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The Digital Divide In Telemedicine Care During The Covid-19 Pandemic

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Abstract

Intro: Telemedicine has offset disruptions to outpatient chronic disease care during the COVID-19 pandemic. Studies have shown decreased video telemedicine engagement among patients of Black race, Hispanic ethnicity, older age, and with public insurance. We assessed if similar patterns were seen among providers who predominantly adopted video telemedicine during the COVID-19 pandemic.

Methods: A single-center longitudinal study of cardiovascular patients from March 16-October 31, 2020 was performed to study trends in video visit volume, variation in provider use of video visits, and identify predictors of video (vs. phone) visits using descriptive statistics and multivariable logistic regression.

Results: A total of 18,950 patients were studied with 51% having at least 1 video visit. Video visit volume rapidly increased from March to June 2020, where it accounted for 42% of all patient encounters. Large variation in the use of video visits among providers was observed with mean (standard deviation) use of 44% (±29). Among patients of high-video-use providers, lower video use was observed among patients of Black race, Hispanic ethnicity, older age, and those with public insurance and an activated MyChart account in descriptive statistics and multivariable adjustment. After adjusting for patient characteristics, patients with a high-video-use provider were 9.35 (95% confidence interval, 8.43-10.39) times as likely to have a video visit compared to patients of low-video-use providers. Patients without an activated MyChart were 0.33 (95% CI, 0.31-0.36) times as likely to have a video visit. Only 47% of patients of Black race had an activated MyChart vs. 66% of White patients (P<.001).

Discussion: Video telemedicine care has rapidly expanded during the COVID-19 pandemic with growing engagement among providers. We find that even among providers with high video adoption, the digital access divide persisted. Ensuring equitable access of telemedicine technology is crucial to reducing disparities as virtual care becomes more commonly integrated into modern healthcare. Increasing the use of MyChart, a patient portal with video telemedicine capabilities, among low video groups may improve accessibility. Other systemic approaches will likely be needed to further improve telemedicine access and engagement.

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Introduction

Telemedicine has offset disruptions to outpatient care during the coronavirus disease 2019 (COVID-19) pandemic[1,2]. Aided by federal regulatory provisions[3-5], phone and video-based virtual visit programs rapidly expanded in March 2020 to decrease transmission of SARS-CoV-2 among at-risk patients and providers.

Short-term studies have found dynamic trends in the use of video and phone (audio-only) telemedicine vs. in-person visits[1,2,6] and have identified decreased engagement with video visits among patients of Black race, Hispanic ethnicity, older age, and with public insurance[7-9]. While it is unclear if video visits are clinically superior to phone visits, video visits offer capabilities for providers to visually assess their patients, show patient radiologic images or lab results, and communicate non-verbally, among other advantages[8]. Additionally, patient subgroups with reduced video engagement also have, on average, poorer baseline healthcare access and outcomes compared to reference groups. The digital divide between patients who experience the full benefits of video telemedicine and those who do not may widen existing disparities in care and outcomes.

Identifying opportunities for interventions to decrease this digital divide is important for the long-term success of telemedicine. Provider use of video may be variable as providers have varying attitudes toward video telemedicine care[10]. Accordingly, we sought to determine how variable video use was among providers and if lower video use in certain subgroups was alleviated among patients of providers who predominantly adopted video visits into their telemedicine practice.

Methods

Study Population

We included all patients with telemedicine visits between March 16th-October 31st, 2020 March 16th-October 31st, 2020 with providers at the Massachusetts General Hospital (MGH) Corrigan Minehan Heart Center. The study period began one week prior to Massachusetts' stay-at-home order issued on March 24, 2020[11] and our institution's policy change to see patients virtually when possible. The study ended several months after our institution permitted in-person and hybrid care in August 2020. MGH's catchment area includes the New England area with most patients residing in Massachusetts. Patients with only research visits (n=17) were excluded.

