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### Title

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### Permalink

<https://escholarship.org/uc/item/68x3j9v9>

### Journal

The American Journal of Surgery, 223(4)

### ISSN

0002-9610

### Authors

Beninato, Toni  
Laird, Amanda M  
Graves, Claire E  
et al.

### Publication Date

2022-04-01

### DOI

10.1016/j.amjsurg.2021.07.009

Peer reviewed



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Contents lists available at ScienceDirect

## The American Journal of Surgery

journal homepage: [www.americanjournalofsurgery.com](http://www.americanjournalofsurgery.com)

## Impact of the COVID-19 pandemic on the practice of endocrine surgery

Toni Beninato <sup>a, \*</sup>, Amanda M. Laird <sup>a</sup>, Claire E. Graves <sup>b</sup>, F. Thurston Drake <sup>c</sup>,  
Amal Alhefdhi <sup>d</sup>, James A. Lee <sup>e</sup>, Jennifer H. Kuo <sup>e</sup>, Elizabeth G. Grubbs <sup>f</sup>, Tracy S. Wang <sup>g</sup>,  
Janice L. Pasioka <sup>h</sup>, Carrie C. Lubitz <sup>i</sup>

<sup>a</sup> Rutgers Cancer Institute of New Jersey, Rutgers Robert Wood Johnson Medical School, 195 Little Albany Street, New Brunswick, NJ, 08903, USA

<sup>b</sup> University of California Davis, 4501 X Street, Suite 3010, Sacramento, CA, 95817, USA

<sup>c</sup> Boston Medical Center, Boston University School of Medicine, 830 Harrison Avenue, Boston, MA, 02118, USA

<sup>d</sup> King Faisal Specialist Hospital and Research Centre, Al Mathar Ash Shamali, Riyadh, 11564, Saudi Arabia

<sup>e</sup> NewYork Presbyterian Hospital-Columbia University Medical Center, 161 Fort Washington Avenue, New York, NY, 10032, USA

<sup>f</sup> University of Texas MD Anderson Cancer Center, 1515 Holcombe Blvd, Houston, TX, 77030, USA

<sup>g</sup> Medical College of Wisconsin, 8800 West Doayne Avenue, Milwaukee, WI, 53226, USA

<sup>h</sup> Cumming School of Medicine, University of Calgary, 1403 29<sup>th</sup> Street NW, Calgary, Alberta, T2N 2T9, Canada

<sup>i</sup> Harvard Medical School, Massachusetts General Hospital, 55 Fruit Street, Boston, MA, 02114, USA

## ARTICLE INFO

## Article history:

Received 1 June 2021

Received in revised form

9 July 2021

Accepted 10 July 2021

## Keywords:

COVID-19

Endocrine surgery

Thyroid surgery

Telemedicine

Survey

Compensation

## ABSTRACT

**Background:** This study investigates the impact of the COVID-19 pandemic on endocrine surgeons.

**Methods:** A survey on the professional, educational, and clinical impact was sent to active and corresponding members of the American Association of Endocrine Surgeons (AAES) in September 2020. Chi-square and paired *t*-test were used for analysis.

**Results:** 77 surgeons responded (14.8 %). All reported suspension of elective surgeries; 37.7 % were reassigned to other duties during this time. The median number of cases backlogged was 30 (IQR 15–50). Most surgeons reported decreased clinical volume (74.6 %). The use of virtual platforms for clinical and educational purposes increased from pre-COVID-19 levels (all  $p < 0.001$ ). Use of in-office procedures ( $p < 0.001$ ) and length of observation prior to discharge for thyroid surgery ( $p < 0.05$ ) decreased.

**Conclusion:** The COVID-19 pandemic led to suspension of operations and decreased practice volume for endocrine surgeons. Surgeons increased use of virtual platforms, decreased in-office procedures, and decreased duration of observation for thyroid surgery in response.

