




Changes in telemedicine use and ambulatory visit volumes at a multispecialty cardiovascular center during the COVID-19 pandemic

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Abstract

Early in the COVID-19 pandemic, cardiology clinics rapidly implemented telemedicine to maintain access to care. Little is known about subsequent trends in telemedicine use and visit volumes across cardiology subspecialties. We conducted a retrospective cohort study including all patients with ambulatory visits at a multispecialty cardiovascular center in Northern California from March 2019 to February 2020 (pre-COVID) and March 2020 to February 2021 (COVID). Telemedicine use increased from 3.5% of visits (1200/33,976) during the pre-COVID period to 63.0% (21,251/33,706) during the COVID period. Visit volumes were below pre-COVID levels from March to May 2020 but exceeded pre-COVID levels after June 2020, including when local COVID-19 cases peaked. Telemedicine use was above 75% of visits in all cardiology subspecialties in April 2020 and stabilized at rates ranging from over 95% in electrophysiology to under 25% in heart transplant and vascular medicine. From June 2020 to February 2021, subspecialties delivering a greater percentage of visits through telemedicine experienced larger increases in new patient visits ($r=0.81$, $p=0.029$). Telemedicine can be used to deliver a significant proportion of outpatient cardiovascular care though utilization varies across subspecialties. Higher rates of telemedicine adoption may increase access to care in cardiology clinics.

Keywords

Telecardiology, telemedicine, telehealth, COVID-19, cardiovascular disease

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Introduction

The COVID-19 pandemic transformed healthcare delivery. Early in the pandemic, primary care and specialty clinics rapidly switched from in-person to virtual care to minimize risks to patients and providers while maintaining access to care.^{1–4} In the United States, this transition was enabled by the U.S. Department of Health and Human Services and the Centers for Medicare & Medicaid Services, which took unprecedented policy actions to broaden access to telemedicine.⁵

Cardiovascular disease is the leading cause of death globally, and it is therefore critical to determine the impact of telemedicine implementation on cardiovascular care delivery.⁶ Previous studies have examined patterns of telemedicine use in cardiology practices during the first few months of the COVID-19 pandemic.^{7–10} Little is known about the persistence of telemedicine use in these practices and associated trends in visit volumes in the later phases of the

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pandemic.¹¹ In addition, there has been no analysis to date of differences in telemedicine use across cardiology subspecialties. An analysis of United States national data on outpatient visits suggested that as of December 2020, telemedicine use in cardiology was relatively low and visit volumes remained below pre-pandemic levels.¹² Further research is needed investigating the impact of telemedicine on access to care in cardiology practices, especially in light of the rise of more transmissible COVID-19 variants, which have prompted health systems to once again prioritize virtual care. A deeper understanding of telemedicine care patterns will also aid policy makers and healthcare administrators as they determine the role telemedicine should play in cardiovascular care delivery following the pandemic.¹³

In this retrospective cohort study, we examined visit volumes and telemedicine use across cardiology subspecialties over the first 12 months of the COVID-19 pandemic at an academic cardiovascular center, which sought to promote high levels of virtual visits.

Methods

Setting

Stanford Health Care (SHC) is an academic health system located in Northern California. Among its specialty clinics are the Heart and Vascular Clinics, which provide ambulatory services in multiple cardiology subspecialties, including adult congenital heart disease, electrophysiology, general/preventive cardiology, heart failure, heart transplant, interventional cardiology, and vascular medicine. Prior to the COVID-19 pandemic, nearly all outpatient visits in these clinics were in-person. CardioClick, a telemedicine program providing video follow-up visits in one preventive cardiology clinic, was implemented in 2017.¹⁴

On March 4, 2020, the governor of California declared a state of emergency due to the COVID-19 pandemic, and on March 16, 2020, Santa Clara County, where SHC is based, issued a shelter-in-place order. SHC clinics rapidly deployed telemedicine, including telephone and video visits, to allow for the continued delivery of outpatient services. To facilitate rapid scaling of video visits, mandatory trainings were created, which conveyed the key principles of conducting successful video visits. Providers could complete video visits from clinic workstations or from secure laptop computers. Patient access to video visits was enabled through the SHC MyHealth mobile application, which allowed visits to be completed from a personal smartphone, tablet, or computer workstation.