Study Measures

We abstracted patient and visit information from the center's administrative database. Data included each visit type (phone, video, in-person), patients' date of visit(s), age, sex, self-reported race (White, Black, Asian, or other) and ethnicity (non-Hispanic, or Hispanic), insurance payor (private, public, or none), residential ZIP code, MyChart activation status—MGH's online patient portal—and the clinician who conducted each visit. Residential ZIP codes were classified as urban or suburban-rural using the U.S. Department of Agriculture's Rural-Urban Commuting Area Codes[12]. Rural and suburban ZIP codes were combined due to small sample sizes in each. Cardiovascular disease (CVD) history was ascertained from up to four diagnostic codes (International Classification of Disease, Tenth Revision, ICD-10) based on conventional grouping of common CVDs (Appendix A).

Missing data was uncommon for most variables. Race was missing for 3% of patients and ethnicity was missing for 9% of patients, and these missing values appeared to be missing at random. To address possible bias, we report these variables with missing data as a "missing" category in the descriptive statistics. Missing values were not imputed. Visit type was missing for 1.4% of visits, so these observations were excluded from analysis. We report false discovery rateadjusted *P*-values to account for multiple comparisons with a *P*-value of <.05 considered statistically significant.

Analysis

Trends in visit types were plotted and tested for linearity using two-sided Cochran-Armitage tests. To calculate these trends, in-person visits were included. All subsequent analyses discussed below only included telemedicine (phone, video) visits.

To determine the variation in the use of video among providers, median and interquartile ranges of provider video use among telemedicine visits was calculated. We tested for trend using a simple median regression using each month to predict changes in the proportion of video visits conducted by provider.

Providers in the upper quintile of video visit use (number of video visits among total telemedicine visits) were classified as high-video-use providers; all other clinicians were classified as low-video-use providers. Quintiles were determined using Jenk's natural breaks optimization, a method which minimizes each quantile's mean deviation from the quantile mean and maximizes each quantile's deviation from other quantile's means.[13]

At the patient-level, the outcome was ever video vs. phone only telemedicine visits across the study period. Patient characteristics were compared by provider video-use level and outcome using Chi-square and Wilcoxon rank-sum tests. To identify predictors of ever video (vs. phone) visits among patients, we calculated a multivariable logistic model controlling for patients' age, sex, insurance, race and ethnicity (self-reported), residence type (urban vs. suburban-rural) by ZIP code, activation of MyChart, and provider video-use-level (high vs. low).

All analyses were conducted using R (Version 1.4)[14]. CG conducted and takes full responsibility for all analyses. Code is available upon request. The Mass General Brigham and Yale University Institutional Review Boards exempted this study from review.

Results

Trends in visit volume

Our center's 169 providers conducted 33,650 visits for 24,562 patients. Telemedicine visits accounted for 73% of visits (24,470/33,650) of which 48% were video visits and 52% were by phone and conducted for 18,950 patients. Phone visits rapidly increased from mid-March to early April (*P*<.001), first peaking at 580 visits in the week of April 12th, 2020 accounting for 83% of all visits that week. Phone visits then steadily declined through the study period (*P*<.001) accounting for 21% of all visits in the last week in October. Video visits also quickly increased in use (*P*<.001), albeit less quickly than phone visits, first peaking the week of May 17th, 2020 with 458 visits (42% of all visits that week). Video visits gradually increased through the study period (*P*<.001) accounting for 34% of all visits during the last week of October 2020. In-person visits abruptly decreased just prior to the study start and remained low through early June 2020, accounting for <5% of all weekly visits during this period. These visits subsequently increased through the study period (*P*<.001), peaking the week of September 20th, 2020 accounting for 46% of all visits that week.

Trends in provider variation of video visit use

There was large variation in the use of video visits among providers with a mean use of 44% (standard deviation= ±29%). Variation in video use, measured by interquartile range (IQR), was largest in June 2020 (46% [IQR=16%-75%]) and persisted throughout the study period (October: 64% [36%-84%]) (Figure 2). Despite this large variation, each subsequent month was associated with a 7.6% increase in median video use (standard error=0.008, *P*<.001).

