical procedures that require the use of an operating room (Table 2). Approximately 70.4% of elective operating room surgeries are currently performed in the inpatient setting. Among patients receiving elective surgery in the inpatient setting, 13.3% did not have any listed Elixhauser comorbidities and required a hospital length of stay ≤2 days in accordance with the CMS two-midnight rule.

In the ASC setting, we found that 8% of surgical procedure categories (20 of 244) were responsible for 66% of surgical volume (Table 3). However, the inpatient setting demonstrated a wider scope of surgical procedures, and the same 20 procedure categories only corresponded to 27.6% of surgical procedure volume in the inpatient setting.

**DISCUSSION**

On December 2, 2020, CMS announced a plan to phase out restrictions that limit certain procedures to the inpatient setting and expand coverage for procedures performed in ASCs.\(^1\) As the country currently battles another wave of COVID-19 cases this winter with repeated delays and cancellations of elective procedures, several health systems and policymakers have suggested using ASCs to accommodate overflow of inpatient procedures in a smaller environment that is separate from larger acute care facilities.\(^9,15,16\) Although recent passage of this CMS policy is primarily intended to increase patient choice and decrease out-of-pocket expenses, the current timing of policy’s approval also creates a unique opportunity for ASC collaboration with local health systems and inpatient facilities to improve surge capacity for elective surgery during the COVID-19 pandemic.\(^9,15,16\)

In the present study, we used the currently available administrative data to evaluate Medicare-certified ASCs and elective surgery performed in both ASCs and inpatient hospitals. Based on the data from the 2019 Medicare Point of Service file, we found that the majority of ASCs were freestanding (not hospital-based) privately-owned facilities. This suggests that future policies and protocols to improve surge capacity for elective surgery using ASCs may require novel clinical and financial partnerships between inpatient hospitals and privately-owned ASCs. However, the details of these partnerships may vary by geographic region and depend on a variety of factors, including local burden of COVID-19 patients, clinical demand for elective surgery, inpatient hospital capacity (staff, space, equipment), and geographic access to nearby ASCs, and individual ASC resources/capacity.

Figure 2 represents a conceptual framework to guide collaboration among local governments, inpatient facilities, and ASCs to expand surge capacity for elective surgery during the COVID-19 pandemic. During an acute COVID surge, staffing (nurses, scrub technicians, surgeons, anesthesiologists) and equipment (ventilator, medication, personal protective equipment) shortages in inpatient facilities may be temporarily relieved with assistance from local ASCs. Similarly, if inpatient facilities need additional space to perform procedures on uninfected high-risk patients, ASCs may be able to provide specialized space to perform these procedures with minimal patient and staff exposure.

As the COVID-19 burden decreases, it may be possible for ASCs to assist referring inpatient facilities with a backlog of elective surgery cases that were delayed due to COVID-19. However, the clinical and economic implications of establishing this relationship will depend on geographic population needs, ASC market forces, local inpatient capacity, and individual ASC resources and ability to provide certain surgical services. The results of our study showed that 13.3% of elective inpatient surgery occurs in healthy patients (no Elixhauser comorbidities)

### Table 1. Hospital-based versus Freestanding ASCs

<table>
<thead>
<tr>
<th></th>
<th>Hospital-based ASCs</th>
<th>Freestanding ASCs</th>
<th>Total</th>
<th>( P^* )</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. ASCs (N, % total)</td>
<td>45 (0.5%)</td>
<td>8495 (99.5%)</td>
<td>8540</td>
<td>NA</td>
</tr>
<tr>
<td>No. ASC operating rooms (N, % total ASCs)</td>
<td>174 (0.7%)</td>
<td>24,552 (99.3%)</td>
<td>24,726</td>
<td>NA</td>
</tr>
<tr>
<td>No. ORs per ASC (mean, median)</td>
<td>3.2 (4)</td>
<td>2.9 (2)</td>
<td>2.9 (2)</td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>Ownership†</td>
<td>5.5 (6)</td>
<td>3.0 (2)</td>
<td>3.0 (2)</td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>Proprietary (N, % ASC category)</td>
<td>19 (42.2%)</td>
<td>7917 (93.2%)</td>
<td>7936 (92.9%)</td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>Non-profit (N, % ASC category)</td>
<td>24 (53.3%)</td>
<td>455 (5.4%)</td>
<td>479 (5.6%)</td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>Government (N, % ASC category)</td>
<td>2 (4.4%)</td>
<td>123 (1.5%)</td>
<td>125 (1.5%)</td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>Co-located services‡</td>
<td>19 (42.9%)</td>
<td>1513 (17.8%)</td>
<td>1532 (17.9%)</td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>Laboratory (N, % ASC category)</td>
<td>21 (46.7%)</td>
<td>1445 (17.0%)</td>
<td>1466 (17.2%)</td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>Radiology (N, % ASC category)</td>
<td>20 (44.4%)</td>
<td>2476 (29.2%)</td>
<td>2496 (29.2%)</td>
<td>0.024</td>
</tr>
</tbody>
</table>

