

Advances in Radiation Oncology

Implementation of Telehealth in Radiation Oncology: Rapid Integration During COVID-19 and its Future Role in our Practice

--Manuscript Draft--

Manuscript Number:	ADVANCESRADONC-D-20-00315R1
Article Type:	Scientific Article
Section/Category:	COVID-19
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Abstract:	<p>Introduction The widespread coronavirus disease 2019 (COVID-19) has resulted in significant changes in care delivery among radiation oncology practices and demanded the rapid incorporation of telehealth. However, the impact of a large-scale transition to telehealth in radiation oncology on patient access to care and the viability of care delivery are largely unknown. In this manuscript, we review our implementation and report data on patient access to care and billing implications. As telehealth is likely to continue after COVID-19, we propose a radiation oncology-specific algorithm for telehealth. Material and Methods In March 2020, our department began to use telehealth for all new consults, post-treatment encounters, and follow-up appointments. Billable encounters from January to April 2020 were reviewed and categorized into one of the following visit types: in-person, telephonic, or two-way audio-video. Logistic regression models tested whether visit type differed by patient age, income, or provider. Results There was a 35% decrease in billable activity from January to April. In-person visits decreased from 100% to 21%. Sixty percent of telehealth appointments in April were performed with two-way audio-video, and 40% by telephonic only. In-person consultation visits were associated with higher billing codes compared to two-way audio-video telehealth visits ($p < 0.01$). No difference was seen for follow-up visits. Univariate and multivariate analysis identified that older patient age was associated with reduced likelihood of two-way audio-video encounters ($p < 0.01$). The physician conducting the telehealth appointment was also associated with the type of visit performed ($p < 0.01$). Patient income was not associated with the type of telehealth visit. Conclusions Since the onset of COVID-19 pandemic, we were able to move the majority of patient visits to telehealth but observed inconsistent utilization of the audio-video telehealth platform. We present guidelines and quality metrics for incorporating telehealth in radiation oncology practice, based on type of encounter and disease subsite.</p>

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Conflict of Interest: None

Financial Support: None

The widespread coronavirus disease 2019 (COVID-19) has impacted the delivery of care within radiation oncology practices and demanded the rapid incorporation of telehealth. Our center, located in the epicenter of the pandemic in March of 2020, rapidly integrated two way-audio-video technology into our clinic. In this paper, we review lessons learned from our implementation data and present guidelines and quality metrics for incorporating telehealth in radiation oncology practices moving forward.

Implementation of Telehealth in Radiation Oncology: Rapid Integration During COVID-19 and its Future Role in our Practice

Abstract

Introduction

The widespread coronavirus disease 2019 (COVID-19) has resulted in significant changes in care delivery among radiation oncology practices and demanded the rapid incorporation of telehealth. However, the impact of a large-scale transition to telehealth in radiation oncology on patient access to care and the viability of care delivery are largely unknown. In this manuscript, we review our implementation and report data on patient access to care and billing implications. As telehealth is likely to continue after COVID-19, we propose a radiation oncology-specific algorithm for telehealth.

Material and Methods

In March 2020, our department began to use telehealth for all new consults, post-treatment encounters, and follow-up appointments. Billable encounters from January to April 2020 were reviewed and categorized into one of the following visit types: in-person, telephonic, or two-way audio-video. Logistic regression models tested whether visit type differed by patient age, income, or provider.

Results

There was a 35% decrease in billable activity from January to April. In-person visits decreased from 100% to 21%. Sixty percent of telehealth appointments in April were performed with two-way audio-video, and 40% by telephonic only. In-person consultation visits were associated with higher billing codes compared to two-way audio-video telehealth visits ($p<0.01$). No difference was seen for follow-up visits. Univariate and multivariable analysis identified that older patient age was associated with reduced likelihood of two-way audio-video encounters ($p<0.01$). The physician conducting the telehealth appointment was also associated with the type of visit performed ($p<0.01$). Patient income was not associated with the type of telehealth visit.

Conclusions

Since the onset of COVID-19 pandemic, we were able to move the majority of patient visits to telehealth but observed inconsistent utilization of the audio-video telehealth platform. We present guidelines and quality metrics for incorporating telehealth in radiation oncology practice, based on type of encounter and disease subsite.

Introduction

Since its initial onset at the end of 2019, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has caused a global pandemic that has transformed health care across the continuum. The widespread coronavirus disease 2019 (COVID-19) caused by SARS-CoV-2 has resulted in rapid and significant change in care delivery among radiation oncology practices everywhere. Our health system, located in the New York City metropolitan area, resides within the epicenter of the COVID-19 outbreak. We alone have diagnosed over 40,000 COVID-19 patients, managed 14,000 hospitalized patients, and discharged over 10,000 of those cases [1]. The health system's crisis management program implemented a comprehensive action plan on March 13th, 2020, with multiple policies designed to protect staff and manage the surge in patient volume. As the volume of COVID-19 positive patients started to overwhelm the health system, policies implemented in radiation medicine allowed for safe, high-quality medical care to continue throughout our multiple locations [2, 3]. In May 2020, with new COVID-19 cases decreasing in New York, it is apparent that healthcare has changed permanently. New approaches to care, including telehealth, were adopted during this period and will redefine how health care is provided worldwide.