Patient outcome: ever video vs. phone telemedicine visit

A total of 24,470 telemedicine visits for 18,950 patients were conducted during the study period. Most patients (79%, n=14940) had one visit, 16% (n=2990) had two visits, and 5% (n=1020) had three or more visits. A slight majority of patients had at least one video visit (51%, n=9575) with the remaining having only phone telemedicine visits (49%, n=9375). The mean (sd) age of patients with an ever video visit was 62 (±16) whereas the mean age of phone-only patients was 70 (±14) (*P*<.001) (Table 1). Among White patients, 51% had a video visit vs. 41% of Black patients, and among non-Hispanic patients, 51% had a video visit vs. 38% of Hispanic patients (both *P*<.001). Patients with private insurance more often had a video visit (61%) vs. those with public insurance (42%) (*P*<.001) as well as patients living in suburban-rural ZIP codes (56%) vs. those in urban ZIP codes (50%) (*P*<.01). Differences in video use were also observed by patient's primary cardiovascular disease diagnosis with 68% of patients with congenital heart disease having a video visit (*P*<.001) compared with 46% of patients with coronary artery disease (*P*<.001), 41% with heart failure (*P*<.001), 45% with hypertension (*P*<.001), and 48% with hyperlipidemia (*P*<.001). Patients with more visits during the study period more often had at least one video visit with 71% of patients with 3+ visits having a video visit (*P*<.001). No difference was observed by sex or stroke diagnosis.

Patient video use by provide video-use level

Thirty-three clinicians (24%) were high-video-use providers, conducting 70% or more of their visits via video. High-video-use providers saw 4,228 patients during 5,084 telemedicine visits with a mean video use of 87% (±10%). Low-video-use providers (n=136) had a mean video use of 34% (±22%) seeing 14,722 patients during 19,386 telemedicine visits.

Patient demographics differed between provider video-use level and outcome with 86% of patients among high-video-use providers having one or more video visits compared to 40% of low-video-use provider patients (Table 2). High-video-use providers saw more female and White patients with private insurance and an activated MyChart (all P<.01). Among high-video-use provider patients, 78% of Black patients engaged in a video visit compared to 86% of White patients (*P*<.001), 74% of Hispanic patients were seen on video compared to 86% of non-Hispanic patients (*P*<.001), and 91% of patients with private insurance had a video visit compared to 79% of patients with public insurance (*P*<.001). Patients with a video visit were younger (*P*<.001) and more often had an activated MyChart (91% vs. 76% without an activated account, *P*<.001). Similar patterns were seen among low-video-use provider patients except for male patients and suburban or rural patients having greater video use. After controlling for patient characteristics, high-video-use provider patients were 9.4 (95% CI, 8.4-10.4) times as likely to have a video visit compared to low-video-use provider patients (Table 3).

Post hoc analysis: MyChart activation status

As patients without an activated MyChart were 0.33 (95% CI, 0.31-0.36) times as likely to have a video visit (Table 3), we stratified our sample by patients' MyChart activation status. Sixty-four percent (12136/18950) of patients with a telemedicine visit had an activated MyChart. Among this group, 75% had at least one video visit compared to 25% of patients without an activated MyChart (P<.001) (Table 5). Patients demographics associated with higher MyChart activation included 66% of female patients vs. 63% of male patients (P<.001), 66% of White patients vs. 47% of Black and 45% of other race patients (P<.001), 65% of non-Hispanic patients vs. 40% of Hispanic patients (P<.001), and 68% of patients with private insurance vs. 60% with public or no insurance (P<.001). Additionally, 64% of urban-residing patients had an activated MyChart vs. 57% of suburban or rural patients (P<.001).

Discussion

In this longitudinal study of 24,470 telemedicine visits among 18,950 patients during the COVID-19 pandemic, video visit volume rapidly increased from March to June 2020 and remained in frequent use through October 2020. We observed increasing use of video visits among 169 providers, with observed variability across providers with a mean video use of 44% (±29). Patient subgroups with decreased video engagement included patients of Black race, Hispanic ethnicity, older age, and with public insurance. We found that these subgroups had lower video engagement even among high-video-use providers. MyChart activation was a strong predictor of video use, and activation was low among patients of Black race (47%) and Hispanic ethnicity (40%) compared to White (66%) and non-Hispanic patients (65%).

