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Telemedicine as a component of forward triage in a pandemic[☆]

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ABSTRACT

Objective(s): Coronavirus disease 2019 (COVID-19) presents an enormous challenge to healthcare systems globally. Optimizing access to healthcare while minimizing face-to-face patient encounters is critical to limiting exposures, conserving resources, and preserving health. We aimed to evaluate the utility of a COVID-focused telehealth program in avoiding potential in-person visits while maintaining high patient satisfaction.

Methods: All patients with COVID-related virtual visits at our center between March and May 2020 were included. Demographic, satisfaction, and clinical information were gathered using a modified, validated telehealth satisfaction questionnaire disseminated via email or telephone. Data were analyzed using Stata.

Results: Of 581 eligible patients, 180 (31%) responded to the survey. Symptoms (73%) and possible exposure (22%) were the main reasons cited for pursuing a virtual visit; cough (44%) and fever (36%) were the most common presenting symptoms. Regarding patient satisfaction, most patients rated the experience as “very good” or “excellent”, and 94% of respondents said they would recommend COVID-focused triage through telehealth to others. Over 81% of patients indicated that, if telehealth was not an option, they would have sought an in-person encounter. Ultimately, only 27% of patients reported pursuing a face-to-face encounter after participating in the virtual visit.

Conclusion: Based on patient self-reporting, telemedicine potentially prevented face-to-face COVID-related encounters. Patients expressed satisfaction with the virtual process and were less likely to pursue in-person consultation. Leveraging a telehealth strategy for forward triage has the potential to reduce exposures while conserving healthcare resources.

1. Introduction

Since February 2020, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has resulted in over 27 million cases of coronavirus disease 2019 (COVID-19) worldwide.¹ Family clinics, primary care practices, general practitioners, and emergency departments (ED) around the world face rising numbers of COVID-19 positive patients and patients under investigation for COVID-19, while simultaneously handling a shortage of medical equipment and personnel.² Crowded waiting rooms and lobbies are areas in which patients are likely to spread the virus to one another or to healthcare professionals.^{3,4} Minimizing unnecessary in-person encounters by triaging patients is critical

for limiting COVID-19 spread, protecting medical staff, and conserving personal protective equipment (PPE).

“Forward triage,” the sorting of patients prior to ED presentation, is a critical component of preventing unnecessary encounters, diverting patients to appropriate care settings, and preserving medical resources.^{5,6} Telemedicine services utilize audiovisual technology to counsel new and established patients across a broad variety of settings and medical specialties. The COVID-19 pandemic has created a strong push for the expansion and development of telemedicine availability, but evidence supporting the use of virtual visits for preventing COVID-19 related face-to-face encounters remains limited.⁷ Moreover, maintaining high patient satisfaction with these systems is important for ensuring that they are utilized effectively.⁸

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List of abbreviations (alphabetical)

| | |
|----------|-------------------------------|
| COVID-19 | Coronavirus disease 2019 |
| ED | Emergency department |
| PPE | Personal protective equipment |

Understanding the ability of telemedicine systems to potentially prevent in-person COVID-19 related encounters, while maintaining high patient satisfaction, could help limit viral spread and preserve resources. The objectives of this study were to 1) evaluate whether telemedicine could potentially prevent unnecessary in-person encounters during the COVID-19 pandemic and 2) to assess patient satisfaction with COVID-19 related virtual encounters.

2. Methods**2.1. Data source and study population**

In March 2020, a COVID-19 virtual “waiting room” was established at a large, urban medical center that serves pediatric and adult patients. The Texas Medical Center is one of the largest medical centers in the world and handles over 10 million patient encounters annually.⁹ The medical center serves a diverse patient population. During the peak of the COVID pandemic, both new and established patients could set up telehealth visits to speak to a healthcare team member about COVID-related concerns. The only requirements for establishing a visit were a working email address and telecommunications (laptop, smartphone) device. An audio-visual platform was utilized for the visits, though audio-only options were available in case of video-related technological problems. All patients who had COVID-19 related virtual visits between March 1 and May 31, 2020 were included. No patients were excluded. Parents were surveyed for patients younger than 18 years old. Data was gathered from the electronic medical record and validated by direct contact with patients. This study is approved by the University of Texas Medical Center at Houston Center for the Protection of Human Subjects/Institutional Review Board (#HSC-MS-20-0371; Ref #200776).