Telehealth, as defined by Office for the Advancement of Telehealth, comprises the use of telecommunications and information technologies to share information and to provide clinical care, education, public health, and administrative services at a distance [4]. Technological improvements have made synchronous telehealth more feasible, defined as the delivery of a live, interactive video connection that transmits information in both directions during the same period [5]. Prior to COVID-19, widespread adoption was slow due to barriers including limited reimbursement, regulatory restrictions, privacy issues, and lack of patient and provider comfort and preference [6, 7]. However, this abruptly changed with the onset of the COVID-19 pandemic.

The COVID-19 crisis created an acute transition to telehealth in order to maintain safe operations for our patients and healthcare providers alike. The U.S. government relaxed the regulatory requirements for telehealth, and the Center for Medicare and Medicaid Services (CMS) greatly expanded financial coverage, paving the way for private insurers to follow suit [8]. The simultaneous removal of these two significant barriers, coupled with the availability of various telehealth platforms already in the market and the government's decision to waive the requirement to use HIPAA-compliant communication platforms, catalyzed telehealth's widespread adoption into the clinic setting [9]. Although the reimbursement parity enacted by CMS and private payers was initially limited to the duration of the COVID-19 pandemic response, CMS has said widespread use of telehealth is likely to continue in post-pandemic care [10].

For telehealth to continue, it must enhance patient access and outcomes, or clinical efficiency, or both. In pursuing these goals, there is much to learn regarding the effective use of telehealth in radiation oncology. Poor implementation and execution of telehealth pose potential risks to the patient due to the complexity of cancer care and the nuances involved with radiation therapy. Telehealth practice carries the risk of exacerbating disparities of patient access to care for those who do not have access to high-speed internet or video calling [11]. Further, continued widespread use of telehealth depends on identifying feasible business models for its use. We must recognize that the rapid adoption of this technology in radiation oncology during COVID-19 has been done with limited data, and we must be careful of unintended consequences [12]. Currently there are no guidelines for optimal and appropriate use of telehealth in radiation oncology, and no quality metrics have been established.

In our academic multi-site radiation oncology department, we rapidly implemented telehealth as the COVID-19 pandemic unfolded. In this manuscript, we review our implementation process, outline lessons learned about patient access and billing, and use these data to propose a radiation oncology-specific algorithm for moving forward with telehealth.

Methods:

Our department consists of seven outpatient radiation oncology facilities spread throughout the New York metropolitan area with 20 full-time faculty. Prior to March 2020, we exclusively saw patients in-person. Our health system had deployed a telehealth strategy over the preceding three years but only on a trial basis. As COVID-19 crisis management planning took hold in mid-March 2020, our department began preparing for full implementation of telehealth. A HIPAA compliant platform, Amwell Telehealth (American Well Corporation, Boston MA), was selected to deliver telehealth care. This platform was purchased by our health system for use throughout all outpatient sites prior to the pandemic. We promptly purchased the necessary equipment and began credentialing physicians for a two-way audio-video software package. Simultaneously, we trained our secretarial and billing teams to be integrated into the department's telehealth workflow process. Secretarial teams were asked to schedule patients for telehealth visits and assist them in accessing the platform. Mid-level providers and resident trainees were also trained and incorporated in the telehealth workflow. In general, mid-level providers and residents would initiate telehealth encounters and troubleshoot any technical difficulties with patients. Upon completion of their assigned clinical tasks, the encounter would be transferred to the attending physician. By March 28th, 2020, all providers had been credentialed and provided guidance to utilize telehealth in their practices. Our initial roll-out was to use telehealth for all new consults, post-treatment encounters (PTEs), and follow-up appointments. Telehealth was to be conducted with a two-way audio-video platform, with telephone-only appointments reserved for situations where two-way audio-video was not feasible. In-person on-treatment visits (OTVs) continued as per our usual pre-pandemic workflow.

Billable encounters, representing consultation and follow-up appointments, from six of our radiation oncology offices between January 1st, 2020 and May 1st, 2020, were available for review in our HIPAA-compliant administrative database. Each encounter was categorized into one of the following visit types: in-person, telephonic, or two-way audio-video. The patient's zip code and provider name were recorded.

Patient income was estimated by using data from the 2018 census that estimates median income by zip code. Age was calculated at date of encounter (available at four of the six facilities).

SPSS was utilized for statistical calculations. The association between type of telehealth visit and charged level of visit was calculated using independent sample T-test. Logistic regression tested differences in visit type by patient demographics including age, income, and provider. All tests were two-sided and were considered to be statistically significant at $p < 0.05$. Analyses were conducted using SPSS (SPSS, Chicago, IL).