Lower video engagement among these subgroups has been identified in other studies during the COVID-19 pandemic[7,8]. Our study adds that even among providers who largely adopted video visits into their telemedicine practice, Black, Hispanic, older, and public insurance patients still had lower video engagement. Suboptimal video engagement may not be surmountable by increased provider adoption of telemedicine alone. Patients with an activated MyChart were more likely to engage in video visits, and patients of Black race and Hispanic ethnicity had low rates of MyChart activation compared to White and non-Hispanic patients. MyChart offers video teleconferencing capabilities which providers at our institution frequently used to conduct video visits, in addition to other teleconferencing platforms. MyChart activation may be a proxy measure of digital literacy in this sample.

Reasons underlying inequities in telemedicine should be better understood at the local level to inform intentional interventions to increase telemedicine access and reduce inequities. Inadequate telecommunication infrastructure, poor patient digital literacy, lack of provider training, and patient or provider preference likely all play a role in unequal video visit use. Because of the identified association between MyChart activation and video visit use in this study, an important next step may be to identify barriers to patients accessing MyChart and enroll patients in MyChart with a focus on Black and Hispanic patients. A recent presidential advisory from the American Heart Association and American Stroke Association called for investments in telemedicine infrastructure to increase access to broadband internet and to devices capable of video teleconferencing to alleviate inequities.[15] For example, Boston has offered low-cost Wi-Fi hotspots[16] to low-income residents during the pandemic. Training providers to use video and other telemedicine technologies and workflows may also increase video telemedicine use and lessen disparities[15,17]. Hospitals may consider establishing internal groups to measure telemedicine use and develop direct interventions for more equitable use[18].

The rapid utilization of telemedicine in a variety of specialties[1,19-21] during the COVID-19 pandemic may mark a paradigm shift in how healthcare is delivered and how physicians and patients interact[22]. The benefits of telemedicine-integrated care has been suggested as early as 1995[23-25], yet implementation of telemedicine as a supplement or alternative to traditional, in-person patient visits has been slow, albeit with increasing use in primary care and mental health services in 2016-2017[26]. Video telecommunications have quickly evolved and are now common in U.S. households, yet people of older age, low income, and whom live in rural areas have lower use[15,27,28].

As telemedicine becomes more accessible and available from providers, certain populations may require intentional engagement and education to achieve equitable access[29]. Many clinical practices are currently developing robust infrastructure and targeting high volume video clinicians to lead efforts to address issues of equity. This study demonstrates that these mechanisms alone may not be adequate to alleviate existing disparities in access.

Limitations

Limitations of this study include enrollment of patients from a single medical subspecialty, which may not be generalizable to other patient populations. However, lower video use among patients of Black race, older age, and public insurance have been observed across multiple medical specialties[8]. Generalizability to other regions may be limited as Massachusetts ranked

1st in the U.S. in the rate of telemedicine visits conducted from March through June 2020[2], yet we believe our sample of largely Massachusetts residents is especially relevant for the study of long-term telemedicine trends and disparities. This study lacks important patient demographic data that may be associated with video use, such as internet access, ownership of a device capable of video teleconferencing, and measurements of social determinants of health. While we lack qualitative patient data on reasons for selecting a video or phone visit, a pre-COVID survey study among cardiovascular patients at MGH found that patients are highly satisfied with video telemedicine visits, especially for its convenience and reduced travel cost, suggesting that video visits could be a preference for patients in the future.[30] The extent to which video visits are offered by the provider or requested by the patient is currently unclear. Nevertheless, by studying the utilization of telemedicine care, we offer insight into trends and disparities in engagement which should be explored in greater depth in subsequent studies.

Conclusion

Our study finds that video telemedicine was rapidly adopted during the COVID-19 pandemic and remained in high use through October 2020 with growing engagement among providers. Telemedicine opens opportunities for patients to not only be safely cared for during public health emergencies, but also allows patients greater flexibility in managing their health with improved convenience, cost, and high-quality continuous care. Population subgroups that lag behind in video telemedicine use, even when their provider largely adopted video visits into their practice, will likely require intentional engagement to improve their telemedicine access. As telemedicine becomes more integrated into care delivery models beyond the current pandemic, identifying and addressing the digital divide must now be a priority to prevent widening inequities.

