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Impact of the COVID-19 pandemic on patterns of outpatient cardiovascular care



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Background The coronavirus disease 2019 (COVID-19) pandemic brought about abrupt changes in the way health care is delivered, and the impact of transitioning outpatient clinic visits to telehealth visits on processes of care and outcomes is unclear.

Methods We evaluated ordering patterns during cardiovascular telehealth clinic visits in the Duke University Health System between March 15 and June 30, 2020 and 30-day outcomes compared with in-person visits in the same time frame in 2020 and in 2019.

Results Within the Duke University Health System, there was a 33.1% decrease in the number of outpatient cardiovascular visits conducted in the first 15 weeks of the COVID-19 pandemic, compared with the same time period in 2019. As a proportion of total visits initially booked, 53% of visits were cancelled in 2020 compared to 35% in 2019. However, patients with cancelled visits had similar demographics and comorbidities in 2019 and 2020. Telehealth visits comprised 9.3% of total visits initially booked in 2020, with younger and healthier patients utilizing telehealth compared with those utilizing in-person visits. Compared with in-person visits in 2020, telehealth visits were associated with fewer new (31.6% for telehealth vs 44.6% for in person) or refill (12.9% vs 15.6%, respectively) medication prescriptions, electrocardiograms (4.3% vs 31.4%), laboratory orders (5.9% vs 21.8%), echocardiograms (7.3% vs 98%), and stress tests (4.4% vs 6.6%). When adjusted for age, race, and insurance status, those who had a telehealth visit or cancelled their visit were less likely to have an emergency department or hospital encounter within 30 days compared with those who had in-person visits (adjusted rate ratios (aRR) 0.76 [95% 0.65, 0.89] and aRR 0.71 [95% 0.65, 0.78], respectively).

Conclusions In response to the perceived risks of routine medical care affected by the COVID-19 pandemic, different phenotypes of patients chose different types of outpatient cardiology care. A better understanding of these differences could help define necessary and appropriate mode of care for cardiology patients. (*Am Heart J* 2021;231:1–5.)

Background

Starting in spring 2020, the coronavirus disease 2019 (COVID-19) pandemic led to national stay-at-home orders, social distancing, and self-isolation to reduce the risk of infection spread in communities and forced abrupt changes in the way health care is delivered. Cardiovascular care saw a sudden reduction in outpatient visits across the United States and patients, physicians, and health systems had to adapt rapidly to maintain quality and continuity of care.^{1,2} Prior to COVID-19,

adoption of telehealth was limited although studies suggested that virtual visits were feasible and could potentially save time and cost compared to in-person visits.^{3,5} Previous legal, payer, and workflow barriers largely disappeared during the COVID-19 national emergency. Billable telehealth encounters without US geographic restrictions were first initiated in 2020. The impact of this current shift to telehealth on outpatient cardiovascular patterns of management are unknown. We sought to investigate trends in outpatient cardiology practices at our institution during the early COVID-19 period.⁶

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Methods

Setting

This study was performed at Duke University Health System (DUHS), an academic health system with more than 140,000 outpatient cardiology visits each year. DUHS institutional review board approved this retrospective study.

Data source and study population

Data from the DUHS electronic health record was used to analyze outpatient encounters. We identified outpatient cardiology encounters between March 15 and June 30, 2019 and March 15 and June 30, 2020. The chosen time period included onset (school closure on March 14) and lifting (phased re-opening on May 22) of some state-mandated restrictions on the population.⁷ Telehealth included telephone and video visit encounters. A total of 33,097 completed patient encounters in 2019 and 22,156 patient encounters in 2020 period were included. There were also 17,975 cancelled or deferred encounters in 2019 and 24,774 in 2020.

Statistical analysis

Demographic, clinical, and socioeconomic characteristics were summarized for the overall population, and stratified by time period with continuous variables summarized as median (first and third quartile). Categorical variables were summarized as counts (percentages, %). Race was defined as Black/African American, Caucasian/white, or other/multiple races/unknown. Differences in patient and visit characteristics between years and modalities were compared using χ^2 and *t* tests. Multivariable Robust Poisson regression was used to estimate adjusted rate ratios (aRR) for binary outcomes of systolic blood pressure, new or refill prescriptions, laboratory, echocardiography, left heart catheterization, electrocardiogram (ECG) and stress test orders, comparing telehealth and in-person visits. Emergency department (ED) and hospital encounters within 30 days after a telehealth visit or cancelled visit were compared to in-person visits also using adjusted rate ratios. All models were adjusted for age, sex, race, and insurance status.

