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Original Article

The state of telehealth: 2 years into the COVID-19 pandemic - back to business as usual?

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Abstract: Introduction: Telemedicine (TM) was underutilized prior to the COVID-19 pandemic presumably due to non-standardized reimbursement routes and a perceived lack of need. Early experience with the pandemic necessitated this form of medical care, although durability of consistent delivery remains in question. We quantify the utilization patterns of TM over the past 2 years over multiple waves of the pandemic across various service lines in a large rural health system. Materials: Data of TM utilization were prospectively collected between March 2020-January 2022. Rates of adoption among the various surgical and non-surgical services disciplines were compared. Subgroup analyses between different surgical subspecialties and within the urologic subspecialties was performed. Results: 3.5 million visits were recorded; 3.14 million (90%) on-site and 349,989 (10%) TM; 254,919 (73%) video-assisted and 95,070 (27%) were telephonic. Throughout the pandemic, non-surgical services utilized TM to a greater extent than surgical services (mean% 12 vs 6). Significant variation in the utilization among surgical services was reported, with Urology representing a high utilizer (15%); Among Urologic subspecialties utilization, Endourology (28%) was highest and Pediatric Urology (5%) was lowest. Following an initial spike in TM utilization during the pandemic, rates have declined and plateaued at 5-7% of all visits over the past 6-months. Conclusion: TM utilization in this large health system has remained under 10% following the initial surge in 2020. Non-surgical services preferentially use TM more than surgical domains. Certain subspecialties utilize TM more than others, possible due to patient population, practice patterns and medical conditions. Barriers to adoption are essential to determine the relatively low volume of use across this health system.

Keywords: Telemedicine, trends, healthcare, delivery, COVID-19

Introduction

Telemedicine (TM) prioritizes the well-being of patients and clinical workforce in the setting of potential contact transmission during the pandemic and could improve patient satisfaction and reduce costs and travel time for patients [1]. Currently, numerous health systems have leveraged telehealth technology to allow clinicians to see patients who are at home. It has played an increasingly important role in surgical care during the coronavirus disease 2019 (COVID-19) pandemic, yet little is known about its usage and correlation to cost both within and across surgical specialties during the pandemic.

In relation to major advancements in communication technology, Telemedicine (TM) had been underutilized prior to the COVID-19 pandemic [2-4]. Historically, TM focused on rural medicine [5, 6]. In 2020, a study performed in New York City demonstrated that TM can be used in urbanized setting with high patient satisfaction [7]. By 2017, over 76% of hospitals in the United States had implemented a full or partial system of Modern Telemedicine (TM) [8]. It is expected that this number will continue to grow in the upcoming years.

Despite the increased capability for providers to use TM, this technology has still widely been underutilized. Prior to the pandemic, several U.S. medical specialties including radiology, psychiatry, and pathology had embraced TM use in their clinics [9]. Nonetheless, only 30% to 40% of physicians interviewed in these specialties reported using telemedicine for physician

patient interactions. Additionally, these authors reported that surgery ranked among the lower utilizers rate of TM at 11.4%. Multiple contributing factors have been considered to explain the low rate of utilization, including reimbursement and regulation. Medicare and private insurance, which accounts for the majority of money spent on healthcare in the U.S., had several restrictions on what TM services it will reimburse [10].

When the U.S. federal government declared the COVID-19 pandemic a public health emergency, multiple waivers were issued for the replacement of in-person visits for TM visits for Medicare patients [11]. In addition, the Medicare program announced it would reimburse physicians for TM visits at the same rate as in-person visits. This policy change created an initial rise in TM utilization in all specialties and has allowed many providers to adapt to the TM technology.

In this article, we aim to depict the rates of adoption and usage of TM among various services lined over a 23-month period beginning March 2020. By performing this comparison, we hope to gain knowledge on the long-term impact of COVID-19 on healthcare delivery through the utilization of TM. Additionally, we further review utilization differences among medical and surgical subspecialties, Urologic subspecialties, and type of providers (physicians vs. advance practice providers).

Materials and methods

Source data

We prospectively collected data from the Penn State Health System over the course of 23 months, from March 2020 to January 2022. We included all scheduled outpatient encounters occurring within our health care system as recorded via an integrated electronic medical record system. Outpatient visits included new and follow-up (existing) patient visits as well as those presenting as outpatient urgent care visits. The primary endpoint of analysis was percentage of TM visit utilization over time.

