ORIGINAL CONTRIBUTION

Trends and Distribution of IPAAs in the United States: Becoming Harder to Find in Colon and Rectal Surgery Residency Training?

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BACKGROUND: There has been concern among colon and rectal surgery residency programs in the United States that IPAA procedures have been decreasing, but evidence is limited.

OBJECTIVE: The study aimed to evaluate the number of IPAAs performed by colon and rectal surgery residents in the United States and analyze the distribution of these cases on a national level.

DESIGN: Retrospective.

SETTINGS: The Accreditation Council for Graduate Medical Education Case Log National Data Reports were used to evaluate the number of IPAAs performed by residents from 2005 to 2021. The Nationwide Inpatient Sample database was used to identify all patients undergoing these procedures from 2005 to 2019.

PATIENTS: All IPAA procedures regardless of indication.

MAIN OUTCOME MEASURES: The primary outcome was the number of IPAAs performed by residents yearly. The secondary outcome was the national distribution of these procedures.

RESULTS: Among colon and rectal surgery residents, case log data revealed an increase in mean and total number of IPAAs from 2005 to 2013, followed by a decline in both metrics after 2013. Despite the decrease, the mean number of cases per resident remained fewer than 6 between 2011 and 2021. A weighted national estimate of 48,532 IPAA patients were identified in the Nationwide Inpatient Sample database. A significant decrease was noted in the number of IPAAs after 2015 that persisted through 2019. There was a significant decrease in rural and urban nonteaching hospitals (from 2.1% to 1.6% and 25.6% to 4.3%, respectively; $p < 0.001$) and an increase in urbanteaching hospitals (from 72.4% to 94.1%; $p < 0.001$).

LIMITATIONS: Nonrandomized retrospective study design.

CONCLUSIONS: Despite the recent increase in the percentage of IPAAs performed at urban academic centers, there has been a decrease in cases performed by colon and rectal surgery residents. This can have significant implications for residents who graduate without adequate experience in performing this complex procedure independently, as well as training programs that may face challenges with maintaining accreditation. See **Video Abstract**.

TENDENCIAS Y DISTRIBUCIÓN DE LA ANASTOMOSIS ANAL CON BOLSA ILEAL EN LOS ESTADOS UNIDOS: ¿SE ESTÁ VOLVIENDO MÁS DIFÍCIL DE ENCONTRAR EN LA CAPACITACIÓN DE RESIDENCIA EN CIRUGÍA DE COLON Y RECTO?

ANTECEDENTES: Ha habido preocupación entre los programas de capacitación de residencia en cirugía de colon y recto en los Estados Unidos porque los procedimientos de anastomosis anal con bolsa ileal han estado disminuyendo; sin embargo, la evidencia es limitada.

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OBJETIVO: Evaluar el número de anastomosis anales con bolsa ileal realizadas por residentes de cirugía de colon y recto en los Estados Unidos y examinar la distribución de estos casos a nivel nacional.

DISEÑO: Retrospectivo.

AJUSTES: Se utilizaron los informes de datos nacionales del registro de casos de educación médica de posgrado del Consejo de Acreditación para examinar el número de anastomosis anales con bolsa ileal realizadas por residentes de 2005 a 2021. Se utilizó la base de datos de muestra nacional de pacientes hospitalizados para identificar a todos los pacientes sometidos a estos procedimientos de 2005 a 2019.

PACIENTES: Todos los procedimientos de anastomosis anal con bolsa ileal independientemente de la indicación.

MEDIDA DE RESULTADO PRINCIPAL: El resultado primario es el número de anastomosis anales con bolsa ileal realizadas por los residentes anualmente. El resultado secundario es la distribución nacional de estos procedimientos.