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## 1. Introduction

On March 11, 2020, coronavirus disease 2019 (COVID-19) was declared a pandemic by the World Health Organization.<sup>1</sup> Shortly after, hospitals began suspending elective operations in order to preserve personal protective equipment and other hospital resources such as beds and personnel<sup>(2)</sup>. Hospitals and subspecialty

organizations issued guidelines and scoring systems to aid with triage of elective operations and to allow “urgent” procedures to proceed<sup>(3,4)</sup>. Hospital systems reported decreased revenue from the suspension of elective procedures, which make up a bulk of income for hospitals and often support less profitable services<sup>(5)</sup>. Many surgeons were reassigned to other roles during this time – some providing ancillary care such as line-placement in COVID-19 patients, others taking general surgery or trauma call so their critical-care surgeon colleagues could manage COVID-19 intensive care units<sup>(6)</sup>. To further prevent spread of the virus, measures were put in place to better encourage social distancing: outpatient practices converted visits to telemedicine formats<sup>(7)</sup>, educational sessions were moved to virtual platforms, and trainees were prohibited from certain care settings to preserve resources or permit social distancing<sup>(8)</sup>.

\* Corresponding author. Rutgers Cancer Institute of New Jersey, 195 Little Albany Street CINJ 3040, New Brunswick, NJ, 08903, USA.

E-mail addresses: [toni.beninato@rutgers.edu](mailto:toni.beninato@rutgers.edu) (T. Beninato), [amanda.laird@cinj.rutgers.edu](mailto:amanda.laird@cinj.rutgers.edu) (A.M. Laird), [cegraves@ucdavis.edu](mailto:cegraves@ucdavis.edu) (C.E. Graves), [frederick.drake@bmc.org](mailto:frederick.drake@bmc.org) (F.T. Drake), [dram2001@gmail.com](mailto:dram2001@gmail.com) (A. Alhefdhi), [jal74@cumc.columbia.edu](mailto:jal74@cumc.columbia.edu) (J.A. Lee), [jhk2029@cumc.columbia.edu](mailto:jhk2029@cumc.columbia.edu) (J.H. Kuo), [egggrubbs@mdanderson.org](mailto:egggrubbs@mdanderson.org) (E.G. Grubbs), [tswang@mcw.edu](mailto:tswang@mcw.edu) (T.S. Wang), [Janice.Pasioka@albertahealthservices.ca](mailto:Janice.Pasioka@albertahealthservices.ca) (J.L. Pasioka), [clubitz@mg.harvard.edu](mailto:clubitz@mg.harvard.edu) (C.C. Lubitz).

Endocrine surgeons were subject to many of the above-mentioned issues, but also had additional specialty-specific challenges. The majority of endocrine surgical procedures can be performed in an outpatient setting or require no more than an overnight stay, using minimal hospital resources and are therefore ideal for continued use in a resource-thin environment. Many procedures, however, are for benign disease or relatively indolent cancers so may be lower on the priority list of “urgent” procedures. Additionally, they require a period of lengthy observation in the recovery room to facilitate outpatient discharge. Furthermore, many surgeons perform in-office procedures such as fine needle aspiration (FNA) of thyroid nodules, ultrasound, and direct laryngoscopy, all procedures that require close contact with patients during an in-office visit. It is unknown whether endocrine surgeons adjusted their practices to aid in patient and provider safety as well as to preserve valuable hospital resources during the initial peak of the pandemic.

In order to determine the impact of the COVID-19 pandemic on the practice of endocrine surgery, a survey was designed and distributed to active and corresponding members of the American Association of Endocrine Surgeons (AAES), a subspecialty group with over 500 members who practice endocrine surgery in the Americas and throughout the world. The aim of this study was to determine the impact of the COVID-19 pandemic on various facets of endocrine surgery, including practice volume, compensation, use of web-based conferences, exposure to trainees, re-assignment to other duties, telemedicine use, and practice patterns such as use of in-office procedures, same day discharge after surgery, and observation duration prior to discharge.

## 2. Material and methods

A survey was administered electronically to the 518 active and corresponding members of the AAES. Active members are those who practice in North, Central, or South America, and meet additional criteria for membership via a subspecialty focus in endocrine surgery, while corresponding members meet those same criteria but practice outside the Americas. The survey asked members about demographic data including age, gender, years in practice, practice type (academic versus non-academic, percent endocrine surgery practice), and location (region of the world, metropolitan versus rural). Members were surveyed on their clinical experience during the COVID-19 pandemic, including data on suspension of non-urgent operations, backlog of cases, and additional duties performed outside their typical scope of practice. Questions were also asked about practice volume, compensation, and layoff or furloughing of administrative or research staff.

