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Review Article

Overview of telehealth in the United States since the COVID-19 public health emergency: a narrative review

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Background and Objective: The coronavirus disease 2019 (COVID-19) public health emergency (PHE) resulted in rapid expansion and use of telehealth services. Regulatory and reimbursement flexibilities were put in place to ensure patients had continued access to care while the health system was overwhelmed by COVID-19 cases. These changes have allowed clinicians to use and researchers to evaluate telehealth in new ways.

Methods: This narrative review focuses on highlighting telehealth research and evaluation that took place from March 2020 to February 2023 in the outpatient setting of the United States healthcare system.

Key Content and Findings: The research conducted during the COVID-19 PHE shows that telehealth was primarily used as a substitute for in-person care, to maintain continuity of care for established patients, and has not had a negative impact on clinical outcomes or resulted in increasing healthcare costs.

Conclusions: Studies show high patient and physician satisfaction, similar clinical outcomes and suggest that telehealth is used as a substitute for in-person care. The findings of this narrative review have direct implications for key stakeholders using telehealth now and beyond the COVID-19 pandemic. Patients, physicians and providers, healthcare leaders and administrators, as well as policymakers should consider how telehealth should continue to be reimbursed and regulated even as the COVID-19 PHE expired in May 2023.

Keywords: Telehealth; telemedicine; outpatient; post-COVID19

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Introduction

Telemedicine, also known as telehealth, has changed the delivery of care throughout the United States and the world. In just 20 years, since the private sector recognized the need, and the public enthusiastically understood the advantages, the use of telehealth in the United States increased 154% increase during early stages of the pandemic and stabilized at levels 38 times higher than levels in 2019 (1).

The coronavirus disease 2019 (COVID-19) pandemic resulted in rapid expansion and use of telehealth services as part of the medical field's response to concerns about the spread of disease while attempting to ensure patient had access to medical care (2). As physicians and providers consider the future of telehealth, focus for using telehealth to minimize the spread of COVID-19 has changed to understanding best practices and lessons learned that can be applied to the future of virtual care delivery (3).

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Telehealth refers to the ability to connect individuals, patients, and healthcare providers when in-person care is not necessary or not possible (4). This includes synchronous, or real-time, connections between patients and providers as well as asynchronous tools where there is a store-and-forward functionality that allows for information to be exchanged and reviewed at different times (5). While these healthcare interactions are not new, there was a rapid and massive expansion in their use during the COVID-19 pandemic.

Prior to the COVID-19 pandemic and declaration of a public health emergency (PHE), the most significant barriers to wide-spread use of telehealth were regulatory and reimbursement issues (5). Public and private insurance had varying and strict definitions for which clinical encounters were permitted. At a national level, providers would only receive payment for telehealth encounters if the patient met the originating site requirement—this required patients to live in rural areas or healthcare professional shortage area (6). Furthermore, patients had to travel to local providers—they could not connect with a provider from their own home. However, the degree of coverage and payment parity varied greatly both for government insurance and type of private payer (5). In March of 2020, the Centers for Medicare and Medicaid services removed the originating site requirement, allowed patients to engage in telehealth from their homes (7). This was followed by state-wide emergency declarations allowing private payers and government insurance for new patient evaluations, providing care across state lines, audio-only visits, eliminating telehealth co-pays, and ensuring payment parity based on the complexity of decision making (8).

Our objective is to review the data which has emerged since the telehealth regulatory and reimbursement landscape changed in association with the PHE. We focused our review on research evaluating impact of outpatient telehealth on patients, providers, and health systems; as well as highlight lessons learned since the declaration of a PHE in the United States. Given high rates of telehealth use in behavioral or mental health disciplines (i.e., psychiatry, psychology, social work), and that by the very nature of these visits a physical exam rarely contributes to medical decision making, we focused on medical and surgical populations. Furthermore, we aim to highlight areas of future consideration as telehealth becomes more entrenched in modern medicine as a tool for connecting patients and providers, as many of the findings are applicable outside of the healthcare ecosystem in the United States. We present this article in accordance with the Narrative Review reporting checklist (available at https://mhealth.amegroups.com/article/view/10.21037/mhealth-23-15/rc).

Telehealth modalities

Synchronous

Video visits

Video visits are live, simultaneous audio and visual interactions with patients using videoconferencing platforms (9). In the United States, these encounters were previously limited to established patients with private insurance. The Medicare population, due to its co-morbidities and cultural need for in-person desires, were less interested in remote care. Further, Medicare did not compensate for telehealth, and healthcare professional shortage areas required adherence to regulations of "originating site". These counterproductive rules essentially doubled the number of professionals necessary: the patient to be in one site with a nurse and the doctor in another other site (10). Importantly, these connections are noted to have inherent technical limitations. Live video requires reliable, high-speed broadband internet on a "smart device" and poor video or audio quality can impact both patient and physician experience.

Audio, or phone, visits are synchronous audio-based interactions without visual feedback. These encounters require less technological software, and their implementation varies from use in settings where broadband internet is limited to being used as a back-up mechanism when a video visit fails. These encounters were not previously reimbursed by commercial insurance or Medicare/Medicaid; however, during the COVID-19 PHE they were employed as a tool for ensuring patients and providers could connect. At the University of Michigan, data from the first 5 months of the pandemic response revealed that across all clinical departments, 45.4% of telehealth encounters were conducted through phone visits (11). Researchers also found that demographic characteristics including age, self-identified ethnicity, type of insurance, and broadband accessibility impacted who used audio instead of video encounters (11,12).

It is important to note that our review focused on data from providers who have integrated telehealth into existing brick and mortar establishments, from private practices to large academic medical centers. This is different from on-demand or direct-to-consumer (DTC) telehealth companies which have also been growing since March of 2020. In

2021, DTC telehealth companies brought in $3.4 billion in venture capital funding through the third quarter, dwarfing the $2.8 billion raised in all of 2020 (13). 72% of U.S. adults who have used telehealth said they have accessed virtual care through their regular provider or health plan, while another 17% received care through a direct-to-consumer platform and 11% have used both types of telehealth. While traditional healthcare providers are increasing their telehealth offerings, it is important to note that insurers UnitedHealthcare and Cigna Corp recently announced they will offer virtual-first health plans (13) due to potential for lowering costs associated with in-person care.

Other uses of synchronous telehealth include expansion of hospital-based services ranging from emergency department (ED) or inpatient video visits consultations to the growing presence of telehealth-intensive care unit (tele-ICU) care for highly complex patients.

Inpatient video visits

In the first months, and even the first year of the COVID-19 pandemic, health systems were evaluating options for minimizing exposure to the virus for healthcare providers, preserving personal protecting equipment (PPE), and ensuring access to appropriate and timely care (14). However, with regionalization of hospital systems, call coverage across multiple sites, and rising concerns regarding physician and provider burnout, the availability of synchronous telehealth to ensure expeditious access to appropriate care flourished (when a physical exam would not alter decision making) (15).

Tele-ICU

The strain of the COVID-19 pandemic on ICUs led to expansion of telehealth to support frontline clinicians through a command center staffed with intensivists (16). Live interactions between providers make up the majority of tele-rounding or tele-mentoring which is seen in studies across the United States. For instance, the United States Army developed the National Emergency Tele-Critical Care Network (NETCCN) in 2018 and throughout 2020, four teams provided support to rural hospitals with the help of 248 remote experts. During the temporary relaxation of state licensing laws, Washington state intensivists helped a New York City hospital expand ICU capacity to 150% during a COVID surge (17). While the recent pandemic experience helped boost growth of this telehealth sector, the U.S. Tele-ICU market is expected to continue growing at a compound annual growth rate of 20% between 2022–2027 due to capacity constraints within hospitals, shortage of ICU-trained intensivists, and ability to deliver care to rural hospitals using hub-and-spoke models (18).

Asynchronous telehealth

Asynchronous telehealth provides important service to patients. These store and forward mechanisms include the use of mobile applications as well as messaging through electronic medical records (EMRs) to share information with physicians and providers. In addition, electronic consultations (eConsults) allow primary care providers and specialists to communicate directly and help triage and expedite access to subspecialty care while avoiding unnecessary visits (11,14).