Results:

Between January 1st, 2020 and May 1st, 2020, 2,997 billable E/M encounters were performed (Figure 1). Overall, there was a 35% decrease in billable activity from January to April. In-person visits represented 100% of visits in January and February, 90% of visits in March, and 21% of visits in April. Sixty percent of telehealth appointments in April were performed with two-way audio-video, and 40% by telephonic only. Since the initiation of our telehealth program, there has been a steady increase in telephone-only encounters ($p < 0.01$).

For patients using telehealth, the median age was 71 years (range 22– 93 years). Median income by zip code was \$88,815 (range \$26,239 - \$168,902). We reviewed clinical and demographic variables to assess the likelihood to complete a two-way audio-video versus telephone-only appointment (Figure 2).

Univariate analysis identified that older patient age by year ($p < 0.01$, OR 0.97) was associated with reduced likelihood of two-way audio-video encounters. The physician conducting the appointment was also associated with the type of telehealth appointment selected ($p < 0.01$), and the percentage of two-way audio-video usage varied from 22% to 100%. Patient income was not associated with the type of telehealth visit ($p = 0.48$). On multivariable analysis, when controlling for median income, physician, and

age, the physician conducting visit ($p < 0.01$) and older patient age ($p = 0.01$, OR 0.97) continued to be associated with lower usage of telehealth appointments.

In-person visits can be billed based on both time and complexity while two-way audio-video encounters are billed only based on time. We identified that for consultations, in-person visits were associated with higher billing codes compared to two-way audio-video encounters ($p < 0.01$). No difference was seen for follow-up visits ($p = 0.36$, Figure 3).

Discussion

The COVID-19 pandemic has resulted in the immediate initiation of telehealth for evaluation and management visits in our radiation oncology department. We were able to successfully move the majority of visits to telehealth while permitting the option of in-person appointments for those who could not participate in telehealth. This rapid implementation allowed us to continue providing patients' access to radiation oncology physicians while reducing patient exposures from travel and in-office visits. Our results support the continued use of telehealth after the pandemic, but whether it should be used for only specific patients or types of visits remains to be determined.

Challenges of rapidly implementing two-way audio-video telehealth

We observed inconsistent utilization of the audio-video telehealth platform and increased use of the backup telephonic visits over time. In order to improve the use of telehealth going forward, it is crucial to understand why this was the case. While the various platforms for telehealth have been in place for some time, many of the factors to establish a successful interface remain less than ideal. Successful implementation of telehealth requires 1) appropriate access to the correct technology (smartphone or computer with appropriate high-speed internet access) and 2) understanding and comfort in utilizing the technology. Our suggested workflow during the initial incorporation of telehealth was for our administrative staff to provide instructions to the patient on how to use the telehealth platform at the time

of scheduling. They would also record the phone number and/or email that would be used for the telehealth appointment. If the patient stated that they were unable to access the telehealth platform due to technological limitations, they were scheduled for a telephonic visit, or if preferred, in-person visit. Clinicians were responsible at time of scheduled appointment to send a web link for the appointment based on the information recorded by the administrative staff, and to facilitate any technical difficulties that may occur.

Our experience found that older patients were less likely to navigate two-way audio-video encounters. With the hypothesis that this may be due to less comfort with the technology, we will be asking administrative staff to call all patients the day before their visit to perform a test visit. Alternatively, if additional training and assistance do not help them use this technology, it may be that some older patients may not be suitable to be assessed via telehealth. Regardless of age, it is unclear why we saw reduced use of audiovisual and increased use of telephone visits over time. We would expect that the platform interfaces will continue to improve with easier access for the patients while at the same time, patients will become more familiar with the technology and embrace telehealth for their medical care. However, we do recognize that certain patients simply prefer in-person visits, and may represent the subgroup that has had difficulty navigating a two-way audio-video encounter. As we move forward from the pandemic, we will be expanding in-person appointments, giving patients the opportunity to select the type of visit most appropriate for them.

In addition to patient-specific factors, we found that physician preference (adopters versus non-adopters) independently predicted the method of telehealth encounter. We plan to re-visit the physician training process, which may help modify provider behavior and improve utilization of two-way audio-video telehealth. Given the issues associated with audio-video platform, we were pleased that on April 30th, 2020, CMS extended their payment of telehealth to include telephonic visits. Nevertheless, we continue to recommend two-way audio-video encounters as the standard of telehealth care to the extent possible, as

we believe the video aspect of the visit is a very valuable component of being able to offer appropriate clinical advice and establish a patient-physician relationship.