Results

Comparisons between 2019 and 2020 visits overall

Outpatient cardiology encounters declined by 33.1% from 33,097 visits in March 15 to June 30, 2019 to 22,156 in March 15 to June 30, 2020. Cancelled visits increased by 19.6%, from 17,975 in March 15 to June 30, 2019 to 24,774 in March 15 to June 30, 2020. As a proportion of total initially scheduled encounters, cancelled encounters accounted for 35% in 2019 (17,975 of 51,072) and 53% in 2020 (24,774 of 46,930). On a relative basis, similar proportions of patients by gender, race, insurance, and co-morbidities were seen in the outpatient practice in both years, with similar patient characteristics for cancellation visits in both years.

Process of care for telehealth, in-person, and cancelled visits in 2020

Of the total 22,156 outpatient visits during the 2020 time period, 4,384 (19.8%) were telehealth visits and

17,772 (80.2%) were in-person visits. A decrease in total outpatient visits coincided with school closures in mid-March with a rise in proportion of telehealth visit from <1% to 55.5% (Figure 1). With the phased re-opening, the total number of outpatient visits started rising, accompanied by a steady decline in telehealth visits. Individuals with telehealth visits were younger, had fewer co-morbidities, and had higher use of commercial insurance compared with in-person visits in 2020 (Table 1). In contrast, individuals with cancelled visits were of similar age, gender, race, ethnicity, insurance, and comorbidity burden as those with in-person visits.

During telehealth visits, vitals were recorded in only 12.8% of visits as compared to 96.0% for in-person visits (aRR 0.13 [95% confidence interval CI], 0.12-0.15). Telehealth visits were less frequently associated with lab orders than in-person visits (5.9% vs 21.8%; aRR 0.27 [95% CI, 0.24-0.31]; Table 2). The adjusted likelihood of medication refills (aRR 0.84 [95% CI, 0.77-0.91]) as well as the initiation of new medications (aRR 0.70 [95% CI, 0.67-0.74]) were also lower in telehealth than in in-person visits. The adjusted likelihood of ECG orders (aRR 0.13 [95% CI, 0.11-0.15]), echocardiography (aRR 0.71 [95% CI, 0.64-0.80]), stress tests (aRR 0.62 [95% CI, 0.54-0.72]), and left catheterization (aRR 0.54 [95% CI, 0.34-0.85]), were all significantly lower in telehealth vs in-person visits.

Outcomes of care

From March 15 to June 30, 2020, in-person visits had lower rates of ED/hospitalization 30 days post visit (5.0%) compared with March 15 to June 30, 2019 visits (6.2%) ($P < .0001$; Table 1). The proportion of visits in 2020 with subsequent ED or hospital encounters within 30 days was similar for telehealth (3.9%) and cancelled visits (3.8%), but rates of both visit types were lower as compared to in-person visits (5.3%) (telehealth: aRR 0.76 [95% 0.65, 0.89] and cancelled: aRR 0.71 [95% 0.65, 0.78]).