Remote patient monitoring (RPM) is the automated collection of patient physiological measurements outside of traditional healthcare settings (19). With expansion in synchronous telehealth, there has also been an associated increase in use of RPM tools. For instance, in the United States there was a fourfold increase in the use of these RPM tools between March 2020 and March 2021 in commercially insured populations (19). Among patients onboarded onto general RPM, most used it for at least 6 months. General RPM use in traditional Medicare increased substantially during the COVID-19 pandemic, reaching more than 6 times the pre-pandemic levels by September 2021 (20).

Methods

To identify relevant literature, we structured our search to find publications which took place between March 13 2020, when the United States declared a national emergency concerning COVID-19, and February 28 2023 when the narrative review data collection was completed (21). PubMed, Google search, and Google scholar to identify outpatient telehealth articles for research and evaluation that was completed in the United States. We searched these databases from August 2022 to February 2023 using MeSH and free text terms—telehealth, telemedicine, as well as outpatient telehealth and outpatient telemedicine. The abstracts were reviewed by two of the authors to ensure findings were applicable to the four categories of interest for this narrative review: patient-centric outcomes, provider-reported outcomes, and clinical outcomes. English language articles ranging from retrospective reviews to randomized controlled trials (RCTs) were included and research performed outside of the United States or in the inpatient, ICU, or ED were excluded. Study methodology is outlined in *Table 1*. Literature search was performed by the primary and secondary authors independently and duplicate articles were removed though some papers address

Table 1 Summary of methodology

Items	Specification
Date of search	August 2022 to February 2023
Databases and other sources searched	PubMed, Google search, and Google scholar
Search terms used	MeSH and free text terms "telehealth", "telemedicine", "outpatient telehealth" and "outpatient telemedicine"
Timeframe	March 2020 to February 2023
Inclusion and exclusion criteria	English language articles ranging from retrospective reviews to randomized controlled trials were included and research performed outside of the United States or in the inpatient, intensive care unit, or emergency department were excluded
Selection process	Abstracts were reviewed by two of the authors to ensure findings were applicable to the four categories of interest for this narrative review: patient-centric outcomes, provider-reported outcomes, and clinical outcomes

outcomes of interest across different categories below. For instance, they included patient survey information while also measuring clinical outcomes in which case the article is cited in separate sections.

Results

Patient-centric outcomes

During and since the pandemic, additional studies and surveys continue to support high patient satisfaction (*Table 2*). In a 2020 survey of over 2,000 patients who had used telehealth at least once during the first year of the pandemic (22). 83% of patients reported overall satisfaction with their visit, 76% indicated telehealth removed transportation as a barrier, and 83% felt that patient-physician communication was strong.

A larger survey, completed June 30, 2021 received responses from over 305,000 patients across three Mayo Clinic campuses in three regions of the U.S. (23). Over a year into the pandemic, there were no significant differences in patient ratings of telehealth visits and in-person clinic visits (P=0.672). Overall, patients reported significantly higher satisfaction with in-person visits for medical specialties (88.6 *vs.* 89.3, P<0.001), driven by differences in satisfaction for visits conducted within Executive Health (91.2 *vs.* 95.8, P<0.001) and General Internal Medicine (85.5 *vs.* 92.7, P<0.001). Conversely, patients reported significantly higher satisfaction with telehealth visits for surgical specialties (89.8 *vs.* 88.8, P<0.01). Beyond surveys, RCTs during the pandemic shed more light on patient satisfaction rates, even at times of increased stress on the healthcare system and lock-down protocols. Between June and December of 2020, 200 patients across multiple specialties were randomized to audio *vs.* video telehealth as part of a noninferiority trial at a tertiary academic medical center (24). The satisfaction rates were higher than anticipated in both groups (78.1% for video *vs.* 84.6% for phone-only) and not significantly different (P=0.32). Satisfaction levels were high for both types of telehealth visits and that the satisfaction rate with phone-only visits was not inferior to video visits. The age- and insurance-adjusted difference in the overall visit satisfaction rate for the phone versus video group was 3.2% with 95% confidence interval (CI): −7.6% to 14%, which did not contain −15% establishing noninferiority. The unadjusted satisfaction rate difference between phone-only and video groups was 6.5% (95% CI: −4.3% to 17.2%; P<0.001). Thus, phone-only visits were not inferior to video visits in this group population which included patients >60 and/or with public insurance (Medicare/Medicaid).

Between June and December 2021, a prospective, RCT of patients undergoing urologic surgery demonstrated once again high patient satisfaction. There was no statistically significant difference between video visits (94%) and in-person encounter (98%; P=0.28) (25). When evaluating time required for appointments, patients reported ~15 minutes time requirement for telehealth visits compared to 1–2 hours for 43% and >2 hours for 35% of those randomized to in-person care (P<0.001). 44% of patients randomized to a face-to-face visit had to take time off work to attend their appointment. When patients were surveyed on what factors may impact ability to attend an in-person appointment, 14.3% highlighted health issues while 29.3% reported transportation would be an issue.

Table 2 Patient-centric outcomes

Title	Research design	Time of study	Number of visits/patients	Patient cohort	Findings
Impact study: Patient Survey Summary	National survey	12/1/20–2/5/21	2,007 patients	Patients who received at least one telehealth visit in the last year	• 83% of patients reported overall satisfaction with their visit • 76% indicated telehealth removed transportation as a barrier • 83% felt that patient-physician communication was strong
Outpatient visit modality and parallel patient satisfaction	National survey	7/1/20–6/30/21	307,185 patients	New and established patients across all specialties	• No significant differences in ratings of telehealth visits and in-person clinic visits (P=0.672) • Significantly higher satisfaction with in-person visits for medical specialties (88.6 *vs.* 89.3, P<0.001) • Significantly higher satisfaction with telehealth visits for surgical specialties (89.8 *vs.* 88.8, P=0.006)
Satisfaction with modes of telemedicine delivery during COVID-19	Prospective, randomized controlled non-inferiority trial	5/28/20–11/5/20	200 patients	Patients scheduled for routine follow-up, age 60 or older or had public insurance, had videoconferencing capability	• High satisfaction rates, 78.1% for video *vs.* 84.6% for phone-only; P=0.32) • Phone visits not inferior to video in age- and insurance-adjusted difference in satisfaction rate; 3.2% (95% CI: –7.6% to 14%) which did not include –15% benchmark for inferiority
Results of the Randomized Evaluation and Metrics Observing Telemedicine Efficacy (REMOTE) Trial	Prospective, randomized controlled trial	6/2021–12/2021	165 patients	Patients undergoing ambulatory urologic surgery	• No difference in patient satisfaction between video visits (94%) and in-person encounter (98%; P=0.28) • Significant difference between time spent on visits: 15 min required for telehealth *vs.* 1–2 hours (43% patients) and >2 hours (35% patients; P<0.0001) • 29% patients reported transportation would have been an issue for in-person care
Estimated Indirect Cost Savings of Using Telehealth Among Nonelderly Patients With Cancer	Economic evaluation of cost savings from completed telehealth visits	4/1/20–6/30/21	11,688 patients	All patients aged 18 to 65 who completed telehealth visit, patients not deemed appropriate for telehealth by clinician judgment or required in-person chemotherapy or radiation were excluded	• Total cost savings per visit for new evaluations: $176.6 (SD 136.3) to $222.8 (SD 177.4) • Total cost savings per follow-up visit: $141.1 (SD 115.3) to $178.1 (SD 150.9) • For new visits, mean (SD) savings of 177.6 (161.6) roundtrip travel miles, 3.4 (2.6) hours of roundtrip driving time and 1.5 (0.0) hours of in-clinic time per visit • For follow-up visits, mean savings of 142.4 roundtrip travel miles, 2.8 hours of roundtrip driving time and 1.1 hours of in-clinic time per visit

CI, confidence interval; SD, standard deviation.