We found that the average level of visit charged for telehealth consultations using the two-way audio-video telehealth encounter was lower than that charged for in-person visits. Our data show that >90% of new consultations done in-person are typically charged as a level 4 or 5 visit compared to only approximately 60% of new consultations seen using two way audio-video telehealth. Among other reasons, the lower level of visit charges are likely reflective of telehealth visits being shorter in duration than in-person visits and the lack of a comprehensive physical exam being performed. While we expect that with experience and training, providers will be able to learn more effective ways to perform better physical exams via telehealth, some level of discrepancy between charge levels will likely persist between these types of visits. Based on E&M Medicare fee schedule, our data suggest that this difference translates to an approximately 11% decrease in revenue per new visit. The average difference will be greater with increased use of telephonic only visits. This may be important for some practices to consider. In our experience, many of the patients seen for initial consultation with telehealth required an in-person visit for further education and physical exam prior to simulation and were charged for a 15-minute in-person follow-up visit, reducing the deficit seen from the consultation charges.

For telehealth to continue as a successful model of care delivery, it must improve patient access to care, patient outcomes, and care efficiency, and ideally it could improve all of these metrics. Given current billing limitations for telehealth, our data show that reliance on telehealth for all care may not be financially sustainable for clinics to implement. It is also not likely appropriate for every clinical encounter. While telehealth was rapidly adopted into our radiation oncology department, the limited literature and overall experience within our discipline mandate that we carefully examine implementation and outcomes [13]. We convened a department task force to define the optimal use of telehealth and

created guidelines for incorporating telehealth for future evaluation and management visits (Table 1). We created separate recommendations based on type of encounter (new consultation, on-treatment visit, post-treatment encounter, follow-up visit). Workflow for new consultation appointments are described in Figure 4. Follow-up recommendations were based on the disease subsite and perceived suitability for telehealth (Table 2). We recognize that the transition to telehealth must be done in tandem with the collection of data on quality measures. The National Quality Forum suggested four domains may be used as a framework for measuring the effectiveness of telehealth: access to care, financial impact/cost, experience, and effectiveness. As such, we propose quality measures applicable to Radiation Oncology utilizing this framework to measure implementation and outcomes (Table 3).

Framework for incorporating telehealth into consultation visits

We see significant opportunities in incorporating telehealth for consultation visits (Figure 3). Telehealth approaches can include telehealth consults through audio-video platforms or telephonic consults supplemented by in office follow up where needed (e.g., for older patients who cannot access or use audio-video platforms). Radiation Oncology is uniquely amenable to telehealth because most of the diagnostic workup is often completed prior to the consultation, and simulation requires patients to travel on site, thereby giving the clinician a built-in opportunity to meet the patient in-person prior to the initiation of treatment.

A potential benefit to incorporating telehealth into the consult workflow includes the ease of scheduling, particularly for vulnerable and elderly populations that are dependent on caregivers [14]. An Australian study showed that 52% of patients reported concern regarding treatment delays in at least one treatment phase of their oncology care, including 31% who expressed concern regarding the time interval between deciding to have radiotherapy to commencement of radiotherapy[15]. Shorter time from diagnosis to treatment improves patient outcomes [16], reduces patient anxiety[15], and improves patients' satisfaction and their perception of the quality of care [17]. Telehealth removes many of the logistical barriers

required to schedule appointments, and we anticipate that it will shorten the interval from referral to consult and expedite scheduling for treatments. The benefit of faster appointment times has been seen in other disciplines; a notable example is the Veterans Affairs liver transplant experience, in which the use of telehealth resulted in a substantial reduction in time from referral to initial evaluation and placement on the liver transplant waitlist. [18]. We feel that similar benefits will be seen in oncology patients in all geographic areas.

We recognize that telehealth can be disruptive and that, in some disease sites, the inability to perform an in-person physical exam may make it difficult for the provider to offer a comprehensive recommendation. For these disease sites, we think it is reasonable to consider the consultation appointment as an opportunity to triage the patient while maintaining the benefit of early access, convenience, and early care coordination. An in-person visit can be scheduled immediately prior to simulation to allow for a more detailed exam. This system can also facilitate telehealth-based care for patients with certain difficulties (e.g., significant cognitive or communication impairment) that necessitate in-person evaluation. We do believe with training and innovation, certain aspects of the physical exam can become more accessible to telehealth, especially with devices that link through the virtual visit. As an example, multiple online resources exist to guide providers in how to conduct a neurological exam using two-way audio-video conferencing [19, 20].

Framework for incorporating telehealth into on-treatment and follow-up care

Post-treatment, we recommend including telehealth as part of routine follow up care as early as safely possible. Telehealth permits discussion of lab and imaging results, as well as side effect management. Any concerning findings during a telehealth visit should always prompt an in-person visit. Certain cancer sub-sites are more dependent on in-person physical exams for assessment of treatment response and surveillance; these considerations are built into our cancer site-specific recommendations. For all disease

sites, telehealth should always be used to prevent duplicated clinic visits and exams by different providers in the multi-disciplinary team.