Discussion

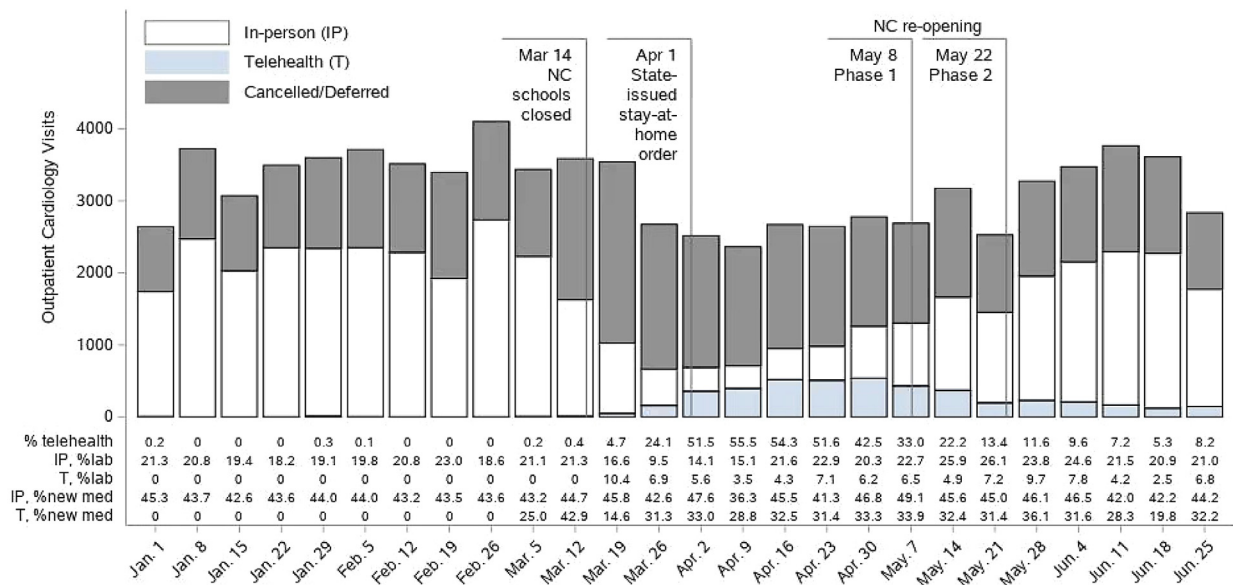
Using data from a large academic health system, we found that the start of the COVID-19 pandemic meaningfully impacted outpatient cardiology care. There was a substantial decline in outpatient cardiology visits during the initial COVID-19 pandemic compared with the same period in the year prior, despite the implementation of telehealth in 2020.^{2,6} Individuals who utilized telehealth tended to be younger with fewer co-morbidities, while those who cancelled or deferred care had similar characteristics to those with in-person visits. Telehealth visits were associated with fewer orders for diagnostic testing, labs, and medications compared with in-person visits. Within 30 days, individuals with in-person visits were

Table 1. Characteristics of cardiology outpatient encounters by year and modality