\(^*\)Means for continuous variables were compared using independent-group t test when the data were normally distributed; otherwise the Mann-Whitney test was used. Proportions for categorical variables were compared using the chi-squared and Fisher exact test as appropriate. For unadjusted comparisons, a 2-sided \( \alpha < 0.05 \) was considered statistically significant.

†Ownership defined by CMS Provider of Services (POS) file.\(^3\)

‡Services were determined to be co-located in the same facility as the ASC if the Centers for Medicare and Medicaid Services (CMS) Provider of Services (POS) file indicated that the services were 1) provided by ASC staff, or 2) provided by a combination of ASC staff and other arrangements.
Table 2. Procedure Intensity by Clinical Setting

<table>
<thead>
<tr>
<th>Procedure Intensity</th>
<th>Inpatient Monthly Procedures (Total)</th>
<th>Outpatient Monthly Procedures (Total)</th>
<th>Inpatient and Outpatient Monthly Procedures (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor†‡</td>
<td>163,022 (29.6%)</td>
<td>2,130,576 (56.9%)</td>
<td>2,293,598 (53.4%)</td>
</tr>
<tr>
<td>Major†</td>
<td>388,357 (70.4%)</td>
<td>1,615,895 (43.1%)</td>
<td>2,004,252 (46.6%)</td>
</tr>
<tr>
<td>Total‡</td>
<td>551,379 (100.0%)</td>
<td>3,746,471 (100.0%)</td>
<td>4,297,850 (100.0%)</td>
</tr>
</tbody>
</table>

Inpatient major procedures were defined using the HCUP Procedure Classes for ICD-10-PCS (beta version). This coding scheme characterizes 71,900 ICD-10 procedure codes into 4 categories: (1) minor diagnostic, (2) minor therapeutic, (3) major diagnostic, and (4) major therapeutic. Minor procedures are defined as procedures that are not performed in operating rooms and major procedures are valid operating room procedures defined by Medicare Severity Diagnosis Related Group (MS-DRG). Results are displayed as the volume of elective inpatient procedures per month (percentage of total monthly elective inpatient procedures).

Surgical intensity among outpatient procedures was determined using the HCUP Surgery Flag Software for Services and Procedures. This coding scheme classifies over 4700 procedural CPT codes as either “narrow” invasive procedures or “broad” non-invasive, percutaneous, or endoscopic procedures. We defined major procedures using the “narrow” definition that includes any invasive therapeutic surgical procedure involving incision, excision, manipulation, or suturing of tissue that penetrates or breaks the skin, typically requires use of an operating room, and also requires regional/general anesthesia or sedation for pain control. Results are displayed as the volume of outpatient procedures per month (percentage of total monthly outpatient procedures).

With short hospital stays (LOS ≤ 2 days) compliant with the current CMS 2 midnight rule. Although these patients may be reasonable candidates to have procedures performed in the ASC setting, we also found that the types of elective procedures performed in the inpatient setting are different from the types of procedures routinely performed in ASCs. Furthermore, hospital-based ASCs were generally larger and included more ancillary services/specialty providers, suggesting that these ASCs may be better equipped to care for more complex patients or perform procedures requiring multidisciplinary surgical intervention. Thus, although large health systems and inpatient hospitals may be driven to collaborate with local ASCs to address increasing clinical demand/backlog of elective procedures, the extent to which specific individual ASCs may assist them with surge capacity needs may vary.