Analysis

We identified SHC cardiology providers, including physicians, nurse practitioners, and physician assistants, by

their primary subspecialty. We extracted visit-level data for these providers from the electronic health record for all outpatient visits from March 4, 2019, to February 29, 2020, (pre-COVID period) and March 4, 2020, to February 28, 2021 (COVID period).

Analyses and data visualizations were performed using Tableau Desktop (Version 2020.1.8, Tableau Software, LLC). Chi-squared tests were used to assess changes in proportions from the pre-COVID to COVID periods. A Pearson correlation coefficient was calculated to quantify the association between the percentage of telemedicine use for new patient visits and the change in new patient visit volumes across subspecialties from June 2020 to February 2021. This study was deemed exempt from review and informed consent as a quality improvement initiative by the Stanford Institutional Review Board. The dataset analyzed for this study includes protected health information that cannot be shared publicly, so supporting data are not available.

Results

There were 33,976 visits during the pre-COVID period and 33,706 visits during the COVID period. Telemedicine use increased from 3.5% of visits during the pre-COVID period to 63.0% during the COVID period. During the COVID period, 81.5% of telemedicine visits were delivered as video visits and 18.5% as telephone visits. New patient visits increased by 11.8% during the COVID period, and return patient visits decreased by 3.9%. The average number of visits per patient was stable, while the average number of visits per provider increased from 201 to 217 (Table 1).

New and return patient visit volumes during the COVID period were below pre-COVID levels from March through May 2020 but then exceeded pre-COVID levels after June 2020. Telemedicine use for new and return patient visits peaked in April 2020 at 96%–97% and stabilized at 60%–69% in the last 3 months of the study period (Figure 1).

Telemedicine use peaked above 75% of visits in all subspecialties and stabilized at rates ranging from over 95% of visits in electrophysiology to under 25% in heart transplant and vascular medicine (Figure 2A). Electrophysiology providers had the largest increase in visit volumes of 11.1% during the COVID period, while heart transplant and vascular medicine providers experienced decreases in visit volumes (Table 1). After visit volumes returned to historical levels in June 2020, there was a positive association between the percentage of new patient visits delivered through telemedicine and the change in new patient visit volumes compared to the previous year across subspecialties ($r=0.81$, $p=0.029$) (Figure 2B).

Table 1. Characteristics of cardiology clinics during the pre-COVID and COVID periods.

Characteristic	Pre-COVID period ^a	COVID period ^a	p value ^b
Total visits	33,976	33,706	
Unique patients, n (visits per patient)	19,032 (1.79)	18,888 (1.78)	
Total providers ^c , n (visits per provider)	169 (201)	155 (217)	
Attending cardiologists	66	71	
Visit type			<0.001
New patient visits, n (%)	6719 (19.8)	7509 (22.3)	
Return patient visits, n (%)	27,257 (80.2)	26,197 (77.7)	
Visit modality			<0.001
In-person visits, n (%)	32,776 (96.5)	12,455 (37.0)	
Telemedicine visits, n (%)	1200 (3.5)	21,251 (63.0)	
Video visits, n (% of telemedicine visits)	211 (17.6)	17,329 (81.5)	
Telephone visits, n (% of telemedicine visits)	989 (82.4)	3922 (18.5)	
Subspecialty visits			<0.001
Adult congenital heart disease, n (%)	2112 (6.2)	1806 (5.4)	
Electrophysiology, n (%)	5748 (16.9)	6385 (18.9)	
General/preventive cardiology, n (%)	12,169 (35.8)	11,879 (35.2)	
Heart failure, n (%)	7808 (23.0)	7970 (23.6)	
Heart transplant, n (%)	1417 (4.2)	1251 (3.7)	
Interventional cardiology, n (%)	3744 (11.0)	3529 (10.5)	
Vascular medicine, n (%)	978 (2.9)	886 (2.6)	

^aThe pre-COVID period was from March 4, 2019, to February 29, 2020, and the COVID period was from March 4, 2020, to February 28, 2021.

^bp values correspond to chi-squared statistics.

^cThe number of total providers includes attending physicians, trainees, and advanced practice providers.