	Mar 15-June 30, 2019		Mar 15-June 30, 2020			
	In-person	Cancelled	Overall	Telehealth	In-person	Cancelled
Number of encounters	33,097	17,975	22,156	4,384	17,772	24,774
Median age, years (IQR)	69.4 (58.6, 77.6)	68.2 (56.8, 77.0)	68.8 (58.0, 77.1)	66.2 (54.1, 74.4)	69.4 (59.0, 77.6)	69.4 (58.6, 77.8)
Female	16,123 (48.7%)	9,121 (50.7%)	10,522 (47.5%)	2,147 (49.0%)	8,375 (47.1%)	12,181 (49.2%)
Race						
Black or African American	6,880 (20.8%)	3,774 (21.0%)	4,902 (22.1%)	886 (20.2%)	4,016 (22.6%)	5,114 (20.6%)
Caucasian/White	24,433 (73.8%)	13,134 (73.1%)	16,019 (72.3%)	3,197 (72.9%)	12,822 (72.1%)	18,083 (73.0%)
Other, multiple, or unknown	1,784 (5.4%)	1,067 (5.9%)	1,235 (5.6%)	301 (6.9%)	934 (5.3%)	1,577 (6.4%)
Insurance						
Commercial	5,580 (16.9%)	3,236 (18.0%)	3,801 (17.2%)	945 (21.6%)	2,856 (16.1%)	4,125 (16.7%)
Medicaid	901 (2.7%)	593 (3.3%)	645 (2.9%)	133 (3.0%)	512 (2.9%)	751 (3.0%)
Medicare	13,356 (40.4%)	6,802 (37.8%)	7,984 (36.0%)	1,569 (35.8%)	6,415 (36.1%)	9,576 (38.7%)
Medicare A	8,181 (24.7%)	4,119 (22.9%)	5,999 (27.1%)	854 (19.5%)	5,145 (29.0%)	6,308 (25.5%)
Other	4,476 (13.5%)	2,521 (14.0%)	3,198 (14.4%)	787 (18.0%)	2,411 (13.6%)	3,206 (12.9%)
Self-pay	603 (1.8%)	704 (3.9%)	529 (2.4%)	96 (2.2%)	433 (2.4%)	808 (3.3%)
Comorbidities						
Diabetes	9,215 (27.8%)	5,011 (27.9%)	6,344 (28.6%)	1,079 (24.6%)	5,265 (29.6%)	6,905 (27.9%)
Hypertension	24,138 (72.9%)	12,568 (69.9%)	16,368 (73.9%)	3,056 (69.7%)	13,312 (74.9%)	17,571 (70.9%)
AFib	12,063 (36.4%)	6,530 (36.3%)	7,904 (35.7%)	1,551 (35.4%)	6,353 (35.7%)	9,622 (38.8%)
CHF	11,919 (36.0%)	6,582 (36.6%)	7,914 (35.7%)	1,316 (30.0%)	6,598 (37.1%)	9,656 (39.0%)
MI	3,209 (9.7%)	1,747 (9.7%)	2,244 (10.1%)	347 (7.9%)	1,897 (10.7%)	2,278 (9.2%)
Stroke	6,058 (18.3%)	3,339 (18.6%)	4,070 (18.4%)	770 (17.6%)	3,300 (18.6%)	4,674 (18.9%)
CAD	14,306 (43.2%)	7,417 (41.3%)	9,711 (43.8%)	1,667 (38.0%)	8,044 (45.3%)	10,396 (42.0%)
PAD	3,993 (12.1%)	2,172 (12.1%)	2,909 (13.1%)	457 (10.4%)	2,452 (13.8%)	3,068 (12.4%)
CKD	6,195 (18.7%)	3,571 (19.9%)	4,247 (19.2%)	678 (15.5%)	3,569 (20.1%)	5,219 (21.1%)
Proportion with systolic blood pressure	32,105 (97.0%)	–	17,616 (79.5%)	563 (12.8%)	17,053 (96.0%)	–
Proportion with order						
Any medication	17,041 (51.5%)	–	11,035 (49.8%)	1,755 (40.0%)	9,280 (52.2%)	–
New medication	14,534 (43.9%)	–	9,321 (42.1%)	1,386 (31.6%)	7,935 (44.6%)	–
Medication refills	5,005 (15.1%)	–	3,328 (15.0%)	564 (12.9%)	2,764 (15.6%)	–
Lab	6,544 (19.8%)	–	4,128 (18.6%)	259 (5.9%)	3,869 (21.8%)	–
Proportion with order						
ECG	10,794 (32.6%)	–	5,769 (26.0%)	190 (4.3%)	5,579 (31.4%)	–
Echocardiography	3,694 (11.2%)	–	2,056 (9.3%)	319 (7.3%)	1,737 (9.8%)	–
Stress test	2,308 (7.0%)	–	1,366 (6.2%)	192 (4.4%)	1,174 (6.6%)	–
Holter/event monitor/ILR	1,723 (5.2%)	–	876 (4.0%)	55 (1.3%)	821 (4.6%)	–
Left heart catheterization	232 (0.7%)	–	168 (0.8%)	20 (0.5%)	148 (0.8%)	–
Proportion with outpatient cardiology visit in prior year	25,638 (77.5%)	15,348 (85.4%)	17,435 (78.7%)	3,613 (82.4%)	13,822 (77.8%)	21,371 (86.3%)
Proportion with ED or hospitalization in prior year	10,889 (32.9%)	6,290 (35.0%)	7,060 (31.9%)	1,504 (34.3%)	5,556 (31.3%)	8,183 (33.0%)
Proportion with ED or hospitalization after 30 days of visit	2,045 (6.2%)	1,059 (5.9%)	1,118 (5.0%)	172 (3.9%)	946 (5.3%)	934 (3.8%)

AFib, atrial fibrillation; CAD, coronary artery disease; CHF, chronic heart failure; CKD, chronic kidney disease; ECG, electrocardiogram; ILR, implantable loop recorder; IQR, interquartile range; insurance other include no insurance; MI, myocardial infarction; PAD, peripheral arterial disease.

Figure 1



Shown are the volume of outpatient cardiology visits and relative proportion of telehealth (T) vs. in-person (IP) visits between Jan 1 and June 30, 2020. Over the same period in 2019, the number of completed visits was relatively constant with an average of 2,159 visits per week, compared to 1,741 in 2020. Similarly, the average number of cancelled/deferred visits during this period in 2019 was 1,148 per week, compared to 1,444 in 2020. The figure also highlights the relative decline in new medication and lab orders at telehealth (T) as compared to equivalent in-person (IP) visits.