The utilization of web-based conferences for grand rounds, morbidity and mortality conference, tumor boards, and research meetings, and their opinions on the quality of these conferences compared to in-person meetings were included. Then, using a 5-point Likert scale (“Never”, “Rarely”, “Sometimes”, “Often”, “Always”), participants were asked questions about their exposure to trainees, if applicable, “pre” and “post” COVID in various settings, including clinic, the operating room and didactic educational sessions. “Pre-COVID” and “Post-COVID” are defined as before and after the start of the spring 2020 surge of the COVID-19 pandemic, respectively. Since the survey was sent out in September 2020, the specific time points designating “before” and “after” were up for interpretation by the respondent.

Finally, practice patterns such as use of telemedicine, performance of in-office procedures, and use of same-day discharge for total thyroidectomy, thyroid lobectomy, parathyroidectomy, and adrenalectomy pre- and post-COVID were collected using the same 5-point Likert scale. Respondents were also asked about duration of

observation in recovery room for these procedures prior to discharge pre and post-COVID.

Study data were collected and managed using REDCap electronic data capture tools hosted at Rutgers Cancer Institute of New Jersey. Participants were solicited via email from the AAES on September 17, 2020 and September 30, 2020. Data collection occurred over four weeks.

Descriptive statistics were calculated for all responses. Pearson's chi-squared tests were used to compare proportions between groups. Paired t-tests were used to compare responses to all questions asked for the pre- and post-COVID time points. Missing data were excluded from analysis for individual questions. Data were analyzed using Stata version 16.1 (College Station, TX). Any  $p$  value  $< 0.05$  was considered statistically significant. The study was approved by the Institutional Review Board at Rutgers University.

## 3. Results

### 3.1. Demographics, practice volume, and compensation

Response rate was 14.8 % or 77 respondents, the majority were male (55.8 %) and under the age of 50 (66.2 %). Complete demographics for participants are listed in Table 1. Respondents most commonly practiced at academic institutions (81.8 %) in metropolitan areas (76.6 %) of the United States (US) (76.6 %). Most respondents had a majority endocrine surgery practice (82.8 %) and were in a practice with multiple other surgeons. US respondents were most likely to practice in the Midwest (28.8 %), followed by Northeast, Southeast, Southwest, and West. Non-US respondents (23.4 %) were in Canada, Mexico, South America, Europe, and Asia.

All respondents reported suspension of elective operations temporarily during the pandemic (Table 2). The majority (89.3 %) reported that procedures deemed “urgent” were permitted to proceed. Approximately one-third (37.7 %) were reassigned to other duties outside the scope of their normal practice, including general surgery call (26.0 %), an ancillary service for COVID-19 patients (14.3 %), trauma surgery call (6.5 %), a medicine or pulmonary service (6.5 %), or to a critical care unit (3.9 %). When elective surgeries were permitted to resume, surgeons had a median of 30 cases to schedule (IQR 15–50), which were mostly performed during normal block time but also during extended hours (28.8 %), on weekends (7.6 %), or at an additional facility (10.6 %).

The majority of surgeons (70.1 %) reported a decrease in compensation. This was more prevalent in private practice surgeons compared to academic (92.9 % versus 65.1 %,  $p = 0.04$ ). This was thought to be mostly due to a decline in volume-based revenue (59.3 %), but surgeons also reported decreases in base salary, academic funds, and contributions for retirement benefits. Most surgeons (73.3 %) expected this decrease to change their income by 25 % or less. Declines in volume were attributed to patient preference to delay care (77.4 %) and fewer referrals (67.9 %), while many also reported a decrease in office-based volume secondary to greater use of telemedicine (54.7 %) and a decrease in the volume of patients seen in order to permit social distancing (47.2 %). Additionally, many respondents reported a change in on-site presence of administrative (87.0 %) and research (40.3 %) staff due to widespread transition to remote work or furloughing of staff.

