# Surgeons and Surgical Trainees Underestimate the Total Charges and Reimbursements Associated With Commonly Performed General Surgery Procedures☆

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**INTRODUCTION:** Surgical care contributes significantly to the fiscal challenges facing the US health care system. Multiple studies have demonstrated surgeons' lack of awareness of the costs associated with individual portions of surgical care, namely operating room supplies. We sought to assess surgeon and trainee awareness of the comprehensive charges and reimbursements associated with procedures they perform.

**METHODS:** We administered a voluntary anonymous survey to attending surgeons, general surgery residents, and fourth-year medical students who applied to general surgery residencies. We compared charge and reimbursement estimates for laparoscopic cholecystectomy and open inguinal hernia repair to the actual values. Additionally, we assessed the importance placed on the financial aspects of surgical care.

**RESULTS:** We had an overall response rate of 94% (n = 45). A majority of attendings, residents, and medical students underestimated charges and reimbursements for open inguinal hernia repair and laparoscopic cholecystectomy. There was no significant difference in the accuracy of charge or reimbursement estimates between attendings, residents, and students for herniorrhaphy or cholecystectomy (Charge: hernia p = 0.08, cholecystectomy p = 0.30; Reimbursement: hernia p = 0.47, cholecystectomy p = 0.89). Years of training as an attending or resident did not predict accuracy of charge or reimbursement estimates for hernia repair or cholecystectomy (p > 0.3 for all regressions). The median (interquartile range) charge estimate for inguinal hernia repair was −$5914 (−$7914 to −$2914) from the actual charge, 45.8% of the true value, and the median reimbursement estimate was −$4519 (−$5369 to −$1218) from actual reimbursement, 27.3% of the true value. The median charge estimate for cholecystectomy was −$5734 (−$8733 to +$1266) from the actual charge, 58.3% of the true value, and the median reimbursement estimate was −$4847 (−$6847 to +$153) from actual reimbursement, 38.2% of the true value.

**CONCLUSIONS:** Surgeons and their trainees underestimate the charges and reimbursements associated with commonly performed procedures. (J Surg Ed 76:802−807. © 2018 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

**KEY WORDS:** general surgery, charge, reimbursement, cost awareness, value-based healthcare, economics

**COMPETENCIES:** Systems-Based Practice

**ABBREVIATIONS:** GDP, gross domestic product; OR, operating room; CPT, current procedural terminology code; IQR, interquartile range

## INTRODUCTION

Surgical care is estimated to represent greater than 5% of US gross domestic product (GDP).[1,2] To put this in perspective, the US defense budget has not consumed 5% of GDP since the Cold War.[3] The amount of control a surgeon has over expenses associated with the care they

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provide is both debatable and variable.[4-6] However, even a relatively small amount of control represents significant sums within a health care system that must consider all avenues of saving.

Despite being associated with significant spending, surgeons, and surgical trainees traditionally receive very little education about the financial aspects of their work. Several reports have identified that a majority of residents across multiple specialties have a limited understanding of the costs associated with portions of care including imaging and lab tests.[7,8] Studies assessing surgeons' and surgical trainees' knowledge of the financial aspects of care have largely focused on the cost of supplies in the operating room (OR).[9] Okike and colleagues demonstrated that despite a majority of orthopedic surgery attendings and residents suggesting that cost should play an important role in implant selection, a majority were unable to accurately estimate the cost of such devices.[10] Focusing on hernia repair, Vigneswarn and colleagues demonstrated that educating surgeons about the variability of disposable supply costs could lead to significant institutional savings.[11]

Understanding the sizeable contribution of surgical care to the fiscal challenges facing the US health care system and that patients are becoming responsible for an increasing portion of their health care expenses, surgeon familiarity with the financial aspects of care justifies study beyond OR supplies.[12,13] We sought to assess attending surgeons' and surgical trainees' knowledge of comprehensive charges and reimbursements associated with two of the most commonly performed general surgical procedures, open inguinal hernia repair, and laparoscopic cholecystectomy.[14,15] We hypothesized that surgeons and their trainees would demonstrate a lack of familiarity with the charges and reimbursements associated with these procedures.