RESULTADOS: Entre los residentes de cirugía de colon y recto, los datos de los registros de casos revelaron un aumento en el número medio y total de anastomosis anal con bolsa ileal de 2005 a 2013, seguido de una disminución en ambas métricas después de 2013. A pesar de la disminución, el número medio de casos por El residente permaneció >6 entre 2011 y 2021. Se identificó una estimación nacional ponderada de 48 532 pacientes con anastomosis anal con bolsa ileal en la base de datos de la Muestra Nacional de Pacientes Hospitalizados. Se observó una disminución significativa en el número de anastomosis anales con bolsa ileal después de 2015 que persistió hasta 2019. Hubo una disminución significativa en los hospitales no docentes rurales y urbanos (del 2,1% al 1,6% y del 25,6% al 4,3% respectivamente, $p < 0,001$) y un aumento en los hospitales universitarios urbanos (del 72,4% al 94,1%, $p < 0,001$).

LIMITACIONES: Estudio retrospectivo no aleatorizado.

CONCLUSIÓN: A pesar del reciente aumento en el porcentaje de anastomosis anal con bolsa ileal realizadas en centros académicos urbanos, ha habido una disminución en los casos realizados por residentes de cirugía de colon y recto. Esto puede tener implicaciones significativas para los residentes que se gradúan sin la experiencia adecuada en la realización de este complejo procedimiento de forma independiente, así como para los programas de capacitación que pueden enfrentar desafíos para mantener la acreditación. *(Traduccion—AI-generated)*

KEY WORDS: IPAA; Pouch; IBD; Ulcerative colitis.

The IPAA procedure is frequently recommended as part of the surgical management for patients with ulcerative colitis or familial adenomatous polyposis.[1–4] It is a technically demanding procedure, and the nuances associated with it (different construction techniques, variations in pouch configuration, obtaining adequate length for a tension-free anastomosis) make it a topic of great interest and one of the most sought-after procedures for colon and rectal surgery (CRS) residents.[5,6] A decrease in the number of IPAA procedures performed could have significant implications for CRS residents and training programs. The current minimum index case requirement of IPAAs for each graduating CRS resident, set by the Accreditation Council for Medical Education (ACGME), is 5. There has been ongoing concern that the frequency of these procedures has continued to decrease over the past decade; however, the evidence to support that claim is limited.

A recent study evaluated the frequency and distribution of IPAA surgery performed for patients with ulcerative colitis using the University HealthSystem Consortium database.[7] The study found that most academic hospitals in the United States perform less than 5 IPAA cases annually (median 1.8). Some argue that with the evolution of biologic agents and medical management of IBD, the need for surgery in this patient population has been decreasing.[8,9] Other studies point out the centralization issue, meaning that only a few centers of expertise have been performing the vast majority of IPAAs in the United States.[7] Some studies outside the United States suggest that centralizing pouch surgery may be beneficial from a clinical outcomes perspective and have been advocating for IPAA centralization.[10] Another possibility is that CRS residency graduates end up practicing in a community that did not previously offer IPAA procedures, thus diluting volumes seen in CRS residency programs. Others have postulated that pediatric and general surgery residency programs are completing more IPAA procedures, thus diluting volumes in CRS residency programs. All of the above raise the question as to whether CRS residents can meet the minimum ACGME requirement and achieve competency in this procedure by the end of training.

Currently, there is a lack of data looking into the trends of IPAAs on a national scale, including all types of hospitals. In addition, there is no literature specifically looking into the number of IPAAs performed yearly by CRS residents or whether there has indeed been a decrease in numbers over the past few years. Therefore, the aim of our study was to evaluate the number of IPAAs performed among CRS residents and analyze the distribution of IPAAs on a national level.

PATIENTS AND METHODS

Study Population

ACGME Case Log National Data Reports from 2005 to 2021 were obtained for CRS, general surgery, and pediatric

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surgery residents to identify the number of IPAAs performed during training.

The National (Nationwide) Inpatient Sample (NIS) was used to identify patients who underwent an IPAA from 2005 to 2019 on a national scale. All patients undergoing an IPAA during the study period, irrespective of the indication and underlying diagnosis, were considered eligible and identified using International Classification of Diseases (ICD)-9 and ICD-10 codes (Table 1).