Penn State Health System serves the greater Harrisburg area as well as most of southern-central Pennsylvania. Overall, there were approximately 3.5 million visits recorded in our dataset for the 23-month period. Visits were categorized into subgroups by department, specialty, practice site, and provider. Data for visit types were isolated and separated into categories of telephone visits, telehealth visits (which included video-conferencing), and in-person visits. TM visits were an aggregate of telephone visits and telehealth visits.

Data aggregation

We separated patient visits by using the following categorization method. First, we recorded total numbers of visits within the Penn State healthcare system. Next, we divided groups into surgical and non-surgical domains. For the surgical domain group, we included all visits under the following department and divisions; Urology, Otolaryngology, Neurosurgery, Plastic surgery, Colorectal surgery, Ophthalmology, and Minimally invasive surgery. The non-surgical domains were all other departments and divisions in the Penn State Health system. Fellowship trained faculty were included in Urology subspecialty analysis and were compared based on their subspecialty.

Finally, categorization of faculty and APP in the urology department was made based on a practitioner level. Those with a MD or DO degree were categorized into faculty and those with other degrees were categorized as APP. Percentages of TM visits were made by dividing the number of TM visits in a category by the total number of visits for a specific month. Figures were created using Excel bar graphs.

Statistical analysis

After data aggregation, we analyzed the percentage differences between categories. Rates of adoption, usage among the various surgical and non-surgical services, and subgroup analysis among the surgical services were extracted and compared by the Wilcoxon rank sum, Kruskal-Wallis tests, Chi-square and student t-test where applicable. Contingency tables of summary counts for on-site vs. telemedicine visits in groups defined by surgical subspecialty, urologic subspecialty, or provider were analyzed using chi-square tests. R 4.1.1 (R Core Team) [12] was used to perform all analyses.

Results

A total of 3.5 million visits were recorded including 3.14 million (90%) on-site and 349,989

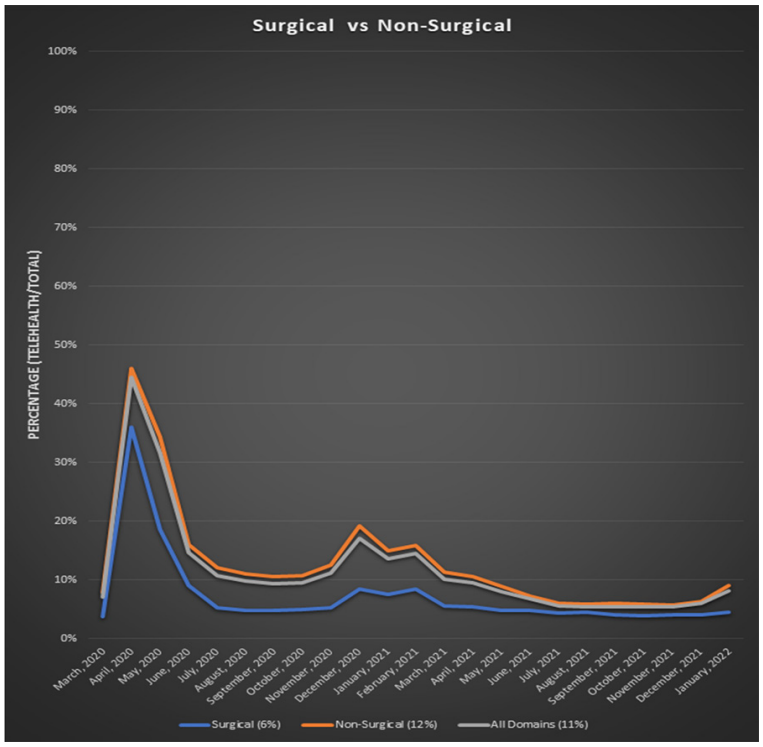

Figure 1. Percentage of monthly TM visits among all domains (March 2020-January 2022, variation P<0.001).

(10%) TM. The breakdown of TM visits showed that 254,919 (73%) were video-assisted and 95,070 (27%) were telephonic.

Figure 1 illustrates the use of TM over the first 23-months of the pandemic. In summary, from (March 2020 to May 2020), there was a significant increase in TM use across all surgical and non-surgical domains from a baseline of 7% to a peak of 45%. This initial peak was followed by a fairly sharp decline over the summer of 2020 with a steady state TM rate of approximately 10% (July 2020-December 2020). A winter surge in early 2021 contributed to a slight increase in TM use (14%) across all domains. Subsequent rates then declined over the last 6 months of the study duration ranging from 5-7% between surgical and non-surgical domains. In aggregate, non-surgical services had a statistically significant higher utilization of TM compared to surgical services (mean TM over 23 months-12% vs. 6%, P<0.001). However, both broad service groups followed a similar trend throughout the pandemic.