## MATERIALS AND METHODS

We administered a voluntary anonymous survey to surgical attendings, general surgery residents, and fourth-year medical students who applied to general surgery residencies. The survey was delivered via email and administered online utilizing REDCap electronic data capture tools hosted at University of Vermont.[16] Institutional Review Board approval was obtained prior to survey distribution. Procedure-specific survey questions focused on comprehensive charges and reimbursements including surgical, anesthesia, and facility components for open inguinal hernia repair with mesh (Current Procedural Terminology code (CPT) 49505) and laparoscopic cholecystectomy without cholangiogram (CPT 47562). The survey was sent to all attendings at our institution that perform open inguinal hernia repairs and laparoscopic cholecystectomies.

Actual charge and reimbursement data were obtained with appropriate permission from financial departments for fiscal year 2016. Average charges and reimbursements across all payers including private insurers, Medicare, and Medicaid were requested in the survey and used for comparisons. Survey results are presented herein as the difference from actual values as a means to protect institutionally sensitive data (sample calculation: actual average charge for CPT 49505 − estimated average charge for open inguinal hernia repair from survey = result reported). All data were analyzed using STATA (Version 15.0, StataCorp, College Station, Texas). Data are reported as median (interquartile range) with differences between attending, resident, and student estimates tested for significance with the Kruskal−Wallis test and accuracy correlation with years of training assessed with linear regression.

## RESULTS

Our survey was completed by 10 attendings, 23 residents, and 12 fourth-year medical students for an overall response rate of 94%. Completion rates for attendings, residents, and medical students were, 77%, 100%, and 100% respectively. The average length of time in practice among surveyed attendings was 14.8 years (range 1-35 years).

A majority of attending, resident, and medical student respondents underestimated the average charge and reimbursement for open inguinal hernia repair (Fig. 1). There was no significant difference in the accuracy of charge or reimbursement estimates between attendings, residents, and medical students for inguinal hernia repair (charge $p = 0.08$, reimbursement $p = 0.47$). Years of training as an attending or resident did not predict accuracy of charge or reimbursement estimates for hernia repair ($p > 0.3$ for all regressions). Across all groups studied, the median charge estimate for inguinal hernia repair was −$5914 (−$7914 to −$2914) from the actual average charge, 45.8% of the true value. The median reimbursement estimate for hernia repair was −$4519 (−$5369 to −$1218) from the actual average reimbursement, 27.3% of the true value.

Similarly, a majority of attending, resident, and medical student respondents underestimated the average charge and reimbursement for laparoscopic cholecystectomy (Fig. 2). There was no significant difference in the accuracy of charge or reimbursement estimates between attendings, residents, and medical students for cholecystectomy (charge $p = 0.30$, reimbursement $p = 0.89$). Years of training as an attending or resident did not predict accuracy of charge or reimbursement estimates for cholecystectomy ($p > 0.4$ for all regressions). Across all groups studied, the median charge estimate for laparoscopic cholecystectomy was −$5734 (−$8733 to +$1266) from the actual average charge, 58.3% of the