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Figures and Tables

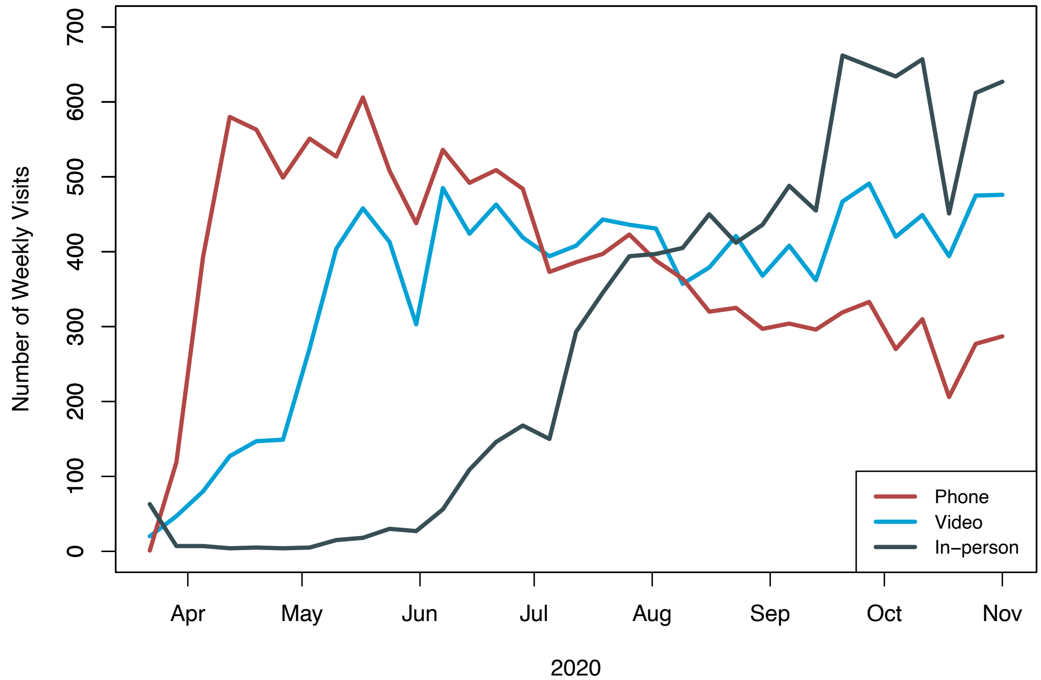

Figure 1. Trends in visit volumes from March 16-October 31, 2020.