### 3.2. Conferences and resident teaching

Participants reported an increase in the use of web-based institutional conferences such as morbidity and mortality conference, grand rounds, tumor board, or research meetings from 23.2 % pre-COVID to 95.7 % post. When asked about the quality of these conferences, most thought that the quality of the virtual

**Table 1**  
Demographics of survey participants.

	Survey Participants (n = 77)
Age (years)	
31-40	22 (28.6 %)
41-50	29 (37.7 %)
51-60	15 (19.5 %)
61-70	10 (13.0 %)
>70	1 (1.3 %)
Gender	
Male	43 (55.8 %)
Female	33 (42.9 %)
Nonbinary	1 (1.3 %)
Primary Specialty	
Endocrine Surgery	66 (85.7 %)
General Surgery	6 (7.8 %)
Surgical Oncology	3 (3.9 %)
Breast and Endocrine Surgery	2 (2.6 %)
ENT	0 (0.0 %)
Years in Practice	
<5	17 (22.1 %)
6-10	18 (23.4 %)
11-20	23 (29.9 %)
21-30	11 (14.3 %)
>30	8 (10.4 %)
Practice Setting	
Academic	63 (81.8 %)
Teaching Hospital	7 (9.1 %)
Community Hospital	7 (9.1 %)
Government-sponsored facility	4 (5.2 %)
Private Practice	9 (11.7 %)
Number of Surgeons in Practice	
1	3 (3.9 %)
2	11 (14.3 %)
3	21 (27.3 %)
4	16 (20.8 %)
5	8 (10.4 %)
>5	18 (23.4 %)
Percent of Practice Endocrine Surgery	
1-25 %	4 (5.2 %)
26-50 %	9 (11.7 %)
51-75 %	15 (19.5 %)
76-100 %	49 (63.6 %)
Location of Practice	
USA	59 (76.6 %)
Canada	4 (5.2 %)
Mexico	3 (3.9 %)
South America	2 (2.6 %)
Europe	7 (9.1 %)
Asia	1 (1.3 %)
Other	1 (1.3 %)
Region of USA (n = 59)	
Northeast	13 (22.0 %)
Southeast	11 (18.6 %)
Midwest	17 (28.8 %)
Southwest	9 (15.3 %)
West	9 (15.3 %)
Practice Environment	
Metropolitan	59 (76.6 %)
Suburban	16 (20.8 %)
Rural	2 (2.6 %)

conferences was “better” or “similar” for morbidity and mortality (79.0 %), grand rounds (82.5 %), tumor boards (75.4 %), and research meetings (78.6 %) compared to in-person. The majority also felt that web-based conferences would continue post-pandemic (Supplemental Table).

A subset of 63 respondents who participate in the education of residents and fellows were asked about whether their exposure to trainees had changed since the start of the pandemic. The majority (56.5 %) said that their exposure to trainees had not changed, but others reported less exposure to trainees due to decreased clinical volume (38.7 %), suspension of didactic sessions (32.3 %), reassignment of trainees to other services (19.4 %), resident restriction

