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Telehepatology Use and Satisfaction Among Vulnerable Cirrhosis Patients Across Three Healthcare Systems in the Coronavirus Disease Pandemic Era



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BACKGROUND AND AIMS: Telehealth has emerged as an important mode of cirrhosis care delivery, but its use and satisfaction among vulnerable populations (eg, racial/ethnic minorities, socioeconomically disadvantaged, substance use disorders) are unknown. We evaluated digital capacity, telehealth use, satisfaction and associated factors among patients receiving hepatology care via telehealth (telehepatology) across 2 Veterans Affairs and 1 safety-net Healthcare systems. **METHODS:** English- and Spanish-speaking adults with cirrhosis (N = 256) completed surveys on telehealth use and satisfaction, quality of life, pandemic stress, alcohol use and depression. Logistic regression analyses assessed telehealth use and general linear models evaluated telehealth satisfaction. **RESULTS:** The mean age was 64.5 years, 80.9% were male and 35.9% Latino; 44.5% had alcohol-associated cirrhosis; 20.8% had decompensated cirrhosis; 100% had digital (phone/computer) capacity; and 75.0% used telehepatology in the prior 6 months. On multivariable analysis, participants with alcohol-associated (vs not) cirrhosis were less likely and those with greater pandemic stress were more likely to use telehepatology (odds ratio = 0.46 and 1.41, respectively; $P < .05$). Better quality of life was associated with higher telehepatology satisfaction and older age was associated with lower satisfaction ($\beta = 0.01$ and -0.01 , respectively; $P < .05$). Latinos had higher satisfaction, but alcohol use disorder was associated with less satisfaction with telehepatology visits ($\beta = 0.22$ and -0.02 , respectively; $P < .05$). **CONCLUSION:** Participants had high telehepatology capacity, yet demographics and alcohol-related problems influenced telehepatology use and satisfaction. Findings underscore the need for interventions to enhance patient experience with telehepatology for certain vulnerable groups including those with alcohol-associated cirrhosis in order to optimize care delivery.

Keywords: Alcohol-Associated Liver Disease; Telemedicine; Underserved; Nonalcoholic Fatty Liver Disease; Metabolic dysfunction-associated steatotic liver disease; MetALD

Introduction

The coronavirus disease 2019 (COVID-19) pandemic significantly disrupted the care and management of vulnerable populations, including those with cirrhosis.^{1–3} The care of patients with cirrhosis is complex and involves frequent and specialized follow-up, disease monitoring, and constant engagement with healthcare systems. Recent studies have shown that during the pandemic, subspecialty care visits for patients with cirrhosis were reduced almost by half⁴ and that 73% of individuals who reported the pandemic had a negative impact on their liver disease felt that the COVID-19 pandemic delayed their care.⁵ In addition to care disruption, known risks for

Abbreviations used in this paper: AUDIT, Alcohol Use Disorders Identification Test; COVID-19, Coronavirus disease 2019; LDQOL, Liver Disease Quality of Life instrument; PHQ, Patient Health Questionnaire Depression Scale; QOL, Quality of Life; SD, Standard Deviation; SF-LDQOL, Short Form Liver Disease Quality of Life; TSUQ, Telemedicine Satisfaction and Usefulness Questionnaire; VA, Veterans Affairs.

Most current article

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cirrhosis progression such as unhealthy levels of alcohol consumption worsened, resulting in higher overall cirrhosis burden (deaths from alcohol liver disease, cases of decompensated cirrhosis and hepatocellular carcinoma)⁶ and mortality,⁷ thereby highlighting the need for novel strategies for enhanced healthcare delivery among patients with cirrhosis.

COVID-19 pandemic mitigating strategies offered an opportunity through telehealth to broaden access to hepatology care, termed telehepatology, and to address risk behaviors such as unhealthy levels of alcohol use in patients with chronic liver disease and cirrhosis.^{2,8} Several studies have examined the use of telehealth to care for hepatology patients. Among patients being evaluated for a liver transplant, studies have shown that telehepatology was helpful in triaging candidates⁹ and that it reduced the time from referral to evaluation.¹⁰ Similarly, telehepatology has been shown to facilitate diagnosis, linkage to care and treatment of patients with hepatitis C.^{11,12} More recently, a study conducted at safety-net hepatology clinics in San Francisco showed that patients with fatty liver disease-related cirrhosis were overall satisfied with telehepatology.¹³ Given the widespread use of telehealth during the pandemic, especially in settings where this technology might have not been easily accessible, better understanding of patient experiences with telehepatology is critical to cirrhosis management now and in the future.