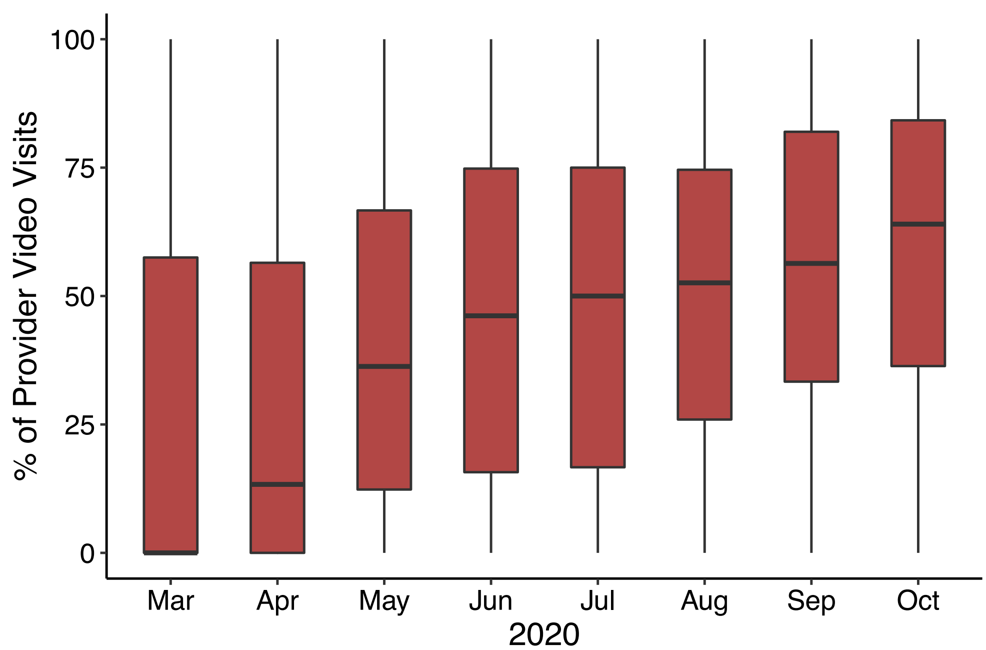

Figure 2. Trends in the proportion of video visits among telemedicine visits conducted by each provider. Each month increase was associated with a 7.6% increase in median video use (standard error=0.008, $P<.001$).

Table 1: Patient demographic and clinical characteristics by outcome status [a,b]

	Ever video (n=9575)	Phone (n=9375)	*P*-value[c]
Age (mean ±sd)	62 (±16)	70 (±14)	<.001
Sex			
Male	51% (5475)	49% (5343)	.82
Female	50% (4100)	50% (4032)	
Race			<.001
White	51% (8520)	49% (8147)	
Black	41% (233)	59% (331)	
Asian	53% (318)	47% (278)	
Other or Missing	45% (504)	55% (619)	
Ethnicity			<.001
Non-Hispanic	51% (8463)	49% (8187)	
Hispanic	38% (229)	62% (375)	
Other or Missing	52% (879)	48% (811)	
Payor			<.001
Private	61% (5301)	39% (3408)	
Public	42% (4223)	58% (5930)	
None	58% (51)	42% (37)	
MyChart			<.001
Activated	59% (7206)	41% (4930)	
Not activated	35% (2369)	65% (4445)	
Residence			<.01
Urban	50% (9112)	50% (9010)	
Suburban-Rural	56% (447)	44% (358)	
History of Major CVD			
CHD	68% (724)	32% (342)	<.001
CAD	46% (2647)	54% (3056)	<.001
Heart Failure	41% (831)	59% (1196)	<.001
Stroke	53% (138)	47% (124)	.56
Hypertension	45% (3534)	55% (4384)	<.001
Hyperlipidemia	48% (2256)	52% (2457)	<.001
Number of Visits			<.001
1	47% (6959)	53% (7981)	
2	63% (1889)	37% (1101)	
3+	71% (727)	29% (293)	

Abbreviations: CVD, cardiovascular disease; CHD, congenital heart disease; CAD, coronary artery disease

[a] Row percents (count) may not sum to 100% due to rounding.

[b] χ^2 and Student's t-tests.

Table 2: Patient characteristics by provider video-use level and outcome [a-c]

	High-video-use Providers			Low-video-use Providers			Difference	
	Ever video (n=3135)	Phone (n=513)	*P*-value[c]	Ever video (n=5925)	Phone (n=8797)	*P*-value[c]	High vs. low video-use	*P*-value[c]
Age (mean ±sd)	60 (±17)	69 (±16)	<.001	63 (±16)	70 (±14)	<.001	-5.7	<.001
Sex			.89			.02		<.001
Male	86% (1660)	14% (270)		41% (5037)	59% (3507)		-5% (-4460)	
Female	86% (1475)	14% (243)		39% (2418)	61% (3760)		5% (-6614)	
Race			.02			<.001		<.01
White	86% (2815)	14% (443)		41% (5239)	59% (7643)		2% (-9624)	
Black	78% (60)	22% (17)		35% (165)	65% (312)		-1% (-400)	
Asian	88% (98)	11% (13)		44% (205)	56% (265)		<-1% (-359)	
Other or Missing	80% (162)	20% (40)		35% (316)	65% (577)		<-1% (-691)	
Ethnicity			<.01			<.001		<.001
Non-Hispanic	86% (2711)	14% (440)		41% (5287)	59% (7684)		-2% (-9820)	
Hispanic	74% (69)	26% (24)		30% (150)	70% (351)		<-1% (-408)	
Other or Missing	88% (352)	12% (49)		39% (487)	61% (760)		3% (-846)	
Payor			<.001			<.001		<.001
Private	91% (1850)	8% (171)		50% (3215)	50% (3221)		12% (-4415)	
Public	79% (1263)	21% (339)		32% (2683)	67% (5542)		-12% (-6623)	
None	88% (22)	12% (3)		44% (27)	56% (34)		<1% (-36)	
MyChart			<.001			<.001		<.001
Activated	91% (2215)	9% (227)		50% (4619)	50% (4671)		4% (-6848)	
Not activated	76% (920)	24% (286)		24% (1306)	76% (4126)		-4% (-4226)	
Residence			.89			.02		.20
Urban	86% (2984)	14% (489)		40% (5646)	60% (8457)		<-1% (-10629)	
Suburban-Rural	86% (145)	14% (23)		45% (270)	55% (334)		<1% (-436)	