**Table 2**  
Impact of COVID-19 on practice volume, compensation, and staff.

	Survey Participants (n = 77)
Elective Surgeries Suspended	
Yes	77 (100 %)
No	0 (0 %)
Urgent Procedures Continued (n = 75)	
Yes	67 (89.3 %)
No	8 (10.7 %)
Reassignment Outside Routine Practice	
None	48 (62.3 %)
General Surgery Call	20 (26.0 %)
Ancillary Service for COVID patients	11 (14.3 %)
Trauma Surgery Call	5 (6.5 %)
Medicine/Pulmonary Service	5 (6.5 %)
Critical Care Unit	3 (3.9 %)
Other	2 (2.6 %)
Median backlog of operations (IQR)	30 (15-50)
Strategies to Schedule Backlog	
Normal Block Time	60 (90.9 %)
Extended Hours	19 (28.8 %)
Additional Facility	7 (10.6 %)
Weekends	5 (7.6 %)
Other	4 (6.1 %)
Impact on Compensation	
Yes	54 (70.1 %)
No	23 (29.9 %)
How Compensation Impacted (n = 54)	
Volume-based revenue	32 (59.3 %)
Base Salary	19 (35.2 %)
Academic Funds	18 (33.3 %)
Retirement Benefits/Contributions	16 (29.6 %)
Research Funds	4 (7.4 %)
Other	3 (5.6 %)
Percent income decline (n = 45)	
0-25 %	33 (73.3 %)
26-50 %	8 (17.8 %)
51-75 %	4 (8.9 %)
76-100 %	0 (0.0 %)
Volume of Practice Changed (n = 71)	
Yes	53 (74.6 %)
No	18 (25.4 %)
Reasons for volume change (n = 53)	
Patient preference to delay care	41 (77.4 %)
Fewer referrals	36 (67.9 %)
Greater use of telemedicine	29 (54.7 %)
Fewer patients scheduled for social distancing	25 (47.2 %)
Outsourcing of office procedures	3 (5.7 %)
Increased volume	5 (9.4 %)
Other	3 (5.7 %)
Change in on-site administrative staff	
Yes	67 (87.0 %)
No	10 (13.0 %)
How did administrative staff change	
Staff were furloughed/laid off	27 (40.3 %)
Work entirely remotely	27 (40.3 %)
Part time remote	45 (67.2 %)
Work with Research staff	
Yes	31 (40.3 %)
No	46 (59.7 %)
Change in presence of Research staff (n = 31)	
Yes	26 (83.9 %)
No	5 (16.1 %)
How did research staff change (n = 26)	
Staff were furloughed/laid off	5 (19.2 %)
Work entirely remotely	13 (50 %)
Part time remote	15 (57.7 %)

from attending clinic (16.1 %), among other reasons (see Supplemental Table). Respondents reported significant decreases in the involvement of residents in their office or clinic ( $p < 0.001$ ) from pre-pandemic levels as well as significant decreases in in-person didactic teaching sessions and increases in use of virtual didactic sessions (both  $p < 0.001$ ). Exposure to residents in the operating room did not change (Table 3).

### 3.3. Change in practice patterns

Respondents were then asked about practice patterns before and after the start of the COVID-19 pandemic. There were significant increases in the use of telemedicine platforms for new consults, postoperative visits, and routine follow up visits (all  $p < 0.001$ , Fig. 1). The percentage of respondents using telemedicine “sometimes”, “often”, or “always” for new consults increased from 6.8 % pre-pandemic to 73.3 % post. Similar increases were seen for postoperative visits (15.1 % pre to 77.5 % post) and routine follow-ups (15.3 % pre to 81.8 % post).

Use of in-office procedures also significantly changed from pre-pandemic levels. There were significant decreases in the reported use of in-office ultrasound, fine needle aspiration, and laryngoscopy (all  $p < 0.001$ , Table 4). Those who reported doing these procedures “sometimes”, “often”, or “always” decreased from 71.2 % pre to 63.4 % post for ultrasound, 52.1 % pre to 46.5 % post for FNA, and 34.2 % pre to 21.5 % post for laryngoscopy. There were no significant changes in the reported use of observation for patients with papillary thyroid microcarcinoma.

Finally, respondents were asked about frequency of same-day discharge for common endocrine surgical procedures. There were no changes in use of same-day discharge for thyroid lobectomy, parathyroidectomy, or adrenalectomy, but there was an increase in use of same-day total thyroidectomy from pre-pandemic levels ( $p = 0.047$ ). Duration of observation in recovery room prior to discharge did not significantly change for patients undergoing total thyroidectomy (4.2 h pre vs. 4.1 h post,  $p = ns$ ), parathyroidectomy (3.3 h pre vs. 3.3 h post,  $p = ns$ ), and adrenalectomy (3.9 h pre vs. 4.2 h post,  $p = ns$ ). There was a slight decrease in the mean length of observation for patients undergoing thyroid lobectomy from a mean of 3.75 h pre-COVID to 3.61 h post ( $p = 0.044$ ) as respondents observing thyroid lobectomy patients for 4 h or fewer increased from 75 % pre pandemic to 81 % post.

## 4. Discussion

The COVID-19 pandemic put an unprecedented strain on the healthcare system throughout the world. This study aimed to determine the professional, educational, and practice impacts of the COVID-19 pandemic on endocrine surgery. Endocrine surgeons affiliated with the AAES reported decreased clinical volume and compensation, transition of office visits, institutional conferences, and resident education to virtual platforms, and decreases in the use of in-office procedures in response to the pandemic. There was also increased use of same-day surgery for patients undergoing total thyroidectomy, and a decrease in observation duration for patients undergoing thyroid lobectomy.

