NORTHWESTERN UNIVERSITY

Patient-Reported Experiences with Telehealth During the COVID-19 Pandemic and Beyond

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ABSTRACT

Objective: To evaluate patient-reported experiences of telehealth and disparities in access, use, and satisfaction with telehealth visits during the COVID-19 pandemic (aim 1), to evaluate prevalence of portal use pre-, peri-, and post-pandemic, among the C3 cohort, and investigate any disparities in use by sociodemographic factors (aim 2), and to explore the telehealth experiences of older adults (age 65+) with multiple chronic conditions in the C3 study, via semi-structured interviews (aim 3).

Materials and Methods: The COVID-19 & Chronic Conditions (C3) study is an ongoing, longitudinal, telephone-based survey of participants. For aim 1, we examined data from the 5th wave of the C3 study conducted between December 2020 and March 2021. For aim 2, we conducted a retrospective analysis of the C3 study cohort and examined portal data between January 2019 and December 2022. For aim 3, we conducted semi-structured interviews on a subset of the C3 cohort, targeting patient experiences of telehealth, including barriers and challenges.

Results: *Aim 1.* Of the 718 participants, 342 (47.6%) reported having a telehealth visit within the past 4 months. Participants who had a recent telehealth visit were younger, reported worse overall health and chronic illness burden, and living below poverty level (all $P < 0.05$). Among participants who had a telehealth visit, 66.7% reported telephone visits and most participants (57.6%) rated telehealth quality as better or equal to in-person visits. Inadequate health literacy was associated with lower likelihood of reporting telehealth quality and usefulness. In multivariable analyses, lower health activation (adjusted odds ratio (AOR) 0.19, 95% CI 0.05 – 0.59) and LEP (AOR 0.12, 95% CI 0.03 – 0.47) were less likely to report telehealth as being better than in-person visits; lower health activation (AOR 0.06, 95% CI 0.003 – 0.41) and income below poverty level (AOR 0.36, 95% CI 0.13 – 0.98) were associated with difficulty remembering telehealth visit information.

Aim 2. Median portal logins increased from 16 (0, 277) in 2019 to 31 (0, 256) in 2020. In multivariable analyses, portal login activity was higher during the 3 years of the COVID pandemic (i.e., 2020, 2021, 2022) than the 2019 baseline (all $P < 0.001$). Portal login activity was also significantly associated with adequate health literacy (IRR 1.51, 95% CI 1.18 – 1.94) and multimorbidity (IRR 1.38, 95% CI 1.17 – 1.64), older age ($\geq$ 70 years) (IRR 0.69, 95% CI 0.55 – 0.85), female (IRR 0.77, 95% CI 0.66 – 0.91), Hispanic/Latinx (IRR 0.66, 95% CI 0.49 – 0.89), non-Hispanic Black (IRR 0.68, 95% CI 0.56 – 0.83), and Other race (IRR 0.42, 95% CI 0.28 – 0.64). Significant interactions between year and gender ($p = 0.004$), age ($p < 0.001$), multimorbidity ($p < 0.001$), and health literacy ($p < 0.001$) were found.

Aim 3. Many older adults reported an overall positive perspective of telehealth and valued telehealth for its convenience and efficiency, particularly for nonurgent or routine visits. Several factors influenced experiences of telehealth among this population, including the patient's primary concern or healthcare need, digital literacy, and provider-specific factors, such as rapport and a patient's desire for human connection.

Discussion: Most participants reported high usefulness and ease of navigating telehealth. Lower SES, limited English proficiency, inadequate health literacy, lower educational attainment, and low health activation were risks for poorer quality telehealth visits. Our investigation also illustrated lower portal use among patients who were older, female, racial/ethnic minorities, have lower health literacy, and have lower chronic illness burden. Sociodemographic disparities in portal use by gender, age, multimorbidity, and health literacy shifted over time at different points in the pandemic. The COVID-19 pandemic may have prompted an increase in portal use, thereby reducing sociodemographic disparities, by gender and age. However, the pandemic seems to have widened disparities in portal use among patients with lower health literacy. Qualitative interviews supplemented quantitative findings and highlighted potential ways to improve or optimize telehealth services for this vulnerable population.

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INTRODUCTION

There has been a growing shift and reliance on telemedicine, accelerated by the pandemic. Regulatory waivers and public health guidance during the pandemic, between 2019 – 2022, also encouraged the continuation of telehealth visits.[1] Though COVID-19-related telehealth visits steadily increased through the pandemic, most encounters continued to be driven by patients seeking care for conditions other than COVID-19.[2] As the transition to telehealth services continued, there was a growing body of research to highlight the ways in which telemedicine has broadly affected patient care and ways to better optimize these services moving forward.

Despite the potential clinical benefits of telemedicine, there have been several barriers identified that limit its utility. Disparities in access and usability of tech-based interventions, smartphones, patient portals, and internet/broadband have been well documented among certain demographics, such as by age, income, education, and community type.[3-5] Patient disparities in access and use of patient portals have also been documented prior to the pandemic, with gender, educational attainment, preference for in-person communication, and having a primary care clinician associated with portal nonusers.[6, 7] Older adults (OAs), more specifically, can face additional challenges with telehealth, and though generally have positive attitudes towards emerging technologies, a lack of familiarity or confidence in technology use (e.g. internet, health information technology) and access are significant barriers.[8-10]

To date, there has been limited research examining patient experiences of telehealth and, specifically, possible disparities that may exist currently in telehealth access and use, especially among vulnerable populations, such as OAs, as the pandemic progressed. Recent studies on telehealth adoption and use have either focused on the first few months of the pandemic crisis (January to March 2020), have been specialty- or condition-specific, and/or evaluating synchronous telehealth visits (e.g. audio/audiovisual).[2, 11-16]

The following dissertation study aimed to evaluate patient-reported experiences of telehealth and health disparities in access, use, and satisfaction of telehealth visits among middle age and older adults' during the COVID-19 pandemic. The primary aim and hypotheses (H) were to: **Aim 1. Evaluate patient-reported experiences with telehealth services during the pandemic and investigate whether any sociodemographic disparities in use have emerged.**

H_1. Patients who are older, have lower educational attainment, have lower health literacy, and low SES will be associated with lower use of telehealth services.

H_2. Among patients who have utilized telehealth, those who are older, with less educational attainment, lower health literacy, and low SES will be associated with greater self-reported difficulty and reduced satisfaction of telehealth services.

To further understand patient experiences, patient portal (i.e., MyChart) data from Northwestern's Electronic Data Warehouse (EDW) was examined among the C3 cohort, with the following secondary aim and hypotheses (H): **Aim 2. Assess prevalence of patient portal use from before and during the pandemic among the C3 cohort and examine disparities in use by sociodemographic factors.**

H_3. Patients' portal use and activity will be greater during the pandemic compared to before the pandemic.

H_4. Adults who are older, with less educational attainment or lower health literacy, and low SES will be less likely to demonstrate frequent portal use.

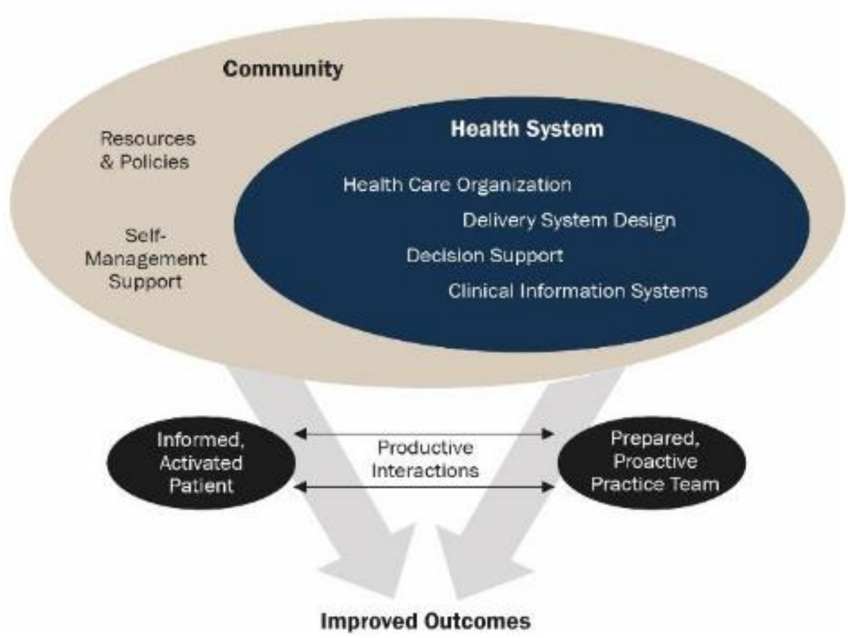
And finally, as older adult patients with multiple chronic conditions were potentially more vulnerable to the challenges presented by telehealth access and use, we conducted qualitative follow-up (n = 23) with this specific target population. The aim was to: **Aim 3. Explore the telehealth experiences of older adults (age 65+) with multiple chronic conditions in the C3 study, via semi-structured interviews targeting specific barriers, challenges, and perceptions of telehealth visits.**

CONCEPTUAL FRAMEWORK

The proposed research aims were grounded within a conceptual framework addressing both patient and health system perspectives. This included deconstructing the many difficulties OAs face when navigating health care systems and self-managing their personal health, made further challenging by transitions to telehealth services. Similarly, the current health system has had many limitations and gaps in providing telehealth services to OAs, given the immediate and abrupt changes in healthcare infrastructure due to the pandemic.

A Health System Perspective. The Chronic Care Model, or Care Model, has served as a practice standard for thinking about how health systems could improve their approach to addressing the increasing numbers of individuals with one or more chronic conditions.[17] It is an organizational strategy for preparing primary care settings, in particular, to manage the care needs of these individuals by implementing practical, supportive, evidence-based interactions between an informed, activated patient and a prepared, proactive practice team (**Figure 1**).

Figure 1. Chronic care model



This model asserts that current health systems are not adequately equipped to meet the needs of chronically ill patients, which may be driven by a multitude of factors, given primary care providers and services are typically time-limited, lacking in care coordination and any capacity to proactively follow-up with patients to optimize outcomes and prevent harm.[17] Furthermore, providers' adherence to evidence-based practices and guidelines can be variable, and patients themselves often lack sufficient skills and/or training to properly self-manage their conditions. Though existing literature has offered several strategies to improve patient-reported outcomes, these recommendations were often separate components of the healthcare system and lack integration. According to the Chronic Care Model, higher quality healthcare is achieved through specific transformations within existing health systems and more productive interactions with the community it serves. For a health system, robust quality improvement strategies must be implemented, strongly supported by leadership, to prompt the use of evidence-based practices; the use of incentives may be necessary. This may require leveraging electronic health records (EHRs) to support clinical decisions and track performance.

Thus, the Care Model offers an evidence-based framework and has since been expanded on to include specific components of patient-centeredness, timeliness, and preventive care.[18] The subsequent analysis leveraged the Care Model framework to better understand telehealth services and patient-reported experiences of those services, to address barriers and disparities, and ultimately improve telehealth delivery that is in line with a patient-centered approach.

Health Literate Care Model. An expansion of the Care Model discussed above is Koh et al.'s Health Literate Care Model, which describes health literacy as an essential component that was not previously included in the original or expanded Care Model.[19] Health literacy is defined as "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health care decisions".[20] Research has illustrated that few individuals in the U.S. have adequate health literacy, with socio-demographic disparities, including age and race.[21] Older adults 65 years or older have been found to have the lowest average health literacy, compared to other age groups, with 1 in 5 OAs lacking the necessary skills to manage tasks necessary for managing their health, including healthcare decisions.[22, 23]

Given the degree to which health literacy influences behaviors related to improving patient outcomes, this model integrated health literacy into the Care Model and starts with "health literacy universal precautions", which is the assumption that all patients are at risk of inadequate health literacy.[19] Providers would then confirm and ensure that patients reach adequate health literacy regarding their care (e.g. diagnosis, treatment information). By leveraging specific interventions in AHRQ's Health Literacy Universal Precautions Toolkit, this model emphasizes how health literacy would "become an organizational value" that is central to all aspects of planning and operations, including self-management support, delivery system design, shared decision-making support, clinical information systems, and assisting patient access to resources.[19]

In summary, access to and utilization of telehealth services relies on health literacy and digital literacy. With the shift to and continued use of remote telehealth services, it is vital to understand the patients that may be left behind and to ensure adequate onboarding or supportive services to improve patient access, utility, and experiences of services.

AIM 1: Patient Factors Associated with Telehealth Quality and Experience among Adults with Chronic Conditions

BACKGROUND AND SIGNIFICANCE

The COVID-19 pandemic accelerated the pace of telehealth adoption through regulatory waivers and loosening of restrictions on interstate licensure or site of telehealth delivery.[24] A growing body of research has investigated how telemedicine affects patient care and ways to better optimize these services. However, studies have focused on telehealth access and individual-level factors associated with perceived telehealth quality remain understudied.[11-13, 15, 25, 26]

Despite the potential clinical benefits of telemedicine, there are several barriers that may limit utility. Disparities in access and usability of technology-based interventions, smartphones, patient portals, and internet/broadband have been well documented among racial and ethnic minorities, patients with limited English proficiency (LEP), older adults, and rural communities.[3-5, 27] Differences in use of patient portals have also been documented prior to the pandemic, with men, lower educational attainment, LEP, preference for in-person communication, and not having a primary care clinician being more likely among portal nonusers.[6, 7] Older adults can face additional challenges with telehealth, and though have generally have positive attitudes towards emerging technologies, may demonstrate a lack of familiarity or confidence in internet and health information technology limiting telehealth utility.[8-10] With the looming expiration of the public health emergency in May 2023, long-term telehealth reimbursement remains uncertain while little data exists regarding its clinical effectiveness, optimal clinical use, and the patient experience. Studies so far have indicated overall high patient satisfaction and acceptability with telehealth visits, including convenience and provider communication; however, experiences differed across sociodemographic characteristics (e.g., gender, age, and SES) and modality of telehealth.[28-31] Patient-reported experience measures (PREMs) have typically focused on overall satisfaction of care, with usefulness, ease of use, and reliability as primary measurements, with limited considerations of perceived effectiveness of visit quality.