Discussion

At this multispecialty cardiovascular center, telemedicine use was maintained at high levels during the COVID-19 pandemic. From April 2020 to February 2021, a majority of new and return patient visits were delivered through telemedicine, significantly exceeding the telemedicine utilization rate of 5% observed in a United States national sample of cardiology visits from December 2020.¹² Telemedicine use stabilized at varied levels across cardiology subspecialties, with electrophysiology providers using telemedicine at a rate over 11 times that of vascular medicine providers and over 4 times that of heart transplant providers from June 2020 to February 2021. Overall visit volumes were preserved, and higher rates of subspecialty

telemedicine use were associated with increased new patient visits during this period compared to the previous year.

The large differences observed in telemedicine use between cardiology subspecialties may be attributable to clinical factors unique to each subspecialty. As has been hypothesized previously, electrophysiology providers were able to maintain the highest level of telemedicine use, likely due in part to the presence of existing infrastructure for and familiarity with remote patient monitoring.¹⁵ Heart transplant and vascular medicine providers, in contrast, used telemedicine at significantly lower rates. Heart transplant clinics may be less well-suited for high telemedicine use because their patients require frequent in-person testing. Subspecialties may also differ in their reliance on the physical examination for commonly evaluated conditions.

Previous analyses of telemedicine use at academic cardiology practices during the COVID-19 pandemic have reported lower overall rates of telemedicine use and greater use of telephone visits as compared to video visits.^{8,10,11} Notably, we found that a majority of visits at this cardiovascular center were delivered by video during the pandemic. This high rate of video-enabled telemedicine was likely due to several factors, including the presence of pre-pandemic infrastructure at this center supporting a small number of annual video visits, a well-developed Digital Health team, and a patient population with likely greater than average technology literacy and access. It is possible that increased use of video as compared to telephone visits at this center contributed to the higher rate of sustained telemedicine use.

Early in the COVID-19 pandemic, the numbers of new and return patient visits at this cardiovascular center were below pre-COVID levels. In contrast to United States national trends, however, visit volumes exceeded pre-COVID levels beginning in June 2020, including from December 2020 to January 2021 when local COVID-19 cases peaked and California enacted a stay-at-home order, prohibiting nonessential in-door business activities (Supplementary Figure S1).¹⁶ The high rate of telemedicine use at this center may have allowed for the preservation of visit volumes and access to care during this period. We did not observe an increase in the number of visits per patient, suggesting that high telemedicine use did not result in increased utilization of total visits per patient as has been observed in other settings.¹⁷

As telemedicine utilization patterns stabilized, new patient visits were more often conducted through telemedicine as compared to return patient visits. These results suggest that many patients are willing to have initial encounters through telemedicine with providers in academic cardiology practices. We found that cardiology subspecialties that maintained higher rates of telemedicine use for new patient visits were more likely to experience increases in new patient visit volumes as compared to pre-pandemic levels, suggesting that greater telemedicine adoption may increase access for patients requiring initial