We continue to recommend in-person weekly OTVs. As patients must travel to the radiation oncology facility for treatment, telehealth for OTVs would not reduce the logistical burden placed on a patient. Further, we believe that weekly in-person assessments of patients including performing a physical exam and taking vital signs are necessary to provide optimal care during treatment. These visits allow us to assess tolerability of the prescribed treatment and to identify symptoms that if not managed appropriately, may result in an emergency department (ED) visit or hospital admission. Preventing avoidable hospital and ED usage has been of utmost importance to us during the acute phase of the pandemic when our hospital system had limited capacity to manage non-COVID patients [3]. We do recognize that in extreme situations where physician shortages may arise, a reverse telehealth model could be considered. In this scenario, the patient can be seen and examined by a midlevel provider in the clinic before being connected to the physician remotely via a telehealth platform.

Benefits and challenges of telehealth as part of routine care

Since the implementation of our telehealth program, we have observed unanticipated benefits. For example, we have seen more multi-disciplinary consultation and follow-up appointments. Prior to COVID-19, our institution was actively establishing multi-disciplinary clinics, although the logistics of such visits have historically been complicated. Since implementation of telehealth, providers feel that telehealth has made it easier to coordinate multi-disciplinary visits with other providers as these visits do not require the providers to be physically present at the same location at a given time. An additional benefit providers have reported is the unique perspective they gain by seeing a patient in their home environment, often surrounded by family members who otherwise would have been unable to accompany the patient to the consult. Telehealth has provided an opportunity for providers to better understand the challenges the patient may encounter in their home environment.

We have also identified potential challenges, most notably ensuring that patients have access to the same ancillary services and educational materials that they otherwise have with an in-person consultation. It will be important for departments to identify opportunities to bridge this gap. We are working on integrating our social workers, nutritionists, and patient navigators to our telehealth platform so they can participate in the consult. In addition, we are working on digitizing our educational material, which we plan to share with patients on-screen during the consult and make available for access digitally after the clinical encounter.

Another challenge of telehealth is ensuring that patient-clinician communication is not negatively impacted. Essential components of effective communication include non-verbal cues, providing adequate time for patient questions, and the ability to build rapport and demonstrate empathy. Studies have emphasized the importance of maintaining effective communication and actively engaging patients during video conferencing [21-23]. However, the majority of clinicians are not trained in effectively conducting a telehealth visit, and some may have more difficulty with the transition. Institutions that plan to adopt telehealth should make training programs and resources available for clinicians to sharpen their communication skills over telehealth.

Conclusion

Telehealth has been an imminent disruptive innovation in healthcare for many years, and few could have anticipated the velocity at which it has been implemented during the COVID-19 pandemic. Our experience has shown that telehealth has many potential benefits if used thoughtfully and systematically. Our department intends on broadly utilizing telehealth, and we have created guidelines for our physicians to use when scheduling visits. At the same time, we understand the limitations and challenges of telehealth and have outlined when telehealth should not be used. The impact of this new approach must be studied, and we propose quality metrics to measure the outcomes of these interventions carefully. The

large-scale adoption of telehealth nationally will generate much-needed experience, which will help guide us moving forward. We must carefully examine the data gathered and lessons learned during this unprecedented time. We believe that the appropriate use of telehealth can improve access and outcomes, and complement the existing clinic-centered model of care. As healthcare providers, we must adapt to and continually improve the use of telehealth, with the ultimate goal of providing patient-centered, feasible, and effective care for all cancer patients.

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Figure Captions:

Figure 1: The number of billable consult and follow-up appointments by method of encounter (in-person vs telephonic vs two-way audio-video). In-person visits became a small portion of our care in April. In April, telephonic only visits increased compared to two-way audio-video and in-person visits.

Figure 2: Factors impacting the type of telehealth visit that was conducted (two-way audio-video vs telephonic only). Median Income was not associated with type of telehealth visit ($p=0.48$). Older age was associated with increased telephonic only visit ($p<0.01$).

Figure 3: The impact of two-way audio-video telehealth on level of visit charges. The level of appointment charged for telehealth appointments were not different for follow-up appointments ($p=0.36$). For consultation appointments, patients were more frequently billed a lower level of visit than for an in-person visit. ($p<0.01$).