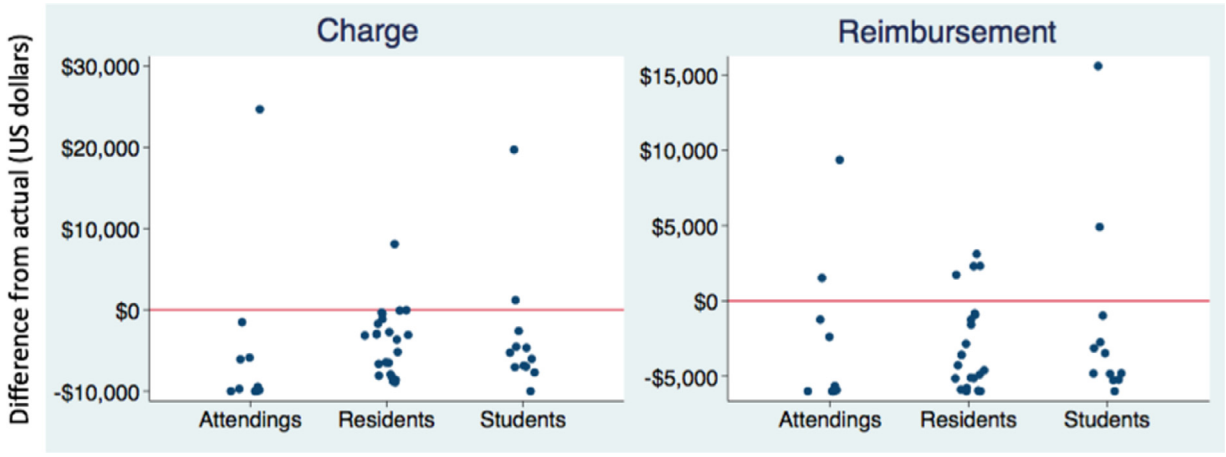


**FIGURE 1.** Accuracy of charge and reimbursement estimates for open inguinal hernia repair by attendings, residents, and medical students. Horizontal red line at $0 represents an accurate estimate of actual value.

true value. The median reimbursement estimate for cholecystectomy was −$4847 (−$6847 to +$153) from the actual average reimbursement, 38.2% of the true value. Attending and resident respondents on average underestimated the percentage of the comprehensive charge represented by the surgeons or professional fee whereas medical students on average over estimated this component of charges (Fig. 3). On average, across all respondents, the facility fee was underestimated and the anesthesia fee was overestimated.

A majority of residents and medical students expected their estimate of charges and reimbursements to be "Not Accurate" whereas six out of ten attendings expected their estimates to be "Somewhat accurate" with the remaining four expecting "Not Accurate" estimates (Fig. 4). A majority of residents and medical students reported believing that understanding the financial aspects of their work was either "Important" or "Very Important" while attendings were more divided, with 50% agreeing with the resident and medical student majority on this question and the remainder answering "Somewhat Important" or "Not important." (Fig. 5). A majority of survey respondents reported that it was either "Important" or "Very Important" for patients to understand the financial aspects of their surgical care.

## DISCUSSION

Inguinal hernia repair and laparoscopic cholecystectomy represent two of the most commonly performed general surgical procedures in the US and our results imply that surgeons and their trainees have a limited understanding of the comprehensive charges and reimbursements associated with these procedures. In our sample, attending surgeon estimates of charges and reimbursements were

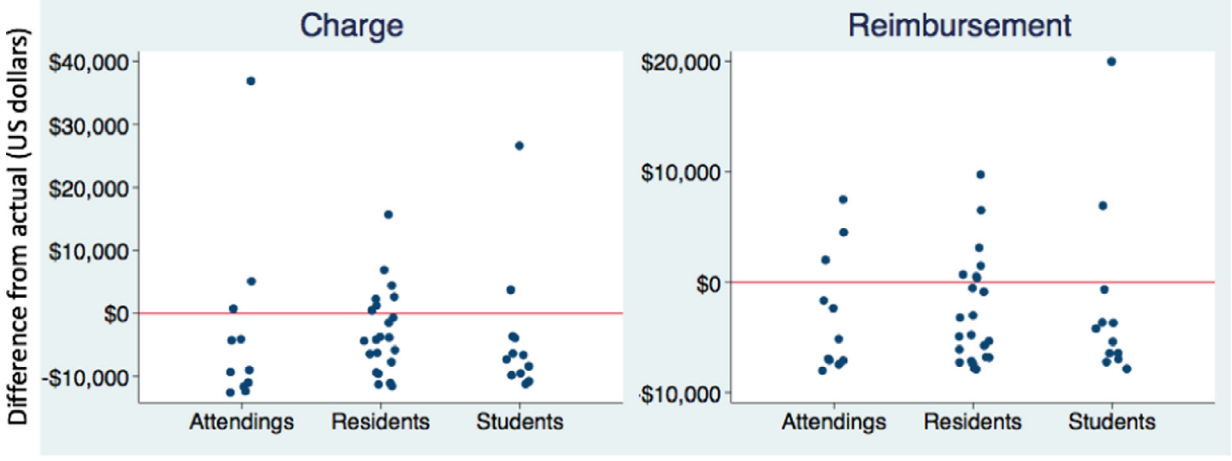


**FIGURE 2.** Accuracy of charge and reimbursement estimates for laparoscopic cholecystectomy by attendings, residents, and medical students. Horizontal red line at $0 represents an accurate estimate of actual value.