Although prior studies suggest that telehealth can be effective, evaluation of factors associated with patient engagement and satisfaction with telehealth among vulnerable populations such as racial and ethnic minorities, individuals with substance use disorder and socioeconomically disadvantaged populations remain limited. One qualitative study conducted with patients receiving care at general medicine, pulmonary, and obstetrics clinics affiliated with the San Francisco safety-net system showed that access to the Internet was key to patient satisfaction and acceptability of telehealth.¹⁴ Moreover, in a quantitative study conducted in the same safety-net system, there was high interest in video visits regardless of race, ethnicity, or age, particularly among patients with smart-phone application use.¹⁵ Another study assessing telehealth use across urban, suburban, and semirural populations receiving general medicine and subspecialty care (including but not limited to cardiology, rheumatology, endocrinology, and nephrology) demonstrated that older age, Asian race, being a non-English-speaker, and having Medicaid insurance were associated with fewer completed telehealth visits.¹⁶

With respect to telehepatology, the data specifically among vulnerable populations are even more limited, and patients with cirrhosis in particular have not been studied. We previously observed that among vulnerable patients with fatty liver disease receiving care at hepatology clinics in the San Francisco safety-net health system, Hispanic ethnicity was associated with lower telehepatology satisfaction, despite overall high participation in a telehepatology visit.¹³ Such findings have important implications for improving care, since patient satisfaction is associated with

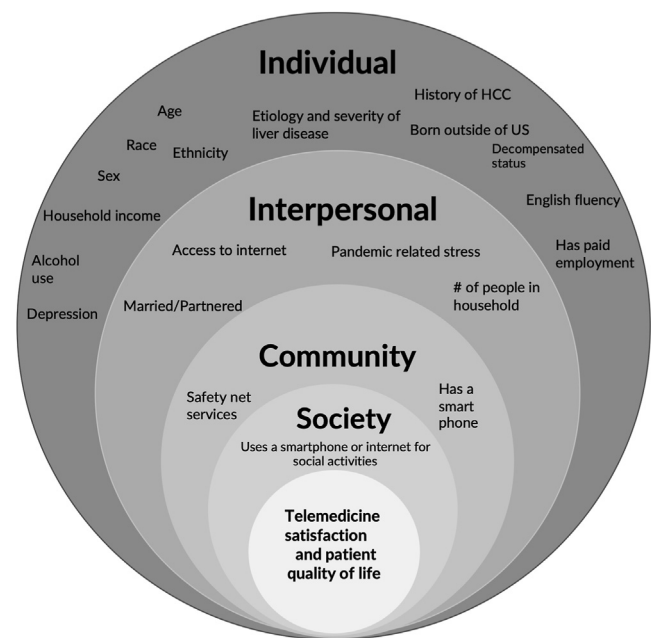


Figure 1. Conceptual framework to indicate factors potentially contributing to telehepatology use and satisfaction among patients with cirrhosis during the COVID-19 pandemic.

better outcomes in the context of liver disease² as well as treatment of other serious medical conditions.^{17,18} Further understanding of telehepatology use, satisfaction and quality of life measures amongst a vulnerable population with cirrhosis is important to deliver effective and equitable care.

Using the National Institute on Minority Health and Health Disparities framework,¹⁹ we developed a conceptual model to demonstrate factors, including patient reported experiences, contributing to telehepatology satisfaction and use among vulnerable populations including socioeconomically and medically disadvantaged groups (Figure 1). Building on this conceptual framework, the aims of this study were to assess digital capacity and evaluate telehealth use, satisfaction, and its associated factors among patients with cirrhosis receiving hepatology care at 2 Veterans Affairs (VA) healthcare systems and a large urban safety-net healthcare system in Northern California. The specific study outcomes included (1) use of telehealth, (2) satisfaction with telehealth systems, and (3) satisfaction with telehepatology visits (ie, visit content and interaction with providers). We anticipated that telehealth use and satisfaction in these settings would potentially be associated with demographic characteristics such as age and race/ethnicity, access to technology, pandemic-related stress, and clinical factors such as etiology of liver disease, quality of life, substance use, and mental health problems.