The NIS is the largest publicly available all-payer inpatient health care database and was designed to produce United States regional and national estimates of inpatient utilization, access, cost, quality, and outcomes. The database contains information on all hospital stays, regardless of expected payer for the hospital stay, and approximately a 20% stratified sample of all discharges from United States community hospitals, excluding rehabilitation and long-term acute care hospitals. Unweighted, it contains data from approximately 7 million hospital stays each year. Weighted, it estimates approximately 35 million hospitalizations nationally.[11]

TABLE 1. List of ICD-9 and ICD-10 codes used to identify patients undergoing an IPAA using the National (Nationwide) Inpatient Sample Database

Code	Definition
ICD-9	
45.95	Anastomosis to anus
ICD-10	
0D180ZQ	Bypass small intestine to anus, open approach
0D184ZQ	Bypass small intestine to anus, percutaneous endoscopic approach
0D188ZQ	Bypass small intestine to anus, via natural or artificial opening approach
0D1B0ZQ	Bypass ileum to anus, open approach
0D1B4ZQ	Bypass ileum to anus, percutaneous endoscopic approach
0D1B8ZQ	Bypass ileum to anus, via natural or artificial opening endoscopic
0D1B07Q	Bypass ileum anus autologous tissue substitute open
0D1B0KQ	Bypass ileum anus nonautologous tissue substitute open
0D1B0JQ	Bypass ileum anus synthetic substitute open
0D1B47Q	Bypass ileum anus autologous substitute percutaneous endoscopic
0D1B4KQ	Bypass ileum anus nonautologous percutaneous endoscopic
0D1B4JQ	Bypass ileum anus synthetic substitute percutaneous endoscopic
0D1B87Q	Bypass ileum anus autologous natural/artificial endoscopic
0D1B8KQ	Bypass ileum anus nonautologous substitute endoscopic
0D1B8JQ	Bypass ileum anus synthetic substitute endoscopic

ICD-9 = International Classification of Diseases Ninth Revision; ICD-10 = International Classification of Diseases Tenth Revision.

Variables

The NIS was used to identify patients who underwent IPAA procedures and relevant data with regard to the hospital where the IPAA was performed. Specifically, we captured data relating to the region of the participating hospitals (Northeast, Midwest, South, and West) and the hospital type (urban teaching, urban nonteaching, and rural).[12]

The ACGME Case Log National Data Reports were used to calculate the mean number of IPAAs performed by surgery trainees as well as the total number of IPAAs performed across all colon and rectal, general, and pediatric surgery residency programs.

Outcomes

The primary outcome of the study was the number of IPAAs performed by CRS residents. Secondary outcomes included the number of IPAAs performed by hospital type and location.

Statistical Analysis

A trend analysis was first done to identify trends in the number of IPAAs performed by surgery trainees, as well as the total number of IPAAs performed across all training programs on the basis of the ACGME data, and subsequently, the total number of IPAAs performed across the United States using the NIS database. Weighted national estimates using NIS data were calculated using previously published methodologies.[13] Overall trends over time were compared using Cochran–Armitage trend tests. Univariate analysis was performed to compare the number of IPAAs performed in urban teaching, urban nonteaching, and rural hospitals during the study period using weighted Rao–Scott χ^2 tests. *P* values of <0.05 were considered statistically significant, and all NIS statistical analyses were conducted using SAS, version 9.4 (SAS Institute Inc, Cary, North Carolina).

RESULTS

IPAAs Performed By Surgery Trainees

Among CRS trainees, ACGME data revealed an increase in both the mean number of IPAAs per resident and the total number of IPAAs across all CRS training programs from 2005 to 2013, followed by a decline in both metrics after 2013 (Fig. 1). The mean number of IPAAs per CRS resident ranged from 3.9 to 5 procedures before 2011, peaked at an average of 9 procedures per CRS resident in 2013, and has been slowly decreasing since then, reaching a nadir with an average of 6.8 procedures per resident in 2021. The total number of IPAAs across all training programs followed the same pattern (Fig. 1).