Cost and time savings

Researchers from a National Cancer Institute-Designated Comprehensive Cancer Center performed an economic evaluation of completed telehealth visits between April 2020 and June 2021. The study included 25,496 telehealth visits with 11,688 patients (26). There were 4,525 new patient encounters and 20,971 (10,049 patients) follow-up visits. According to cost models which included travel costs and lost productivity, the estimated mean [standard deviation (SD)] total cost savings ranged from $147.4 ($120.1) to $186.1 ($156.9). For new evaluations, the mean (SD) total cost savings per visit ranged from $176.6 ($136.3) to $222.8 ($177.4), and for follow-up visits, the mean (SD) total cost savings per visit was $141.1 ($115.3) to $178.1 ($150.9). Per visit, telehealth was associated with mean savings of 148.6 roundtrip travel miles and 2.9 hours of roundtrip driving time. For new or established visits, telehealth was associated with mean (SD) savings of 177.6 (161.6) roundtrip travel miles, 3.4 (2.6) hours of roundtrip driving time and 1.5 (0.0) hours of in-clinic time per visit. For follow-up visits, telehealth was associated with mean (SD) savings of 142.4 (138.8) roundtrip travel miles, 2.8 (2.3) hours of roundtrip driving time and 1.1 (0.0) hours of in-clinic time per visit.

Physician and provider reported outcomes

In addition to the patient perspective, many researchers have sought to understand how physicians and providers feel about using telehealth (*Table 3*). In a May 2020 survey of 221 physicians (65% of participants) and allied providers across multiple specialties at a U.S. integrated healthcare system, telehealth was overall rated highly. 87% felt comfortable using video telehealth, 65% felt that video and audio quality was good enough for a medical visit, 65% felt the patient-provider relationship was unimpaired, and 54% felt that video visits saved time (27). In contrast, primary care physicians/providers have expressed concerns with telehealth including, technology-related barriers, evaluations without a physical exam, duplication of consultations, weakened therapeutic relationships, and hindered patient engagement/expectations (28). Not surprisingly, providers who had good experience with audio and video quality of telehealth visits with patients were 2.6 times more likely to have overall positive view of telehealth. Only 29% of providers felt they were able to examine the patient properly. More than half of providers believed that up to 25% of visits would occur through telehealth in the future.

In winter of 2021, the American Medical Association (AMA) distributed an anonymous online survey with 2,232 physician responses (29). About half physicians (46.8%) said up to 20% of their patient visits were conducted via telehealth. One-fifth of respondents (21.3%) reported seeing more than 80% of patients through telehealth. The majority (80%) conducted telehealth visits in the clinic, while 64% also do them at home. 68% used telehealth to manage chronic diseases. Notably, 63% said 75% or more of telehealth visits are with established patients.

In 2022, the AMA performed a survey replicating 2016 and 2019 evaluation of physician attitudes surrounding digital health tools (30). The percentage of physicians who thought digital health tools are an advantage for patient care grew from 85% in 2016 to 93% in 2022. The use of "tele-visits" (including video and phone visits) increased from 14% in 2016, to 28% in 2019, to 80% in 2022. Importantly, 88% of physicians felt that telehealth improved clinical outcomes and work efficiency. The percentage of physicians using remote monitoring devices grew from 12% in 2016 to 30% in 2022. The digital health tools that garner the most enthusiasm among physicians are video visits (57%) followed by remote monitoring devices (53%).

Health system outcomes

Multiple researchers have evaluated the role telehealth has played on healthcare utilization (*Table 4*), efficiency (*Table 5*), and potential for fraud.

Healthcare utilization

An evaluation of multi-payer claims data from January 2019 to December 2020, which included over 70 million commercially insured and Medicare Advantage enrollees, summarized trends in telehealth use (31). During this time period, there were over 1.6 million hospital discharges. The percent of discharges with an in-person visit dropped from 72% in April 2019 to 55% in April 2020, whereas those with a telehealth visit increased from 0% to 46% over the same period. The mean number of in-person visits went from 2.94 in 2019 to 2.35 in 2020, a decrease of 0.6. Telehealth visits increased from 0.02 in 2019 to 0.70 in 2020, an increase of 0.68. The percentage of patients completing a post-discharge visit stayed around 70%, highlighting that telehealth served as a substitute for in-person care even as general ambulatory visits could not be completed due to the pandemic.

Table 3 Physician reported outcomes

Title	Research design	Time of study	Number of visits/patients	Physician cohort	Findings
Physician Perspective and Key Satisfaction Indicators with Rapid Telehealth Adoption during COVID-19	Survey of UPMC physicians	5/20–6/20	221 physicians and allied providers	Ambulatory care providers who completed telehealth visits between Feb and May 2020 across multiple specialties	• 87% felt comfortable using video telehealth • 65% felt that video and audio quality was good enough for a medical visit • 65% felt the patient-provider relationship was unimpaired • 54% felt that video visits saved time • More than half of providers believed that up to 25% of visits would occur through telehealth in the future
AMA 2021 Telehealth Survey Report	National survey	11/1/21–12/31/21	2,232 physicians	Email and social media outreach to individuals, state and medical societies including the American Medical Association	• Nearly half (47%) physicians said up to 20% of patient visits were conducted via telehealth • 21% reported seeing more than 80% of patients through telehealth • 80% conducted telehealth visits in the clinic; 64% also do them from home • Majority (63%) said 75% or more of telehealth visits are with established patients
AMA 2022 Digital Health Research	National Survey	Completed 11/2022	1,300 physicians	Survey including PCPs, specialists across multiple practice settings	• 93% thought digital health tools are an advantage for patient care • Use of telehealth visits increased from 14% in 2016 to 80% in 2022 • 88% of physicians felt that telehealth improved clinical outcomes and work efficiency • 30% of physicians using remote patient monitoring

UPMC, University of Pittsburgh Medical Center; AMA, American Medical Association; PCP, primary care physician.

Table 4 Health system outcomes: healthcare utilization

Title	Research design	Time of study	Number of visits/patients	Patient cohort	Findings
Trends in Outpatient Care and Use of Telemedicine After Hospital Discharge in a Large Commercially Insured Population	Retrospective review of multi-payer claims data	1/19–12/20	70 million patients; 1.6 million hospital discharges	Commercially insured and Medicare advantage enrollees age 50 and older discharged during study period	• Mean number of in-person visits went from 2.94 in 2019 to 2.35 in 2020 • Telehealth visits increased from 0.02 in 2019 to 0.70 in 2020 • The percentage of patients completing a post-discharge visit remained stable around 70%
An evaluation of telehealth use by Medicare beneficiaries in 2020	Retrospective review of Medicare claims data	1/19–12/20	~4.5 million monthly E&M services	20% random sample of fee-for-service Medicare beneficiaries	• Telehealth services made up 0.2% of all outpatient E&M services in February 2020 • Telehealth peaked at 51% in April 2020 • Total number of monthly telehealth and in-person services in 2020 did not exceeded the median monthly E&M services in 2019
Trends in telehealth use by Medicare fee-for-service beneficiaries and its impact on overall volume of healthcare services	Retrospective review of Medicare claims data	1/19–12/21	255–289 million E&M services	20% random sample of fee-for-service Medicare beneficiaries	• Total number of all outpatient E&M services was 289.0 million in 2019, 255.2 million in 2020, and 260.7 million in 2021 • From April 2020 through December 2021, the monthly volume of telehealth services slowly declined and plateaued between 8.5–9.5% of all outpatient E&M services
The impact of expanded telehealth availability on primary care utilization	Retrospective review across 3 health systems	1/19–12/21	4,114,000 encounters; 939,000 patients without	Completed in-person or telehealth appointments for primary care	• Mean number of encounters from 2019 to 2021 for all patients were 2.30, 2.26, and 2.27 visits per year • Mean number of encounters for commercial insurance were 1.99, 1.99, and 2.01 visits per year • Mean number of encounters for Medicaid insurance were 2.53, 2.58, and 2.57 visits per year • Mean number of encounters for Medicare insurance were 3.01, 2.83, and 2.83 visits per year
Telehealth Visits Unlikely to Require In-Person Follow-Up Within 90 Days	Retrospective review of EMR data	3/20–5/22	35 million telehealth encounters across 180 health systems	Completed telehealth (synchronous and synchronous) visits across all specialties with >50,000 encounters	• Of 33 specialties included, only geriatrics, fertility, and OB/GYN required an in-person appointment in 3 months more than 50% of the time • Return for in-person care at 3 months was 92% for OB/GYN, 54% fertility, and 47% for geriatrics • For these 3 specialties, review of in-person encounters found that visits required in-office test, procedure or exam

E&M, evaluation & management; EMR, electronic medical record; OB/GYN, obstetrics & gynecology.