The reason for decreased clinical volume was multifactorial. The majority of endocrine surgeons believed it was due to patient

preference to delay care and to decreased volume of referrals. For those surgeons receiving volume-based compensation, decreased volume led to a decrease in compensation, reported by 70 % of responding endocrine surgeons. Similar findings were found in a survey of practicing neurosurgeons, who reported a greater than 50 % decrease in clinical volume, particularly in the Northeast, along with reductions in salary and benefits but no corresponding decrease in practice expenses<sup>(9)</sup>. Further decreased in-person volume was due to conversion of visits to a telemedicine platform. The French Association of Endocrine Surgery published guidelines recommending use of telemedicine to ensure continuity of care during the pandemic<sup>(10)</sup>. The majority of endocrine surgeons in this study had never used telemedicine platforms for new patient, postoperative, or follow-up visits until the pandemic started, and a majority reported using them post-pandemic for all visit types. Telemedicine visits for postoperative endocrine surgery patients were evaluated by Schumm et al., who found similar patient experience and satisfaction scores for telemedicine as in-person postoperative visits<sup>(7)</sup>. Teleconference platforms were also used at high frequency for resident education and institutional conferences, with most respondents reporting remote institutional conferences to be of similar quality as in-person meetings. Future research will need to assess the impact of these changes on resident education and whether these platforms will continue to be used at a high volume once social distancing guidelines are relaxed.

Many endocrine surgeons also perform in-office procedures such as ultrasound, FNA, or direct laryngoscopy. These procedures require close contact with patients and, during the pandemic, could have put the surgeon at higher risk for contracting the novel coronavirus-19 because of the surgeon's proximity to, or actual manipulation of, the patient's airway. Accordingly, surgeons reported decreased use of these in-office procedures post-pandemic. It is unclear whether this is due to a desire to maintain social distancing or increased use of telemedicine, or whether their use will rebound as pandemic conditions improve.

Endocrine surgical procedures can usually be performed on an outpatient basis with a less than 24 h stay; many surgeons routinely perform same-day thyroidectomy and parathyroidectomy, with discharge after a period of observation in recovery. Same day surgery uses fewer inpatient beds and personnel and therefore may be ideal for continuation in an environment where preservation of these resources is essential. Similarly, minimizing the time that patients are in a hospital setting would also decrease their potential for exposure to the coronavirus. It is also possible that hospitals may not have permitted “elective” procedures requiring an overnight stay or lengthy observation period to proceed. The majority of surgeons were already performing same-day thyroid lobectomy and parathyroidectomy either “sometimes” “often” or “always” prior to the pandemic. A minority of surgeons performed same day total thyroidectomy, but the number of surgeons who reported

**Table 3**  
Exposure to trainees in various settings pre- and post-COVID.

	Never	Rarely	Sometimes	Often	Always	P value
Office/clinic						
Pre-COVID	2 (3.2 %)	7 (11.1 %)	16 (25.4 %)	11 (17.5 %)	27 (42.9 %)	
Post-COVID	7 (11.9 %)	13 (22.0 %)	10 (16.9 %)	9 (15.3 %)	20 (33.9 %)	<0.001
OR						
Pre-COVID	0 (0 %)	0 (0 %)	0 (0 %)	16 (25.4 %)	47 (74.6 %)	
Post-COVID	0 (0 %)	0 (0 %)	3 (5.2 %)	13 (22.4 %)	42 (72.4 %)	0.103
In person Didactic						
Pre-COVID	2 (3.2 %)	4 (6.3 %)	8 (12.7 %)	22 (34.9 %)	27 (42.9 %)	
Post-COVID	17 (28.8 %)	18 (30.5 %)	9 (15.3 %)	7 (11.9 %)	8 (13.6 %)	<0.001
Virtual Didactic						
Pre-COVID	40 (63.5 %)	13 (20.6 %)	3 (4.8 %)	4 (6.3 %)	3 (4.8 %)	
Post-COVID	7 (12.1 %)	4 (6.9 %)	9 (15.5 %)	23 (39.7 %)	15 (25.9 %)	<0.001