Figure 4: Framework for incorporating telehealth into consult workflow

Table 1: Telehealth recommendations by type of encounter

Table 2: Recommendations regarding appropriateness of telehealth for follow up care with minimum number of in-person exams

Table 3: Radiation oncology specific quality metrics for telehealth

Supplemental Table: NCCN recommended (in-person) surveillance schedule by disease site and potential for telehealth

Visit type	Recommendations
Consult	Patients option of booking their initial consult via two-way audio-video telehealth (See Figure 3)
	Coordinate in person follow up or physical exam with simulation
	Telephonic only consult is discouraged
On treatment visits	OTVs should continue in person
	Telehealth can be used as a secondary tool to provide additional clinical care
Post treatment evaluation	Patients option of booking PTE via telehealth, except for head and neck, gynecologic, and anal cancer
	In person exams can be scheduled after telehealth as clinically indicated
Follow up	Multidisciplinary team discussion to coordinate telehealth visits to reduce duplicated physical exams and visits
	Recommendations are made based on disease subsite, incorporating NCCN recommendations for follow-up and in consideration of a) the necessity of a physical exam finding to assess treatment response, and b) requirement of an in-person physical exam for cancer surveillance (See Table 2)

Table 1: Telehealth recommendations by type of encounter

Appropriateness	Disease site	Minimum site-specific in-person exams
High	CNS Breast Lung GI (except anal cancer) GU-prostate Soft tissue sarcoma Skin	Year 1-2: one to two exams annually Year 3-5: as clinically indicated
Moderate	GI- anal cancer (After CR) Lymphoma	Year 1-2: two exams annually Year 3-5: annual exam
Low	Head and neck cancer Gyn-endometrial Gyn-cervical	Year 1-2: every 3-6 months Year 3-5: every 6-12 months

Table 2: Recommendations regarding appropriateness of telehealth for follow up care with minimum number of in-person exams

Domain	Measures
Access to care	Time from referral to consult Time from consult to simulation Access to care for underserved patients Simulation cancellation rate
Financial impact	Cost of telehealth implementation and maintenance Number of 2nd opinion consults Difference in reimbursement Cost savings to patients – direct and indirect Cost savings from care coordination
User experience	Patient satisfaction Provider satisfaction Time required for technical troubleshooting
Clinical effectiveness	Documentation of pain or KPS Rate of unexpected hospital admissions Effectiveness in coordination and shared care Patient adherence to recommended follow up schedule Clinical outcomes

Table 3: Radiation oncology specific telehealth quality metrics

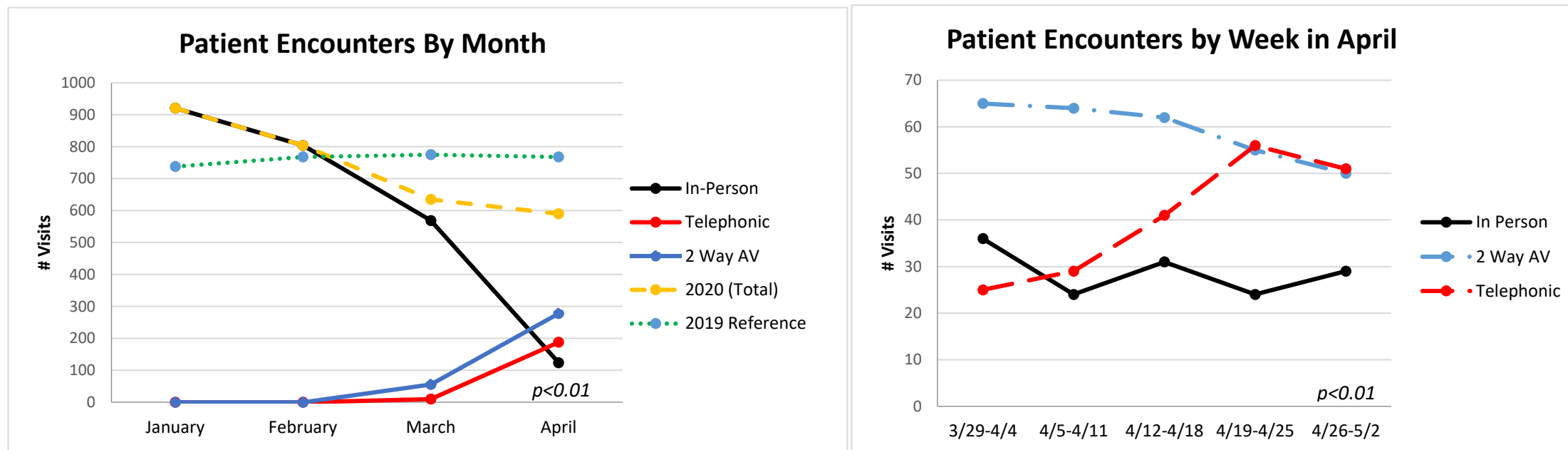


Figure 1: The number of billable consult and follow-up appointments by method of encounter (in-person vs telephonic vs two-way audio-video). In-person visits became a small portion of our care in April. In April, telephonic only visits increased compared to two-way audio-video and in-person visits.