Table 5 Health system outcomes: clinical efficiency

Title	Research design	Time of study	Number of visits/patients	Patient cohort	Findings
Telemedicine versus in-Person Primary Care: Impact on Visit Completion Rate in a Rural Appalachian Population	Retrospective cohort study	1/19–11/20	13,000 telehealth visits	Patients seen in person, video, or phone visit at WVU family medicine outpatient clinics	• 90% visits were with established patients • Rural patients who used telehealth had 20% higher completion rates • Use of telehealth was associated with higher completion rates for older patients with more comorbidities based on LACE index score
Telemedicine Associated with Decreased No-Show Visits among Surgical Specialties	Retrospective cohort	3/20–12/20	553,400 patient visits	Telehealth cohort compared to contemporary cohort (3/20–12/20 in-person) and historical cohort (1/18–3/20, in-person) at UAB surgical specialties	• No show rate for in-person appointments was 11.7% • Telehealth visits, including video and audio, had no-show rate of 2.5% • Male gender, black or Asian self-identification, Medicaid insurance, and higher social vulnerability index were associated with higher no show rates • Telehealth was associated with 79% reduction in odds of no-show
Clinical Outcomes and Hospital Utilization Among Patients Undergoing Bariatric Surgery With Telemedicine Preoperative Care	Retrospective cohort	7/20–12/21	1,180 patients	Telehealth new patient evaluations compared to historical cohort of in-person new patient surgical evaluation	• Operating room delay was mean 7.8 min (SD 25.1; 95% CI: 5.1 to 10.5) for control cases compared to 4.2 min (SD 11.1; 95% CI: 1.0 to 7.4; P=0.002) for those evaluated with telehealth • Procedure duration was mean 134.4 min (SD 52.8; 95% CI: 130.9 to 137.8) *vs.* 105.3 min (SD 41.5; 95% CI: 100.2 to 110.4; P<0.001; margin of inferiority set to 45 min) for telehealth evaluations • Length of hospital stay with mean 1.9 days (SD 1.1; 95% CI: 1.8 to 1.9) for in-person eval *vs.* 2.1 days (SD 1.0; 95% CI: 1.9 to 2.2; P<0.001; margin of inferiority set to 1 day) for telehealth visit
The Lack of a Physical Exam During New Patient Telehealth Visits Does Not Impact Plans for Office and Operating Room Procedures	Retrospective review	3/20–5/20	590 patients	Telehealth new, outpatient evaluations	• 195 (33%) were evaluated by new patient video visits and had a procedure or surgery scheduled • 186 (95%) plans were concordant with telehealth evaluation • Days between video visit and in-person evaluation did not differ significantly in concordant cases (median 37.5; IQR, 16–80.5) as compared to discordant cases (median 58.0; IQR, 20–224; P=0.12)

WVU, West Virginia University; LACE, acronym for L—length patient stay in the hospital, A—acuity of admission of patient in the hospital, C—comorbidity and E—emergency visit; UAB, University of Alabama at Birmingham; SD, standard deviation; CI, confidence interval; IQR, interquartile range.

In a similar analysis, but focused on Medicare claims data, researchers evaluated outpatient evaluation and management (E&M; term for clinical encounters) visits between January 2019 and December 2020 across the country (32). The researchers found that telehealth use surged during the early months of the coronavirus pandemic and then plateaued through the end of December 2020. Telehealth services made up 0.2% of all outpatient E&M services in February 2020 and reached a peak of 50.7% in April 2020. From July 2020 through December 2020, monthly rates of telehealth ranged from 13.5% to 18.3%. During the study period, the combined number of monthly telehealth and in-person services in 2020 did not exceed the median number of monthly E&M services in 2019, suggesting that telehealth had been used primarily as a substitute for in-person care in the early stages of the pandemic.

With extension of the PHE, further analysis of Medicare claims data through end of December 2021 was possible (33). The total number of all outpatient E&M services was 289.0 million in 2019, 255.2 million in 2020 (11.7% lower than 2019), and 260.7 million in 2021 (9.8% lower than 2019). Monthly telehealth services peaked at 7.2 million (or 50.7% of monthly E&M services) in April 2020, followed by a slow decline through the end of 2021. From April 2020 through December 2021, the monthly volume of telehealth services slowly declined and plateaued between 8.5–9.5% of all outpatient E&M services received by Medicare fee-for-service beneficiaries. Importantly, the total volume of outpatient E&M services was lower in 2020 and 2021, suggesting that the COVID-19 telehealth flexibilities have not increased the overall volume of outpatient E&M services received by Medicare beneficiaries.

Similar data has been highlighted across different types of insurance coverage. In a study of over 4.1 million primary care encounters and more than 930,000 patients across three major health systems between 2019 and 2021, there was no statistical difference in the number of visits per year, even as video and phone visits increased (34). The mean number of encounters from 2019 to 2021 for all patients was 2.30 (SD 1.91), 2.26 (SD 1.92), and 2.27 (SD 1.89). Furthermore, the number of average visits remained stable across different insurance groups—Medicare, Medicaid, Commercial, and other. In 2021, telehealth services leveled off at around 5 percent of all visits for primary care in this study.

Most recently, researchers looked at a large dataset of 35 million telehealth visits conducted between March 1, 2020, and May 31, 2022 at 180 hospitals and clinics using Epic EMR across all 50 states (35). In nearly every specialty studied, most patients who had a telehealth visit did not require an in-person follow-up appointment in that specialty in the next three months. Mental health and psychiatry had the largest volumes of telehealth utilization and some of the lowest rates of needing in-person follow-up. Only 15% of the time did a patient who had a psychiatry or mental health telehealth visit need an in-person follow-up visit in the next three months. The specialties with the highest rates of return in-person care were obstetrics (92%), fertility (54%), and geriatrics (47%); however, reviewing those encounters suggested that visits were related to needing additional care (such as an in-office test or procedure) as opposed to duplicative care.

Clinical efficiency

A retrospective cohort study on primary care patients at an academic center that serves a largely rural population sought to understand whether telehealth impacted ability of patients to follow-up with their doctors (36). Between January 2019 and November 2020, 110,999 total patient appointments were scheduled including 13,013 telehealth visits. Telehealth encounters included video and phone visits. The vast majority (89.5%) of all visits were with established patients. The authors found that rural patients who used telehealth had 20% higher completion rates. Importantly, the study suggests that patients with higher LACE index score [length of stay (L), acuity of the admission (A), comorbidity of the patient (C) and ED (E) use in the 6 months before admission, a readmission risk score (37)] were more likely to complete their visits when using telehealth compared to in-person follow-up. The authors highlight how patients with higher LACE scores had lower completion rates overall, but telehealth helped mitigate this difference compared to the rest of the cohort.

Other authors explored impact of telehealth on no-show rates in a surgical patient population. Telehealth visits at the University of Alabama Birmingham from March 2020 to December 2021 were compared to a historical control between 2018 and 2020 as well as in-person visits that took place during the same time period in the pandemic (38). There were 553,475 total visits, 11.3% of which were no-shows. The no-show rate was highest among in-person appointments (11.7%) compared to telehealth visits (2.5%). In a diverse patient cohort of patients receiving surgical care across various forms of health insurance, telehealth use was associated with a 79% reduction in patients missing their

clinical appointment.

In a cohort study of patients undergoing video telehealth pre-operative evaluation for bariatric surgery between July 2020 and December 2021, surgical efficiency measures were non-inferior when compared to a cohort of patients who had an in-person pre-operative visit (39). There was no difference between the control and telehealth groups with regards to operating room delay or time to operating room—the margin for inferiority was set to 10 min with mean 7.8 min (SD 25.1; 95% CI: 5.1 to 10.5) delay for control cases compared to 4.2 min (SD 11.1; 95% CI: 1.0 to 7.4; P<0.01) for those evaluated with telehealth. Similar results were noted for procedure duration (margin of inferiority set to 45 minutes with control mean 134.4 min, SD 52.8, 95% CI: 130.9 to 137.8 *vs.* 105.3 min, SD 41.5, 95% CI: 100.2 to 110.4, P<0.001), length of hospital stay (margin of inferiority set to 1 day with mean 1.9 days, SD 1.1, 95% CI: 1.8 to 1.9 *vs.* 2.1 days, SD 1.0, 95% CI: 1.9 to 2.2, P<0.001) for telehealth evaluations. The findings suggest that a virtual evaluation does not impact operating room and hospital metrics and efficiency.