To date, limited research links patient experiences of telehealth to sociodemographic and psychosocial characteristics, yet to optimize telehealth visit quality, understanding potential barriers is important for clinicians and policymakers to optimize telehealth use. To fill these gaps, we examined: sociodemographic factors associated with PREMs in a diverse sample of middle aged and older adults with at least one chronic condition who received care at academic practices and federally qualified health centers (FQHCs) in Chicago, IL.

MATERIALS AND METHODS

The COVID-19 & Chronic Conditions (C3; R01AG030611-S1) study is an ongoing, longitudinal, telephone-based survey of participants who are currently active in 1 of 5 ongoing, primary care based, NIH-funded studies (R01AG030611; R01AG046352; R01DK110172; R01HL126508; R01NR015444; See **Appendix Table A**). The survey objective was to track the experiences of middle aged and older adults, with underlying health conditions that placed them at higher risk for infection and adverse outcomes from COVID-19, through the course of the pandemic. The parent studies were chosen due to enrollment of participants that would have greater risk for COVID-19 (e.g., largely middle-aged or older adult participants, with 1 or more chronic conditions).

Procedure

Participants in parent studies were recruited from multiple academic and community health center performance sites in Chicago, IL: 1) Northwestern Memorial Healthcare (NMHC), consisting of multiple, large academic practices; 2) Access Community Health Network

(ACCESS), a Public Health Service 330-funded network of FQHCs; and 3) Erie Family Health Center, a network of FQHCs comprised of 12 large health centers affiliated with the AllianceChicago EHR user community. The expanded C3 cohort for T3, T5, and T7 included participants from 4) Mount Sinai Icahn School of Medicine academic practice in New York, New York. All sites serve diverse patient populations and have centralized EHR systems (Epic and GE Centricity [AllianceChicago only]).

Eligible participants were identified via EHR queries, sending letters to eligible participants describing the study, telephoning eligible patients who did not opt out of being contacted, screening patients for eligibility, scheduling baseline interviews. Common exclusion criteria for all studies were having severe or uncorrectable cognitive, visual, or hearing impairment. The C3 study targeted study participants who had an interview completed between 2018 and March 2020, which helped to ensure the data collected previously in the parent study was most current. Detailed information on the C3 study procedures has been previously published.[17] Northwestern University's Institutional Review Board serves as the single IRB of record, and all research staff maintain Human Subjects Training (CITI).

Data Collection

The C3 cohort was recruited from a subset of patients enrolled in the parent studies, which had uniform data collected on a range of patient-reported outcomes within one year prior to COVID-19, as well as EHRs and pharmacy records. This study used data from T5 (December 2020) time point (**Figure 2**).

Figure 2. C3 Study Time Points

Measurement

The C3 study collected self-reported information on patient psychosocial characteristics, COVID-19 related beliefs and actions, health and lifestyle behaviors, health services use, and mental and physical health (**Appendix Table B**).

Sociodemographic and Psychosocial Characteristics. All parent studies had uniform collection of patient information, including demographics (age, sex, race, ethnicity), socioeconomic status (household income, number in household, educational attainment, employment status, and health insurance), self-reported chronic conditions, and a 1-item, self-reported overall health (excellent, very good, good, fair, or poor). Measures of socioeconomic status are routinely collected during C3 waves to note any changes to employment or income. In addition, the C3 survey included measures of other factors, including:

<u>Social Support.</u> Participants' perceived adequacy of tangible social support was evaluated using a 2-item social support scale as part of the parent studies and the C3 battery.[18]

<u>Self-Efficacy.</u> The Self-Efficacy for Managing Chronic Disease 6-item Scale covers multiple domains of chronic disease self-management, including symptom control, role function, emotional functioning and communicating with physicians, and inquires about patient confidence in completing each activity.[19]

<u>Health Literacy.</u> All studies also included health literacy, measured by the Newest Vital Sign (NVS). The NVS is a reliable screening tool used to determine risk for limited health literacy by asking questions about a nutrition label. Patients are given a copy of a nutrition label and asked six questions about how they would interpret and act on the information contained on the label. The number of correct responses is summed to produce a health literacy score ranging from 0-6. Scores are classified in terms of likelihood of limited literacy (0-1: likely limited; 2-3: possibly limited; 4-6: adequate).[20]

Patient Activation. The Consumer Health Activation Index (CHAI) was used to assess patients' degree of '"activation" or motivation to participate in healthcare decisions and actions.[21]

Telehealth Patient-Reported Experience Measures (PREMs)*.* The C3 telephone survey at T5 used an array of self-report questions evaluating participants' telehealth experiences, including satisfaction and preferences for future clinical visits, developed by Polinski et al.[32] These survey questions, response choices, and operationalization of PREMs are provided in **Appendix Table C**. To evaluate self-reported telehealth use, we first asked C3 participants if had telemedicine appointments in the past 4 months and how many telemedicine appointments they had as well as whether the visits were via video or telephone. Additional outcome measures included self-reported difficulty and satisfaction with telehealth services. Participants were asked how telehealth visits compared to in-person visits, to comment on difficulty remembering visit instructions, and perceived usefulness of telehealth once the COVID-19 pandemic is over.

Analysis Plan

Statistical analysis was conducted using RStudio version 3.6.1. Appropriate descriptive statistics (e.g., percentage, frequency, median) were performed on all patient variables. Univariable analysis was conducted to determine if there were any statistically significant demographic disparities between the following telehealth experience outcomes: 1) participants who had vs. did not have a telehealth visit in the past 4 months, 2) who reported higher vs. lower satisfaction of telehealth, and 3) who reported higher vs. lower difficulty of remembering information discussed during telehealth services, 4) higher vs. lower perceived usefulness of telehealth visits once COVID is over.

For categorical variables, data was analyzed using chi-square tests, or Fishers-Exact test when expected cell counts were less than 5. Telehealth experience outcomes with Likert scale responses were collapsed into binary measures. Quality of telehealth compared to in-person visits (better, just as good, worse, not sure) was dichotomized as better/just as good and worse/not sure. Difficulty of remembering information discussed during telehealth services (very easy, somewhat easy, somewhat difficult, very difficult) was dichotomized as very/somewhat easy and very/somewhat difficult. Perceived usefulness of telehealth visits once COVID is over (very useful, somewhat useful, neutral, not useful) was dichotomized as very/somewhat useful and neutral/not useful. As all outcomes were dichotomous, logistic regression models were performed for telehealth experience outcomes. All models were adjusted for any covariates associated with the outcomes in univariable analysis at p <.05, and unadjusted and adjusted odds ratios (ORs and AORs, respectively) were reported.

RESULTS

Of the 718 participants enrolled in the C3 study at T5, 342 (47.6%) reported having a telehealth visit within the past 4 months. Patient characteristics of this subsample are presented in **Table 1**.

Table 1. Characteristics of participants who had vs. did not have a telehealth visit in past 4 months

	All Participants (N = 718)		**Those who had telehealth visit in past 4 months (n = 342)**		**Those who have NOT had telehealth visit in past 4 months (n = 372)**		
Participant Characteristics	**Count**	**%**	**Count**	**%**	**Count**	**%**	**p-value**
Age (mean, sd)	65.8 (11.1)		64.6 (11.9)		66.8 (10.2)		0.03 **
Age group							0.02 **
< 60 years	188	26.2%	105	55.9%	81	43.1%	
60-69 years	244	34.0%	115	47.1%	126	51.6%	

≥ 70 years	289	40.3%	122	42.2%	165	57.1%	
CHAI (Patient Activation)							0.42
High Activation	52	7.2%	28	53.8%	24	46.2%	
Moderate Activation	283	39.4%	138	48.8%	145	51.2%	
Low Activation	351	48.9%	158	45.0%	189	53.8%	
Gender							0.89
Male	251	35.0%	122	48.6%	128	51.0%	
Female	467	65.0%	220	47.1%	244	52.2%	
NVS (health literacy)							0.12
Adequate (NVS ≥ 4)	271	37.7%	128	47.2%	143	52.8%	
Inadequate (NVS ≤ 3)	243	33.8%	130	53.5%	111	45.7%	
Primary Care Setting							0.34
Academic	538	74.9%	249	46.3%	286	53.2%	
Federally qualified health center	180	25.1%	93	51.7%	86	47.8%	
Health Insurance							< 0.01 **
Private	130	18.1%	53	40.8%	76	58.5%	
Medicare or Medicare + Private Supplement	251	35.0%	130	51.8%	121	48.2%	
Medicaid or Medicaid + Private Supplement	163	22.7%	91	55.8%	71	43.6%	
Self-Reported Overall Health							< 0.01 **
Excellent	77	10.7%	24	31.2%	51	66.2%	
Very Good	220	30.6%	95	43.2%	125	56.8%	
Good	268	37.3%	141	52.6%	126	47.0%	
Fair/Poor	153	21.3%	82	53.6%	70	45.8%	
Number of Chronic Conditions							< 0.01 **
≥ 3	403	56.1%	215	53.3%	187	46.4%	
< 3	315	43.9%	127	40.3%	185	58.7%	
Hispanic							0.87
No	434	60.4%	217	50.0%	215	49.5%	
Yes	110	15.3%	57	51.8%	53	48.2%	
Race							0.36
Black/African American	334	46.5%	83	24.9%	80	24.0%	
White/Caucasian	165	23.0%	176	106.7%	158	95.8%	

Other	29	4.0%	12	41.4%	17	58.6%	
Highschool Graduate							0.93
No	156	21.7%	73	46.8%	82	52.6%	
Yes	562	78.3%	269	47.9%	290	51.6%	
Education Level							0.13
HS or less	156	21.7%	73	46.8%	82	52.6%	
Some college or Technical	172	24.0%	95	55.2%	76	44.2%	
College graduate	390	54.3%	174	44.6%	214	54.9%	
Limited English Proficiency							0.76
No	657	91.5%	311	47.3%	342	52.1%	
Yes	61	8.5%	31	50.8%	30	49.2%	
Marital Status							0.94
Currently married	276	38.4%	136	49.3%	138	50.0%	
Not currently married	372	51.8%	181	48.7%	190	51.1%	
Employment Status							0.64
Not currently working	542	75.5%	261	48.2%	278	51.3%	
Currently working	175	24.4%	80	45.7%	94	53.7%	
Below Poverty Level							0.01 **
No	543	75.6%	244	44.9%	297	54.7%	
Yes	169	23.5%	96	56.8%	71	42.0%	
Access to video-enabled device							
Phone	559	77.9%	249	44.5%	278	49.7%	0.05 **
Laptop/Computer	472	65.7%	279	59.1%	257	54.4%	0.16
Tablet	312	43.5%	213	68.3%	159	51.0%	0.67
None	72	10.0%	29	40.3%	42	58.3%	0.11
Access to internet							0.22
No	55	7.7%	24	43.6%	30	54.5%	
Yes	661	92.1%	318	48.1%	341	51.6%	

** indicates statistically significant differences between groups (p-value ≤ 0.05)

The median age was 65.8 years (range 23-91), 35.0% (251/718) were male, and 46.5% (334/718) were African American. There were no significant differences between participants who had or did not have a telehealth visit within the past 4 months by gender, race, education, health literacy, primary care setting, English proficiency, marital status, or employment status.

Participants who did not report a recent telehealth visit were older (mean 66.8 (SD 11.1) vs. 64.6 (SD 11.9) years old; P = 0.03), more likely to have private insurance (58.5% vs. 40.8%; P < 0.01), more likely to report better overall health (66.2% vs. 31.2%; P < 0.01), more likely to have a lower chronic illness burden (46.4% had $\geq$3 chronic conditions vs. 53.3%; P < 0.01), and more likely to be living above poverty level (54.7% vs. 44.9%; P < 0.01).

Among participants with a recent telehealth visit, the average number of visits was 2.61 (range of 1 to 22), and 66.7% (228/342) reported that their most recent visit was via telephone. More than half (57.6%, 197/342) reported that the quality of telehealth was better or just as good as in-person visits. Most participants also reported ease of navigating telehealth visits: 88.9% (304/342) reported it was very or somewhat easy to describe their current health during a telehealth appointment, and 84.8% (290/342) reported it was very or somewhat easy to remember information discussed during their telehealth appointment. Most of the participants perceived telehealth as useful during the pandemic (80.4%, 275/342) and once the pandemic is over (75.1%, 257/342).

Characteristics of recent telehealth use (video vs. telephone)

A total of 66.6% (228/342) of participants reported their most recent telehealth visit being via telephone. As shown in **Table 2** , individuals were less likely to report having a recent video vs. telephone telehealth visit if they had inadequate health literacy (OR 0.39, 95% CI 0.23 – 0.66), received primary care at a FQHC (OR 0.29, 95% CI 0.16 – 0.54), less than a high school education (OR 0.49, 95% CI 0.27 – 0.90), LEP (OR 0.36, 95% CI 0.13 – 0.95), were not married (OR 0.60, 95% CI 0.37 – 0.96), and reported income below poverty level (OR 0.49, 95% CI 0.29 – 0.84).