Table 1 and **Figure 2** summarize the TM utilization rate stratified by surgical specialty. Notably, variations of initial adoption, mean TM use over 23-months, and TM rates over the last 6 months of the study interval were observed between different surgical domains (P< 0.001). In particular, Urology represented one of the higher surgical specialties using TM (15%) while Orthopedic, Colorectal, and Plastic Surgery had an under 5% use over the study interval. Similar to other domains, Urology TM utilization peaked 2 months into the pandemic ranging between 46%-60% in (April-May 2020), followed by a sharp decline ranging between 12-13% between (July 2020-December 2020). A small winter spike peaking at 19% in February 2021 was observed and thereafter a low steady state is appreciated from (March 2021 to January 2022) ranging between 12%-14%.

Our Urology department had a total 55,382 visits; 32,437 visits (59%) were conducted by a faculty member and 14,740 (41%) by APC. **Figure 3** shows trends of utilization; APCs had a higher TM utilization (3,367/14,740, 19%) compared to faculty members (4,838/32,437, 13%). Subgroup analysis of Urologic subspecialties showed statistically significant difference. Endourology (28%) and Female Urology (26%) were highest utilizer vs. Oncology (18%) and Pediatric Urology (5%) which were the lowest utilizer (P<0.001, **Figure 4**). **Table 2** demonstrates Urologic visits stratified by specialties.

Discussion

The COVID-19 Pandemic has affected the vast majority of clinical practices worldwide, including Urology [13, 14]. Telemedicine (TM) provides a safe alternative and prioritizes the well-being of patients and clinical workforce in the setting of potential contact transmission during the pandemic [15]. With the spread of the virus, Congress passed “the Coronavirus Preparedness and Response Supplemental Appropriation” Act to lower regulatory barriers on TM, thereby allowing physicians to continue actively caring for their patients in the midst of this cri-

Table 1. Surgical subspecialties outpatient visits March 2020-January 2022

Surgical Subspecialty	Number of visits TM (%)	Number of visits on-site (%)	Total	*P* value
Minimally Invasive Surgery	3025 (28)	7967 (72)	10992	<0.001
Urology	8206 (15)	47277 (85)	55483	
Otolaryngology	9301 (13)	64471 (87)	73772	
Neurosurgery	4222 (13)	28431 (87)	32653	
Colorectal	393 (5)	8125 (95)	8545	
Plastic Surgery	1044 (4)	25057 (96)	26101	
Orthopedic	4078 (3)	152624 (97)	156702	

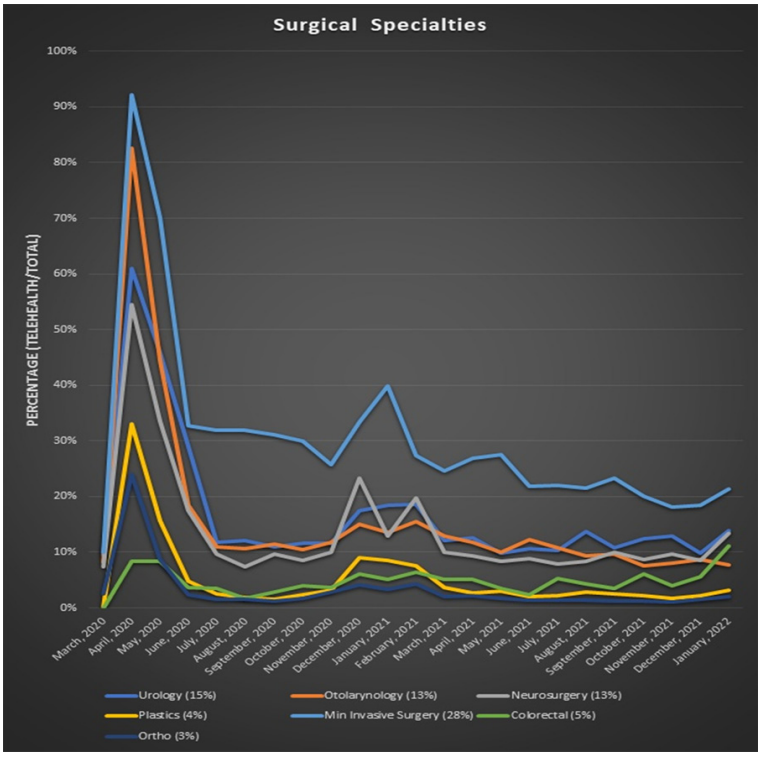

Figure 2. Percentage of monthly TM visits among surgical subspecialties (March 2020-January 2022, variation P<0.001).

sis virtually [16]. This lowered the reimbursement barrier that many providers faced in regards to adopting TM.