In a retrospective review of 590 consecutive new patient telehealth evaluations of urologic conditions, researchers found that 99% of procedural plans and 91% of surgical plans developed during new-patient video visit remained unchanged after an in-person examination (40). Overall, 195 (33%) were evaluated by new patient video visits and had a procedure scheduled, of which, 186 (95%) had concordant plans after in-person evaluation. Days between video visit and in-person evaluation did not differ significantly in concordant cases [median 37.5; interquartile range (IQR), 16–80.5] as compared to discordant cases (median 58.0; IQR, 20–224; P=0.12). Of the four patients (2.1%) whose surgical plans had to change, two (1%) were due to additional imaging, and the remaining three (1.5%) were counseled that the surgical approach for treating their penile cancer would be finalized based on genitourinary examination findings in the pre-operative area.

No evidence of higher rates of fraud

While concern that the ease of use of telehealth could lead to abuse and fraud, the 2022 Office of the Inspector General report on Medicare telehealth program integrity found that only 0.23% of providers were identified as having billing practices that were flagged as high risk (41). Each of these 1,714 providers had concerning billing that may indicate fraud, waste, or abuse of telehealth services. For example, these providers may be billing for telehealth services that are not were never provided or at higher complexity than the care provided. In addition, more than half of the high-risk providers identified are a part of medical practices where multiple providers have been flagged as high risk to Medicare due to potential fraud, waste, or abuse. Of these 1,700 providers, only a small fraction (41 in total, ~2%) were associated with telehealth companies.

Clinical outcomes

The wide-spread adoption and use of telehealth allowed providers and researchers to compare telehealth models to their own previous practice patterns (*Table 6*). In a large Midwestern healthcare system, 8,263 unique patients with heart failure with 15,421 clinic visits were seen from March 15 to June 15, 2020 (42). Telehealth (video or phone) encounters made up 88.5% of visits in 2020 but 0% of their comparative cohort from 2018 to 2019. Despite the pandemic, more outpatients were seen in 2020 (n=5,224) versus 2018 and 2019 (n=5,099 per year). Using propensity matching, 4,541 telehealth visits in 2020 were compared with 4,541 in-person visits in 2018 and 2019, and groups were well-matched. Admissions to the ED were lower after the telehealth visits than after in-person visits at both 30 days (3.0% *vs.* 4.4%; P<0.01) and 90 days (8.5% *vs.* 11.2%; P<0.001). Admissions to the hospital were lower after the telehealth visits than after in-person visits at both 30 days (4.6% *vs.* 7.7%; P<0.001) and 90 days (12.9% *vs.* 16.6%; P<0.001 for both). Among hospitalized patients, there was no difference in ICU admissions between telehealth and in-person visits at either 30 (8.7% *vs.* 9.7%; P=0.44) or 90 days (24.5% *vs.* 22.4%; P=0.32). Similarly, there was no difference in mortality at either 30 (0.8% *vs.* 0.7%; P=0.47) or 90 days (2.9% *vs.* 2.4%; P=0.13).

Similar findings have been demonstrated in surgical patient populations. In a prospective, RCT of post-operative telehealth *vs.* in-person follow-up there was no difference in 30-day complications and readmission rates (25). This trial conducted between June and December 2021 recruited 165 patients undergoing urologic surgery of the 197 patients undergoing ambulatory surgery during the time period of the study. Most patients underwent an endoscopic surgery (n=108, 77.1%), compared to an open surgery (n=32, 22.9%). Of the patients in the telehealth arm, 4 (5.9%) had video visits and 64 (94.1%) had telephone visits. Rates of readmission were similar between the telehealth arm (n=6, 8.8%; P=0.92) and the in-person arm (n=6, 8.3%). None of the patients in the telehealth arm were requested for an in-

Table 6 Clinical outcomes

Title	Research design	Time of study	Number of visits/patients	Patient cohort	Findings
Outpatient Management of Heart Failure During the COVID-19 Pandemic After Adoption of a Telehealth Model	Retrospective propensity-matched analysis	3/20–6/20	8,263 patients with heart failure; 15,421 clinic visits	Large Midwestern health care system of 16 cardiology clinics, 16 EDs, and 12 hospitals	• Fewer ED visits after the telehealth visits than after in-person visits at both 30 days (3.0% *vs.* 4.4%; P=0.001) and 90 days (8.5% *vs.* 11.2%; P<0.001) • Fewer hospital admissions after telehealth visits than after in-person visits at 30 days (4.6% *vs.* 7.7%; P<0.001) and 90 days (12.9% *vs.* 16.6%; P<0.001) • No difference in mortality at 30 days (0.8% *vs.* 0.7%; P=0.465) or 90 days (2.9% *vs.* 2.4%; P=0.133)
Comparison of Patient Satisfaction and Safety Outcomes for Postoperative Telemedicine vs Face-to-Face Visits in Urology: Results of the Randomized Evaluation and Metrics Observing Telemedicine Efficacy (REMOTE) Trial	Prospective, randomized controlled trial	6/21–12/21	165 patients undergoing urologic surgery	Surgical patients, single institution	• Of patients in the telehealth arm, 4 (5.9%) had video visits and 64 (94.1%) had telephone visits • Rates of readmission were similar between the telehealth arm (8.8%) and the in-person arm (8.3%; P=0.92) • No patients in the telehealth arm were requested for an in-person follow-up by their surgeon after their telehealth visit
Clinical Outcomes and Hospital Utilization Among Patients Undergoing Bariatric Surgery With Telemedicine Preoperative Care	Retrospective, cohort study	7/20–12/21	257 bariatric surgery patients; 925 historical control patients	Bariatric surgery patients undergoing preoperative evaluation; historical cohort patients between 2018 and 2019	• Video telehealth pre-operative visits for bariatric surgery were non-inferior compared to in-person ones in terms of clinical outcomes • Major adverse events within 30 days: control (3.8%) *vs.* telehealth 1.6% (95% CI: 0.4% to 3.9%; P=0.001) • Major adverse events between 31 and 60 days: control (2.2%) *vs.* telehealth (1.6%; P<0.001) • Frequency of emergency room visits within 30 days: control (18.8%) *vs.* telehealth (17.9%; P=0.03) • Hospital readmissions within 30 days: control (10.1%) *vs.* telehealth (6.6%; P=0.02)

ED, emergency department; CI, confidence interval.

person follow-up by their surgeon after the initial telehealth encounter. When evaluating 30-day complication rates, the in-person arm had higher rates of culture-confirmed urinary tract infections following postoperative visits (12.5% *vs.* 4.4% for telehealth), however the results were not statistically significant (P=0.09). One patient (1.5%; P=0.3) in the in-person follow-up arm developed a wound infection, and there was no difference in post-operative urinary retention.

In a cohort study of patients undergoing video telehealth pre-operative evaluation for bariatric surgery between July 2020 and December 2021, clinical outcomes were non-inferior when compared to a cohort of patients who had an in-person pre-operative visit (39). Two hundred and fifty-seven patients had a telehealth evaluation and this was compared to historical cohort of 925 patients between 2018 and 2019. There was no difference between the in-person control group and telehealth groups with major adverse events within 30 days (control 3.8%, 95% CI: 3.0% to 5.7% *vs.* telehealth 1.6%, 95% CI: 0.4% to 3.9%; P<0.01), major adverse events between 31 and 60 days (2.2%, 95% CI: 1.3% to 3.3% *vs.* telehealth 1.6%, 95% CI: 0.4% to 3.9%, P<0.001), frequency of emergency room visits (18.8%, 95% CI: 16.3% to 21.4% *vs.* telehealth 17.9%, 95% CI: 13.2% to 22.6%, P<0.05), or hospital readmission (10.1%, 95% CI: 8.1% to 12.0% *vs.* telehealth 6.6%, 95% CI: 3.9% to 10.4%, P<0.05). In addition to previously highlighted similarity in intra-operative and post-operative clinical efficiency measures, the clinical outcomes were equivalent across the group evaluated via telehealth.

RPM

In addition to synchronous telehealth, there has been a massive expansion in the use of RPM services. Driven by lock-down orders and efforts to minimize exposures to COVID-19, RPM was leveraged to monitor patients from their homes or, at least, outside the hospital setting.