2.2. Telehealth survey

Patients were contacted via phone or email to complete a COVID-specific telehealth questionnaire (Supplementary Table 1). The questionnaire, a modified version of a previously validated telehealth survey, queried data regarding patient demographics and COVID-related health behaviors.¹⁰ Patient satisfaction questions related to the quality of technology and medical advice were scored on a 5-point Likert scale ranging from “Poor” to “Excellent.” The last survey question invited participants to contribute free-text, open ended thoughts related to their telemedicine experience.

Surveys were conducted by a team of three research personnel using a standardized script, and Spanish-speaking patients were surveyed by a bilingual research team member.

2.3. Outcomes of interest and statistical analysis

The primary outcome of interest was the ability of the telemedicine option to prevent potential face-to-face visits.¹¹ Additional outcome measures included patient satisfaction with the audiovisual technology, the medical counseling they received, and the overall telehealth experience.

Survey responses were collected using Qualtrics (Qualtrics, Provo, UT). All data were analyzed using StataIC 16 (StataCorp., College Station, TX) and Prism 8 (GraphPad Software, San Diego, CA). Analyses

include descriptive statistics for all data, chi-squared for categorical variables, and Mann-Whitney U tests for continuous variables, where appropriate. Sensitivity analyses were performed comparing phone versus email respondents and minors versus adult patients.

3. Results**3.1. Patient characteristics**

There was a total of 656 COVID-related virtual visits for 581 unique patients between March and May 2020. Of these patients, 180 (31%) responded to our survey. There was no difference in sex or age between respondents and non-respondents (Table 1).

3.2. COVID-related behaviors

Amongst the patients that responded to the survey, the most common reasons for seeking a telemedicine encounter were presence of COVID-19 symptoms (72.9%) and concern for possible exposure (21.6%) (Table 2). The most commonly presenting symptoms were cough and fever, and, in the free-text portion of the survey, many patients described other symptoms such as sore throat (19 patients), body aches (14 patients), and fatigue (9 patients). 44 (24.4%) patients reported being asymptomatic. Over half (56.1%) of survey respondents said they had been tested for COVID-19 at some point, and 15.6% of those patients said they tested positive.

3.3. Potentially avoided visits

A majority of patients, 145 of 178 (81.5%), said they would have sought an in-person encounter if telemedicine options were not available. However, only 48 (27.0%) of patients ultimately did seek an in-person encounter after their virtual visit. 27.7% of patients had multiple telemedicine encounters.

3.4. Patient satisfaction

For each patient satisfaction question on the survey, most patients rated the experience as “very good” or “excellent” (Fig. 1). Patients were most satisfied with how well their privacy was respected (98.3% responded “Good” or better) and with the ease of scheduling a virtual visit (92.7%). They were least satisfied with the quality of the audiovisual technology (84.2% responded “Good” or better), but 90.1% of respondents were satisfied with how the telemedicine team handled technical difficulties. Of the respondents, 93.2% said they were likely to use telemedicine again in the future, and 94.4% said they would encourage others to use telemedicine for COVID-related concerns.

Table 1
Baseline patient and encounter data.

| Baseline Data | | | | |
|---------------------------------------|--------|-------------------------------|-----------------------------|------|
| Patient characteristics | | | | |
| Variable | | No response to survey n = 401 | Responded to survey n = 180 | p |
| Age (years), median (IQR) | | 37 (22–51) | 36.5 (18.2–51) | 0.60 |
| Sex, n(%) | Female | 256 (64.2) | 117 (65.0) | 0.85 |
| | Male | 143 (35.8) | 63 (35.0) | |
| Pediatric patients, n(%) | | 80 (20.0) | 42 (23.3) | 0.36 |
| Virtual encounter characteristics | | | | |
| Total telehealth encounters | | 656 | | |
| Telehealth encounters per month, n(%) | March | 170 (25.9%) | | |
| | April | 420 (64.0%) | | |
| | May | 50 (7.6%) | | |
| | June | 16 (2.4%) | | |

Table 2

Patients' reasons for pursuing telemedicine encounter and most common presenting symptoms. Multiple answers per patient were accepted for this portion of the survey.

| Reason for pursuing visit | |
|---------------------------|-------|
| Symptoms | 72.9% |
| Possible exposure | 21.6% |
| Confirmed exposure | 12.9% |
| Travel history | 5.7% |
| Other | 21.0% |
| Symptoms | |
| Fever | 35.9% |
| Cough | 43.7% |
| Shortness of breath | 25.4% |
| Sensory changes | 11.1% |
| Other | 34.3% |

3.5. Sensitivity analyses

To ensure no difference in survey responses based on survey type (phone versus email), sensitivity analyses were performed. Of all respondents, 41 patients (22.8%) answered the survey via email, and 139 (77.2%) answered via phone. There was no difference in patient satisfaction (% of responses as "Good" or better) for any of the survey items between phone and email respondents (all $p > 0.05$). COVID-related behavior was also similar between email and phone respondents (Table 3).