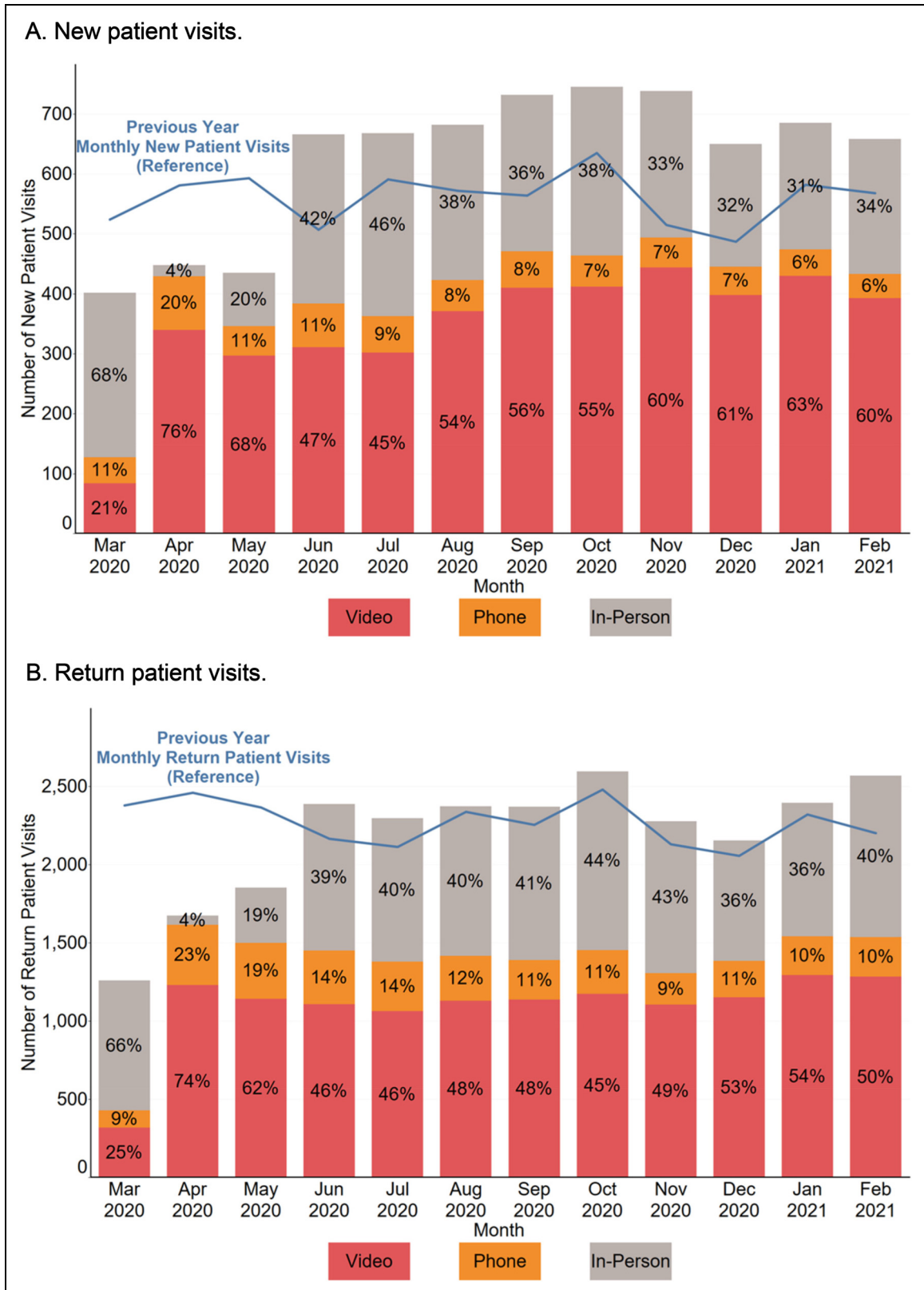


Figure I. Monthly outpatient cardiology visits by visit modality during the COVID period. (A) New patient visits. (B) Return patient visits.