In a Mayo Clinic retrospective study of patients with COVID-19 at high risk of for severe disease, those who used the RPM program had lower hospitalization, ICU admission and mortality rates (43). In this RPM program, patients were provided with cellular-enabled tablet; preconnected, Bluetooth-enabled, medical grade devices (blood pressure cuff, pulse oximeter, and scale); and a thermometer for self-reported temperature to provide twice daily symptom reporting along with vital signs. Among 5,796 RPM-enrolled patients, 80.0% engaged with the technology. Following matching, 1,128 pairs of RPM-engaged and non-engaged patients comprised the analysis cohorts. Mean patient age was 63.3 years, 50.9% of patients were female, and 81.9% were non-Hispanic White. Patients who were RPM-engaged experienced significantly lower rates of 30-day, all-cause hospitalization (13.7% *vs.* 18.0%, P<0.05), prolonged hospitalization (3.5% *vs.* 6.7%, P<0.01), ICU admission (2.3% *vs.* 4.2%, P<0.05), and mortality (0.5% *vs.* 1.7%; odds ratio =0.31; P<0.05). Cost of care (USD $2,306.33 *vs.* USD $3,565.97, P<0.05), was also lower for those who used RPM.

However, which patient populations will benefit the most form RPM tools remains to be seen. A different team of researchers from Mayo conducted a RCT of RPM use after surgery between April and December 2021 (44). A total of 292 patients participated and 147 were randomized to RPM monitoring post-operatively. The patients randomized to RPM were given a digital tablet and digital blood pressure cuff, thermometer, weight scale, and pulse oximeter. They answered a survey on questions related to post-operative complications along with submitting vital signs and if there was a concern, they received a nursing phone call. There were no differences in the readmission rate (RPM: 19.7% *vs.* no RPM: 20.7%; P=0.84) or ED visits (RPM: 6.8% *vs.* no RPM: 7.6%, P=0.80). There were also no differences in secondary outcomes including deep vein thrombosis, pulmonary embolism, heart attack, cerebrovascular accident, pneumonia, urinary tract infection, or surgical site infection.

Health equity: differences in use not driven by clinical factors

As different forms of telehealth were evaluated, it became clear that geography and socioeconomic factors may impact what kind of telehealth is used by patients (*Table* 7).

Rurality impacts use of telehealth

When evaluating a national sample of Medicare beneficiaries, Ellimoottil *et al.* found that rural beneficiaries used telehealth services less than their non-rural counterparts (32). While 44% percent of all Medicare beneficiaries received at least one telehealth service in 2020, only 34% of rural residents used telehealth compared to 47% who lived in non-rural zip codes. This difference in rates of telehealth use was corroborated by an analysis of rural and urban safety-net clinics. In a cohort study comparing post-COVID-19 telehealth use to care delivered between 2019 and March 2020, telehealth use in urban areas rose by 52.3% while patients in rural areas only had a

Table 7 Health equity: the digital divide

Title	Research design	Time of study	Number of visits/patients	Patient cohort	Findings
An evaluation of telehealth use by Medicare beneficiaries in 2020	Retrospective review of Medicare claims data	1/19–12/20	~4.5 million monthly E&M services	20% random sample of fee-for-service Medicare beneficiaries	• 44% percent of all Medicare beneficiaries received at least one telehealth service in 2020 • 34% of rural residents used telehealth compared to 47% who lived in non-rural zip codes
During Pandemic Telemedicine Use: An Analysis of Rural and Urban Safety-Net Clinics	Retrospective review	3/19–3/21	1,016,000 patients	Adult patients who completed at least one telehealth clinic in a safety-net clinic	• Telehealth use in urban areas rose by 52.3% • Patients in rural areas only had a 27.2% increase in use of telehealth
Telehealth Use Among Safety-Net Organizations in California During the COVID-19 Pandemic	Retrospective review	2/19–8/20	1,700,000 patients	Adult patients seen in California federally qualified health centers	• For primary care, 48.1% of visits were in person, 48.5% through telephone and 3.4% via video • For behavioral health, 22.8% of visits were in person, 63.3% through telephone, and 13.9% via video
OIG 2022 Telehealth Databrief	Retrospective review of Medicare data	1/20–2/21	28 million patients	Medicare patients who used telehealth	• 45% of urban beneficiaries used telehealth • 33% of rural beneficiaries used telehealth • 12.7 million beneficiaries (19%) used audio-only telehealth services • Patients with lower socioeconomic status and Hispanic beneficiaries were more likely to use audio-only services
Predictors of Audio-Only Versus Video Telehealth Visits During the COVID-19 Pandemic	Retrospective review	4/20–6/20	104,200 patients	Patients at University of Michigan Health system who had at least one telehealth visit	• 45.4% received care through phone visits only • Older age decreased odds of video telehealth use by 7% for every 10 years of age increase • African American race decreased odds of video telehealth use by 10% • Need for an interpreter decreased odds of video telehealth use by 19% • Medicaid as primary insurance decreased video telehealth use by 12% • Living in a zip code with low broadband access decreased odds of video telehealth by 7%
Rapid Transition to Telehealth and the Digital Divide: Implications for Primary Care Access and Equity in a Post-COVID Era	Provider survey	4/20–6/20	1,100 providers	Primary care providers in New York	• 62.2% of providers indicated that most of their services were provided through telehealth during early stages of pandemic • In high social vulnerability index areas, 42% of providers delivered most patient care through telephone services • In low social vulnerability index areas, 24% of providers delivered most patient care through telephone services

Table 7 (*continued*)

Table 7 (*continued*)

Title	Research design	Time of study	Number of visits/patients	Patient cohort	Findings
National Survey Trends in Telehealth Use in 2021: Disparities in Utilization and Audio vs. Video Services	Patient survey	4/21–10/21	808,000 patients	Patients who responded to Census Bureau's Household Pulse Survey	• Telehealth use rates were ranged from 21% to 27% among most demographic subgroups • Rates were much lower among those who were uninsured (9.4%) • Video telehealth rates were lowest among those without a high school diploma (38.1%), adults ages 65 and older (43.5%), and Latino (50.7%), Asian (51.3%) and Black individuals (53.6%)
Association of Adequacy of Broadband Internet Service With Access to Primary Care in the Veterans Health Administration Before and During the COVID-19 Pandemic	Retrospective review	3/20–6/21	6,996,000 veterans	All veterans with outpatient appointment in VHA	• In second quarter of 2020, 1,750,000 primary care telephone encounters took place compared to around 150,000 video encounters • By the second quarter of 2021, telephone encounters dropped to 1,100,000 visits but video visits slowly rose to 200,000 • Patients in areas where broadband speed was classified as inadequate (<25 MB/s) had lowest increase in video visit use throughout the study period

E&M, evaluation & management; OIG, Office of Inspector General; VHA, Veterans Health Administration; MB/s, megabytes per second.

27.2% increase in use of telehealth (45).

Data from federally qualified health centers (FQHCs), which provide comprehensive primary care to low-income individuals, revealed that the transition to telehealth early in the pandemic sustained similar number of patient encounters per month, ensuring access to primary and behavioral health. Between March and August of 2020, FQHCs in California had high rates of audio-only or telephone visits to ensure continuity of care (46). In the primary care setting, 48.1% of visits were in person, 48.5% through telephone and 3.4% via video. For behavioral health, 22.8% of visits were in person, 63.3% through telephone, and 13.9% via video. This same trend was highlighted in the Office of the Inspector General 2022 telehealth data brief, expanding on the 2020 data evaluated by Ellimoottil *et al.*, the trend persisted with 45% of urban beneficiaries using telehealth and only 33% of those in rural areas using these services (47).

Socioeconomic and demographic factors correlate with audio-only telehealth

Early in the pandemic, researchers at the University of Michigan identified factors that predicted which patient populations used audio-only instead of video visits (12). Between April and June 2020, a total of 104,204 patients across all specialties and insurance coverage had at least one telehealth visit and 45.4% received care through phone visits only. The authors several demographic characteristics associated with lower probability of using video visits. Furthermore, they quantified the impact of these variables using average marginal effects instead of odds ratios which shows the percent impact on probability of using video-telehealth by each unit change in the variables studied. Ultimately, they highlighted that age [average marginal effect (AME): −6.9% for every 10 years of age increase, 95% CI: −7.8% to −4.5%], African American race (AME: −10.2%, 95% CI: −11.4% to −7.6%), need for an interpreter (AME: −19.3%, 95% CI: −21.8% to −14.4%), Medicaid as primary insurance (AME: −12.1%, 95% CI: −13.7% to −9.0%), and living in a zip code with low broadband access (AME: −7.2%, 95% CI: −8.1% to −4.8%) were all associated with lower rates of video telehealth use.