Table 2. Likelihood of most recent telehealth visit being video

Those who had telehealth visit in past 4 months (n = 342)	**Likelihood of most recent telehealth visit being video**			
Participant Characteristics	**Telephone (n)**	**Video (n)**	**Unadjusted OR (95% CI)**	**p-value**
Age group				0.07
< 60 years	61	44		
60-69 years	83	32	0.53 (0.30, 0.94)	
≥ 70 years	84	38	0.63 (0.36, 1.08)	
CHAI (Patient Activation)				0.77
High Activation	17	11		
Moderate Activation	92	46	0.77 (0.33, 1.78)	
Low Activation	107	51	0.74 (0.32, 1.69)	
Gender				0.11
Male	74	48		
Female	154	66	0.66 (0.42, 1.05)	
NVS (health literacy)				< 0.01 **
Adequate (NVS ≥ 4)	71	57		
Inadequate (NVS ≤ 3)	99	31	0.39 (0.23, 0.66)	
Primary Care Setting				< 0.01 **
Academic	150	99		
Federally qualified health center	78	15	0.29 (0.16, 0.54)	
Health Insurance				0.08
Private	28	25		
Medicare or Medicare + Private Supplement	88	42	0.53 (0.28, 1.03)	
Medicaid or Medicaid + Private Supplement	64	27	0.47 (0.23, 0.95)	
Self-Reported Overall Health				0.23
Excellent	13	11		
Very Good	59	36	0.72 (0.29, 1.78)	
Good	96	45	0.55 (0.23, 1.33)	
Fair/Poor	60	22	0.43 (0.17, 1.11)	
Number of Chronic Conditions				0.84
≥ 3	152	72		
< 3	86	41	0.93 (0.58, 1.48)	
Hispanic				0.11
No	137	89		
Yes	43	14	0.56 (0.29, 1.08)	
Race				0.77

White/Caucasian	113	63		
Black/African American	55	28	0.91 (0.53, 1.58)	
Other	9	3	0.60 (0.16, 2.29)	
Highschool Graduate				0.03 **
Yes	171	98		
No	57	16	0.49 (0.27, 0.90)	
Limited English Proficiency				0.05 **
No	202	109		
Yes	26	5	0.36 (0.13, 0.95)	
Marital Status				0.04 **
Currently married	82	54		
Not currently married	130	51	0.60 (0.37, 0.96)	
Employment Status				0.07
Currently working	46	34		
Not currently working	181	80	0.60 (0.36, 1.00)	
Below Poverty Level				0.01 **
No	152	92		
Yes	74	22	0.49 (0.29, 0.84)	
Access to video-enabled device				0.01 **
Yes	199	114		
No	29	0	0.03 (0.002, 0.49)	
Access to internet				0.04 **
Yes	207	111		
No	21	3	0.27 (0.08, 0.91)	

** indicates statistically significant differences between groups (p-value ≤ 0.05)

Individuals were less likely to have a video telehealth visit if they did not have access to the internet at home (OR 0.27, 95% CI 0.08 – 0.91), such as Wi-Fi or data plan through a phone, or access to any video-enabled device (OR 0.03, 95% C 0.002 – 0.49), this included their own or a family member’s device.

Telehealth Patient-Reported Experience Measures (PREMs)

Factors associated with telehealth PREMs in univariable analyses and multivariable analyses are shown in **eTable 3.**

Telemedicine being better or just as good as in-person visits

A total of 145 respondents (42.4%) reported that telehealth was worse than in-person visits or reported being unsure. In univariable analysis, inadequate health literacy (OR 0.60, 95% CI 0.46 – 0.98), care at FQHC (OR 0.56, 95% CI 0.35 – 0.91) , female gender (0.62, 95% CI 0.39 – 0.97), Hispanic ethnicity (OR 0.37, 95% CI 0.20 – 0.67), and LEP (OR 0.15, 95% CI 0.06 – 0.38) were associated with lower likelihood of reporting that telehealth was better or as good as in-person visits. In multivariable models, low patient activation (AOR 0.19, 95% CI 0.05 – 0.59) and moderate patient activation (AOR 0.24, 95% CI 0.07 – 0.75), female gender (AOR 3.19, 95% CI 1.67 – 6.27), LEP (AOR 0.12, 95% CI 0.03 – 0.47), and receiving telehealth via telephone (AOR 0.52, 95% CI 0.27 – 0.99) were independently associated with lower odds of rating telehealth as better or just as good as in-person visits.

Ease of remembering information discussed during telehealth visit

A total of 84.8% participants reported that it was very or somewhat easy to remember information discussed during their telehealth visit. In univariable analyses, participants reporting difficulty remembering information discussed during the telehealth visit were more likely to have inadequate health literacy (OR 0.45, 95% CI 0.22 – 0.90), care at an FQHC (OR 0.44, 95% CI 0.24 – 0.82), be of Hispanic ethnicity (OR 0.40, 95% CI 0.20 – 0.79), have LEP (OR 0.39, 95% CI 0.17 – 0.91), not currently working (OR 0.40, 95% CI 0.23 – 0.79), and have income below poverty level (OR 0.43, 95% CI 0.23 – 0.79). In multivariable models, low patient activation (AOR 0.06, 95% CI 0.003 – 0.41) and living below poverty level (AOR 0.36, 95% CI 0.13 – 0.98) remained significantly associated with difficulty remembering information during a telehealth visit.

Usefulness of telehealth visits once COVID pandemic is over

About 25% of individuals reported that telehealth visits would not be useful post-pandemic. In univariable analyses, those who endorsed telehealth to be not useful post-pandemic were more likely to have inadequate health literacy (OR 0.47, 95% CI 0.26 – 0.84) or reported race as Other (OR 0.26, 95% CI 0.07 – 0.90). Technology-related access was also a significant factor, with no access to video-enabled devices (OR 0.37, 95% CI 0.17 – 0.80), no access to internet (OR 2.79, 95% CI 1.20 – 6.49), and telephone vs. video visit (OR 0.49, 95% CI 0.28 – 0.87) associated with reporting telehealth visits being not useful once COVID is over. In multivariable models, only having 3 or more chronic conditions remained significantly associated with a higher likelihood to report usefulness of telehealth visits post-COVID (AOR 2.11, 95% CI 0.99 – 4.62).

DISCUSSION

We report on telehealth access and patient experience in a unique diverse cohort with chronic medical conditions and detailed sociodemographic and behavioral data in the Chicago area. Telehealth use was less common among participants of older age, fewer chronic conditions, and living above poverty level. Two thirds of participants with a telehealth visit had their appointment via telephone vs. video. Access to technology, such as video-enabled devices or internet, were barriers to participants having a video visit, as were inadequate health literacy, LEP and lower SES (e.g., less than high school education, income below poverty level).

Participants with a recent telehealth visit typically reported greater than 2 visits within 4-months and overall positive experiences regarding quality (57.6%) and ease of navigating visits (88.9%), similar to results found in a 2020 systematic review which illustrated high patient and provider satisfaction with telehealth during the pandemic.[33] Furthermore, 80% reported telehealth to be useful during the pandemic, and 75% thought it would be useful post-pandemic.

Most participants reported it was easy to describe their current health during a telehealth appointment and that it was easy to remember health information discussed during the appointment. Although this highlights the potential benefits and success of continued access to telehealth services, concerns around widening existing health disparities in healthcare access were also highlighted by our data.

Our study highlights continued health disparities across key sociodemographic characteristics (e.g., English proficiency, ethnicity, SES, modality of telehealth) in healthcare access and patient experiences of telehealth visits. Prior studies evaluating patient satisfaction of telehealth visits have indicated limited technology access as a contributing factor in patients' negative perceptions of telehealth quality; however, these studies typically relied on qualitative interviews with small sample sizes, making it difficult to assess for sociodemographic disparities specifically in patient experiences of telehealth.[34-36]. Several studies have evaluated patient disparities in telehealth use and found that older patients, racial and ethnic minorities (e.g., Hispanic ethnicity, Black), LEP, and low SES (e.g., uninsured, Medicaid insured) were less likely to attend telemedicine appointments.[37-41] Challenges with technology access, use, and general readiness with telehealth have also been documented, with telehealth "unreadiness" more prevalent in patients who were older, men, not married, Black or Hispanic, had lower SES, and had poorer self-reported health.[42]

In sum, vulnerable populations, such as those with lower health literacy, LEP, low SES, Hispanic ethnicity, receiving care at a FQHC, or telephone visits may be more likely to report having less favorable telehealth experiences (e.g., lower quality telehealth visits, less likely to remember telehealth visit information). This may indicate that patients who have greater difficulty understanding health information, whether because of lower health literacy or LEP, may be more likely to report difficulties remembering telehealth information. Thus, telehealth visits also may be less effective for these populations, given the increased likelihood of challenges in remembering telehealth information. Furthermore, perceptions of usefulness of telehealth post-COVID, were significantly associated with technology access and modality of telehealth visits (telephone). Patient barriers to technology and internet access, as well as ease of navigating technology, may be important considerations when evaluating reach and effectiveness of telehealth services.

There were several limitations of this study. First, the C3 study surveyed patients who were participants with underlying health conditions actively enrolled in existing, NIH-sponsored studies or clinical trials in one, large U.S. city, which limit the generalizability of findings. Second, this was a cross-sectional analysis of a longitudinal study. Further research is necessary to determine how these health disparities may have potentially changed over the continued pandemic.

Despite these limitations, this study captured cognitive and psychological determinants of health (e.g., CHAI) and their potential impact on patient experiences of telehealth access and use. Currently, limited research studies have been able to capture such detailed psychosocial determinants of health and telehealth PREMs. Recent studies on telehealth adoption and use have either focused on the first few months of the pandemic crisis (January to March 2020), have been specialty- or condition-specific, and/or evaluating synchronous telehealth visits (e.g., audio/audiovisual).[2, 11-16]. This makes it difficult to make concrete conclusions of effectiveness or on patients' experiences of telehealth services.

Given the continued use of telehealth services as part of routine healthcare, best practices should target the entirety of the telehealth "ecosystem", as described in several publications, to better address the structural determinants influencing telehealth care, including accessibility, technology-related barriers, and existing healthcare disparities.[43-46] Clinicians should consider in-person visits, if feasible, for vulnerable patients who may be more at risk for appointment no-show and/or poorer quality visits when using telehealth (e.g., low SES, LEP). At a system or institutional-level consideration, also finding opportunities to evaluate a patients' technology/internet access and internet quality as part of the scheduling process and providing technology onboarding and support as needed.[47, 48]

CONCLUSION

COVID has accelerated and revolutionized telehealth, however disparities in healthcare access and utilization have persisted, and perhaps been exacerbated with telehealth. In particular, patients with lower SES, LEP, and low health literacy may not have high quality visits and have difficulties retaining instructions and information discussed during their telehealth visit. Health-systems and clinicians need to be aware of these vulnerabilities in order to build effective and equitable telehealth programs.

AIM 2: Disparities in Portal Use among Adults with Chronic Conditions during the COVID-19 Pandemic

BACKGROUND AND SIGNIFICANCE

The COVID-19 pandemic disrupted face-to-face health care delivery and accelerated the adoption and use of digital health modalities. As the pandemic progressed, digital health tools, like patient portals, offered continuity of care for patients managing their health, especially those with more chronic conditions and thus more complex care needs.

Patient portals are “secure websites for patients, typically maintained by provider practices, that offer access to a variety of functions linked to a physician’s EHRs”.[49] Basic functions of patient portals typically include viewing protected health information (PHI) (e.g., lab results, immunizations), requesting prescription refills, scheduling appointments, and sending secure messages to providers – acting as a central hub of sorts for patients to engage and manage their healthcare and health-related information [50]. Given the potential clinical and organizational benefits, patient portal use has been on the rise.[7, 51] Additionally, recent activation of provisions from the 21st Century Cures Act prohibits information blocking and ensures patients have access to their health data, including notes and most electronic health information (EHI), as quickly as possible.[52] However, research evaluating use and impact of patient portals pre-pandemic demonstrated mixed results overall, with some studies finding portal use associated with improved patient health outcomes, safety, and quality of care, while other studies found patient portals having little-to-no effect on patient empowerment or health outcomes.[53, 54].

Research also highlighted challenges in expanding portal use among members of vulnerable populations (e.g., adults managing multiple chronic conditions, older adults) who might be considered to benefit the most from the portal.[55-57] Sociodemographic disparities emerged across portal access, adoption, and use. Overall, patients with lower SES, educational attainment, literacy, no regular PCP, no internet, Hispanic ethnicity, and who were older had lower portal adoption, access, and use.[7, 49, 55, 58, 59] Existing studies have highlighted patient-specific barriers to portal adoption and use, including concerns around privacy and security, access to technology and internet, limited digital and/or technology literacy, limited health literacy, and a general preference for face-to-face modality of care.[57, 59, 60]

What is less clear is how portal adoption and use have shifted given the COVID-19 pandemic and recent changes due to the 21st Century Cures Act and whether these health disparities have continued despite greater health system adoption and meaningful use. Portal studies have typically evaluated barriers and disparities in “earlier time periods” of the pandemic (i.e. 2017-2019), with limited analyses evaluating multivariable models.[61] A recent study on identifying disparities in portal access within the U.S. was conducted in 2020; however, the study was a cross-sectional analysis and relied on patient surveys to measure portal use.[59]

In this analysis, we investigate patient portal data between 2019 and 2022 among a diverse sample of middle aged and older adults with at least one chronic condition at a large health system that includes academic and community-based practices. The study aim is to characterize portal adoption and use, evaluate temporal changes in use, and to examine any sociodemographic disparities in portal adoption and use.

MATERIALS AND METHODS

This study was a retrospective analysis of an ongoing, longitudinal cohort study, The COVID-19 & Chronic Conditions (C3; R01AG075043) study. The C3 study is a telephone-based survey of participants who are currently active in 1 of 5 ongoing, primary care based, NIH-funded studies (R01AG030611; R01AG046352; R01DK110172; R01HL126508; R01NR015444; See **Appendix Table A**). The survey objective was to track the experiences of middle aged and older adults, with underlying health conditions that placed them at higher risk for infection and adverse outcomes from COVID-19, through the course of the pandemic. The parent studies were chosen due to enrollment of participants that would have greater risk for COVID-19 (e.g., largely middle-aged or older adult participants, with 1 or more chronic conditions). C3 parent studies include detailed information on sociodemographics (e.g. education, income), health literacy, and patient-reported outcomes that are not routinely collected in clinical care.

To assess the prevalence of C3 participants' portal use pre-, peri-, and now post-pandemic and examine sociodemographic disparities in portal use, data from the C3 cohort was matched (using unique patient hospital identification numbers) to data, on use and activity of Northwestern's patient portal (i.e. MyChart), recorded by the Enterprise Data Warehouse (EDW) between 01/01/2019 - 12/31/2022.

Measurement

Sociodemographic and Psychosocial Characteristics. The C3 study collected self-reported information on patient psychosocial characteristics, COVID-19 related beliefs and actions, health and lifestyle behaviors, health services use, and mental and physical health (**Appendix Table B**). All parent studies had uniform collection of patient information, including demographics (age, sex, race, ethnicity), socioeconomic status (household income, number in household, educational attainment, employment status, and health insurance), self-reported chronic conditions, and a 1-item, self-reported overall health (excellent, very good, good, fair, or poor). Measures of socioeconomic status are routinely collected during C3 waves to note any changes to employment or income. In addition, the C3 survey included measures of other factors, including health literacy as measured by the Newest Vital Sign (NVS) [14], patient activation captured with the Consumer Health Activation Index (CHAI) [15], and tangible social support assessed with a 2-item validated scale [16].