Methods

Study Participants

English- and Spanish-speaking patients aged 18 years and older with a clinical diagnosis of cirrhosis who had at least 1

hepatology clinic visit within the prior 6 months were identified using electronic medical record (EMR) data from 3 medical centers: Palo Alto VA Medical Center, San Francisco VA Medical Center, and Zuckerberg San Francisco General Hospital, a hospital affiliated with the safety-net healthcare system in San Francisco. A randomly ordered list of eligible patients was created at each site. Patients were contacted via mail, telephone and in person during clinic visits and invited to participate in a 1-time survey. Informed consent was obtained from all consenting participants. This study was conducted in compliance with the Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects. The study was approved by the institutional review boards of the University of California, San Francisco and Stanford University as well as by Zuckerberg San Francisco General Hospital, San Francisco VA Medical Center, Palo Alto VA Medical Center local review committees.

Data Collection

Consenting participants completed surveys during interviews with trained research personnel over the phone or in person. Surveys included fixed response items about participant characteristics and standardized patient-reported symptom and quality-of-life measures. Certified medical interpreters assisted with interviews of Spanish-speaking participants as needed. Research personnel abstracted additional clinical information from EMRs. Participants were compensated \$35 for study participation.

Measures

Participant characteristic variables. Sociodemographic information consisted of participant-reported age, sex, race/ethnicity (categorized as White, Black, Asian/Pacific Islander, Native American/Alaska Native, Latino, other), country of birth, preferred language, self-reported English fluency (categorized as fluency like a native English speaker, speaking English well, so-so, poorly, or not at all), household size, education, marital status, annual household income, and employment status. Information on liver disease etiologies and current and/or history of decompensated cirrhosis was obtained from the EMR. Cirrhosis decompensation was defined based on hepatology clinical note documentation or presence of decompensation clinical events: ascites, variceal bleeding, encephalopathy, or Child-Pugh Class B or C.²⁰ History or presence of hepatocellular carcinoma was also captured from EMR.

Telehepatology capacity. Capacity for accessing telehepatology was assessed using 6 questions that were adapted for low-income individuals from the Pew Research Center's 2021 American Trends Panel survey.²¹ Participants were asked if they had access to a device that could be used for telehepatology (cellphone, landline phone, digital tablet, or computer), whether they had a device they could use in private, and whether they used any of their devices for 8 common phone/Internet tasks or activities (phone calls, video calls/meetings, listening to music, watching movies/videos/television program, social media, ordering groceries/products/services, religious services, and remote work). Participants were also asked whether they had used telehepatology, which is defined as one or more prior remote video/telephone visit with the hepatology clinics.

Other patient-reported measures. Patient perceptions of the impact of liver disease and its symptoms were assessed using the short form of the Liver Disease Quality of Life instrument (SF-LDQOL), a 36-item disease-specific measure that has been shown to be reliable and valid in patients with cirrhosis.²² Higher scores reflect better quality of life. Alcohol use was assessed using the Alcohol Use Disorders Identification Test (AUDIT), a reliable and valid 10-item measure developed by the World Health Organization. AUDIT scores are associated with validated risk categories (0–7 = low risk, 8–15 = risky/hazardous, 16–19 = harmful, ≥ 20 = high risk/probably dependent).²³ Impact of the COVID-19 pandemic was assessed using the Pandemic Stress Index item, "How much is/did COVID-19 (coronavirus) impact your day-to-day life?" which is answered using a 5-point Likert response scale that ranges from 1 = not at all to 5 = extremely.²⁴ Depression symptoms were assessed using the Patient Health Questionnaire Depression Scale-8 (PHQ-8), an 8-item measure that uses a response scale ranging from 0 = not at all to 3 = nearly every day. Higher scores reflect higher levels of depression symptoms; a score of 10 or more is associated with a diagnosis of major depression.^{25,26}

Telehealth use and satisfaction. Primary satisfaction outcomes were assessed with the Telemedicine Satisfaction and Usefulness Questionnaire (TSUQ). The TSUQ includes 21 satisfaction items that use a 5-point response scale that ranges from 1 = strongly disagree to 5 = strongly agree.²⁷ The TSUQ items form 2 scales, the Impact and Use Scale that focuses on the telehealth system and the Visit Scale that focuses on telehealth visits. Higher scores reflect greater satisfaction. Prior research documents the reliability and validity of the TSUQ.²⁷

Statistical Analysis

Descriptive statistics, including means and standard deviations for continuous variables and frequencies for categorical variables, were computed for all variables. In preparation for analyses of factors associated with telehepatology use and satisfaction, correlations and associations between variables were examined. Several participant characteristics (preferred language, English fluency, education, country of birth, marital status, and annual household income) were excluded from subsequent analyses because they were confounded with site. The SF-LDQOL and PHQ-8 scores were highly correlated; the SF-LDQOL score rather than the PHQ-8 was retained for further analysis because it is directly related to liver disease.