In a New York study of small, primary care practices, social vulnerability index (SVI) was associated with type of telehealth use between April and June 2020 (48). The SVI was developed by the Center for Disease Control to identify communities who could benefit from support after "natural or human caused disaster including disease

outbreaks" (49). The index incorporates information on poverty status, unemployment, income, education, percent elderly, minority status, language and a few other variables collected from the American Community Survey. Overall, 62.2% of providers indicated that most of their services were provided through telehealth, including 64.7% of providers in high-SVI areas and 60.2% of providers in low-SVI areas. In high-SVI areas, 41.7% of providers delivered most patient care through telephone services, as compared with 23.8% of providers in low-SVI areas (P<0.001). The opposite was true for telehealth through video: 18.7% of providers in high-SVI areas used it for most patient care *vs.* 33.7% of providers in low-SVI areas (P<0.001). Based on SVI, providers in high-SVI areas were nearly twice as likely than counterparts in low-SVI communities to rely on telephone as their primary mode of telehealth delivery and only half as likely to rely on video-based telehealth services.

Nationwide data from the U.S. Census Bureau's Household Pulse Survey showed differences in telehealth use based on sociodemographic factors and type of insurance coverage (50). Between April and October 2021, over 800,000 adults responded to the survey. Telehealth use rates were similar (21.1–26.8%) among most demographic subgroups but were much lower among those who were uninsured (9.4%) and young adults ages 18 to 24 (17.6%). Among telehealth users, the highest share of visits that utilized video services occurred among young adults ages 18 to 24 (72.5%), those earning at least $100,000 (68.8%), those with private insurance (65.9%), and White individuals (61.9%). Video telehealth rates were lowest among those without a high school diploma (38.1%), adults ages 65 and older (43.5%), and Latino (50.7%), Asian (51.3%) and Black individuals (53.6%)

Interestingly, differences in use of audio-only and video visits were noted even in the Veterans Health organization which has for years been using telehealth services to connect veterans with their providers. When comparing post-pandemic telehealth use between March 2020 and June 2021 to visits before February 2020, patients living in areas with poor broadband speed were less likely to use video telehealth after the onset of the COVID-19 pandemic (51). In second quarter of 2020, as in-person visits plummeted, approximately 1,750,000 primary care telephone encounters took place compared to around 150,000 video encounters. By the second quarter of 2021, as more patients returned to in-person care, telephone encounters dropped to 1,100,000 visits but video visits slowly rose to 200,000. Patients in areas where broadband speed was classified as inadequate (<25 MB/s) had lowest increase in video visit use throughout the study period.

In the Office of the Inspector General 2022 telehealth data brief, 12.7 million beneficiaries (19%) used audio-only telehealth services, with most of these beneficiaries using these audio-only services exclusively (47). Older beneficiaries were more likely to use these audio-only services with 23 percent of beneficiaries 75 and older used audio-only services, compared to 21 percent of beneficiaries under 65. In addition to older patients, those with lower socioeconomic status and Hispanic beneficiaries were more likely to use audio-only services highlighting that video-only telehealth may not be an option for all patients.

Discussion

The PHE declaration removed regulatory and reimbursement barriers that allowed for telehealth to be used in new ways to connect patients and providers. Post-pandemic telehealth allowed patients to seek out new providers or specialty care. Medicare patients could use telehealth from the comfort of their own homes. Phone and video visits were reimbursed at similar rates, based on complexity of medical decision making or time spent counseling patients. All of this has allowed researchers to gather data that was not available before COVID-19.

Patient experience

Even prior to the March 2020, researchers have highlighted how synchronous, video telehealth has high rates of patient satisfaction with increased convenience due to reduced travel time and expenses. Patient satisfaction with video visits has ranged from 88% in a RCT of patients after prostatectomy (52) to 95–97% of veterans who received sub-specialty care through video conferencing at their local Veterans Affairs primary care clinic prior to March 2020 (53). Despite high satisfaction rates, qualitative studies highlight that up to 20% patients experienced technical issues during their video visits which can contribute to negative experiences with the technology (54,55). A study of 600 patients who had follow-up care using video visits at the University of Michigan, patients who used telehealth would have traveled significantly further for care (82 *vs.* 68 miles, P<0.001) compared to a random cohort of patients that were seen by the same clinicians for the same clinical condition (9). The same group found that patients only required 24 minutes for

telehealth, with the majority of that time spent with a physician or provider, compared to 80 minutes at an in-person clinic for the same types of appointments (56).

In our review of the recent literature since the COVID-19 pandemic, we found that patient satisfaction rates remain high and range from 78% to 94% despite substantial and wide-spread increase in the use of telehealth (23,25). Satisfaction rates are also high with audio-only or telephone visits at 85% (24) and not all patients may be able to engage in video encounters. Across the medical and surgical literature, the potential for cost savings is estimated to range from $48 to over $252 when calculating travel costs and lost wages from having to take time off work for an in-person appointment (25,26,57). Not surprisingly, patients who used telehealth reduced travel distances, travel time, and time spent at an appointment. However, for the first time researchers have been able to demonstrate that new patients who used telehealth to seek care had saved more money and time than patients using telehealth for follow-up visits (26).

Clinician experience

It has been crucial for researchers to understand physician and provider perspectives surrounding telehealth. Multiple surveys since March 2020 have highlighted both increased adoption and use of telehealth with high satisfaction rates. However, it is important to researchers and clinicians to continue to evaluate how telehealth use impacts the experience of clinicians. As part of the evaluation of physician burnout, researchers have found that increased messages and alerts as well as time spent on the EMR is associated with burnout (58).

In the early months of the pandemic, a retrospective study of over 2,000 physicians in New York found that those who used telehealth more seemed to spend more time on the EMR to complete documentation after-hours (59). If this trend persists or is not mitigated, it will negatively impact physician experiences with telehealth. This could be a barrier to universal adoption or could contribute to physician burnout and dissatisfaction.

Health system outcomes

Researchers have explored impact of telehealth use on efficiency and cost primarily through retrospective studies at the institutional, payer, or claims level. Prior to the pandemic, regulatory barriers existed to limit broader use of telehealth due to concerns that easy access to care through telehealth would result in higher utilization of health services. Major studies evaluating anywhere from thousands to millions of telehealth encounters have consistently shown that telehealth served as a substitute for in-person care when it was provided by physicians and providers affiliated with a "brick and mortar" health systems. It is important to highlight that DTC telehealth data is mixed. In 2017, Ashwood *et al.* found that DTC telehealth replaced visits to other providers in only 12% of cases and otherwise represented new use of healthcare services (60). In 2021, this was also demonstrated by researchers who evaluated DTC telehealth for the management of acute respiratory infections found that DTC-users had higher rates of repeat visits compared to patients seen in-person (61). On the other hand, McKinsey and company claims-based analysis estimated that approximately 20 percent of all emergency room visits could potentially be avoided via virtual care offerings and 24 percent of healthcare office visits and outpatient volume could be delivered virtually (62). Given private payers interest in reducing healthcare cost and utilization, it remains important to continue evaluating which diagnoses and treatments are suitable for DTC telehealth. In an ideal telehealth environment, DTC use would be available and reimbursed when cost-efficient or when access to care is a challenge while establishing a channel for referral or access to local physicians when a physical exam, emergency evaluation, or surgical intervention is necessary.

The potential for improved clinical efficiency resulting in more patients seen by providers and health systems is supported by recent papers highlighted in this review. In health systems serving largely rural populations or diverse patient populations, completion rates are higher especially for patients with higher comorbid conditions and no-show rates are lower compared to in-person care (37,38). For surgeons, this review highlights one of the only studies that shows that pre-operative evaluations for surgery are non-inferior to in-person, pre-operative visits (39). While this paper was focused on a cohort of patients undergoing bariatric surgery, there have been other studies highlighting that telehealth can be used for new patient surgical evaluations. In both urologic and orthopedic literature, 94–95% of surgical plans developed during new-patient telehealth visit did not change after an in-person examination (40,63). This data supports the notion that surgical and subspecialty care can be delivered to patients regardless of geographic constrictions.