A similar trend was observed among general surgery residents. Specifically, the mean number of IPAAs

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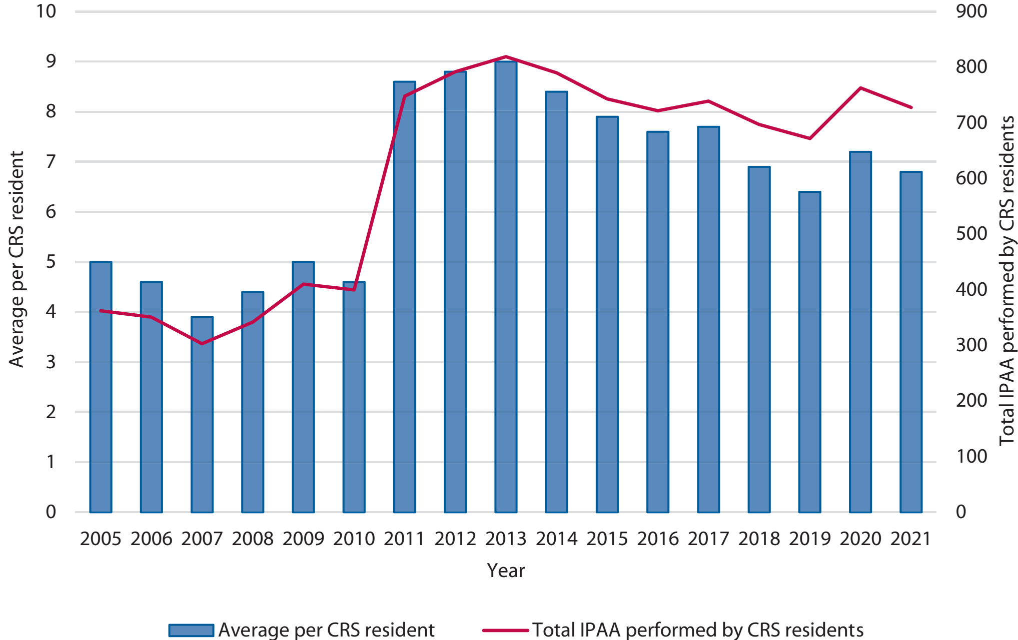

FIGURE 1. Average number of IPAAs performed by CRS residents (blue bars) and total number of IPAAs performed per year by all CRS residents in the United States, from 2005 to 2021 (red line). CRS = colon and rectal surgery.

per resident was 0.1 until 2008, peaked at 0.5 cases per resident between 2010 and 2013, and has been declining since, with a mean of 0.2 procedures per resident in 2021. In pediatric surgery training programs, there has also been a decrease in IPAAs over the past decade. There were a total of 116 IPAAs performed in 2008, with the number of cases reaching a nadir of 27 across all training programs in 2018. Before 2019, pediatric surgery used "pull through for IBD or polyposis" to define IPAA procedures. In 2019, the definition of IPAA was replaced by "total colectomy with ileoanal reconstruction or coloanal." Figures 2 and 3 depict the IPAA trends in general surgery and pediatric surgery training programs, respectively.

National Distribution of IPAAs by Hospital Type

A total of 48,532 patients who underwent an IPAA were identified in the NIS database from 2005 to 2019. There was a statistically significant increase in the frequency of IPAA procedures before 2014 ($p < 0.001$). An abrupt decrease was noted in the number of IPAAs in 2016, which persisted through 2019. There was no statistically significant change in the number of IPAAs performed from 2016 to 2019 ($p = 0.45$). These findings are demonstrated in Figure 4.

There was no difference in IPAA trends over time based on hospital location (Northeast, Midwest, South, and West, $p = 0.95$). However, there was a significant decrease in the proportion of patients undergoing IPAA in rural and urban nonteaching hospitals (from 2.0% to 1.6% and 25.6% to 4.3%, respectively; $p < 0.001$) and an increase in IPAAs performed in urban teaching hospitals (from 72.4% to 94.1%, $p < 0.001$). These trends are demonstrated in Figure 5.

DISCUSSION

The present study confirms the concerns that the number of IPAAs performed by CRS trainees in the United States has been declining over the past few years. This can have significant implications for residents who graduate without adequate experience in performing this complex procedure independently, as well as training programs that may face challenges with maintaining accreditation.