To identify factors associated with telehepatology use and satisfaction, adjusted logistic regression analyses were conducted for use of telehepatology and adjusted general linear model analyses were conducted for TSUQ scores. Analyses were conducted using SAS statistical software (version 9.4). Site was included as a fixed effect in all analyses to account for measured and unmeasured factors associated with site. Initial analyses were univariable, examining the relationship of each study variable to telehepatology use and satisfaction. Variables selected *a priori* and also based on the recommendation of Hosmer and Lemeshow, variables associated with telehepatology use or satisfaction at $P < .25$ were included in the final multivariable analyses.²⁸

Results

Participant Characteristics

Of the 714 patients contacted via mail, 14 (2%) opted out of further contact by mail or telephone. Research staff were able to speak with 492 (68.9%), 273 (55.5%) of whom consented to participate, and 256 of 273 (93.8%) completed interviews (Figure 2). The characteristics of the 256 study participants are summarized in Table 1. Sociodemographically, the participants' median age was 65 years and ranged from 29 to 92 years. The majority of patients were male (n = 207, 80.9%) and White (n = 104, 40.6%) or Latino (n = 92, 35.9%). Twenty-eight percent (n = 71) of participants were born outside of the United States and 18.0% (n = 46) spoke English less than well. Twenty-one percent had an education level below high school (n = 55), 22.3% (n = 57) had current paid employment, and 56.9% (n = 95) had a household income of \$30,000 or less.

The most common etiology of cirrhosis was alcohol associated (n = 114, 44.5%) and chronic hepatitis C (n = 106, 41.4%). Twenty-one percent (n = 53) of participants had evidence of decompensated cirrhosis at the time of conducting the survey, and an additional 15.3% (n = 39) had a history of decompensated cirrhosis in the past. In terms of alcohol use in the prior 12 months, most participants had AUDIT scores in the "low risk" category (n = 213, 83.9%), but 5.9% (n = 15) had scores in the

"high risk category" that suggests alcohol dependence. Twenty-three percent of participants had PHQ-8 scores of 10 or more, reflecting a probable diagnosis of major depression.

Telehepatology Capacity, Use, and Satisfaction

As shown in Table 2, 100% of study participants had the technical capacity to participate in telehepatology in that they had access to a device (phone, tablet, or computer) that could be used for telehepatology care. A similar number (n = 255, 99.6%) had a device that they could use in a private place. Ninety percent (n = 229) had a smart phone. Almost all participants (n = 254, 99.2%) also had experience relevant to using their device for telehepatology in that they used their devices for other phone/Internet tasks and activities; on average, participants reported using their device for 4.30 (SD = 1.94) of the 8 tasks queried. The most frequently reported task was phone calls (n = 263, 98.4%) and the least frequently reported was remote work (n = 36, 14.0%). Seventy-five percent (n = 192) of participants reported participating in telehepatology in the prior 6 months. On a response scale ranging from 1 to 5, where higher scores reflect greater satisfaction, participants' mean score on the TSUQ Use and Impact Scale, which reflects satisfaction with a telehealth system, was 3.68 (SD = 0.68); participants' mean score on the TSUQ Telehealth Visit scale was 3.77 (SD = 0.68). Participants recruited from Zuckerberg San Francisco General Hospital had higher scores on TSUQ Use and Impact Scale and TSUQ Telehealth Visit scale compared to San Francisco VA Medical Center and Palo Alto VA Medical Center sites (3.9 vs 3.6 vs 3.6, P = .01, and 3.9 vs 3.8 vs 3.6, P = .05, respectively).

Factors Associated with Telehepatology Use and Satisfaction

As shown in Table 3, univariable analyses identified 2 variables significantly related to telehepatology use: Alcohol-associated (vs nonalcohol) liver disease etiology was associated with lower use of telehepatology while greater COVID-19 pandemic impact, as measured by the Pandemic Stress Index, was associated with greater use of telehepatology (P < .05). These 2 relationships also remained statistically significant in the multivariable model.

In univariable analyses focused on satisfaction with the telehealth system as measured by the TSUQ Use and Impact Scale score, higher LDQOL summary scores were associated with greater satisfaction (P < .05). In the multivariable model, only age and LDQOL summary score were significant: older age was associated with lower satisfaction ($\beta = -0.01$; P = .04) and higher LDQOL summary scores were associated with greater satisfaction ($\beta = 0.01$; P = .02).