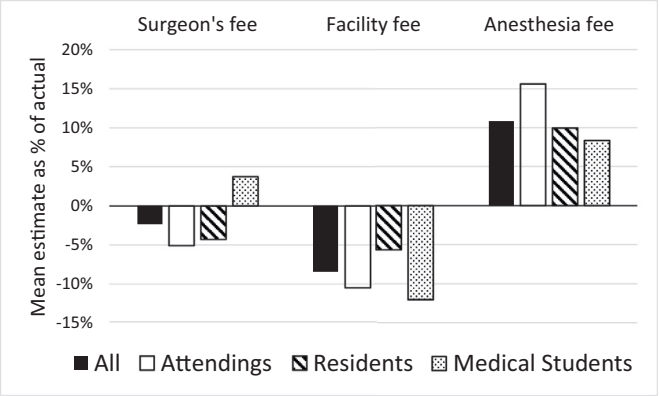


**FIGURE 3.** Accuracy of attending, resident, and medical student estimation of the components of comprehensive procedural charges. Mean estimates from the following survey question: "The following are components of a bill for a procedure, please provide your estimate of the percent of total charges that these components represent on average for procedures such as laparoscopic cholecystectomy and open inguinal hernia repair at your institution (please have percentages total 100%) Professional/Surgeon's fee___ Facility fee___ Anesthesia fee___".

similarly as inaccurate as their residents' and medical students'. It is important to highlight that our sample is relatively small and inadequately powered to detect anything except large differences between groups. Supporting our hypothesis, a majority of attending surgeons, general surgery residents, and fourth-year medical students applying for general surgery residency demonstrated a lack of familiarity with the charges and reimbursements associated with inguinal hernia repair and cholecystectomy. A majority of respondents underestimated the monetary magnitude of their work. Multiplying the median estimate of reimbursement for laparoscopic cholecystectomy by the annual volume of this procedure at our single institution, results in an underestimation of actual annual reimbursement of more than one million dollars.

A majority of survey respondents acknowledged their lack of familiarity with the financial aspects of surgical care while simultaneously reporting that these aspects of care are important for them and their patients to understand. This seemingly contradictory finding highlights a persistent lack of transparency within a complex health care billing infrastructure in the United States. Even if a provider or patient wants to know the charges associated with an elective procedure it can be challenging to determine a priori.[17,18] Despite being an important factor for patients, it is difficult to include cost in the decision-making process when values are unknown.[19]

The increasing prevalence of high deductible health plans has already had an effect on surgical patient behavior including the rise of cost shopping.[20,21] For common elective procedures, it is likely that an increasing number of patients will expect their surgeon to be familiar with associated charges. Patients are most interested in how much money they will have to pay for a procedure and it

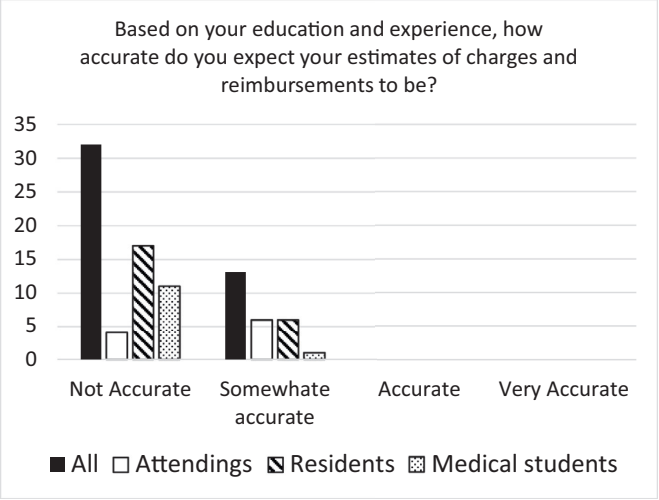


**FIGURE 4.** Expected accuracy of charge and reimbursement estimates among attending, resident, and medical student survey respondents.