In the United States, the ACGME sets and monitors educational standards essential in preparing physicians to deliver safe, high-quality medical care to all US residents. After 5 years of general surgery residency, trainees can apply for a year of subspecialty CRS residency training. The ACGME oversees accreditation of residency programs in the United States. Training in a residency program affords a trainee the opportunity to obtain board certification at the completion of training. There are 67 ACGME-accredited CRS residency programs in the United States. CRS fellowships, of which there are 8 in the United States, are not accredited by the ACGME and trainees in those programs do not have the opportunity to obtain board certification when completed. In our study, we focused only on ACGME CRS residency programs.

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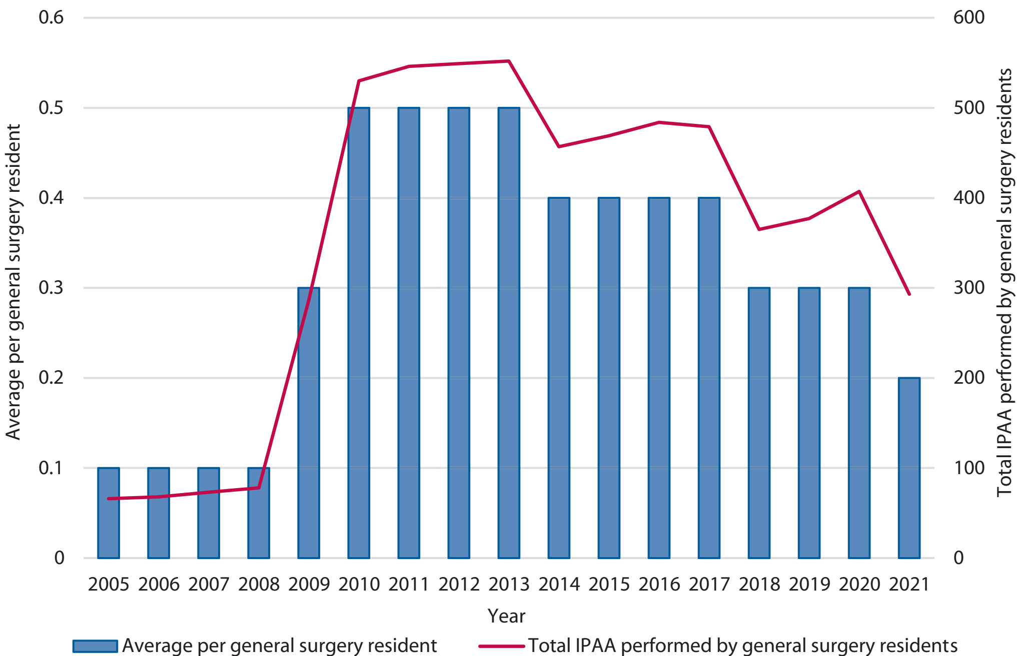

FIGURE 2. Average number of IPAAs performed by general surgery residents (blue bars) and total number of IPAAs performed per year by all general surgery residents in the United States from 2005 to 2021 (red line).