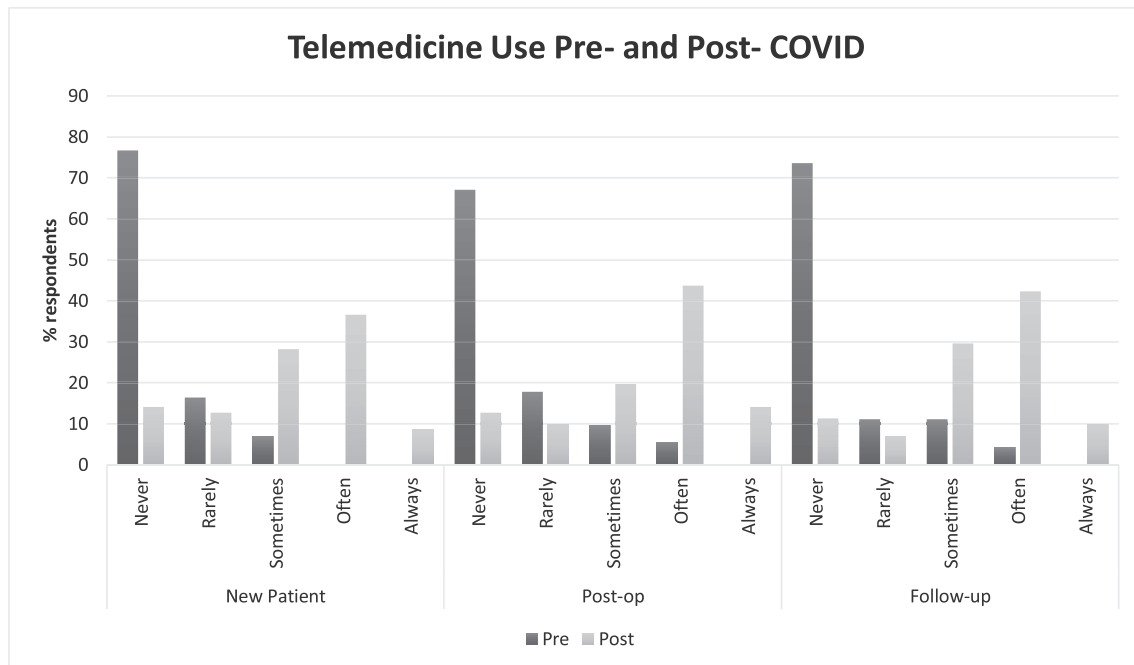


Fig. 1. Telemedicine use pre- and post- COVID among survey respondents.

Table 4

Practice Patterns pre- and post- COVID.

	Never	Rarely	Sometimes	Often	Always	P value
Ultrasound						
Pre-COVID	9 (12.3 %)	12 (16.4 %)	5 (6.8 %)	18 (24.7 %)	29 (39.7 %)	
Post-COVID	16 (22.5 %)	10 (14.1 %)	10 (14.1 %)	16 (22.5 %)	19 (26.8 %)	<0.001
FNA						
Pre-COVID	24 (32.9 %)	11 (15.1 %)	9 (12.3 %)	11 (15.1 %)	18 (24.7 %)	
Post-COVID	33 (46.5 %)	5 (7.0 %)	13 (18.3 %)	6 (8.5 %)	14 (19.7 %)	<0.001
Laryngoscopy						
Pre-COVID	38 (52.1 %)	10 (13.7 %)	14 (19.2 %)	6 (8.2 %)	5 (6.8 %)	
Post-COVID	44 (62.9 %)	11 (15.7 %)	9 (12.9 %)	4 (5.7 %)	2 (2.9 %)	<0.001
Obs PTMC						
Pre-COVID	20 (27.4 %)	23 (31.5 %)	17 (23.3 %)	10 (13.7 %)	3 (4.1 %)	
Post-COVID	16 (23.2 %)	23 (33.3 %)	15 (21.7 %)	14 (20.3 %)	1 (1.4 %)	0.199
Same day TL						
Pre-COVID	13 (17.8 %)	7 (9.6 %)	8 (11.0 %)	18 (24.7 %)	27 (37.0 %)	
Post-COVID	14 (19.7 %)	5 (7.0 %)	6 (8.5 %)	19 (26.8 %)	27 (38.0 %)	0.708
Same day TT						
Pre-COVID	32 (44.4 %)	9 (12.5 %)	5 (6.9 %)	11 (15.3 %)	15 (20.8 %)	
Post-COVID	28 (39.4 %)	9 (12.7 %)	7 (9.9 %)	11 (15.5 %)	16 (22.5 %)	0.047
Same day PT						
Pre-COVID	13 (17.8 %)	5 (6.8 %)	8 (11.0 %)	22 (30.1 %)	25 (34.2 %)	
Post-COVID	13 (18.3 %)	3 (4.2 %)	7 (9.9 %)	22 (31.0 %)	26 (36.6 %)	0.483
Same day AD						
Pre-COVID	53 (73.6 %)	11 (15.3 %)	2 (2.8 %)	4 (5.6 %)	2 (2.8 %)	
Post-COVID	52 (74.3 %)	11 (15.7 %)	1 (1.4 %)	3 (4.3 %)	3 (4.3 %)	0.536

