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Long-term Institutional Experience with Telemedicine Services for Radiation Oncology: A Potential Model for Long-term Utilization --Manuscript Draft--

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Abstract:	<p>With the development of the COVID-19 pandemic, healthcare practices and radiation oncology departments have begun to incorporate telemedicine services to practice social distancing and minimize the chances of disease spread. Given the severity of this pandemic, it will likely fundamentally impact the use of these services for years to come. Our institution and radiation oncology department have used telemedicine services for many years; we would like to report on our departmental experience to guide other radiation oncology practices on its long-term use for clinical evaluation and patient care. Our institution's telemedicine program provides clinical services for a number of remote locations and represents the largest telehealth network in the world, with over 300 sites and 60,000 patient encounters a year. Specifically for our radiation oncology department, over 200 patient encounters occur via telemedicine a year. Patients report great appreciation and satisfaction with these encounters, as they eliminate the time and energy needed for travel from long distances. It has resulted in improved efficiency and cost-effectiveness as well. Based on our institutional experience, our long-term vision for telemedicine (after the COVID-19 pandemic has hopefully subsided) is as an excellent and cost-efficient tool to provide long-term follow-up for patients, especially for those who live far away in rural or underserved areas.</p>

Title

Long-term Institutional Experience with Telemedicine Services for Radiation Oncology: A Potential Model for Long-term Utilization

Running Title

Telemedicine Services for Radiation Oncology

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Summary

During the COVID-19 pandemic, radiation oncology departments have incorporated telemedicine services to minimize disease spread. We report our long-term departmental experience to guide other radiation oncology practices on its long-term use for patient care.

Based on our institutional experience, our long-term vision for telemedicine (after the COVID-19 pandemic has subsided) is as an excellent and cost-efficient tool to provide long-term follow-up for patients, especially for those who live far away in rural/underserved areas.

Abstract

With the development of the COVID-19 pandemic, healthcare practices and radiation oncology departments have begun to incorporate telemedicine services to practice social distancing and minimize the chances of disease spread. Given the severity of this pandemic, it will likely fundamentally impact the use of these services for years to come. Our institution and radiation oncology department have used telemedicine services for many years; we would like to report on our departmental experience to guide other radiation oncology practices on its long-term use for clinical evaluation and patient care. Our institution's telemedicine program provides clinical services for a number of remote locations and represents the largest telehealth network in the world, with over 300 sites and 60,000 patient encounters a year. Specifically for our radiation oncology department, over 200 patient encounters occur via telemedicine a year. Patients report great appreciation and satisfaction with these encounters, as they eliminate the time and energy needed for travel from long distances. It has resulted in improved efficiency and cost-effectiveness as well. Based on our institutional experience, our long-term vision for telemedicine (after the COVID-19 pandemic has hopefully subsided) is as an excellent and cost-efficient tool to provide long-term follow-up for patients, especially for those who live far away in rural or underserved areas.

Introduction

Telemedicine and telehealth services (defined as patient interactions facilitated via video-conferencing software) are becoming a popular technology for medical practice. Prior to the start of the coronavirus (COVID-19) pandemic, multiple medical specialties were increasingly beginning to integrate telemedicine services into their clinical workflows. Radiation oncology departments have previously incorporated video-conferencing technology into multiple components of a patient's care (multidisciplinary tumor boards, educational conferences, and even radiotherapy treatment planning)¹, but there have only been a handful of reports in other countries on the use of telemedicine to follow cancer patients in rural or underserved areas¹⁻³. There have been no reports on the use of telemedicine services specifically for radiation oncology but a pilot study was funded by the Radiation Oncology Institute in 2018 to assess the utility of telemedicine as part of a survivorship program⁴.

With the development of the COVID-19 pandemic, healthcare practices and radiation oncology departments began to incorporate telemedicine services to practice social distancing and minimize the chances of disease spread. Given the severity of this pandemic, it will likely fundamentally impact the use of these services for years to come. Since our institution and radiation oncology department have used telemedicine services for many years (with hundreds of patients seen), we would like to report on our departmental experience to guide other radiation oncology practices on its long-term use for clinical evaluation and patient care.

Experience

Our institution (YYY) has an established telemedicine program that provides clinical services for a number of remote locations, including rural communities⁵, polar research stations⁶, and the XXX state prison system⁷. It represents the largest telehealth network in the world, with

over 300 sites and 60,000 patient encounters a year⁵. The large majority of patient volume for our institution is via the XXX system. Prior to the COVID-19 pandemic, the XXX system was the only source of telemedicine patients for radiation oncology department, which is the focus of this article. YYY has an agreement with the XXX where a large portion of inmates in the system receives specialty medical care via YYY. Inmates have unit providers (physicians and midlevel providers) at their prison units who can manage chronic health problems (including Primary Care, HIV, Dialysis, Mental Health, and Wound Care) but anything requiring further specialty care (such as Radiation Oncology) is managed by YYY.