Portal Use and Activity. Number of days of portal login by year was recorded for all study participants by the EDW. The following portal activities were reported in this study: echeck-ins, requesting appointments, cancelling appointments, confirming appointments, viewing clinical notes, viewing after-visit-summaries (AVS), downloading AVS, checking test or lab results, viewing scans, viewing documents, patient-physician messaging. All portal activities were reported by frequency by year (2019 – 2022).

Analysis Plan

Among the C3 study participants (N = 718), 536 (74.7%) had data on portal use. Statistical analysis was conducted using RStudio version 4.3.0 and Stata/SE version 18. Descriptive statistics were conducted on all patient variables. As the outcome of portal login activity was continuous and non-normally distributed, we applied Generalized Estimating Equation (GEE) with negative binomial regression to model average change in yearly portal login activity throughout the pandemic (2019 – 2022), adjusting for sociodemographic characteristics and COVID year as independent variables. For our model, we implemented an autoregressive correlation structure, as we assumed correlations between portal usage are highest between adjacent timepoints. We used 2019 as our baseline value to compare change in portal use over time. Incidence rate ratios (IRRs) and estimated probability were reported, with significant results at $p < 0.05$.

Additionally, in order to determine if portal activity differed by year across certain sociodemographic characteristics, interaction terms between years and significant variables identified in our initial multivariate model (i.e., race, gender, age, multimorbidity, and health literacy) were tested separately. We adjusted these interaction models using the same variables as our initial multivariate model.

RESULTS

Patient characteristics of this subsample are presented in **Table 4**. The mean age was 66.7 years (SD 12.01, range 23-91), 37.3% were male, 8.2% were Hispanic/Latinx, 26.5% were non-Hispanic Black, and 0% had limited English proficiency. 46.3% of patients had low patient activation and 13.4% had limited health literacy. When looking at measures of SES, 12.7% of patients had an education level of high school-or-less and 11.0% reported living below poverty level. The majority of patients (63.2%) had multimorbidity (3 or more chronic conditions).

Table 4. Participant Characteristics of Portal Users in C3 Cohort

Participant Characteristics (n = 536)	**Count**	**%**
Age (mean, sd)	66.7 (12.01)	
Age group		
< 60 years	123	22.9%
60-69 years	161	30.0%
> 70 years	252	47.0%
Gender		
Male	200	37.3%
Female	336	62.7%
Race		
Hispanic/Latinx	44	8.2%
Non-Hispanic White	322	60.1%
Non-Hispanic Black	142	26.5%
Other	20	3.7%
Education Level		
HS or less	68	12.7%
Some college or Technical	127	23.7%
College graduate	341	63.6%
Employment Status		
Not currently working	324	60.4%
Currently working	180	33.6%
Below Poverty Level		
No	471	87.9%
Yes	59	11.0%
Health Insurance		
Private	145	27.1%
Medicare or Medicare + Private Supplement	331	61.8%
Medicaid or Medicaid + Private Supplement	59	11.0%

Limited English Proficiency		
No	536	100.0%
Yes	0	0.0%
Marital Status		
Currently married	220	41.0%
Not currently married	271	50.6%
CHAI (Patient Activation)		
High Activation	39	7.3%
Moderate Activation	216	40.3%
Low Activation	248	46.3%
NVS (health literacy)		
Limited	72	13.4%
Marginal	111	20.7%
Adequate	353	65.9%
PROMIS Anxiety		
None	369	68.8%
Mild	94	17.5%
Moderate/Severe	69	12.9%
PROMIS Depression		
None	417	77.8%
Mild	66	12.3%
Moderate/Severe	49	9.1%
Number of Chronic Conditions		
≥ 3	339	63.2%
< 3	197	36.8%
Self-Reported Overall Health		
Excellent	71	13.2%
Very Good	191	35.6%
Good	196	36.6%
Fair/Poor	78	14.6%
Tangible Support		
No support needed	442	82.5%
Adequate support	29	5.4%
Inadequate support	61	11.4%
Primary Care Setting		
Academic	534	99.6%
Federally qualified health center	2	0.4%

Portal use and activity over time. Distribution of portal logins by year are shown in **Figure 3**. Frequency of portal activity across 2019 to 2022 are reported in **Table 5**. When looking at median number of days of portal logins, patient logins increased from 16 (IQR 0 – 45.3) in 2019 to 31 (IQR 2 – 52) in 2020. The median number of days of portal logins in 2021 and 2022 were 31.5 (IQR 6 – 65.3) and 31 (IQR 4.8 – 65) respectively. The most frequent portal activity was checking lab or test results, with medians as follows: 4 (IQR 0 – 13) in 2019 and 2020, 6 (IQR 0 – 14) in 2021, and 7 (IQR 0 – 17) in 2022. All other portal activities, such as scheduling (i.e., echeck-ins or requesting, cancelling, and confirming appointments) and messaging, were low and had medians at-or-close to 0 across each COVID year.

Figure 3. Boxplot of Number of Days of Portal Logins by Each Year (2019-2022)

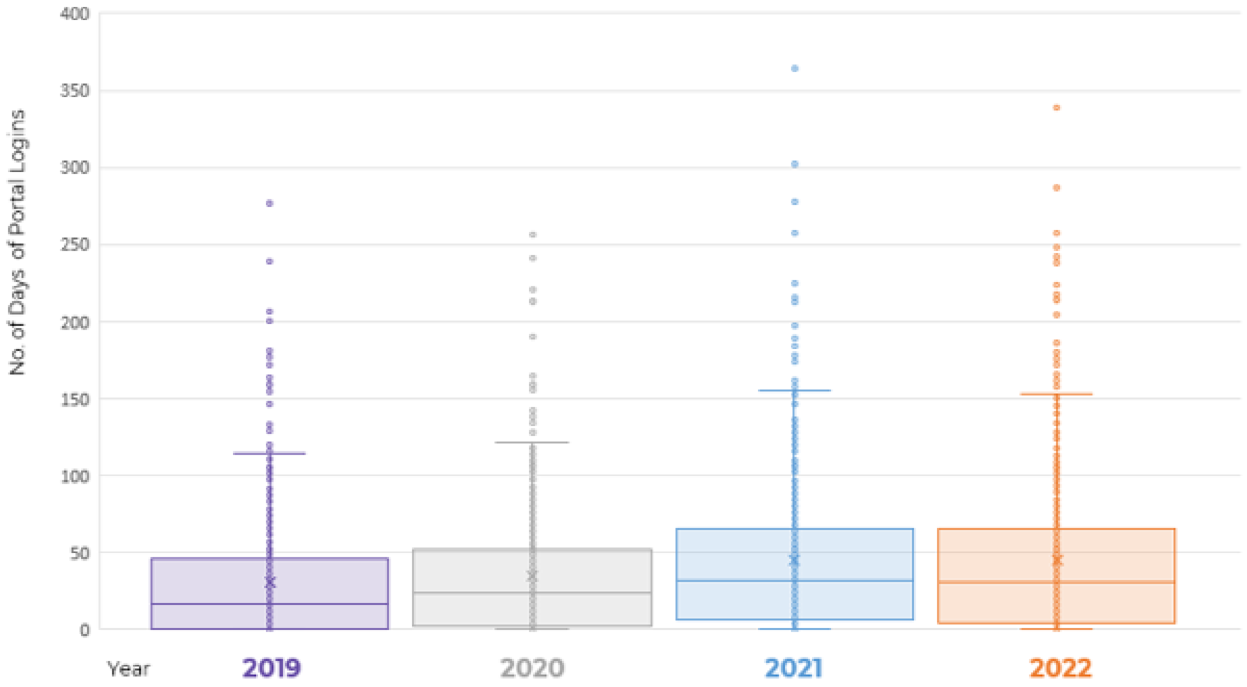


Table 5. Frequency of portal activity from 2019 to 2022

Portal Activity (median, range)	**2019**	**2020**	**2021**	**2022**
No. of days patient logged in to MyChart	16 (0, 277)	31 (0, 256)	31.5 (0, 364)	31 (0, 339)
No. of echeck-ins	0 (0, 7)	0 (0, 25)	0 (0, 8)	1 (0, 48)
No. of appt requests	0 (0, 3)	0 (0, 3)	0 (0, 3)	0 (0, 3)
No. of appt cancellations	0 (0, 11)	0 (0, 0)	0 (0, 0)	0 (0, 0)
No. of appt confirmation	0 (0, 19)	0 (0, 51)	0 (0, 22)	0 (0, 23)
Clinical note views	0 (0, 9)	0 (0, 13)	0 (0, 37)	1 (0, 40)
AVS views	0 (0, 2)	0 (0, 1)	0 (0, 2)	0 (0, 1)
AVS downloads	0 (0, 1)	0 (0, 2)	0 (0, 3)	0 (0, 1)
Results checked	4 (0, 214)	4 (0, 109)	6 (0, 163)	7 (0, 124)
Scan views	0 (0, 2)	0 (0, 7)	0 (0, 1)	0 (0, 6)
Document views	0 (0, 3)	0 (0, 11)	0 (0, 36)	0 (0, 37)
New conversation messages	0 (0, 0)	0 (0, 0)	1 (0, 47)	4 (0, 163)

Associations between portal login activity and sociodemographic characteristics. Results of the multivariate, negative binomial regression model are summarized in **Table 6**. After adjusting for sociodemographic characteristics, portal login activity was higher during the 3 years of the covid pandemic than the 2019 baseline (2020: IRR 1.18, 95% CI 1.12 – 1.25; 2021: IRR 1.60, 95% CI 1.48 – 1.72; 2022: IRR 1.58, 95% CI 1.45 – 1.73). Higher portal login activity was also significantly associated with adequate health literacy (IRR 1.51, 95% CI 1.18 – 1.94), and higher chronic illness burden (IRR 1.38, 95% CI 1.17 – 1.64). Participants who were older (≥ 70 years) (IRR 0.69, 95% CI 0.55 – 0.85), female (IRR 0.77, 95% CI 0.66 – 0.91), and racial/ethnic minorities (Hispanic/Latinx: IRR 0.66, 95% CI 0.49, 0.89; Non-Hispanic Black: IRR 0.68, 95% CI 0.56 – 0.83; Other: IRR 0.42, 95% CI 0.28 – 0.64) demonstrated lower portal activity. Tangible social support was not associated with portal login activity.

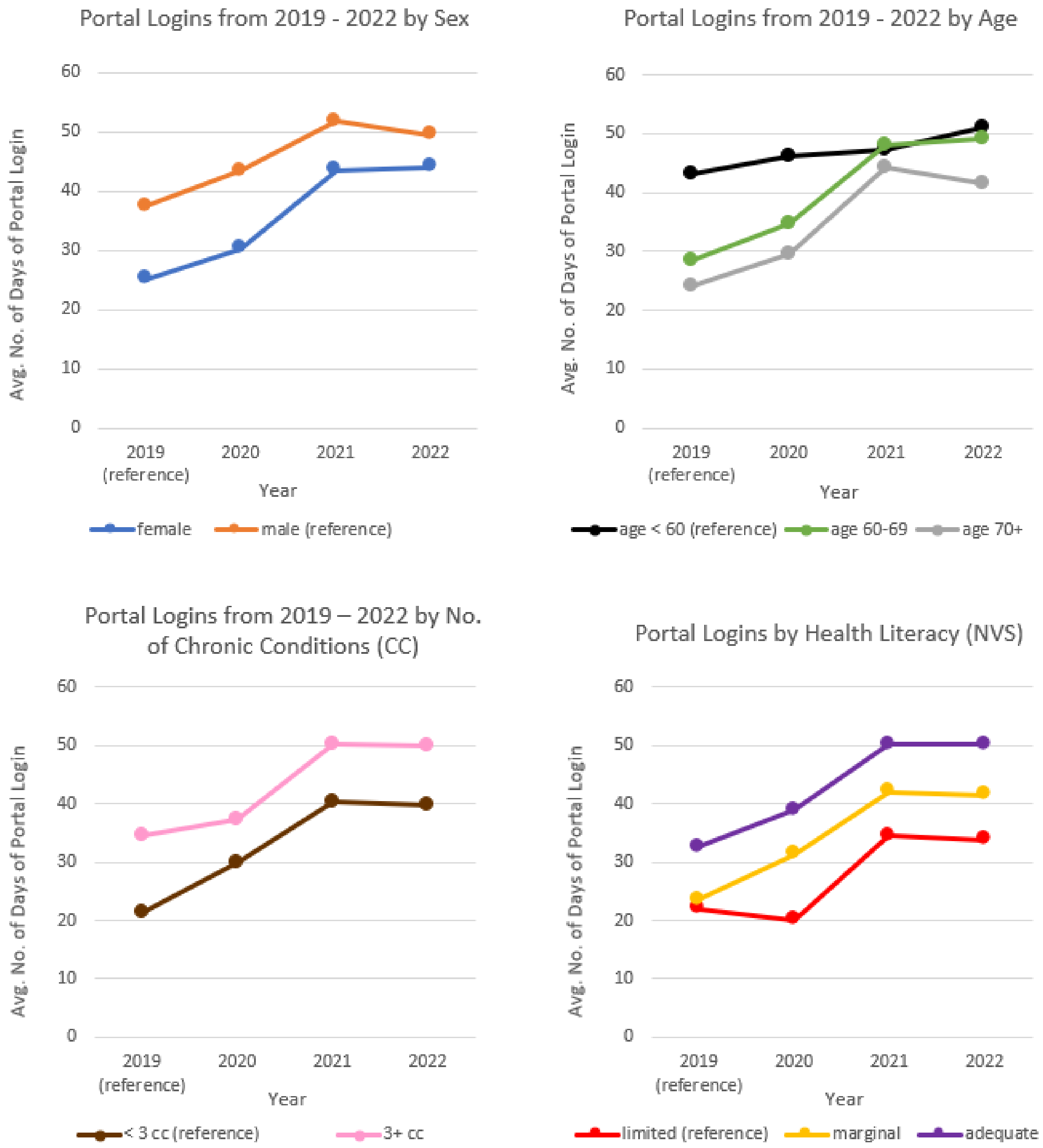
Table 6. Multivariate model evaluating the association of sociodemographic characteristics with portal login activity

Variables	**IRR (95% CI)**	**p**
Year		
2019		
2020	1.18 (1.12, 1.25)	**< 0.001 ****
2021	1.60 (1.48, 1.72)	**< 0.001 ****
2022	1.58 (1.45, 1.73)	**< 0.001 ****
Age group		
< 60 years		
60-69 years	0.81 (0.65, 1.01)	0.06
≥ 70 years	0.69 (0.55, 0.85)	**0.001 ****
Gender		
Male		
Female	0.77 (0.66, 0.91)	**0.002 ****
Race		
Hispanic/Latinx	0.66 (0.49, 0.89)	**0.006 ****
Non-Hispanic White		
Non-Hispanic Black	0.68 (0.56, 0.83)	**< 0.001 ****
Other	0.42 (0.28, 0.64)	**< 0.001 ****
NVS (health literacy)		
Limited		
Marginal	1.18 (0.90, 1.55)	0.22
Adequate (NVS ≥ 4)	1.51 (1.18, 1.94)	**0.001 ****
Number of Chronic Conditions		
≥ 3	1.38 (1.17, 1.64)	**< 0.001 ****
< 3		
Tangible Support		
No support needed	0.82 (0.64, 1.04)	0.10
Adequate support	0.90 (0.61, 1.33)	0.60
Inadequate support		

** indicates statistically significant differences between groups (p-value ≤ 0.05)

Interaction analyses of portal use over time. To evaluate for sociodemographic disparities in portal logins over time, interaction terms with year were then included separately in the model for race, gender, age, multiple chronic conditions, and health literacy. An interaction between year and race was not significant (p = 0.15); however, significant interactions were noted by gender (p = 0.004), age (p < 0.001), multimorbidity (p < 0.001), and health literacy (p < 0.001) (see **Figure 4**).