Importantly, while patient satisfaction remains high across disciplines this has also been demonstrated with high

Press Ganey scores, which have been used for evaluating value-based care since the signing of the Affordable Care Act (64). Finally, with any application of digital technology to healthcare, concerns exist regarding the potential for fraud or abuse. The 2022 OIG report found only 0.23% providers were flagged as being high risk in their Medicare billing practices for telehealth (41). For reference, in 2015 ProPublica examined provider billing patterns for Medicare and 1,825 health professionals had high risk billing practices that could represent fraud or abuse/neglect (65). Given that in 2015 there were 665,772 providers (66), the 2022 OIG rate of concerning billing for telehealth (0.23%) is lower than the 0.27% of providers deemed high risk in 2015.

Clinical outcomes

Prior to the March of 2020, there have been few RCTs outside of the behavioral health and mobile health app space assessing clinical outcomes in medical and surgical populations. In 2019, researchers found that telehealth visits resulted in equivalent Hemoglobin A1c control in patients with type 1 diabetes compared to face-to-face visits (67). A randomized control trial for patients undergoing robotic prostatectomy provided feasibility data by emphasizing high patient satisfaction and improved convenience of video visits, but did not compare clinical data on post-operative outcomes or complications (52).

This review builds on pre-pandemic work by highlighting a recent RCT and other real-world use studies that have compared telehealth cohorts with patients seeking in-person care for the same conditions or diagnoses. In 2021, researchers randomized patients undergoing urologic surgeries to telehealth and in-person follow-up. This study found there was no difference in 30-day readmissions or complications, highlighting the safety of post-surgical telehealth care (25). Despite a transition to telehealth to ensure continued access to care due to COVID-19 pandemic precautions, multiple studies in medical and surgical populations demonstrated similar or better outcomes with regard to emergency room evaluations, re-admissions, and 30-day hospitalization rates (25,42).

While most studies on clinical outcomes focused on synchronous telehealth use, there have been some RPM studies with promising results. In 2018, a meta-analysis of RPM RCTs found that is evidence supporting improved outcomes for patients with select conditions, including obstructive pulmonary disease, Parkinson's disease, hypertension, and low back pain (68). In the PHE-era, RPM studies continue to show mixed results with improved outcomes for acute care of COVID-19 patients but no difference in post-operative care (43,44). As RPM use and adoption continues to increase, ongoing evaluations will be necessary to determine for which patients and conditions can RPM improve outcomes while understanding the implications on costs of care.

Diversity, equity, and inclusion: the digital divide

The term digital divide has garnered attention through the pandemic as different forms of synchronous telehealth were used by different patient populations. The term refers to how a focus on video-only telehealth could result in new health inequities driven by lack of access to broadband internet and smart devices (69). COVID-19 itself helped highlight existing disparities in the United States healthcare system with Black, Hispanic, and Native Americans testing positive for and dying of COVID-19 at a higher rate than other racial and ethnic groups (70). Beyond this, researchers across the country repeatedly found that socioeconomic and demographic characteristics, rather than clinical factors, were predictive of whether patients used video or audio-only (phone) visits to connect with clinicians (12,41,48,50,51,71). Notably, across studies that looked at rural or diverse patient cohorts, rates of audio-only telehealth use were much higher than the 30% of visits that Center for Medicare & Medicaid Services (CMS) estimated were audio-only during the first years of the pandemic (72). This serves to highlight that relying on video visits for telehealth alone may result in worsening access to care across different patient populations.

One question that remains unanswered is whether higher rates of phone visits are due to limited access to broadband Internet or smart devices, or whether patient preference plays a large role, or both. In a RCT evaluating satisfaction with video and audio telehealth, researchers found that phone visit satisfaction was slightly higher than that of video encounters (24). This study was in older patients with Medicare and younger patients with Medicaid who tend to have a lower socioeconomic status than the general United States population. This finding supports the idea that certain patient populations may be more comfortable connecting with their physicians through a phone call rather than a video encounter. However, a 2022 survey of Medicaid managed care plans found that 90% of patients identified broadband access, smart devices, or computer literacy as the primary barrier to using telehealth. Finally, other authors have identified language and need for a translator, telehealth

requiring the use of a patient portal, and lack of comfort with technology as barriers to relying on video-telehealth only (48). For synchronous telehealth, video or phone visits serve as a mechanism for clinicians to evaluate and manage conditions. Restricting or incentivizing only one of these modalities will result in unintended and unexpected inequities in access to care—ranging from primary care to specialty and surgical care.

Health policy

In the United States, the regulatory and reimbursement changes that promoted telehealth adoption took place at the state and national level. Statewide policies primarily impact Medicaid and private payer coverage for patients. Over the course of the pandemic, 22 states changed laws or policies to require more robust insurance coverage of telehealth. States focused on three key areas: requiring coverage of audio-only services, waiving cost-sharing or requiring cost-sharing no higher than identical in-person services, and requiring reimbursement parity between telehealth and in-person services (73). In addition, the ability to deliver telehealth across state lines was temporarily facilitated by state-specific emergency declarations (8). At the height of the pandemic, out-of-state telehealth made up small share of outpatient visits (0.8%) and of all telehealth visits (5%); the majority of telehealth delivered across state lines was for continuity of care with established patient-physician relationships (74). As statewide emergency declarations have been reversed, individual states are actively deciding which telehealth policies to focus on.

At the national level, the most recent and important telehealth update came with the signing of the 2023 Omnibus bill. Signed on December 29, 2022 by President Biden, the FY2023 Omnibus Appropriations Bill (H.R. 2617) includes a 2-year extension of widely supported Medicare telehealth services as well commercial market flexibilities that Congress enacted at the start of the pandemic (75,76). This extension will provide certainty to beneficiaries and healthcare providers, along with continued access to these critical telehealth services, while encouraging researchers to continue studying the impact of telehealth on patients, providers, and health systems.

Limitations

This narrative review provides an overview of data that has emerged within the cultural, economic, and health policy context of the United States after the COVID-19 pandemic. It resulted in nationwide changes in telehealth regulation and reimbursement. Given that the studies analyzed were from the United States, there is limited generalization to other countries. There is also limited generalizability to health care delivery settings beyond outpatient care, such as EDs, inpatient units, and ICUs. Furthermore, the papers compiled and analyzed look at very heterogenous patient populations with varying conditions, demographics, comorbidities, and even telehealth modalities. Most notably, as a narrative review as opposed to a systematic review or meta-analysis, it is beyond the scope of this analysis to evaluate the strengths and weaknesses of each individual study referenced. However, this study provides a starting place for clinicians, researchers, and policymakers to understand and evaluate existing data that emerged due to changes imposed by the COVID-19 PHE in the United States.

Conclusions

These limitations notwithstanding, the research highlighted in this narrative review has direct implications for all key stakeholders using telehealth now and beyond the COVID-19 pandemic. Given that telehealth is a tool for physicians to provide care to patients, the outcomes of the studies included in this narrative review should be used to design additional research to understand whether similar patient, physician, health system or clinical outcomes can be achieved across different specialties and geographies within and outside the United States.

For patients, the data shows that their peers have high satisfaction rates while saving time and money. For clinicians, new patient telehealth evaluations and equal reimbursement for phone visits has to potential to improve access to equitable care, regardless of socioeconomic status or geography, and not just continuity of care as was the case prior to the pandemic. The data also highlights that if an in-person exam, intervention, or surgery is not needed, the medical decision making based on the clinician's judgement suggests there is no difference in clinical outcomes. For healthcare leaders and administrators, this review highlights how telehealth integrated with existing health systems acts as a substitute for in-person care with the potential to maintain or improving clinical efficiency. Finally, and arguably the most important group, this data is very important to policymakers. In the coming months and years, health policy decisions surrounding telehealth will dictate

what the future of telehealth will look like in the United States. Given that the largest barriers to continued use and adoption of telehealth are regulation and reimbursement, it is critical for clinicians, health systems, and researchers to continue analyze the impact of telehealth on patient care to craft permanent health policy changes based on real-world experiences.

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