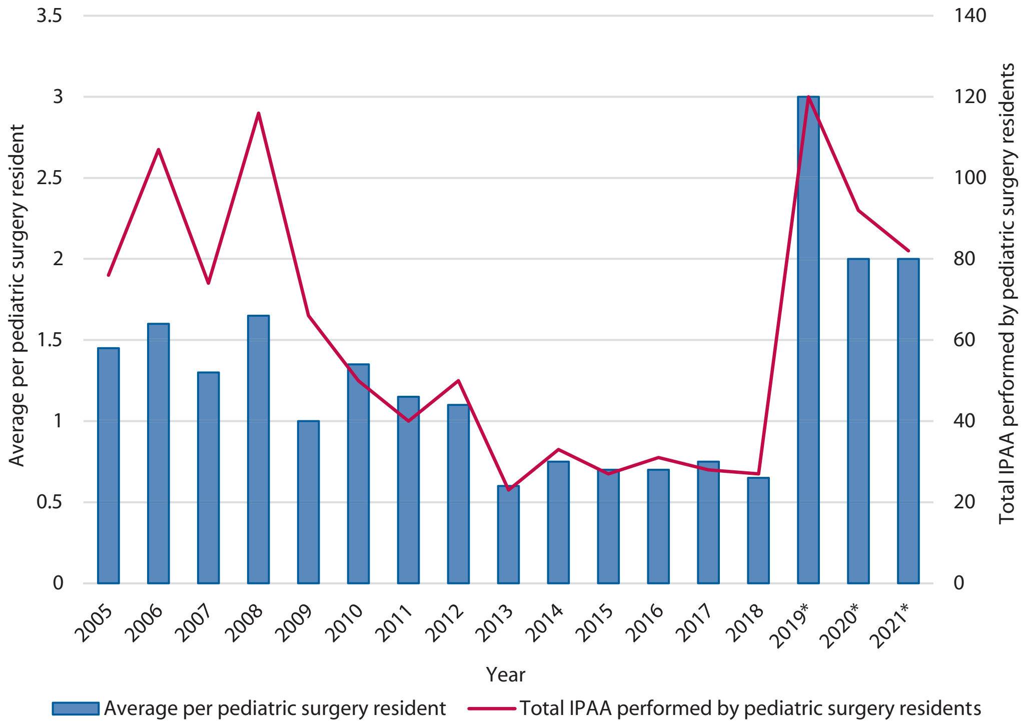

FIGURE 3. Average number of IPAAs performed by pediatric surgery residents (blue bars) and total number of IPAAs performed per year by all pediatric surgery residents in the United States from 2005 to 2021 (red line). *Before 2019, pediatric surgery used "pull through for IBD or polyposis" to define IPAA procedures. In 2019, the definition of IPAA was replaced with "total colectomy with ileoanal reconstruction or coloanal."

The ACGME program requirements for graduate medical education in CRS outline standardized uniform training requirements for all CRS residency programs across the country.[14] The ACGME, along with its Colon and Rectal Surgery Review Committee (CRS RC), recognized that each CRS resident should have a reasonably

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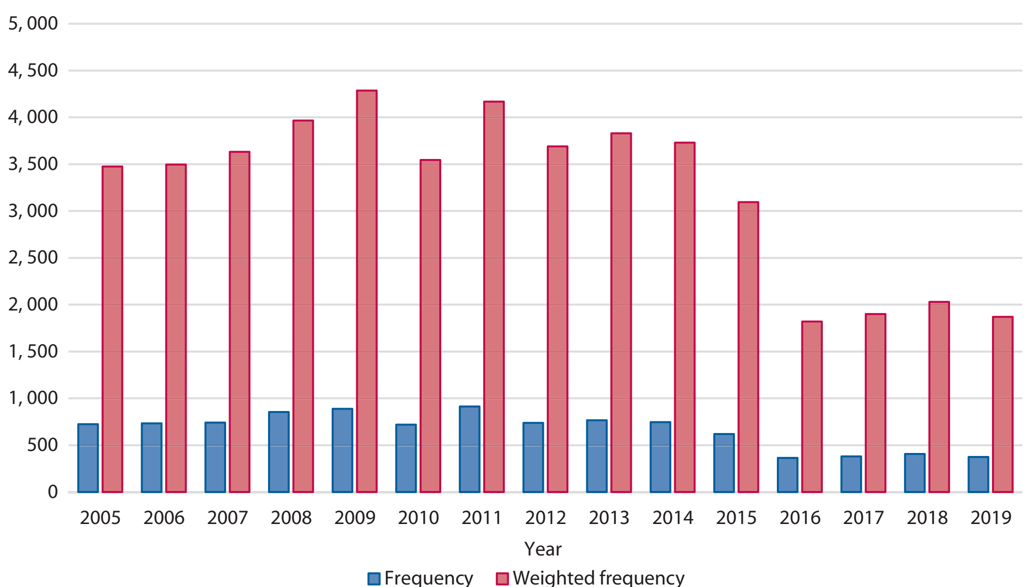

FIGURE 4. Frequency and weighted estimates of IPAA procedures performed nationally on the basis of National (Nationwide) Inpatient Sample data.