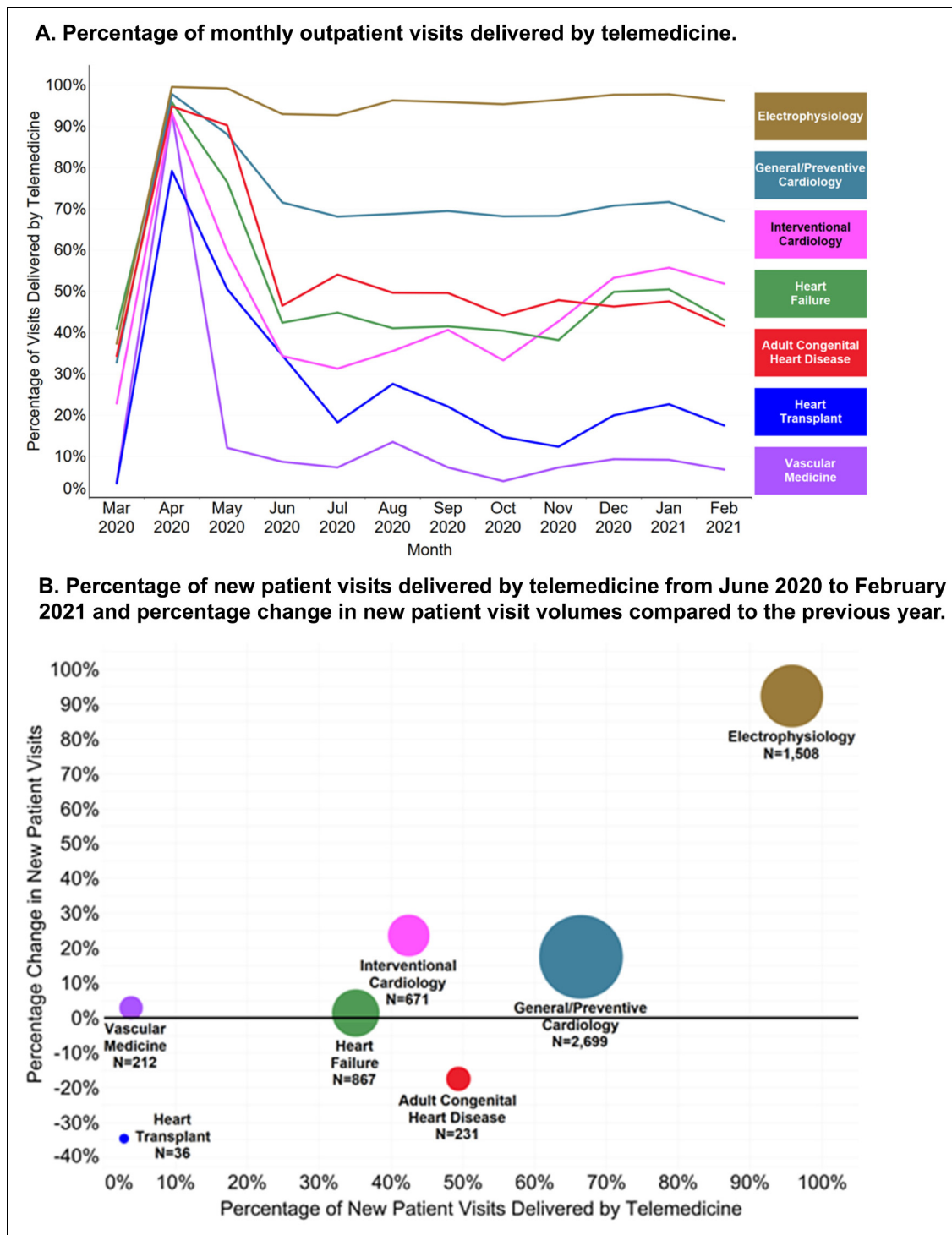


Figure 2. Telemedicine use across cardiology subspecialties during the COVID period. (A) Percentage of monthly outpatient visits delivered by telemedicine. (B) Percentage of new patient visits delivered by telemedicine from June 2020 to February 2021 and percentage change in new patient visit volumes compared to the previous year. The size of each circle represents the number of new patient visits for each subspecialty.

cardiology consultations. Patients are likely to continue to seek care through telemedicine following the pandemic, and pre-pandemic policies like those in place in the United States restricting telemedicine authorization to

return patient visits should be reevaluated.⁵ Further research is needed to understand how changes in patient preferences resulting from exposure to telemedicine during the pandemic will affect demand for virtual care in the future.

Limitations

The results of this study should be interpreted in the context of some limitations. The single-center, observational design of this study limits its ability to isolate the effect of telemedicine adoption on visit volumes from other changes related to the COVID-19 pandemic. This study was conducted at a single center, and the findings may not be generalizable to other settings. Finally, longer-term follow-up is needed to determine whether variation in telemedicine use across subspecialties is associated with differences in clinical outcomes.

Conclusions

At this academic cardiovascular center, a majority of outpatient care was provided through telemedicine during the first 12 months of the COVID-19 pandemic with preserved visit volumes. There was significant variation in telemedicine use across cardiology subspecialties. During this challenging period for healthcare delivery, subspecialties using telemedicine at higher rates experienced larger increases in new patient visits. Future research should investigate drivers of variation in telemedicine use and the relationship between the uptake of telemedicine and access to care.

Declaration of conflicting interests


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Supplemental material

Supplemental material for this article is available online.

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