Obs – observation.

PTMC – papillary thyroid microcarcinoma.

TL – thyroid lobectomy.

TT – total thyroidectomy.

PT – parathyroidectomy.

AD - adrenalectomy.

doing so increased post-COVID. Additionally, surgeons reported a slight but significant decrease in the duration of observation for thyroid lobectomy in recovery prior to discharge, with an increased proportion of surgeons observing patients for 4 h or fewer after the start of the pandemic. Other specialties reported a similar shift to same day procedures influenced by the pandemic. Specht et al. developed a pathway to perform mastectomy with immediate

breast reconstruction as a same day procedure, with no resulting readmissions or emergency room visits in eligible patients<sup>(11)</sup>. Similarly, Perdoncin et al. reported safe use of same day discharge after transcatheter aortic valve replacement<sup>(12)</sup> and Abaza et al. reported a 98 % same day discharge rate for robotic urologic procedures in response to the pandemic, up from 52 % pre-pandemic<sup>(13)</sup>. One of the unforeseen benefits of the pandemic may

be an acceleration of the need to challenge established patterns of post-operative observation and inpatient admission in selected specialties. This has the potential to safely<sup>(14,15)</sup> minimize resource use for the health care system<sup>(16)</sup> and ideally sustain these practices when resources are no longer critically limited.

This study was limited primarily by its low response rate. It is possible that respondents were biased towards those that were less burdened personally or professionally by the pandemic. Even so, this would likely skew the data towards those who had to make fewer changes to their practices; despite this potential bias, many practice changes were reported. Demographic data of the membership of the AAES is not publicly available, so it is unclear whether the respondents were a representative sample of the entire membership. Additionally, this study was not designed to collect data on patient safety or oncologic outcomes, so it is unknown whether there were any differences in outcomes resulting from delays or triage of surgical procedures or changes in use of in-office procedures, same day surgery, or decreased recovery observation. There may also be reporting or recall bias inherent to the survey design. Finally, the surveyed population was from a subspecialty society with a majority endocrine surgery practice; changes reported may not be applicable to all those performing endocrine surgical procedures.

## 5. Conclusions

In conclusion, this survey of active and corresponding members of the AAES aimed to determine the impact of the COVID-19 pandemic on the professional, educational, and clinical aspects of endocrine surgery. Surgeons uniformly reported suspension of elective procedures, decreased clinical volume, and reduced compensation. There was decreased exposure to trainees in clinic and in-person didactic settings and increased use of virtual platforms for educational sessions. In response to the challenges of the pandemic, endocrine surgeons increased use of virtual and telemedicine platforms, performed more ambulatory total thyroidectomies, and an increased proportion of surgeons observed thyroid lobectomy patients for 4 h or fewer prior to discharge. There was also a reduction in the use of in-office procedures. Future studies will determine the impact these changes to the practice of endocrine surgery had on patient safety and outcomes and whether they will be sustained as the pandemic wanes.

## Funding

This study was funded by direct research support from the Rutgers Cancer Institute of New Jersey.

## Declaration of competing interest

The authors have no relevant conflicts of interest to disclose.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amjsurg.2021.07.009>.

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