Figure 4. Interactions between Year (2019-2022) and Sex, Age, Multimorbidity, and Health Literacy Level with the Outcome of Number of Annual Portal Logins



Portal Logins from 2019 - 2022 by Sex

Portal Logins from 2019 - 2022 by Age

Portal Logins from 2019 – 2022 by No. of Chronic Conditions (CC)

Portal Logins by Health Literacy (NVS)

Women logged in to the portal on average 12 fewer times than men in 2019 (p < 0.001) and 13 fewer times than men in 2020 (p < 0.001). By 2021, this difference by gender was attenuated and no longer significant (adjusted mean difference: -8.1, 95% CI 17.2 – 0.95; p = 0.08), shrinking further by 2022 (adjusted mean difference: -5.4, 95% CI 14.2 – 3.5; p = 0.24). Similarly, preexisting disparities in portal usage by age were reduced. Compared to younger patients (< 60 years), older C3 participants (age 60 – 69 and ≥ 70 years) were significantly less likely to use the portal in 2019 (age 60 – 69 adjusted mean difference: -14.57, 95% CI -24.22 – -4.92; p = 0.003; age ≥ 70 adjusted mean difference: -19.11, 95% CI -28.32 – -9.90; p < 0.001). By 2021, differences in portal login by age were reduced and no longer significant (age 60 – 69 adjusted mean difference: 0.74, 95% CI -11.38 – 12.84; p = 0.91; age ≥ 70 adjusted mean difference: -3.20, 95% CI -14.47 – 8.06; p = 0.58).

When looking at chronic illness burden, patients with multimorbidity (i.e., 3 or more chronic conditions) logged in to the portal, on average, 13 more times than those without multimorbidity (i.e., less than 3 chronic conditions) in 2019 (p < 0.001). Disparities in portal use were consistently significant throughout the entirety of the pandemic, with the gap narrowing in peak COVID years of 2020 and 2021. Specifically compared to patients with fewer chronic conditions, patients with multimorbidity logged into the portal about 7 more times in 2020 (95% CI 1.13 – 13.68, p = 0.02), 9 more times in 2021 (95% CI 1.36 – 18.21, p = 0.02), and 10 more times in 2022 (95% CI 1.87 – 18.55, p = 0.02).

Disparities in portal login by health literacy illustrates a different narrative of what is seen in gender and age. In 2019, patients with adequate health literacy logged in to the portal on average 10 more times than those with limited health literacy (p = 0.002). In 2020, during the peak of the COVID-19 pandemic, disparities in portal usage by health literacy were exacerbated. Compared to those with inadequate health literacy, patients with marginal and adequate health literacy logged in to the portal 11 (p = 0.004) and 19 more times, respectively (p < 0.001). Furthermore, significant differences in portal login between adequate and limited health literacy persisted into 2021 (adjusted mean difference: 15.77, 95% CI 5.23 – 26.30; p = 0.003) and 2022 (adjusted mean difference: 16.31, 95% CI 5.96 – 26.67; p = 0.002).

DISCUSSION

Despite a two-fold increase in overall portal logins, utilization was lower among certain population groups. Multivariate models adjusting for covariates showed the portal was more likely to be used in later pandemic years (2020 – 2022) and less likely to be used by patients who were older, female, racial/ethnic minorities, have lower health literacy, and have lower chronic illness burden.

Of note, our study highlighted significant disparities in portal logins by key sociodemographic characteristic, including gender, age, multimorbidity, and health literacy, as well as shifts in those disparities over time. Near the beginning of the pandemic in 2019, patients who were women, older, had lower chronic illness burden, or had lower health literacy had significantly fewer portal logins. While gender- and age-related disparities were reduced as the pandemic progressed, disparities by multimorbidity remained. Disparities by health literacy not only remained but worsened with the course of the pandemic. These results suggest that for certain populations the COVID-19 pandemic may have prompted an increase in portal use (possibly out of necessity to manage healthcare during a global crisis) thereby reducing sociodemographic disparities by gender and age.

However, the pandemic seems to have widened disparities in portal use among patients with lower health literacy, who may have more difficulty navigating technology and/or digital health modalities (e.g., patient portals). This highlights that pre-existing vulnerable populations, including those with low health literacy, may continue to be left behind in the shift towards digital health.

Though portal logins increased overall during the pandemic, specific portal activity was limited to reviewing test and lab results vs. scheduling, messaging, or viewing other documents in the portal. We also saw significant outliers in portal logins, potentially indicating “superusers” of the portal; however, as our analysis was reliant on the EDW database and evaluated specific portal activities, it is unclear whether we fully capture a patient’s portal activity and is a limitation of this analysis. Our analysis may capture “phantom logins” where a patient logs in and passively views their portal dashboard or notification or message alerts.

There were other limitations with this study. This analysis is on a process-based outcome (i.e., frequency of annual portal logins) and did not examine whether portal use was associated with better perceived healthcare quality or improved health outcomes. Logging in to the portal may not equate to meaningful use of the patient portal or meaningful engagement with healthcare providers in the system. We were not able to evaluate the impact of portal use on clinical decision-making or clinician factors that may impact use. It may be possible that increased logins might potentially indicate patients are struggling with their healthcare or have unmet needs or concerns. Thus, we cannot infer that increased portal logins are a positive outcome. Lastly, generalizability of findings is limited, as the C3 study surveyed patients with underlying health conditions actively enrolled at a single health-care system located in one, large U.S. city. Follow-up investigations are currently underway to examine disparities among C3 participants who sought care in other community healthcare locations.

Despite these limitations, this study is novel in its analysis of how disparities in portal use evolve over time, providing a unique trend analysis for evaluating sociodemographic differences in portal use during 4 years of the COVID-19 pandemic among a diverse sample of patients.

CONCLUSION

We include a novel analysis of sociodemographic disparities in portal use over 4 time points during the COVID-19 pandemic. Though interaction analysis between year and gender and age group illustrated initial disparities in 2019, these disparities were minimized as the pandemic progressed, ultimately reaching no significant differences by 2021 and 2022. Despite increased portal utilization and reduced disparities by gender and age, portal utilization remained significantly lower among patients with lower health literacy, further widening the digital gap. Further research may be warranted to fully understand effective interventions at site-wide and system-wide levels to bridge the gap in portal use and to minimize vulnerable populations, like patients with limited health or digital literacy, continuing to be left behind.

Aim 3: A Qualitative Study on Patient Perceptions and Drivers of Telehealth Experiences among Older Adults with Multimorbidity

INTRODUCTION

Overall, research has indicated that patients have reported positive experiences and satisfaction with telemedicine. Prior exploratory, qualitative studies conducted amongst patients and caregivers have highlighted several factors that influence patient experiences of telemedicine, across specialty care (e.g., cancer, surgery, sleep medicine). These factors include prior experience with telemedicine, system-specific factors (e.g., ease of scheduling visits, smooth connection, access to technical support), provider-specific factors (e.g., communication quality, visit thoroughness), convenience factors (e.g., accessibility, cost-saving, time-saving), and perceived usefulness (e.g., ability to effectively communicate concerns with provider).[62-69]

Existing research on the access and use of digital health and technology-based interventions have also highlighted sociodemographic disparities, such as among racial and ethnic minorities, older adults, non-English speaking patients, rural communities, and lower SES.[3-7] These disparities, also known as the “digital divide”, have persisted into the pandemic, with the shift to telemedicine services.[27, 70] Prior analyses by our team (i.e., evaluating patient experiences of telehealth) have illustrated sociodemographic disparities in how patients perceive and experience telemedicine visits, with vulnerable populations (e.g., low health literacy, older adults, Hispanic ethnicity, limited English proficiency) being more likely to report lower quality telehealth visits **(Aim 1)**.

Limited research, to date, has been conducted to further delineate these patient experiences of telehealth, particularly among vulnerable populations, including older adults. This study aimed to evaluate telehealth experiences and perceived challenges and barriers among older adults managing multiple chronic conditions.

METHODS

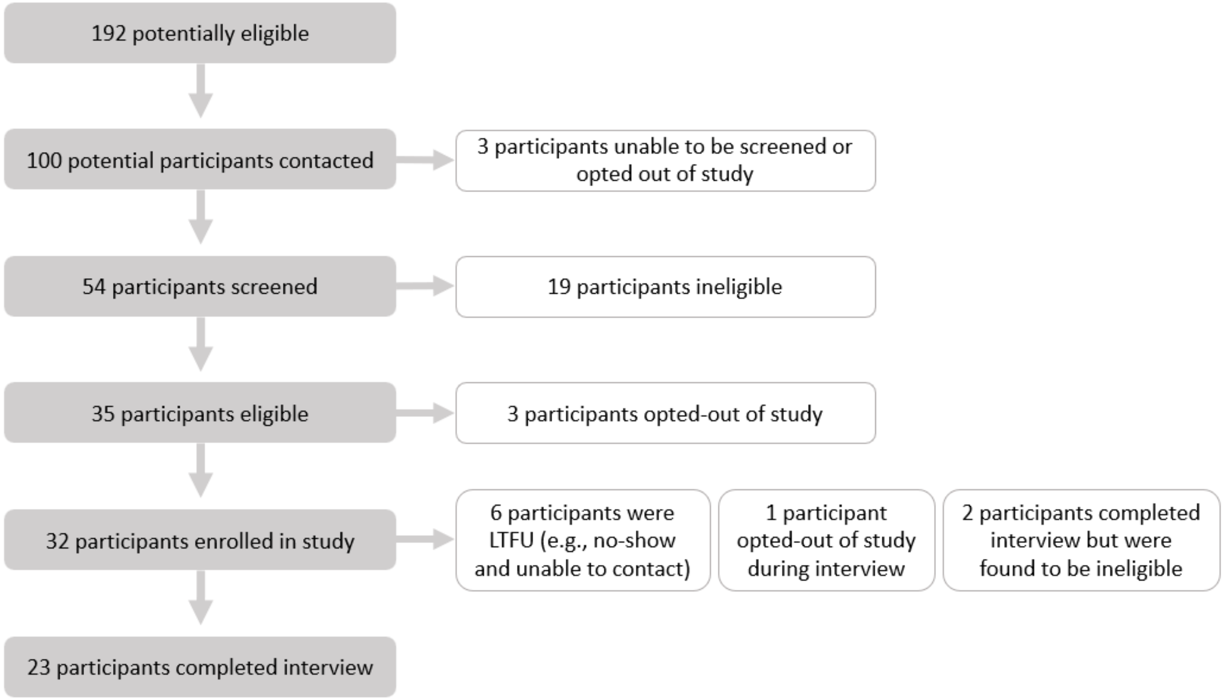
This study utilized semi-structured interviews among a sub-sample from The COVID-19 & Chronic Conditions (C3) study. The C3 (R01AG075043) study is an ongoing, longitudinal, telephone-based survey of participants who are currently active in 1 of 5 ongoing NIH-funded studies (R01AG030611; R01AG046352; R01DK110172; R01HL126508; R01NR015444). The objective was to track the experiences of middle age and older adults, with underlying health conditions that placed them at higher risk for infection and adverse outcomes from COVID-19, through the course of the pandemic. The parent studies were chosen due to enrollment of participants that would have greater risk for COVID19 (e.g. largely middle-aged or older adult participants, with 1 or more chronic conditions).

The research team developed a semi-structured qualitative interview guide (**Appendix Supplementary S1**). Interview questions were informed by a comprehensive literature review of patient experiences of healthcare visits, as well as potential perceived benefits and barriers of telehealth. Recruitment and data collection occurred between April and May 2023 in Chicago, IL. Participants were eligible if they (a) were 65 years of age or older, (b) had two-or-more chronic conditions, (c) had access to the internet, video conferencing technology, and/or a cell phone, (d) had at least one telehealth visit (audio and/or audiovisual) in the last 2 months, and (e) proficient in English. The study was approved by the Northwestern University Institutional Review Board.

Recruitment and Data Collection

Participants were recruited via purposive sampling methods, with potential participants identified through The C3 study. For this sub-study, potentially eligible participants who had provided consent to be contacted for future research opportunities were contacted by telephone on a rolling basis to participate in an individual, qualitative interview held virtually via Zoom. During the pre-screening call, eligible participants provided verbal consent to participate in the interviews. A flow chart of participant recruitment is provided in **Figure 5**. A total of 100 patients were identified as potentially eligible and contacted to participate. Of contacted patients, 35 completed screening and were found to be eligible; 32 patients enrolled and provided verbal consent. Ultimately, 23 eligible and enrolled participants completed the qualitative interview.