With the demand for TM increasing and reimbursement barriers lowered, our institution had a significant initial spike in TM utilization across domains during the first wave of the pandemic, with the utilization peak at around 45% of all visits. However, these rates were not sustained over time, with a significant decrease and plateau noted. TM visits averaged 5-7% of all visits over the past 6 months. Some of these barriers to continued usage of TM include the learning curve of the TM software that both patients and providers had to overcome when first introduced to the technology. Additionally, there are extra burdens on the office staff in preparing patients for TM visits and troubleshooting problems and technical difficulties before and during the TM visit. These obstacles may have swayed physicians to return to in person visits rather than continue to implement TM visits for their patients. Additionally, the Urology patient cohort is generally of older patient age and such a group may be less facile with virtual interfaces or may prefer in person contact with their health care providers. A better understanding of the barriers to adoption are essential to determine lack of sustained utilization across this health system. Importantly, we noted that most recent surge of COVID-19 cases with the Omicron variant, a spike in TM utilization was not appreciated, suggesting that perhaps this low steady state, maybe fairly permanent irrespective of future variant.

While all domains showed similar patterns in TM utilization as evidenced by similarities in the graph trends, medical specialties statistically utilized TM more often. An explanation for this may be related to the need for a physical exam on pre- and post-operative visits for the surgical fields. Visits for routine check-ups or to review recent objective data including imaging and lab work may be more appropriate to utilize TM.

We further aimed to quantify the differences of TM within subspecialty providers of Urology.

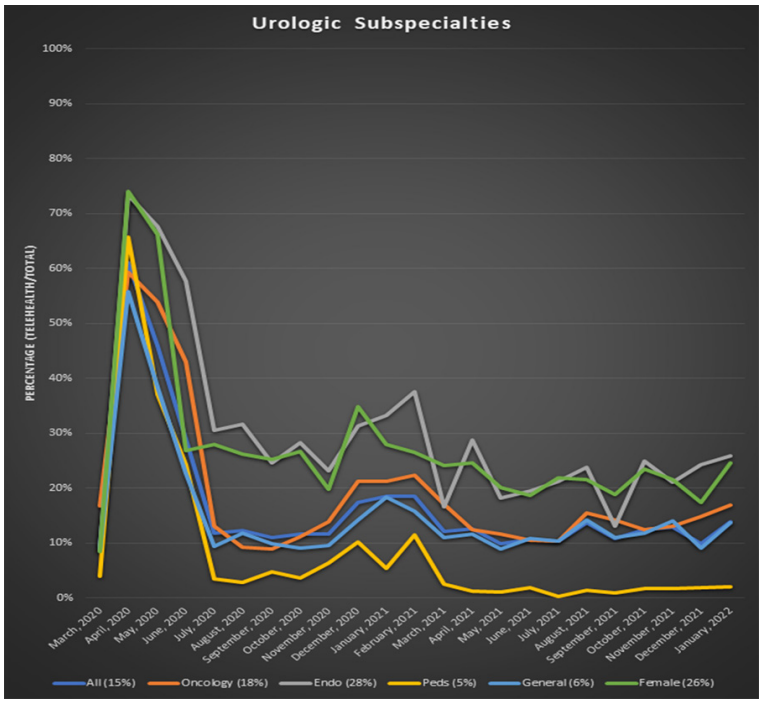

Figure 3. Percentage of monthly TM visits among Urologic subspecialties (March 2020-January 2022, variation P<0.001).