Because parents answered surveys for patients younger than 18 years old, additional analyses were performed to ensure no differences in response between pediatric and adult patients. Of the 180 survey respondents, 42 (23.3%) were younger than 18 years old. There was no difference in patient satisfaction (% of responses as "Good" or better) for any of the survey items between pediatric and adult patients (all $p > 0.05$). Significantly fewer pediatric patients were tested for COVID than adult patients, although a similar percent of both adult and pediatric patients tested positive (Table 3).

4. Discussion

COVID-19 has placed significant strain on healthcare institutions around the country, forcing the development and implementation of systems to conserve resources and minimize potential infectious exposures. We found that a telemedicine system devoted to patients with

COVID-related concerns can potentially prevent unnecessary in-person encounters. Moreover, patients from our cohort had high satisfaction and expressed comfort with the telemedicine technology and the overall virtual visit experience for a CoVID-specific use-case.

Since the beginning of the pandemic, there have been numerous calls for the expansion of telehealth infrastructure as a way to re-redirect medical resources and to keep potential COVID-positive patients isolated.^{5,6} Our data support the ability of telemedicine during the pandemic to help avoid both adult and pediatric encounters. In the absence of a virtual option, many patients in our cohort would have sought a clinic or emergency room encounter, but, after their telehealth visit, most patients no longer felt a need to be seen in person. Importantly, a large majority of patients said they would use telemedicine again if needed. These results highlight the utility of telemedicine for virtual triage of newly symptomatic patients, patients awaiting test results, and patients with potential or known COVID exposure.

Previous reports on patient satisfaction with telemedicine show

Table 3

Sensitivity analyses comparing phone and email respondents as well as pediatric and adult respondents.

| Sensitivity Analyses | | | |
|---|------------------|---------------|-------|
| Phone vs. Email Respondents | | | |
| Variable | Phone n = 139 | Email n = 41 | p |
| Tested for COVID-19, n(%) | 74 (53.2) | 26 (65.0) | 0.19 |
| Tested positive for COVID-19, n(%) | 11 (15.7) | 4 (16.0) | 0.97 |
| Would have sought an in-person visit, n (%) | 115 (83.3) | 30 (76.9) | 0.36 |
| Did seek an in-person visit, n(%) | 38 (27.5) | 10 (25.6) | 0.81 |
| Would use telemedicine again, n(%) | 130 (94.9) | 34 (87.2) | 0.09 |
| Would recommend to others, n(%) | 130 (94.9) | 36 (92.3) | 0.539 |
| Pediatric vs. Adult Respondents | | | |
| Variable | Pediatric n = 42 | Adult n = 138 | p |
| Tested for COVID-19, n(%) | 10 (23.8) | 91 (65.9) | <0.01 |
| Tested positive for COVID-19, n(%) | 1 (10.0) | 14 (16.3) | 0.61 |
| Would have sought an in-person visit, n (%) | 37 (88.1) | 108 (79.4) | 0.21 |
| Did seek an in-person visit, n(%) | 13 (31.0) | 35 (25.7) | 0.51 |
| Would use telemedicine again, n(%) | 40 (95.2) | 125 (92.6) | 0.55 |
| Would recommend to others, n(%) | 40 (95.2) | 127 (94.1) | 0.78 |