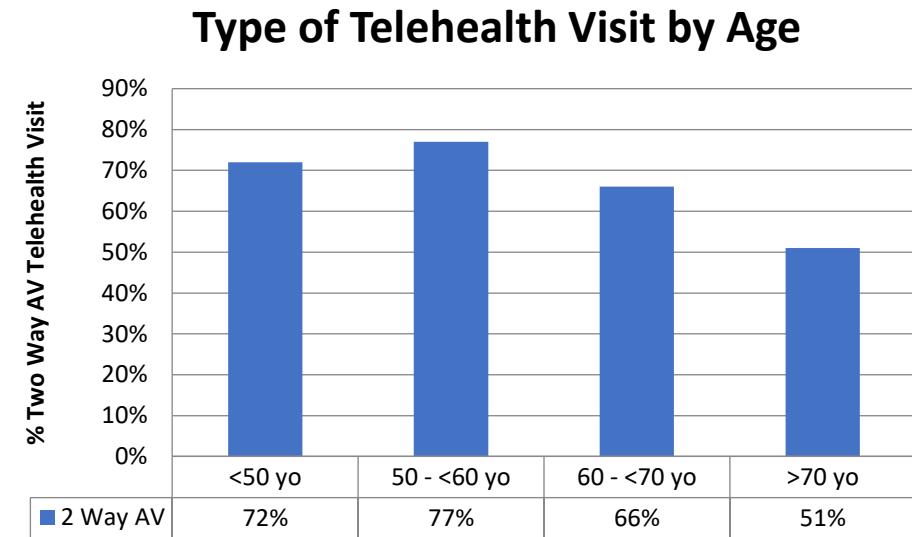
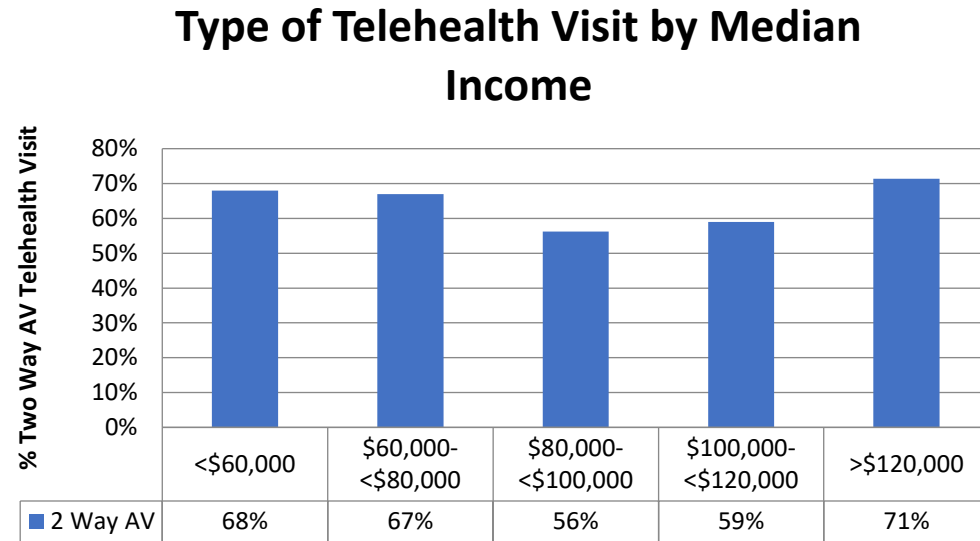


Figure 2: Factors impacting the type of telehealth visit that was conducted (two-way audio-video vs telephonic only). Median Income was not associated with type of telehealth visit ($p=0.48$). Older age was associated with increased telephonic only visit ($p<0.01$).