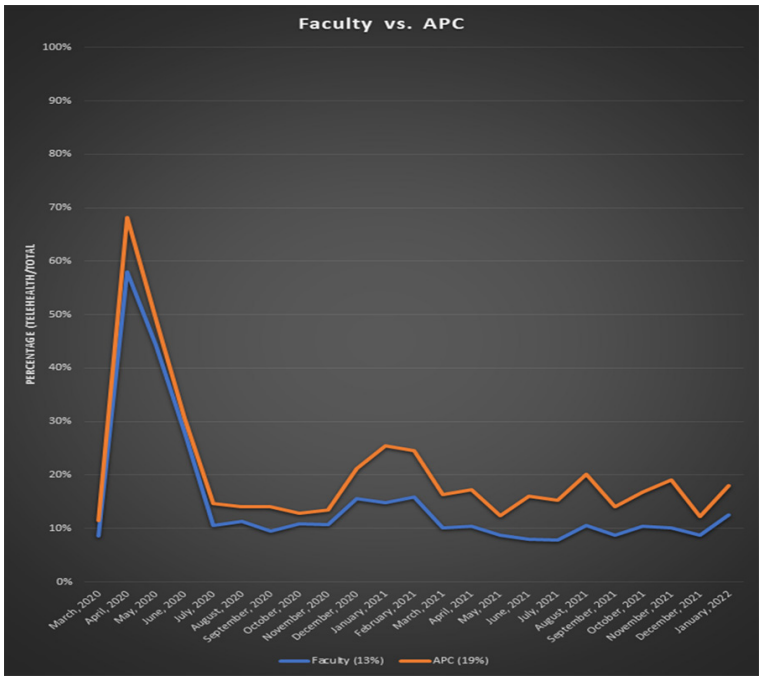

Figure 4. Percentage of monthly TM visits among Urology providers (March 2020-January 2022, variation P<0.001).

Among Urologic subspecialties, TM utilization varied significantly. Endourology had the highest usage rate (28%). This is possibly due to the ability to use imaging (cross-sectional or plain radiography) to evaluate burden of stone disease without the need for an in-person visit. Oncology had lower usage rate (18%); this may be in part due to nature of malignant diagnoses where patients and respective providers may be more comfortable discussing their cancer diagnosis and care in-person rather than virtually.

Pediatric Urology showed the lowest usage rate of only 5%. We suspect this is related to the role of physical examination which perhaps more essential in the pediatric urology population. It is evident that within specialties, there can be a range in TM utilization due to the distinct needs of each subspecialty.

TM utilization should consider patients' preferences and eligibility. In a study published early in the pandemic, 85% of patients preferred TM over in-person. The majority of those refusing TM was attributable to technical limitations of the platform. Additionally, no differences were observed between benign and malignant conditions. When evaluating physicians' assessment of patient suitability for TM, interestingly, only 63% were deemed eligible for TM and tended to be younger [17].

Despite the barriers to adopting TM and the varied utilization of TM across specialties and subspecialties, there are many advantages for physicians in medicine and surgery to adopt this platform in the future [18]. TM presents a decreased burden of travel for all patients. TM visits represent an ease of the burden of disease for patients who require frequent follow-

Table 2. Urologic subspecialties outpatient visits March 2020-January 2022

Urologic subspecialty	Number of visits TM (%)	Number of visits on site (%)	Total	*P* value
Endourology	1171 (28)	3003 (72)	4174	<0.001
Female	925 (26)	2701 (74)	3626	
Oncology	1617 (18)	7579 (82)	9169	
General	692 (6)	11671 (94)	12363	
Pediatric	433 (5)	7483 (95)	7916	

ups. Furthermore, TM decreases the risk of potential infection exposure for at-risk patients for COVID-19 and other highly communicable diseases. There are multiple convenience and safety factors that TM offers which would benefit physicians and patients. Furthermore, TM can increase access to healthcare [11, 19] particularly in Urology, where there is a significant projected shortage of Urologists over the next decade [20, 21].

We acknowledge some limitations of the study. This has a retrospective study design [22] from a single institution in central Pennsylvania with a homogenous rural and suburban population. Observations may be related to the specific TM platform used within the health system and the respective ease of use for patients and providers. Finally, the data is aggregate in nature and may not capture the individual practice patterns of specific providers who may have differing perspectives on the use of TM.

Future research for TM utilization should focus on comparing usage among patient populations as opposed to the medical services. By understanding usage among vulnerable or economically disadvantaged patient populations, we could understand use and potentially lower barriers to usage for those who would benefit the most from virtual visits. In addition, a qualitative study should be conducted to discover reasons for individual physicians and hospital systems to adopt or not adopt TM. These studies would enlighten the medical community of the best settings for TM utilization.

Conclusion

For a new method in healthcare delivery to be adopted there needs to be a clinical demand and an efficacious mode of delivery. The COVID 19 pandemic brought forth a demand for virtual medical visits. Although our use of this technology was spurred on by the events of 2020, the sustained use has remained under 10% and exploration is needed to better integrate this into our health care practice.

Disclosure of conflict of interest

None.

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