Figure 5. Recruitment flow chart



The lead author (EY) conducted all interviews following the semi-structured interview guide. Participants were asked a series of open-ended and close-ended questions regarding their telehealth experiences in the last 2-months. All interviews were conducted virtually via Zoom video conference platform’s audio-only function in order to: (a) protect participants’ privacy for the recording, and (b) allow participation of individuals without access to video technology. Each interview was administered in English and lasted approximately 15 minutes, were audio recorded, and transcribed. Each participant received a $20 gift card for their time and effort. Interviews were supplemented with sociodemographic and health information collected from the C3 study.

Data Analysis

Transcripts were analyzed both deductively and inductively, following a hybrid coding process.[71] A preliminary codebook was created with initial themes that were used to inform the interview guide. A team of two coders (EY, FT) independently reviewed transcripts. Coders met regularly to reach a coding consensus, reconciling differences in interpretation and updating the coding scheme as initial themes were adapted and supplemented with emergent codes that arose during review of the transcripts. All qualitative coding was conducted using NVivo Version 14 (Lumivero). Descriptive statistics were conducted using RStudio version 4.3.0.

RESULTS

Participant characteristics. This sample consisted of 23 English-proficient, older adults between the ages of 65 and 86 (mean = 71.7, sd = 5.9); 15 participants were female, 9 identified as non-Hispanic Black, 2 identified as Hispanic/Latinx, and 12 identified as non-Hispanic White. Majority of participants had higher SES (16 were college graduates; 21 reported living above poverty level), higher chronic illness burden (≥3) (n = 14), lower patient activation (n = 13) and received care at an academic medical center (n = 17). 7 participants were considered to have limited health literacy, and 13 reported having inadequate support. (**Table 7**)

Table 7. Qualitative interview participant characteristics

Participant Characteristics (n = 23)	**Count**	**%**
Age (mean, sd)	71.7 (5.9)	
Gender		
Male	8	34.8%
Female	15	65.2%
Race		
Hispanic/Latinx	2	8.7%
Non-Hispanic White	12	52.2%
Non-Hispanic Black	9	39.1%
Other	0	0.0%
Education Level		
HS or less	1	4.3%
Some college or Technical	6	26.1%
College graduate	16	69.6%
Below Poverty Level		
No	21	91.3%
Yes	2	8.7%
Health Insurance		
Private	12	52.2%
Medicare or Medicare + Private Supplement	6	26.1%
Medicaid or Medicaid + Private Supplement	3	13.0%
Marital Status		
Currently married	14	60.9%
Not currently married	9	39.1%
CHAI (Patient Activation)		
High Activation	1	4.3%
Moderate Activation	8	34.8%
Low Activation	13	56.5%
NVS (health literacy)		
Limited	7	30.4%
Marginal	4	17.4%
Adequate	11	47.8%
Number of Chronic Conditions		
≥ 3	14	60.9%
< 3	9	39.1%
Self-Reported Overall Health		
Excellent	4	17.4%
Very Good	8	34.8%
Good	5	21.7%
Fair/Poor	6	26.1%
Tangible Support		

No support needed	6	26.1%
Adequate support	2	8.7%
Inadequate support	13	56.5%
Primary Care Setting		
Academic	17	73.9%
Federally qualified health center	6	26.1%
Access to video-enabled device		
Yes	21	91.3%
No	2	8.7%

Prior technology experience. The majority of participants reported having prior, video call experience through their computer (n = 14) or phone (n = 16). Patients had the most prior experience with video calls for personal reasons (e.g., with friends or family) (n = 14), with a few who reported past video call experience in a professional setting (n = 5) and healthcare visits prior to the COVID-19 pandemic (n = 3). Video platforms most often mentioned were Zoom (n = 14), Cisco WebEx (n = 6), and FaceTime (n = 4). (**Table 8**)

Table 8. Self-reported prior technology experience

Prior Tech Experience (n = 23)	Count	%
Device Type		
Computer	14	60.9%
Phone	16	69.6%
Tablet	2	8.7%
Video Platform		
Zoom	14	60.9%
FaceTime	4	17.4%
Skype	3	13.0%
Microsoft Teams	1	4.3%
Google Duo	1	4.3%
Cisco WebEx	6	26.1%
GoToMeetings	1	4.3%
Purpose of past video calls		
Personal	14	60.9%
Professional	5	21.7%
Healthcare (prior to COVID)	3	13.0%

Domains and major themes. Four domains, or research questions, around patient perceptions and experiences of telehealth were developed *a priori* and explored: 1) pre-visit preparation, 2) positive experiences of telehealth, 3) challenges and barriers to telehealth, and 4) post-visit instructions and follow-up. As mentioned previously, transcripts were coded deductively and inductively, and emerging themes and subthemes were generated during the coding process. Domains and themes are discussed below, along with illustrative quotes by patient ID (PID).

Domain 1: pre-visit preparation

When asked to describe how patients prepared for their most recent telehealth visit, patients described either minimal-to-no preparation or some proactive involvement to prepare for their visit.

Theme 1A: Minimal preparation. A majority of patients (n = 20) typically described minimal-to-no preparation for their telehealth visit, often illustrating themselves as passive participants of telehealth set-up: “I didn't prepare at all, to be honest with you. I just participated” (PID 13); “They made the appointment for me. I didn’t prepare at all” (PID 16). Some patients expressed some minimal, “mental” preparation to allow themselves time and space to prepare for their telehealth appointment, including arranging a private space and/or setting up their device: “Really wasn't much to prepare for…I knew, prior to the call, the date, the time. And so everything is focused on my end. I've already decided where I'm going to be at and have the technology ready pretty much” (PID28). Others specifically noted using reminders, on their own or from the clinic schedulers (e.g., MyChart appointment notification, phone call from a scheduling assistant), to remember the appointment date, time, and how to log-in to the visit: “I don't know about preparing, but I, you know, put them on my calendar and make sure I have the links for them or the Facetime phone number, or am ready for an announcement that I should dial-in or something” (PID 22)

Theme 2B: Proactive preparation. A small sample of patients described more specific actions that denoted some involvement to prepare for their telehealth visit, such as writing down questions and/or reviewing health information: “I wrote down a lot of questions that I had ahead of time. I kind of went over my last lab results, and I pretty much had all my questions in my bag, and I wrote them down, so I would be sure to include all of them in my-when I got to talk to the doctor” (PID 09); “I wrote down questions that I had…I had my questions all ready for the doctor” (PID 21). These preparation steps seemed to ensure that patients were able to optimize their telehealth visit by address appropriate health-related questions and concerns, as well as streamlining their telehealth visit: “the preparation was making sure that you would write down all the issues that you were calling about. It's easy to get lost on a video call and get off on a lot of different tangents. So, having a list in front of you makes sure you-make sure that you accomplish what your goals were” (PID 39).

Domain 2: positive experiences of telehealth

A majority of patients endorsed that they were able to discuss their concerns (n = 22): “we discussed the issues that I wanted to discuss” (PID 38); I did get to cover all of them-the-pretty much all the information I wanted” (PID 09). Additionally, most patients also reported understanding instructions and follow-up discussed during their telehealth visit (n = 22): “Yeah, no problem at all.” (PID 40). Though some patients reported general, unspecified positive sentiment, several patients identified definitive drivers of their positive telehealth experiences related to convenience, effectiveness, and incorporating telehealth as part of a comprehensive healthcare plan.

Theme 2A: Telehealth is convenient. Participants described explicit or implicit aspects of conveniences as part of the reasons for their positive perceptions of telehealth. Much of the convenience was related to not having to commute for telehealth and reducing subsequent challenges or frustrations as part of commuting process (e.g., traffic, parking, cost of commute, getting physically ready): “…you don't have to dress up. You don't have to prepare. You don't have to leave early in the morning to get to the appointment…” (PID 09); “You know it's just so much easier to sit down and the computers as opposed to getting the car and drive” (PID 13) “It's not as time-consuming as it is when you have to get in the vehicle, drive, find somewhere to park, and then walk to the doctor, and then go to the machine, put your ticket in...” (PID 14). One patient went further, highlighting how eliminating the commute improved his vitals for the provider to read and document: “can I get a better blood pressure reading than I did get when I coming out of the parking lot at Northwestern? Yeah. Because I'm not, you know, whether I realize it or not, I'm going to have some sort, anxiety is the wrong word, but some sort of effect of sitting in the parking lot for as much as 20min before I come in” (PID 39).

Patients also described improved efficiency of visits via telehealth, compared to in-person, due to minimizing wait-times in-office and visits beginning or ending in a more timely fashion: “The telehealth is easier. In-person visit, sometimes you know, you forget them…there's all the waiting and different rhythms in the visits, you know. You could have been waiting for a long time. You could, you know, be in a hurry” (PID 12); “I think it gives me a little bit more time when I talk with him, 'cause it's telehealth over the phone, as opposed to in-person. And I know it's more on time, because sometimes what he does [for in-person visits], if another patient client is late, and I'm on time, they come-he'll take them first, which is my appointment time [laughs], which I didn’t like. But I find that's not the case over the phone.” (PID 37). Overall, visits are more concise: “when I have to go to the doctor's appointments, I think I do tele-visits more than in-person, because it’s shorter. It’s to the point, you know…short and sweet” (PID 48). And a few perceived that this benefit extended beyond patients, to providers as well: “I'm a big believer in [telehealth]. I really like them, and I think they're more efficient for the physicians." (PID 22); "I think it's better for both parties, the doctor, as well as myself, because it's much quicker" (PID 28).

Some patients also discussed the ease of scheduling telehealth visits, due to the flexibility in availability or perceptions that telehealth visits are more readily available, compared to in-person visits: "if I have something else going on, I like it, because, like, for instance, I was called in my car, and I was in a traffic jam. And we continued the telehealth during the whole traffic jam" (PID 40); "I was also grateful because I had to cancel a [face-to-face] visit because I was not able to get back to Chicago from Spain. So I had to cancel it. So we substituted it a couple of days later with a telehealth." (PID 56); "in some instances, [telehealth is] preferable to going in to see the care provider, because you get an appointment quicker" (PID 39).

Of note, one patient perceived telehealth to be more cost-effective from an insurance reimbursement standpoint: "I'm a happy camper to use teleconference calls, in part because I believe they are less expensive – billed less expensive – than in-office call" (PID 22).

Theme 2B: Telehealth as a supplement to in-person visits to optimize healthcare management. Patients described using telehealth for nonurgent issues, such as an "exchange in information" (PID 56) regarding medications, symptoms, and test results: "most of my visits are routine. It's just a-a routine check. Well, a routine check in my mind can be done over the phone" (PID 28); "I probably didn't have as much information to cover because it was strictly a minor problem. And I think we, [the provider and I], both felt that maybe we could just cover it quickly, and it wasn't a real big issue." (PID 09). Patients additionally utilized telehealth to triage care, particularly when symptomatic or unsure if health concerns necessitated an in-person appointment. As such, some patients described their telehealth visits as being just as good or better than in-person visits, in terms of quality and effectiveness: "in most cases, that's exactly what happened, it's just a conversation. You walk into office. You have a conversation, and you walk out. Well, that could be done over the phone." (PID 28); "I think that discussing it with him on the phone was equally good to going into the office... the same thing went on that would happen if I had gone into the office.” (PID 46). The patient leaves the telehealth visit with the perception that their expectations and/or purpose of visit was met.

Overall, patients identified the value of leveraging telehealth as part of their broader healthcare management and like having telehealth as an option, in addition to in-person appointments: “I like the option of-of choosing between doing it via telehealth or in-person. And again, it's from a convenience standpoint. It's when circumstances warrant telehealth, I think it's really nice. It's-it's very convenient and it certainly saves a lot of time and effort on my part.” (PID13); “it's also good to know that you have another way of talking to your doctor” (PID 40). One patient went further to position telehealth as a “first point-of-contact” (PID 28) for all patients to improve access and quality of care. Some patients specifically noted telehealth as an opportunity to improve access to care for vulnerable populations, including those who are immunocompromised, home-bound (e.g., mobility difficulties), or living in rural communities. In addition to access, one patient specified safety as a reason for doing telehealth: “being very immunocompromised, I feel safer doing the calls from home than going into a hospital environment” (PID 22).

Theme 2C: Familiarity with technology enhances telehealth experiences. Unsurprisingly, patients reported that some basic knowledge of technology was helpful to meaningfully participate in telehealth visits. Knowledge included both understanding and comfortability in using technology. For some patients, their provider and/or personal community were important sources of technical support that enabled them to build comfortability with telehealth: “I wasn’t familiar with it and, the truth is, my son has showed me some of the things to do with the Zoom, and I am a little better with it” (PID 33). When telehealth visits operated smoothly with no technical issues or issues that could be easily troubleshooted, patients often endorsed that their telehealth visit went well. Having the audio and visual component, in particular, was helpful for patients to build rapport with their provider and add visual context to some of their health concerns (e.g., provider able to see specific symptoms on the screen): “I feel like I prefer them when they include Facetime so that I can get visual, read cues and responses from my doctor.” (PID 22).

Theme 2D: Provider-specific influences of telehealth experiences. A patient’s relationship with the telehealth provider was also described as an important component of positive experiences. Patients perceived that when their provider takes the time to build good rapport, they had a better connection with their provider despite not being physically in the same room, and therefore, had a better telehealth experience: “as long as the doctor is patient and is really kind of baby-stepping you through it. You will understand it. And you’ll get to understand them. And that really helps. Just being patient and listening to me as the patient. And you know, it just takes time.” (PID 11).

Domain 3: barriers and challenges to telehealth

When asked about challenges or difficulties in using telehealth, patients identified their inadequate knowledge or comfort with technology and limited utility of telehealth in addressing all of their healthcare concerns. Barriers in technology also influenced perceived challenges in building adequate rapport or working relationship with the medical provider, which often negatively impacted a patient’s telehealth experiences.