When an inmate is referred to Radiation Oncology, they receive standard of care workup (physical exam, laboratory testing, and imaging) and treatment (including IMRT, SBRT, SRS, and brachytherapy) as appropriate just like any other patient. After therapy is completed, patients may be seen for follow-up in-person or via telemedicine. This decision is made by the treating physician only and typically depends on the disease site being treated. For example, prostate cancer patients are seen in-person for the first follow-up visit, after that they are seen via telemedicine with remote monitoring of PSA levels. In contrast, for head and neck patients, follow-up appointments are seen in-person for the first several visits to monitor for disease recurrence and recovery from acute side effects. After that, they are typically seen via telemedicine. The majority of patients seen via telemedicine are prostate cancer patients, which is largely due to disease prevalence. Most telemedicine encounter visits involve patients within the first two years of radiation treatment completion.

Telemedicine software and equipment (Tandberg 990 codecs (Polycom, California, USA)) is present at the prison unit and YYY. This typically comprises of webcams, LCD monitors, and speakers. Dedicated telemedicine coordinators are present at YYY to help

facilitate appointment scheduling and logistics with communications/connections. Nurses are present at the prison unit to collect vital signs and relay recommendations from the treating physicians to the prison's unit providers. YYY providers also have access to the prison's electronic health record (EHR) to view clinical information.

During the telemedicine visit, radiation oncologists may assess inmates for signs/symptoms of cancer recurrence, treatment side effects, or long-term toxicities. If there are any clinical concerns (with a low threshold of suspicion), in-person appointments with their radiation oncologists can be scheduled quickly. If there are no concerning/alarm symptoms, the inmates will be continued to be followed in-person by their unit providers (where basic labs and imaging can be ordered as needed) as well as their radiation oncologists via telemedicine appointments. If imaging studies are required, they are completed either locally (close to their unit) or at our institution before their next scheduled appointment; the imaging reports are routed to the ordering physician for review and further recommendations. In between telemedicine appointments, if there is any concerning change in the clinical course of an inmate (abnormal symptoms, labs, or imaging findings), the treating radiation oncologist is notified and an in-person appointment is scheduled quickly.

In our department, approximately 250 radiation oncology patient encounters occur via telemedicine each calendar year and the program has been in place for our department since 2008. Inmates in the XXX express great appreciation for this opportunity, as journey to YYY may involve several days of arduous travel back and forth. Due to their protected research status, collecting prospective data from inmates is restricted, but previously reported internal data indicate high degrees of satisfaction for patients, nurses, and specialty physicians.⁷ The telemedicine system has also served as a way to limit costs in an increasingly expensive

healthcare environment; based on the most recent reported data from 2015, Texas spent \$4077 per inmate, which is less than the median state expenditure of \$5720 and \$15,000 less than the state with the highest expenditure, California, at \$19,796⁸.

Discussion

Given the rapidly growing concerns for disease spread and virulence of COVID-19, telemedicine services have been incorporated emergently into radiation oncology practices as a means practice social distancing and minimize disease transmission. It is unclear how long these precautionary measures will need to remain in place. We aimed to share our long-term experience to help guide its use in other radiation oncology practices for extended durations.

Based on our institutional experience, there are several benefits to incorporating telemedicine services into a routine radiation oncology clinical workflow. First, incorporating telemedicine services may serve as a way to improve efficiency by reducing the time and costs needed for follow-up appointments. In addition, telemedicine also allows for increased convenience for patients, particularly for those from rural/underserved areas who may have to travel long distances for care and evaluation. Telemedicine also allows for continuity of care with patients who would otherwise not be able to follow up with their treating radiation oncologists. The treating physician is the person who is going to be most familiar with a patient's chances for disease control, side effects, complications, and long-term toxicities. Leaving survivorship follow-up to other healthcare providers may lead to suboptimal clinical management.

There are also potential downsides to incorporating telemedicine services. Telemedicine may further mitigate the role of physical examination, which is an important tool for assessing disease recurrence (i.e. digital rectal exams for prostate cancer, flexible laryngoscopies for head

& neck cancer, pelvic exams for gynecologic cancers, etc.). However, this downside could be minimized by using telemedicine for follow-up after 3-5 years post-treatment, when the risk of recurrence is lower. In addition, telemedicine need not be solely used as a way to *replace* in-person follow-up visits, but as a supplementary tool to *screen* patients who need in-person follow-up visits. In addition, further improvements in technology may even allow for remote/virtual physical examinations.

Future directions

Regardless of the current merits of incorporating telemedicine into clinical care, this technology is already being implemented across the healthcare system as a means of evaluating patients while minimizing the risk of COVID-19 transmission in the setting of a pandemic. Based on our institutional experience, our long-term vision for telemedicine is as an excellent (and cost-efficient) tool to provide long-term follow-up for patients, especially for those who live far away in rural or underserved areas. This would also allow for increased compliance with survivorship programs and better data collection of long-term toxicity and recurrence rates.

With the increased consolidation of healthcare systems, one can even envision it as a system for patients who required specialized radiotherapy (proton therapy, brachytherapy, SRS/SBRT, etc. in major cities/centers) to travel to their nearby satellite facilities for follow-up. There they can not only undergo imaging, laboratory testing, and in-person exams as needed but also be seen by their treating radiation oncologist via telemedicine. We believe our institutional experience serves as a good model and we look forward to the reports on its use during the COVID-19 pandemic as well as its use in the pilot study funded by the Radiation Oncology Institute.

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