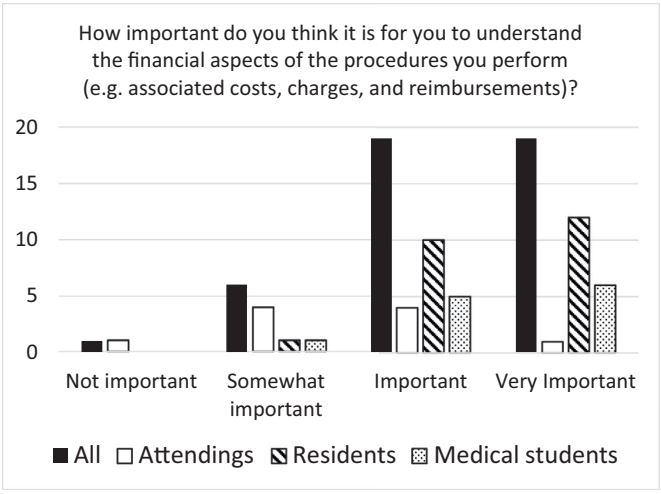


**FIGURE 5.** Self-reported importance placed on understanding the financial aspects of surgical care among attending, resident, and medical student survey respondents.

is likely that ongoing and future payment reform will require increasing transparency around these numbers.[12] Our results suggest that there is work to be done to adequately prepare practicing surgeons and their trainees for these inevitable changes. We chose to focus on comprehensive charges and reimbursements as we believe these values are more relatable to patients than individual components of care such as supply costs where previous investigations have focused.[9,11,22] Though it is important to highlight that these comprehensive charges and reimbursements, in most instances, are not representative of out-of-pocket patient costs. Furthermore, we believe that the magnitude of these values, relative to supply costs, will help surgeons and trainees understand the impact of their work on bigger picture health care spending.

Practice setting would undoubtedly influence our results, and requires further investigation. The generalizability of our survey results is limited by having been performed at a single academic medical center that operates in a region with minimal competition for patients. We suspect that surgeons, and potentially their trainees, in a private practice setting or a city with multiple competing healthcare enterprises would be more accurate in their estimation of charges and reimbursements associated with procedures they perform. An additional limitation of our work is that we requested estimates of the average charges and reimbursements across all payers and compared these estimates to the actual averages across all payers. This limitation highlights a counterintuitive complexity of health care billing where a surgeon can perform the identical procedure on two patients who rely on different payment methods and produce drastically different charges and reimbursements. For example, at our institution, the highest reimbursement for inguinal hernia repair is 2.5 times that of the lowest reimbursement. Similarly, for laparoscopic cholecystectomy the highest reimbursement is 2.4 times that of the lowest reimbursement.

There is a clear need for surgeon and trainee education about the financial implications of their work. Forward-thinking surgeons are starting to promote the need and knowhow to teach trainees about these topics[23] Chandawarkar and colleagues demonstrated an effective method for integrating cost awareness into general surgery training programs by providing a detailed list of the costs associated with patient care to residents.[24] To this end, we aim to use our findings to develop a curriculum to educate surgical trainees about the financial aspects of care including the complexities of current practice procedural billing as well as infrastructure improvements on the horizon.

## CONCLUSIONS

The American College of Surgeons Health Policy Research Institute reported that there were 135,854 practicing surgeons in the US as of 2008, representing just 0.08% of the country's active labor force.[25,26] The unsustainable spending practices within the US health care system are certainly not limited to surgical care. However, given the enormous sums of money attributed to a relatively limited number of providers, surgeons represent a promising target for intervention. Our results demonstrate that surgeons and their trainees underestimate the monetary implications of their work and are not prepared to have conversations with patients about the financial aspects of the care they provide. Our work contributes to the growing call for transparency, progress that would help clinicians play a necessary role in the realignment of our health care system around value.

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