Outpatient cardiology visits and ordering patterns before and during the COVID-19 pandemic of 2020.

Table 2. Multivariable Robust Poisson regression on vitals and orders placed in telehealth vs in-person visits during COVID-19 pandemic in 2020

Outcome	Telehealth visits N (%)	In-person N (%)	Adjusted rate ratio for telehealth vs in-person visits (95% CI)*	Adjusted P values
Systolic blood pressure	563 (12.8%)	17,053 (96.0%)	0.13 (0.12, 0.15)	<.001
New medication order	1,386 (31.6%)	7,935 (44.6%)	0.70 (0.67, 0.74)	<.001
Medication refill order	564 (12.9%)	2,764 (15.6%)	0.84 (0.77, 0.91)	<.001
Lab order	259 (5.9%)	3,869 (21.8%)	0.27 (0.24, 0.31)	<.001
ECG	190 (4.3%)	5,579 (31.4%)	0.13 (0.11, 0.15)	<.001
Echo	319 (7.3%)	1,737 (9.8%)	0.71 (0.64, 0.80)	<.001
Left heart cath	20 (0.5%)	148 (0.8%)	0.54 (0.34, 0.85)	.01
Stress test	192 (4.4%)	1,174 (6.6%)	0.62 (0.54, 0.72)	<.001
ED/Hosp within 30 days	172 (3.9%)	946 (5.3%)	0.76 (0.65, 0.89)	.001

* Adjusted for age, sex, race, and insurance status.

more likely to have an ED or inpatient encounter compared with those who used telehealth or deferred care.

The observed decline in overall outpatient cardiology care is consistent with several prior reports during the COVID-19 period.⁸ Telehealth was initiated at our institution during this time, and our observation that younger, less co-morbid patients tended to choose telehealth compared with in-person visits is also consistent with recent literature.⁹ Of note, similar racial proportions of

patients were seen in both telehealth and in-person visits during the initial COVID-19 period. This is important as early reports of the pandemic indicate persistent health disparities amongst vulnerable populations.^{9,10} Whether differences in patient phenotype can account for the significant differences in ordering patterns of laboratory testing, imaging, other diagnostic testing, and medication orders is unknown. Further research will be necessary to determine if the lower degree of ordering

with telehealth visits is due to the patients not needing such measures, not wanting such measures (especially if there is hesitation to present for labs or other testing), or whether providers felt less comfortable placing orders in a virtual setting.

This is one of the first studies to examine the outcomes of patients during the COVID-19 pandemic by type of outpatient cardiology care received.¹¹ The higher rate of hospitalization after in-person compared with telehealth visits is potentially related to the differences in patient characteristics between these groups, with in-person patients being older with more co-morbidities. The fact that in-person visits were associated with a higher 30-day hospitalization rate than deferred/cancelled visits may also reflect that individuals with more acute issues chose in-person visits, and their acute issues led to short-term hospitalization. Further research will be necessary to determine if these hypotheses are valid.

Limitations

This study has limitations. First, this is based on a single-center experience and results may not be widely generalizable. Second, our study combined telephone and video visits under the telehealth rubric, though these distinct types of visits may be associated with different patterns of care and outcomes. Third, we did not distinguish between cancelled visits initiated by patients vs the health system. Fourth, encounter-level data could include patients with more than one cardiology visit type during this time period (e.g, patient with in-person and telehealth visit). Fifth, we did not have information on orders completed/executed vs orders placed but not completed (e.g, an echocardiogram is ordered but patient does not follow through to get the test). Finally, data from consumer-based devices (ECG, blood pressure cuff) were not systematically accounted for in this study.

Conclusions

The COVID-19 pandemic has affected outpatient cardiology care in unforeseen ways. In response to the perceived risks of routine medical care affected by the COVID-19 pandemic, different phenotypes of patients chose different types of outpatient cardiology care. Despite the rapid uptake of telehealth medicine, overall outpatient cardiology visits declined in our health system in the initial COVID-19 period compared with the same time period in 2019. Different phenotypes of patients chose telehealth vs in-person visits vs deferral of care altogether, and these different types of visits were

associated with varying 30-day outcomes. A better understanding of these differences could help define necessary and appropriate modes of care for cardiology patients.

Declaration of Competing Interest

No conflicts relevant to this work for all authors.

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