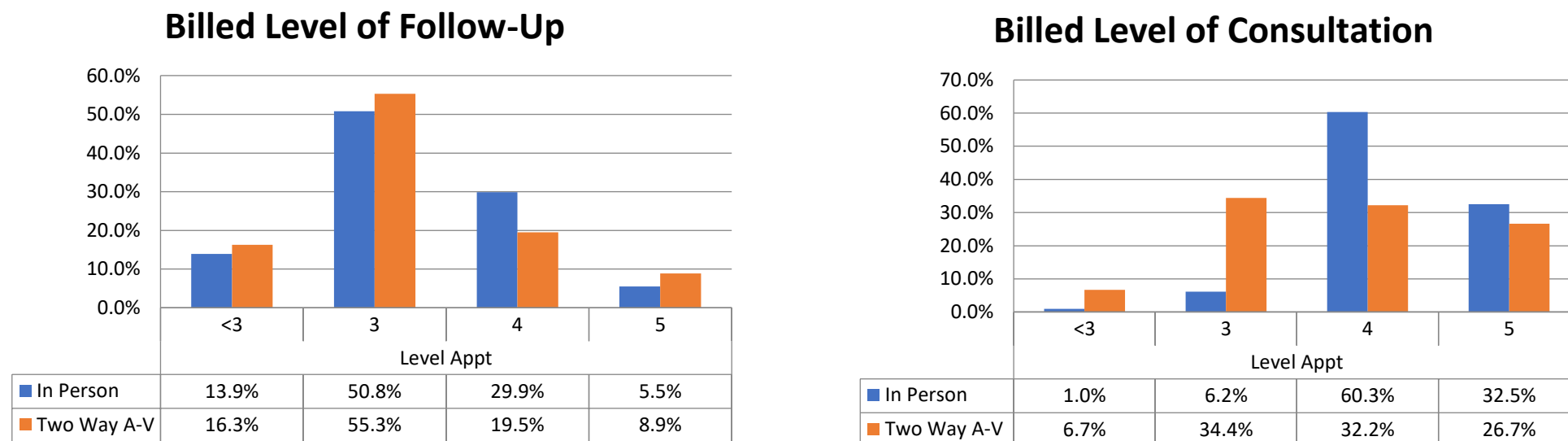


Figure 3: The impact of two-way audio-video telehealth on level of visit charges. The level of appointment charged for telehealth appointments were not different for follow-up appointments ($p=0.36$). For consultation appointments, patients were more frequently billed a lower level of visit than for an in-person visit. ($p<0.01$).

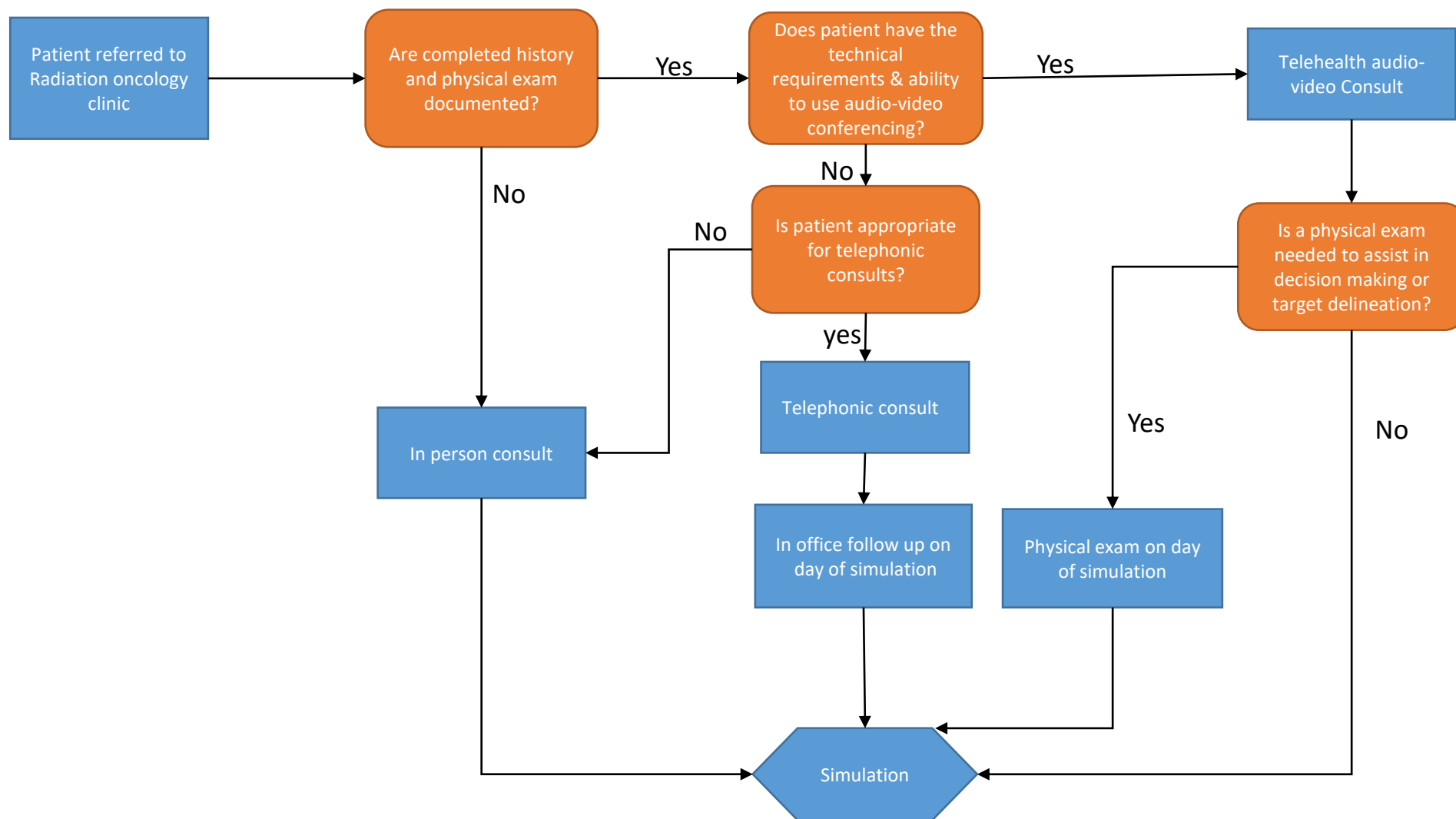


Figure 4: Framework for incorporating telehealth into consult workflow