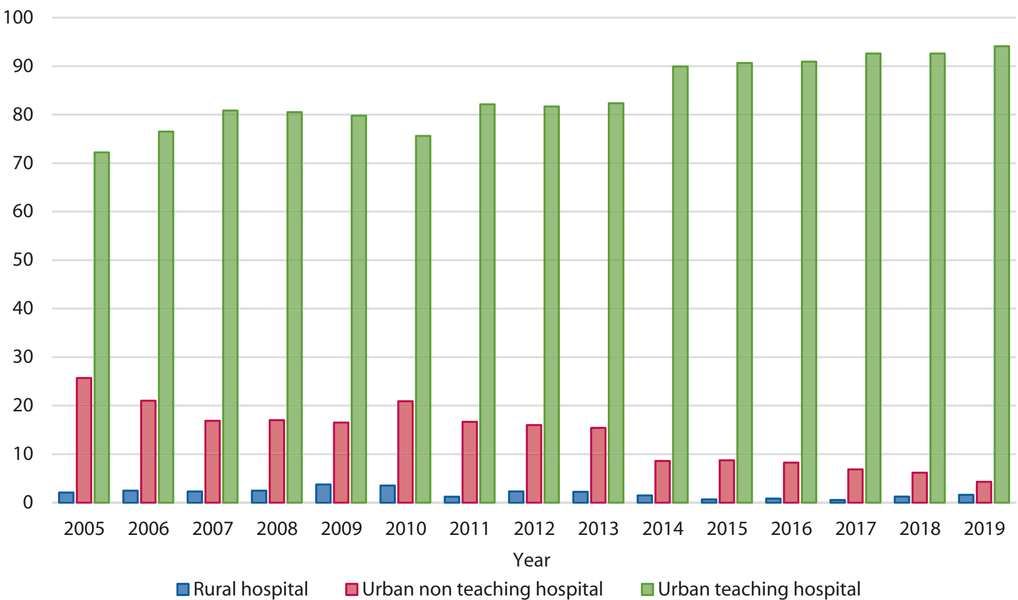

FIGURE 5. Proportion of IPAAs performed in rural, urban nonteaching, and urban teaching hospitals from 2005 to 2019.

equivalent educational experience to prepare for independent practice. In collaboration with the American Board of Colon and Rectal Surgery, in 2011, the CRS RC published minimum index case numbers that each CRS resident should obtain during training.[15] Each CRS resident is expected to graduate with 5 IPAA index case numbers (procedures) and be trained in the perioperative management of IPAA patients.[16]

When CRS residents record an IPAA index case number, it is expected that they did more than merely observe or assist during the case, but rather performed significant portions of the procedure (lengthening maneuvers, pouch creation, anastomosis, etc). The IPAA index case is isolated to that part of the procedure alone, and not combined with other procedures (proctocolectomy, completion proctectomy), which are recorded separately under their own index case categories.

Some authors have raised concern regarding the potential impact of lower IPAA volumes on clinical outcomes, but other studies have not been able to establish such a correlation.[7,10] Unlike other countries where IPAAs and other specialized procedures (ie, rectal cancer) are performed in highly specialized/ tertiary centers, that is not the case in the United States. Any hospital that

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employs a surgeon (general or colon and rectal) capable of performing an IPAA can offer that to their patient population, and the vast majority are performed by colon and rectal surgeons.

In a recently published study by Hoang et al, the frequency and distribution of IPAA procedures was examined among patients with ulcerative colitis undergoing surgery.[7] The authors identified a low median annual IPAA case volume of only 1.8 cases among the participating sites, which comprised academic institutions across the United States. In addition, nearly half of the elective IPAA cases were performed by a minority of these academic institutions. These findings raised concerns regarding the adequacy of training among general surgery and mostly CRS residents and whether the latter will be able to perform an IPAA safely and independently upon graduation. The authors acknowledged that they were unable to evaluate the number of IPAAs per resident and that only 53% of colon and rectal training programs participated in the studied consortium; hence, the results may not accurately reflect reality in many CRS training programs.