[a] Row percents (count) may not sum to 100% due to rounding.
[b] 580/18950 (3%) patients were seen by both types of providers and were excluded.
[c] χ^2 and Student's t-tests.

Table 3. Association of patient factors with ever video (vs. only phone) telemedicine visits [a,b]

	Ever video vs. phone only		
	OR	95% CI	*P*-value
Age (per year)	0.97	0.97-0.97	<.001
Female sex	0.87	0.81-0.93	<.001
Race			
White, Asian, Other	Ref	-	-
Black	0.74	0.61-0.90	<.01
Ethnicity			
Non-Hispanic	Ref	-	-
Hispanic	0.57	0.46-0.69	<.001
Payor			
Private	Ref	-	-
Public or None	0.73	0.68-0.79	<.001
Residence			
Urban	Ref	-	-
Suburban or Rural	1.27	1.07-1.49	<.01
MyChart			
Activated	Ref	-	-
Not activated	0.33	0.31-0.36	<.001
Provider video-use			
Low	Ref	-	-
High	9.35	8.43-10.39	<.001

Abbreviation: CI, confidence interval

[a] n=18370 for this model. 580 patients with visits with both high and low-video-use providers were excluded. 29 patients had missing ZIP codes.

[b] Model was determined by stepwise backward selection based on minimizing the Akaike Information Criterion. Race groups were combined (White, Asian, Other), and ethnicity groups were combined (other was added to non-Hispanic) for model parsimony as the uncombined categorizations had statistically insignificant effects on the outcome (all *P*>.05).

Table 4. Patient characteristics by MyChart activation status [a-c]

	Activated MyChart (n=12136)	Non-activated MyChart (n=6814)	*P*-value
Age (per year)	65 (±15)	67 (±16)	<.001
Sex			<.001
Male	63% (6800)	37% (4018)	
Female	66% (5336)	34% (2769)	
Race			<.001
White	66% (10982)	34% (5685)	
Black	47% (266)	53% (298)	
Asian	64% (383)	36% (213)	
Other	45% (505)	55% (618)	
Ethnicity			<.001
Non-Hispanic	65% (11897)	35% (6443)	
Hispanic	40% (239)	60% (365)	
Payor			<.001
Private	68% (5962)	32% (2747)	
Public or None	60% (6174)	40% (4067)	
Residence			<.001
Urban	64% (11660)	36% (6462)	
Suburban or Rural	57% (462)	43% (343)	
Telemedicine visit outcome			<.001
Ever video	75% (7206)	25% (2369)	
Phone only	53% (4930)	47% (4445)	
Provider video-use[c]			<.001
Low	63% (9290)	37% (5432)	
High	67% (2442)	33% (1206)	

[a] Row percents (count) may not sum to 100% due to rounding.
[b] χ^2 and Student's t-tests.
[c] 580 patients were seen by both types of providers and were excluded from this statistic.

Appendix

Appendix A: Cardiovascular disease history groupings using the International Classification of Disease, 10th Revision

Cardiovascular Disease	ICD-10
Atrial fibrillation	I48
Congenital heart disease	Q20-Q26
Coronary artery disease	I21-I25
Hypertension	I10-I16
Heart failure	I50
Stroke	I63
Hyperlipidemia	E78.2 E78.4 E78.5 E78.0

Abbreviation: ICD-10, International Classification of Diseases, 10th Revision