Theme 3A: Limited digital literacy. Patients perceived that a subset of older adults are unfamiliar with technology and, therefore, not able to use telehealth visits effectively: “not all elderly patients understand iPhones and computers” (PID 21). Several older participants reported being unprepared for the adoption and use of telehealth largely due to lack of understanding in technology: “Well if I had known what I was doing, it would have been better I think. I feel like I wasn’t prepared for it.” (PID 33). While others reported apathy or aversion to technology more generally: “I didn’t care for it, mostly because I’m not a tech person. I’m a generation that did not grow up with this, and I feel self-conscious using it. And I feel awkward setting it up. It’s just not my cup of tea.” (PID 38).

And challenges with technology extended beyond navigating the telehealth visit specifically. A few patients reported being unable to access their email (e.g., forgetting their password) to retrieve the telehealth appointment information, difficulties with the appointment link, or internet or connectivity issues. Sometimes these technical issues forced appointments to be missed or rescheduled, which was frustrating for patients: “It went horribly. That sums it up. The doctor never got to talk-the doctor didn’t even see me.” (PID 16). In addition to patients’ digital literacy, one patient noted a provider’s readiness in providing telehealth services as a barrier: “there was some failed attempts at getting on, and from my standpoint it was on their end because I didn't have a connectivity issue.” (PID 19).

Theme 3B: Limited physical components. When inquiring about patient preferences and decision-making for their visit modality, patients mentioned choosing in-person visits when they need to be “physically checked on” (PID 03), such as certain medical specialties (e.g., ophthalmologist, audiologist), completing bloodwork, symptoms or concerns needing a physical examination by a provider. Even with an audio-visual telehealth, there is often a limitation in physical components that makes patients describe their visit as feeling incomplete or not as detailed as an in-person visit: “When you do it with Zoom, you know, even though you're kind of face-to-face it's not the same. They don't have an overall top-to-bottom view of you. There's no vital checks, and-and in my case I don't know if I'm supposed to say anything about specific illnesses” (PID 13). Additionally, when patients feel that their health concerns are severe or urgent, they might prefer an in-person visit, given the physical limitations of telehealth: “The only time I try to do a face-to-face, if there's something I'm concerned about that I can't describe over the phone. Then I would try to do in-person visit.” (PID 28).

Theme 3C: Limited human connection. About half of participants (n = 10) described perceiving telehealth as less personable as in-person appointments: “I guess it's just something that, it's more personal, you know, just to being seen in-person…it's just, [telehealth] is uncomfortable, 'cause I like to see somebody in-person.” (PID 44). 5 participants verbalized a strong preference for in-person visits, due to perceptions that telehealth did not replicate the same kind of human connection that they perceive as having during their in-person appointments. This may be due to a combination of factors, including limited digital literacy or comfortability with technology. Several patients who reported being unfamiliar with technology endorsed using audio-only telehealth visits as the idea of using video felt confusing or overwhelming. For some, this seemed to exacerbate negative experiences of telehealth, as patients felt unable to build satisfactory rapport with their provider without seeing each other: “Over the phone, I can't see somebody, you know, ‘cause I don't have Zoom. You know, and I can see the facial, whether they're, you know, is he pissed, or is he happy, or is he, you know?” (PID 44); “I don't feel as connected to who I'm talking to if it's just over the phone.” (PID 22).

There were also patient preferences for in-person communication and navigating interpersonal relationships: “[I] think I can, you know, say what I need to say better when I see the doctor in person. Or anybody else.” (PID 56). These preferences may be driven by sociocultural factors that are also integrated into patients’ digital literacy. As one patient described it: “I'm of an age where I think we're losing a lot as much as we're gaining with technology, because we're losing the one-on-one interaction, and I think our culture has changed, and I want to hang on to as much-as much of the kind of old-fashioned ways to communicate as I can. You know, I realize it's an age thing. But I don't think we can all text our way into relationships and solve problems with texts and emails. And I think it takes some one-on-one, good old face communication to really best communicate with each other." (PID 22).

Theme 3D: Logistical issues. A small portion of our sample described logistical challenges, such as scheduling issues and unexpected telehealth appointments. A few patients reported having unscheduled and unexpected telehealth visits that left them feeling surprised and jarred: "I wasn't expecting a call. I wasn't expecting her to call me when she did. They just took it upon themselves to use a telehealth call, and it wasn't easy to work with." (PID 33). For one patient, who had a telehealth visit scheduled and was unable to complete the appointment due to technical issues, he faced further complications with getting in contact with his providers to reschedule: "they're trying to say that they contacted me twice. I have no record of any phone call from them on my call log… I called them for the next four hours, every hour on the hour until I could get a direct phone call." (PID 16).

Domain 4: post-visit instructions and follow-up

In addition to patient experiences during their telehealth visit, we inquired about their experiences after the visit, specifically evaluating potential challenges with follow-up.

Theme 4A: Simple follow-up during telehealth visits. Patient post-visit instructions or follow-up steps were usually scheduling follow-up appointments or related to medications (e.g., prescription refill, discontinuing or tapering medications). On occasion, additional steps of completing lab work-up or behavioral recommendations were provided. The majority of patients reported having no challenges in understanding or completing follow-up instructions (n = 18), and instructions were described as routine or simple enough to comprehend and implement: "they were pretty basic" (PID 11); "the doctor calls the-the prescriptions into the pharmacy… at the end of the visit I knew the pharmacy was going to call when they were filled, and everything was going to be fine.” (PID 13). A little more than half (n = 13) of patients reported receiving some materials summarizing their telehealth visit upon completion of their telehealth visit via the patient portal (i.e., MyChart) or email; however, many were uncertain whether this summary was an after-visit summary (AVS) or other clinical note summary. Of the patients who did not receive an AVS (n = 10), a few noted that they usually do get an AVS following an in-person appointment: “I only get those when I go in and have an office visit” (PID 56).

A few patients did endorse some challenges following their telehealth visit related to recalling or reviewing information discussed during their visit. Two patients endorsed not receiving an AVS after their telehealth visit and thought having an AVS would have been helpful to remember information from their visit. Three patients mentioned challenges with using or navigating their patient portal, to find their AVS.

Theme 4B: What’s next? A subset of patients reflected on their telehealth experiences and discussed what could be helpful in improving telehealth visits for themselves specifically or for older adults generally. Overall, patients voiced two recommendations: 1) improving logistics to reduce scheduling errors and remind patients of appointment modality; 2) fostering a patient’s telehealth readiness.

As mentioned previously, patients use and benefit from appointment reminders (e.g., personal calendar, reminder calls from the clinic) and endorse frustration with errors in scheduling or rescheduling. So from the provider-side, a few patients reported that they would like to have clinics confirm the appointment date, time, and modality so that they can stay organized and manage expectations for their upcoming visit: “make sure the patients are informed it’s gonna be telehealth, [because] they didn't inform me. I guess they took it upon themselves, and they checked the box that I wanted telehealth, and I didn't even say anything about it or know anything about it.” (PID 40). Additionally, having a pre-visit call, similar to when a nurse or medical assistant completes an intake during an in-person visit, might be helpful in streamlining the telehealth appointment: “let them know how soon the doctor will-will call-in and prepare them for the doctors, so the doctor doesn't have to spend a lot of time with techie stuff.” (PID 21).

On the patient-side, there is interest in improving their technology literacy, such as learning how to use video components on their devices, to enhance their future telehealth experiences: “[telehealth] might work better with having it visual on the computer. Maybe someday I'll learn how to do, but I haven't so far” (PID 56). Also thinking of using some portion of in-person appointments to orient patients to telehealth with clear, written instructions that they can take home, for smoother onboarding: “the doctor in a in-person appointment, or someone, they should give like instruction-written instructions on how to do it on the phone” (PID 36).

DISCUSSION

This study explored perceptions and drivers of telehealth experiences during the COVID-19 pandemic among older adults with multimorbidity. Our investigation identified several factors that influence patient experiences of telehealth that highlight potential ways to improve or optimize telehealth services for this vulnerable population.

Patients typically identified themselves as passive recipients of telehealth by just showing up to the appointment virtually, with a few patients who were more proactive in their health management and visit preparation by reviewing health information and writing a list of questions or concerns they wanted to address with their provider. Most patients reported positive experiences of telehealth and often described minimal set-up required and convenience of telehealth visits. Convenience was largely related to time, energy, and costs saved by minimizing commute, reducing in-office waiting, improving timeliness of visits, and availability of appointments. Older adults seemed to prefer telehealth for the ease and accessibility of appointments, particularly for nonurgent concerns or routine appointments. Furthermore, older patients highlighted that having telehealth as an option to supplement in-person appointments was a valuable part of their overall healthcare management.

Our study included older adults who had a range of self-reported experiences with video calls and comfortability with technology, which were closely related to their experiences and perceptions of telehealth. Indeed, technology was a double-edged sword in its influence on telehealth PREMs. Older adults who reported positive experiences also reported some baseline level of digital literacy or familiarity or support with technology to be able to navigate telehealth appointments and problem-solve any technical issues that could have arisen. Those who were more unfamiliar or uncomfortable with technology were more averse to relying on telehealth as their primary means of healthcare. In addition to patient-specific factors of telehealth, patients also emphasized provider-specific factors that influence positive or negative experiences of telehealth. Having good rapport or a solid patient-provider relationship was a recurring theme for many of our older participants. Patients often endorsed a desire for the human connection, particularly in the context of communicating and navigating healthcare concerns or uncertainty in which patients often felt vulnerable.

Our study also inquired into experiences of following a telehealth visit, specifically understanding any challenges or barriers in follow-up. Though a majority of patients did not have any difficulty understanding or completing follow-up instructions, a few did endorse challenges in recalling information discussed during the visit. About half of patients reported not receiving an AVS, with a few participants who perceived that an AVS was only received after an in-person appointment.

This study had several limitations. First, with any retrospective data collection, recall bias may be a factor, particularly in qualitative interviews. Participants may have had difficulty remembering details of their telehealth visit, especially if interviews were not conducted close to their most recent visit. Thus, our inclusion criteria was limited to patients who have had at least one telehealth visit in the past 2 months of their screening call, which would hopefully have provided enough of a window to recruit enough eligible patients but also limit recall bias. Second, generalizability is limited, given the small sample and recruitment from English-speaking, multimorbid older adults living in one, urban, U.S. city. However, this study purposefully evaluated patient experiences from this vulnerable population to better understand potential gaps and challenges in telehealth services, and our findings add to an ongoing body of research of patient-reported telehealth experiences following the COVID-19 pandemic.

CONCLUSION

With the end of the federal COVID-19 public health emergency as of May 2023, it is unclear if and how telehealth will be continued. Our overall findings have identified generally positive telehealth experiences that may suggest continuing benefits to healthcare access and quality for adults living with chronic conditions. However, in our small sample of patients there were some highlighted concerns related to technology competencies for older patients that might point to a need for greater digital literacy skills, training, and technical support services. Further, as multiple participants appreciated a 'hybrid' care approach, reflecting how telehealth could better respond to more routine or minor issues or for triaging and determining whether an in-person is necessary, clinical workflows might reconsider how best to operationalize and utilize remote access for certain—or all—patient groups. To date, it is not clear to what extent ambulatory care practices have defined practices for when to offer telehealth services. Moving forward, further research should continue to explore best practices for the deployment of telehealth services in an optimal manner for older adults with diverse digital literacy skills and technology access.

DISCUSSION AND CONCLUSION

This study evaluated various outcomes of telehealth experiences among a diverse, urban cohort of chronically ill, middle aged and older adults (OAs). Overall, telehealth was less likely to be used among patients who were older, had lower illness burden, and living above poverty level. The majority of participants who had reported a recent telehealth visit were largely conducting audio-only telehealth vs. audio-visual. Access to technology, inadequate health literacy, limited English proficiency (LEP), and lower SES (e.g., less than high school education, income below poverty level) were barriers to audio-visual visits. Despite general positive experiences of telehealth among the C3 cohort, study findings illustrated key sociodemographic disparities in patient-reported experience measures (PREMs) of telehealth. Our study highlighted a subset of patients who may be more likely to report having lower quality telehealth visits and less likely to recall information discussed during their telehealth visit. This included patients with lower health literacy, LEP, low SES, Hispanic ethnicity, receiving care at a FQHC, or telephone visits and highlight an existing vulnerable population who may continue to be left behind in the transition to digital health.

Similar disparities were found in portal utilization. Though portal logins in 2022 doubled from the start of the pandemic in 2019, the portal was less likely to be used by patients who were older, female, racial/ethnic minorities, have lower health literacy, and have lower chronic illness burden. Our study also illustrated that disparities by gender, age, and health literacy shifted over time (between 2019 – 2022). Although differences in portal use existed prior to the pandemic, gender- and age-related disparities were alleviated over the course of the pandemic, while disparities by health literacy were significantly exacerbated over time. So not only did our study highlight cross-sectional disparities in portal use, but how those sociodemographic disparities shifted or persisted over the course of the pandemic.

The qualitative patient interviews supplemented our quantitative analyses by providing additional context of the specific challenges and barriers in utilizing telehealth among OAs.

Digital literacy, familiarity with technology, and having technical support from providers and/or friends and family were significant drivers of patient-reported experiences of their telehealth visits. Namely, OAs with some baseline level technology literacy or familiarity described being more comfortable navigating telehealth appointments and meaningfully engaging with their providers digitally. Whereas OAs who identified as having limited knowledge or comfort in using technology described telehealth as being less personable and much more preferred in-person visits to manage their healthcare needs. Qualitative analyses illustrated a spectrum of digital literacy and points of intervention that might improve telehealth services among OAs.

Despite some of these gaps and challenges in leveraging telehealth services, OAs overall reported positive sentiment telehealth as one of many tools in their healthcare repertoire. Though the post-pandemic landscape of telehealth availability and reimbursement is still unknown, OAs voiced an overall appreciation of telehealth as a convenient and effective supplement for nonurgent concerns or for immediate access to their care providers, compared to in-person visits. The findings may serve to inform further research patient-oriented solutions to improve equitable access and use in telehealth services, as well as providing preliminary data to inform clinical practice for individual providers to evaluate telehealth readiness and potential barriers among their patient population.