To overcome some of the aforementioned limitations, in the present study, the ACGME Case Log National Data Reports were used to evaluate the total number of IPAAs and derive the mean number of IPAAs performed yearly by CRS, general, and pediatric surgery residents. The data verified that the number of IPAAs has been declining steadily since 2013. Fortunately, the mean number of IPAAs performed by CRS residents remains higher than 5 per year of training, which is the minimum number required by the ACGME. Nevertheless, this number represents a decrease compared with 2013–2014 when the minimum requirement set by the ACGME was 8 IPAA procedures per year. It is evident that although the mean number of IPAAs remains higher than 5, there are a number of training programs that have been unable to meet this requirement. Specifically, in the academic year 2021–2022, a total of 11 programs and 18 CRS residents failed to meet the minimum number of IPAAs.[17] It is possible that if the decreasing trend continues, the number of programs facing citations and more importantly the number of CRS residents who graduate and are not adequately prepared to perform IPAAs in their practice will increase.

The reasons behind the clear decrease in IPAA numbers should be investigated, which our study was not designed to address. Despite previous reports that reveal centralization of IPAA in a few select academic programs, one should consider the possibility that a significant number of IPAAs are being performed outside the academic realm, leading to a dilution of cases that are available for CRS residents. This could be the case because a large number of CRS graduates who have been trained and feel comfortable performing IPAA end up practicing in the community or private practice settings. However, the NIS data do not support this hypothesis because there seems to be a significant decrease in the percentage of IPAAs performed in rural and urban nonteaching hospitals over the past 2 decades. Another theory was that general surgery residents have been performing more IPAAs during training, hence compromising the experience of CRS residents. However, this theory is not supported by our data either. Although the ACGME does not mandate IPAA index case numbers for general surgery trainees, and few IPAAs are performed during general surgery training, the IPAA trends among general surgery residents have followed a very similar pattern and have been declining over time. Another possibility for a decrease in IPAA index case numbers is because faculty were in their own learning curves for minimally invasive (laparoscopic, robotic) IPAA procedures, thus decreasing opportunities for residents other than for observing and assisting. The NIS data do not support this hypothesis for rural and urban nonteaching hospitals, but it could be a contributor in urban teaching hospitals.

Ulcerative colitis and familial adenomatous polyposis are the 2 most common indications for proceeding with IPAA, although rates of familial adenomatous polyposis have not changed in decades. It seems that the decrease in IPAA procedures is directly correlated to a change in treatment of ulcerative colitis. Many argue that the evolution of treatment strategies involving biologic agents has been the culprit for the decrease in IPAA procedures because many patients with ulcerative colitis who receive treatment with such medications can avoid surgery. In fact, there has been growing evidence in the literature that since the introduction of treatment with tumor necrosis alpha inhibitors, there has been a statistically significant decrease in the number of patients undergoing colectomy.[18–20] Some studies reported that although the use of biologics seems to be useful in avoiding urgent colectomies, the risk of elective colectomy seems to be similar.[21] However, other studies show that the decrease is not specific to emergent settings. For instance, a previous study reported that after the approval and increasing use of antitumor necrosis factor alpha inhibitors, the total colectomy incidence rate for medically refractory ulcerative colitis has been decreasing by 16% per year.[22] Regardless of the exact reason behind the decrease in IPAA procedures, the reality remains that the numbers have been decreasing to the detriment of CRS residents.

The limitations of the present study include its nonrandomized retrospective nature. However, the ACGME Case Log National Data Reports accurately represent the number of IPAAs performed by CRS residents and ultimately offer an approximation of the total number of IPAAs performed within the confines of training programs. With regard to NIS, ICD-9 codes were used before October 1, 2015, whereas ICD-10 codes were used thereafter. As a result, a different set of ICD codes were used to identify IPAAs across the study period, which could at

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least partially explain the significant drop in the number of IPAAs after 2015. In addition, NIS data beyond 2019 are not available yet. Nevertheless, NIS offered the opportunity to evaluate the trends on a national level up to 2019 and to ascertain the performance of IPAA even outside academic hospitals.

CONCLUSIONS

Despite the increase in the percentage of IPAAs performed at urban academic centers over the past few years, there has been a slow but steady decrease in the total number of IPAAs performed by surgery trainees. The reasons behind this remain unclear. Nevertheless, the mean number of IPAAs performed by CRS residents remains above the minimum requirement set by the ACGME. Further studies are needed to evaluate alternative effective ways to train residents to perform these complex operations.

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