Limitations of Current Data and Recommendations for Future Data Collection

The data used in the current study have substantial limitations and underscore the need to develop robust data collection systems for elective surgery that are capable of informing current and future public health policy. First, the lack of national encounter-level data from both hospital-based and freestanding physician-owned ASCs precludes comprehensive assessment of elective surgery procedures to adequately inform surge capacity protocols. At present, there are many ASC credentialing bodies (Medicare, state, AAAASF, AAAHC, IMQ, JCAHO) and each independently collect different types of facility-level information. However, a central dataset with uniform information to readily analyze does not exist, and the only national publicly available dataset is the Medicare Point of Service file used in the current study. Furthermore, none of these datasets maintain encounter-level information for each procedure performed within an ASC to assess the volume and scope of practice in this setting.

Among state-specific ambulatory surgery datasets that do provide procedure-specific information, all are limited to administrative claims data from individual states, and most only include data from hospital-based ASCs. For the present study, we used encounter-level administrative claims data from a single state (California) and expanded these results across all Medicare-certified ASCs to obtain national estimates. Due to lack of available information, this expansion was performed without discharge weights or consideration of different ASC size/capacity. Given that the California Health and Human Services Open Data Portal Ambulatory Surgery Database includes a greater proportion of hospital-based ASCs that are larger in size compared with smaller freestanding facilities in other states, it is possible that we overestimated the volume of procedures performed within ASCs.

Another important limitation in all datasets is the lack of critical information regarding personnel, medication,
and equipment to guide surge capacity protocols and inform collaborative protocols between inpatient hospitals and ASCs. Although administrative claims data make researchers well equipped to conduct broad population analyses, those data often lack detailed information to guide specific interventions. Compared with clinical registry data, administrative claims used for billing purposes is prone to issues with coding bias, accuracy, and completeness.20–31

The results of our study demonstrate potential variation in ASC size, availability of ancillary services, and scope of currently performed elective procedures. To understand the potential for each ASC to safely expand their volume and scope of practice and assist inpatient facilities with surge capacity, it is critical to collect detailed data regarding space, equipment, personnel (quantity, training). It is also important to anticipate potential threats to patient safety and collect data regarding the resuscitability of various specialties (eg, blood transfusion capacity, staff training) for each ASC and geographic distance to an inpatient hospital. This information is needed to estimate additional required resources (space, personnel, equipment) in the ASC setting and understand the economic implications of specific collaborative relationships between ASCs and inpatient facilities. Finally, local community data regarding the quantity of various specialties in a geographic area is critical to ensure that the volume of specialists necessary for treating acute patients in the inpatient setting is maintained, especially in areas with shortages of procedural specialists.

CONCLUSIONS

In a future that is rife with uncertainty, one thing is clear: the COVID-19 pandemic has obliged all sectors of our economy to restructure their business and changed the way Americans choose to conduct their daily lives. Necessary elective surgical procedures are a critical component of our healthcare system, and safely maintaining the delivery of these services during the COVID-19 pandemic and future public health crises is essential to providing high-quality care. Given recent CMS policy to phase out the IPO list and expand coverage for surgical procedures performed in ASCs, there may be potential opportunity to develop protocols that allow ASCs to assist inpatient facilities and provide surge capacity resources for elective procedures. However, the specific details of these protocols may vary by geographic region and depend on local population needs, inpatient facility capacity, and individual ASC resources.

At present there is a lack of robust facility, provider, and procedure-level data in the ASC setting to guide surge capacity protocols and monitor the safety of inpatient procedures in the ASC setting under the new CMS rule. Given the clinical breadth of plastic surgery and the common practice of plastic surgery in the ASC setting, plastic surgeons are well positioned to work with other specialties and lead novel collaboration between inpatient facilities and privately-owned ASCs, as well as develop critical public health data infrastructure to guide current and future health policy. For example, plastic surgeons who primarily operate in the outpatient setting may work with various ASC credentialing bodies to organize and provide necessary data regarding resources within non-Medicare-certified ASCs. In the inpatient setting, the clinical breadth and diversity of plastic surgery procedures makes plastic surgeons well positioned to work with their inpatient facilities and health systems to evaluate the unique logistic (eg, equipment, ancillary services, specialty mix), economic, and geographic challenges of performing different categories of procedures within individual ASCs.
Plastic surgery is a relatively small and unique field with a wide variety of clinical interests and practice arrangements. However, our commitment to diversity and innovation provides us with a unique perspective to solve complex clinical and scientific problems. During this unprecedented public health crisis and transitional era for elective surgery, it is imperative that plastic surgery invest in the education and training of health services researchers to guide safe implementation of surge capacity protocols and future policy in best interests of our patients.

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REFERENCES