INNOVATION

These study results and subsequent discussion are provided in the context of limitations, which were discussed in each paper individually. Despite these limitations, the study yielded many innovative investigations for several reasons. First, the C3 cohort was recruited from community primary care practices in two urban, geographic locations hit hardest by the pandemic and was diverse by age, sex, race/ethnicity, socioeconomic status, education, health literacy, English language proficiency, and comorbidities. Second, the C3 data capture came from, not only patient phone surveys using validated assessments (with high retention rates to date; 83-94%), but also electronic health (including patient portal use) to access healthcare use and clinical information. And lastly, the C3 cohort provided a unique opportunity to evaluate patient-reported experience outcomes related to telehealth services among middle age and OAs with chronic conditions (69.4% with ≥3 chronic conditions) and understand the challenges posed by telehealth services.

The research approach was conceptually grounded, and pragmatically focused on helping healthcare and public health systems identify 1) patient factors associated with limited access to telehealth services, 2) factors associated with lower use and satisfaction to telehealth services, and 3) viable, modifiable targets for optimizing telehealth experiences moving forward.

The potential value of this research was in understanding the current landscape of patient experiences with telehealth visits. The hope is that the study results will shed light on attributes of telehealth visits that are important or challenging to patients, as well as disparities in access and use of telehealth services. These results may further the development and optimization of patient-centered telehealth care, particularly for OAs who may be more vulnerable to challenges surrounding telehealth services.

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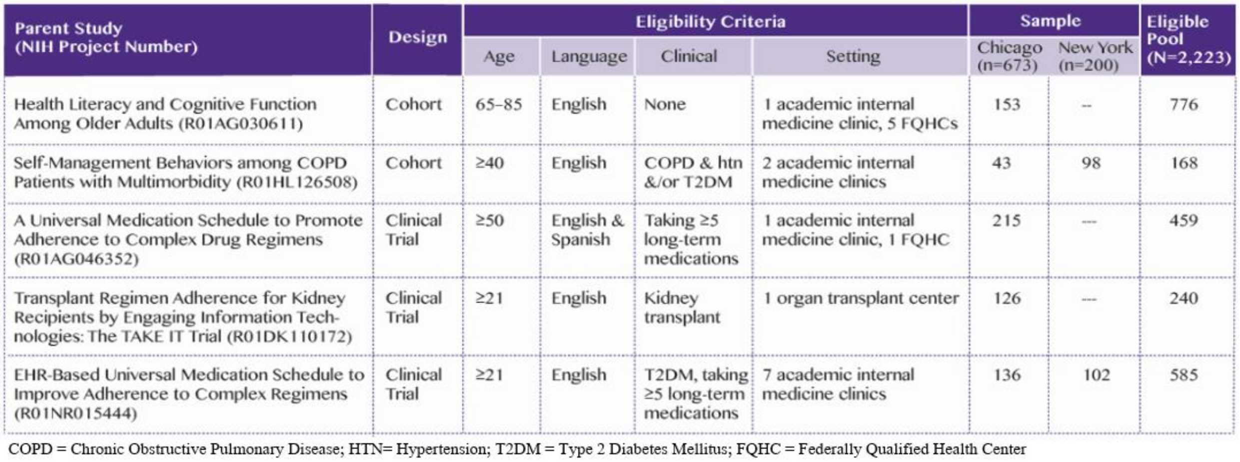
APPENDICES

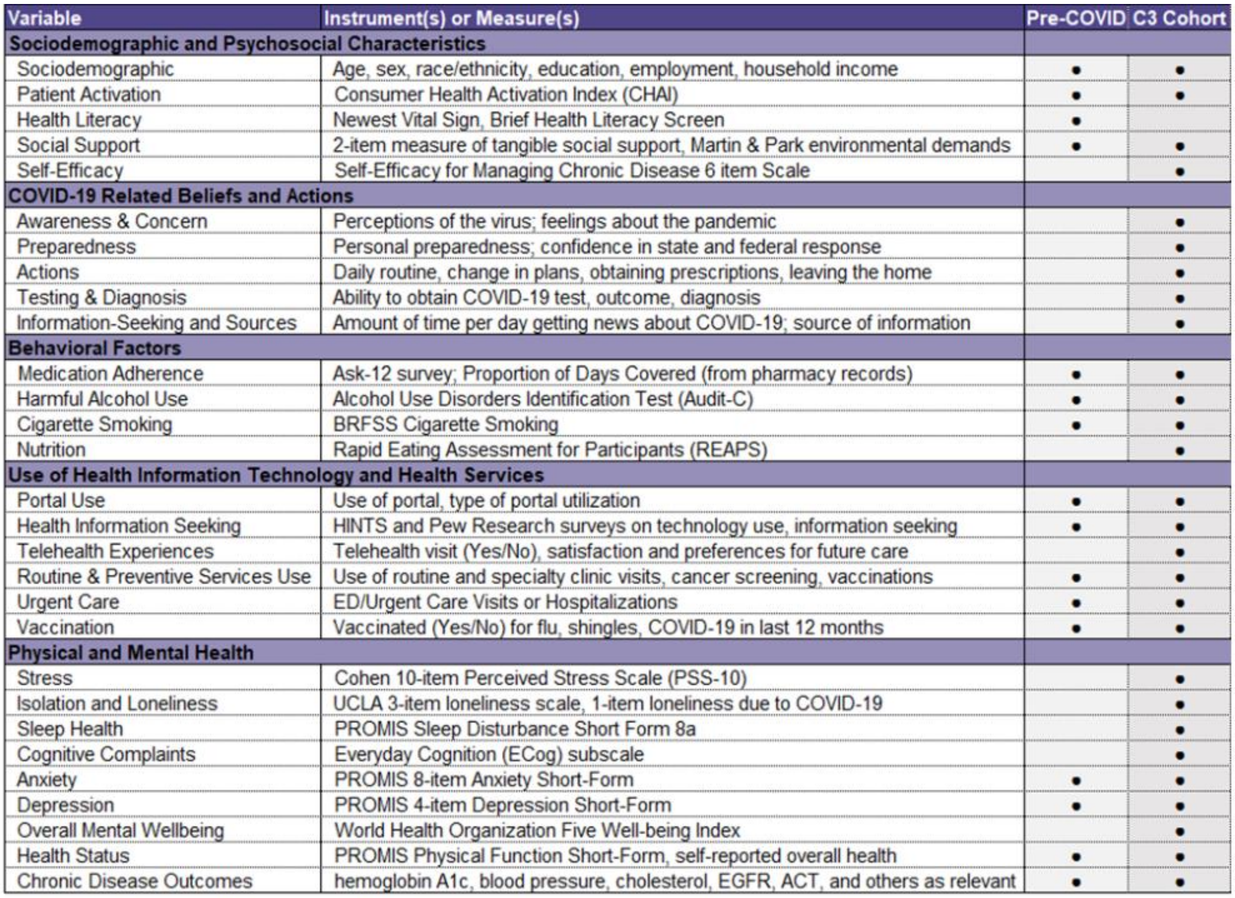
Appendix Table A. C3 Parent Studies



Parent Study (NIH Project Number)	Design	Eligibility Criteria				Sample		Eligible Pool (N=2,223)
		Age	Language	Clinical	Setting	Chicago (n=673)	New York (n=200)	
Health Literacy and Cognitive Function Among Older Adults (R01AG030611)	Cohort	65–85	English	None	1 academic internal medicine clinic, 5 FQHCs	153	--	776
Self-Management Behaviors among COPD Patients with Multimorbidity (R01HL126508)	Cohort	≥40	English	COPD & htn &/or T2DM	2 academic internal medicine clinics	43	98	168
A Universal Medication Schedule to Promote Adherence to Complex Drug Regimens (R01AG046352)	Clinical Trial	≥50	English & Spanish	Taking ≥5 long-term medications	1 academic internal medicine clinic, 1 FQHC	215	---	459
Transplant Regimen Adherence for Kidney Recipients by Engaging Information Technologies: The TAKE IT Trial (R01DK110172)	Clinical Trial	≥21	English	Kidney transplant	1 organ transplant center	126	---	240
EHR-Based Universal Medication Schedule to Improve Adherence to Complex Regimens (R01NR015444)	Clinical Trial	≥21	English	T2DM, taking ≥5 long-term medications	7 academic internal medicine clinics	136	102	585

COPD = Chronic Obstructive Pulmonary Disease; HTN= Hypertension; T2DM = Type 2 Diabetes Mellitus; FQHC = Federally Qualified Health Center

Appendix Table B. C3 Study Measures & Outcomes



Variable	Instrument(s) or Measure(s)	Pre-COVID	C3 Cohort
Sociodemographic and Psychosocial Characteristics			
Sociodemographic	Age, sex, race/ethnicity, education, employment, household income	●	●
Patient Activation	Consumer Health Activation Index (CHAI)	●	●
Health Literacy	Newest Vital Sign, Brief Health Literacy Screen	●	
Social Support	2-item measure of tangible social support, Martin & Park environmental demands	●	●
Self-Efficacy	Self-Efficacy for Managing Chronic Disease 6 item Scale		●
COVID-19 Related Beliefs and Actions			
Awareness & Concern	Perceptions of the virus; feelings about the pandemic		●
Preparedness	Personal preparedness; confidence in state and federal response		●
Actions	Daily routine, change in plans, obtaining prescriptions, leaving the home		●
Testing & Diagnosis	Ability to obtain COVID-19 test, outcome, diagnosis		●
Information-Seeking and Sources	Amount of time per day getting news about COVID-19; source of information		●
Behavioral Factors			
Medication Adherence	Ask-12 survey; Proportion of Days Covered (from pharmacy records)	●	●
Harmful Alcohol Use	Alcohol Use Disorders Identification Test (Audit-C)	●	●
Cigarette Smoking	BRFSS Cigarette Smoking	●	●
Nutrition	Rapid Eating Assessment for Participants (REAPS)		●
Use of Health Information Technology and Health Services			
Portal Use	Use of portal, type of portal utilization	●	●
Health Information Seeking	HINTS and Pew Research surveys on technology use, information seeking	●	●
Telehealth Experiences	Telehealth visit (Yes/No), satisfaction and preferences for future care		●
Routine & Preventive Services Use	Use of routine and specialty clinic visits, cancer screening, vaccinations	●	●
Urgent Care	ED/Urgent Care Visits or Hospitalizations	●	●
Vaccination	Vaccinated (Yes/No) for flu, shingles, COVID-19 in last 12 months	●	●
Physical and Mental Health			
Stress	Cohen 10-item Perceived Stress Scale (PSS-10)		●
Isolation and Loneliness	UCLA 3-item loneliness scale, 1-item loneliness due to COVID-19		●
Sleep Health	PROMIS Sleep Disturbance Short Form 8a		●
Cognitive Complaints	Everyday Cognition (ECog) subscale		●
Anxiety	PROMIS 8-item Anxiety Short-Form	●	●
Depression	PROMIS 4-item Depression Short-Form	●	●
Overall Mental Wellbeing	World Health Organization Five Well-being Index		●
Health Status	PROMIS Physical Function Short-Form, self-reported overall health	●	●
Chronic Disease Outcomes	hemoglobin A1c, blood pressure, cholesterol, EGFR, ACT, and others as relevant	●	●

Appendix Table C. C3 Study Telehealth Patient-Reported Experience Measures

Survey Question	**Survey Response**	**Collapsed Response (if applicable)**
Do you, or someone you live with, have a phone, laptop, computer, or tablet that you could use for a video-call with your doctor?	• Yes, Phone • Yes, Laptop/Computer • Yes, Tablet • No	• Yes (phone, laptop/computer, or tablet) • No
Are you able to access the internet in your home? This could be through Wi-Fi or a data plan on your phone.	• Yes • No • Don't know	
In the past 4 months, have you had a telemedicine/telehealth appointment (appointment with your provider by video or phone instead of an in-person appointment)?	• Yes • No • Don't know	
How many telemedicine visits have you had in the last 4 months?		
Was your most recent telemedicine visit done by:	• Telephone • Video	
How did your telemedicine/telehealth visit compare to a traditional in-person medical visit?	• Better than a traditional visit • Just as good • Worse • Not sure	• Better or just as good • Worse or not sure
How easy or difficult was it to describe your current health or symptoms during your telehealth visit?	• Very easy • Somewhat easy • Somewhat difficult • Very difficult	• Very or somewhat easy • Very or somewhat difficult
How easy or difficult has it been to remember all that was discussed during your telehealth visit?	• Very easy • Somewhat easy • Somewhat difficult • Very difficult	• Very or somewhat easy • Very or somewhat difficult
How likely would you be to recommend a telemedicine/telehealth visit to someone else?	• Definitely will • Probably will • Probably will not • Definitely will not	• Would recommend (definitely will or probably will) • Would not recommend (probably will not or definitely will not)
How useful have your medical appointments with telemedicine/telehealth been during the COVID pandemic?	• Very useful • Somewhat useful • Neutral • Not very useful	• Useful (very or somewhat useful) • Not useful (neutral or not very useful)
How useful do you think it will be to have medical appointments with telemedicine/telehealth after the coronavirus pandemic is over?	• Extremely • Very • Moderately • Slightly • Not at all	• Useful (extremely, very, moderately, or slightly) • Not useful (not at all)

Appendix Supplementary S1. Semi-Structured Qualitative Interview Guide

Patient Perceptions of Telehealth Interview Guide

We are talking to you today because you have previously received care from a doctor at Northwestern through a telehealth visit. We are interested in hearing about your telehealth experience.

Pre-visit

1. What experiences have you had with video calls before having telehealth visits, if any?
    a. Who was it with (friends, family)? What platform (e.g. FaceTime, Skype)? What modality (e.g., phone, tablet, computer)?

2. How did you prepare for your last telehealth visit?
    a. Probe: scheduling, issues with set-up

During Visit

3. Tell me more about your most recent telehealth visit - how would you describe your experience? What went well? What could have been better?

4. Did you have opportunities to discuss your concerns with the clinician?

5. Did you understand the instructions / subsequent follow-up?

Post-visit

6. What follow-up instructions did you receive (e.g., medication refill, testing, appointments)?

7. What challenges or difficulties did you experience in receiving or understanding follow-up recommendations from your provider?
    a. Probe: after-visit summary

Closing Question

8. Is there anything else you would like to share with me today about your telehealth experiences at Northwestern?