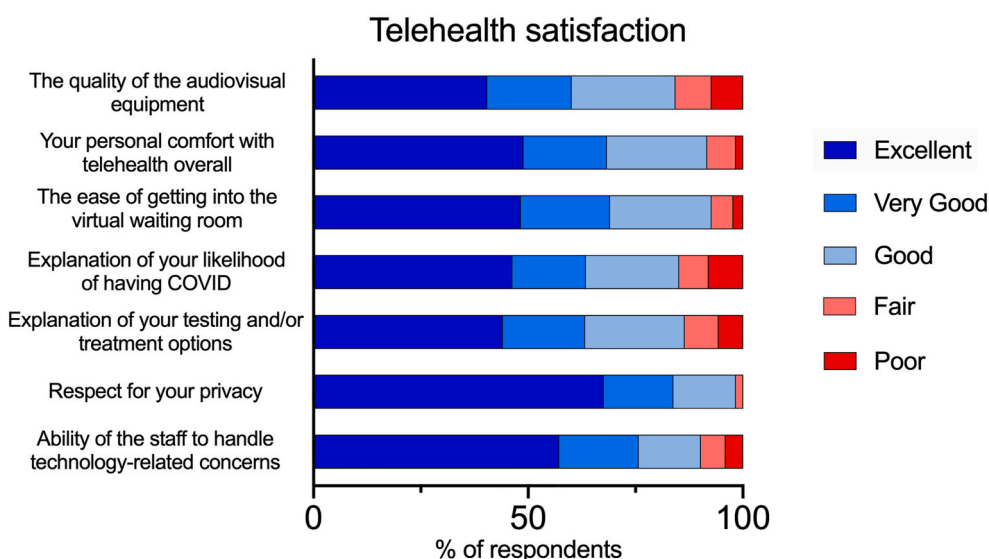


Fig. 1. Patient satisfaction survey results.

mixed results.^{8,12} However, these studies occurred prior to the COVID-19 pandemic in a time with minimal exposure risks for patients and with less sophisticated technology. There are limited data on patient satisfaction with telemedicine during the pandemic. Studies of subspecialty (Allergy & Immunology, Otolaryngology, and Oncology) telemedicine visits during the pandemic show that patients have moderate to high satisfaction with virtual visits but may still prefer some aspects of the in-person encounter.^{13–15} In a recent systematic review of patient telehealth satisfaction, patients with a wide variety of chronic conditions (psychological and mental health conditions, genitourinary cancers, rheumatologic diseases, etc.) expressed overall high satisfaction with telemedicine visits during the pandemic.¹⁶ Similarly, our results show that, for COVID-19 related concerns, patients had high overall satisfaction with the virtual visit, and most patients would recommend telehealth visits to others. Of note, this work focuses on patient satisfaction with regards to COVID-related encounters, and the results may not be applicable to other clinical scenarios. Attitudes regarding virtual visits may change over time as the pandemic brings unique circumstances such as PPE shortages and the risk of viral transmission.¹⁷

Similar to other studies, our respondents were least satisfied with the audiovisual technology, representing a specific area for future process optimization.¹⁴ Because our system primarily utilized audiovisual technology, we were unable to comment on differences in patient satisfaction between audio-only (usually telephone) and audiovisual (video and audio) platforms. Visual capabilities allow for some limited examination of signs and symptoms, some facial interaction, and can increase the feeling of connectedness between patient and provider. Existing literature in this area suggests that audiovisual systems, though susceptible to technological difficulties, have higher patient and provider satisfaction than audio-only systems.^{18,19}

There are some key limitations to this study. This is a single-center, retrospective study with roughly one-third of patients responding to the questionnaire, so selection bias may be present. However, we do capture patients from a large academic medical center in a diverse, urban environment, and the results may still be broadly applicable to other health systems. Another limitation is that two different survey modalities (telephone and email) were employed, allowing for possible non-response bias. Our sensitivity analysis showed no difference in the primary or secondary outcomes when controlling for survey modality. This survey, while based on a validated telehealth questionnaire, may not capture the many detailed nuances of patient satisfaction and outcomes. Finally, our primary outcome was focused on forward triage, the ability to minimize in-person encounters.²⁰ Future studies with comparator groups are required to investigate the effectiveness of telemedicine for key metrics such as patient outcomes, cost-effectiveness, and sustainability.^{11,21}

In conclusion, a telemedicine system for COVID-19 related encounters can help potentially prevent in-person encounters during the pandemic. We found that virtual visits decreased patients' desire to seek in-person encounters while also leaving patients with high overall satisfaction. As COVID-19 cases continue to rise around the world, these data support the expansion of telemedicine systems as a way to minimize patient and provider exposures and to conserve valuable resources. Ongoing efforts to improve audiovisual technology and applying telehealth to other clinical areas will be critical for realizing telemedicine's full potential.

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Declaration of competing interest

All authors have reviewed the manuscript and approved it for submission. None of the authors have any conflicts of interests or relevant disclosures. There are no prior publications or submissions with any overlapping information, including studies and patients. It will be presented, in part, at the American Public Health Association Virtual Meeting.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.hjdsi.2021.100567>.

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