In univariable analyses focused on the TSUQ Telehealth Visit Scale, Latino ethnicity ($\beta = 0.23$; P = .03) and higher LDQOL Summary Scores were significantly related to greater

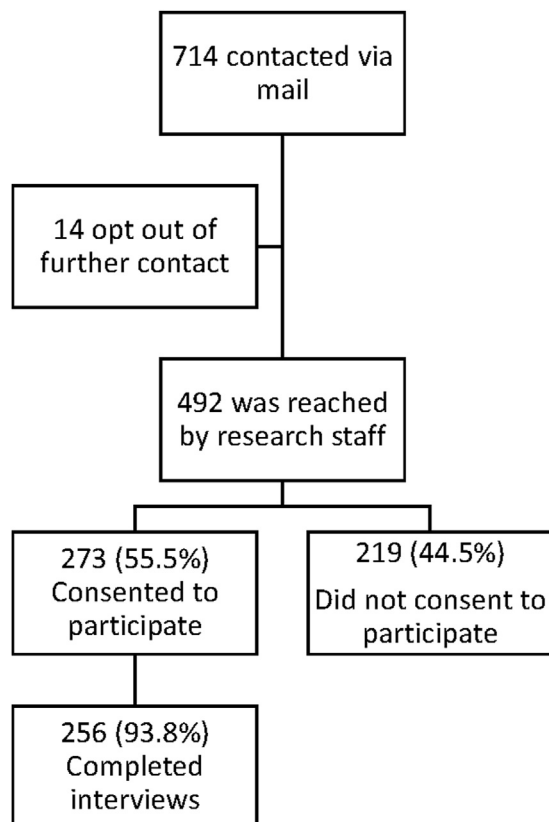


Figure 2. Flow of study participants from initial recruitment contact through interview completion.

Table 1. Participant characteristics

Characteristic	N = 256
Demographics	
Mean age in years (SD)	64.45 (10.22)
Male	207 (80.9%)
Race/Ethnicity	
White	104 (40.6%)
Black	23 (9.0%)
Asian/Pacific Islander	19 (7.4%)
Native American/Alaska native	4 (1.6%)
Latino	92 (35.9%)
Other	14 (5.5%)
Born outside of the United States	71 (27.6%)
Speaks English less than well	46 (18.0%)
Total # people in household	
1–2	172 (67.2%)
3–5	66 (25.8%)
>5	18 (7.0%)
Less than high school education	55 (21.4%)
Married/Partnered	83 (32.4%)
Annual household income ≤\$30K (missing: n = 90)	95 (56.9%)
Has paid employment	57 (22.3%)
Liver-related characteristics	
Liver disease etiology (may have multiple etiologies)	
Alcohol-associated	114 (44.5%)
Hepatitis B	16 (6.3%)
Hepatitis C	106 (41.4%)
NAFLD/NASH	72 (28.1%)
Other	40 (15.6%)
Decompensated cirrhosis	
None	163 (63.9%)
Prior	39 (15.3%)
Current	53 (20.8%)
History of HCC	27 (10.6%)
Mean (SD) SF-LDQOL summary score (higher score reflects better QOL)	73.18 (17.62)
Substance use/Mental health	
Mean (SD) AUDIT score (higher score reflects more alcohol problems)	0.18 (7.00)
AUDIT risk categories	
Low risk	213 (83.9%)
Risky/hazardous	20 (7.9%)
Harmful	6 (2.4%)
High risk (probably dependent)	15 (5.9%)
Mean (SD) pandemic impact rating (higher rating reflects greater impact)	2.76 (1.27)
Clinically significant depression (PHQ-8 score ≥ 10)	59 (23.0%)
AUDIT, Alcohol Use Disorders Identification Test; HCC, Hepatocellular carcinoma; NAFLD/NASH, nonalcoholic fatty liver disease/nonalcoholic steatohepatitis; PHQ-8, Patient Health Questionnaire Depression Scale; QOL, Quality of Life; SD, Standard Deviation; SF-LDQOL, Short Form Liver Disease Quality of Life.	

satisfaction ($\beta = 0.01$; $P = .01$). In the multivariable model, only 2 variables were statistically significant: Latino race/ethnicity (relative to white) remained associated with greater satisfaction ($\beta = 0.22$; $P = .04$), while higher levels of alcohol-related problems, as measured by the AUDIT score, were associated with lower satisfaction ($\beta = -0.02$; $P = .04$).

Discussion

In this study, which uniquely examined demographic and clinical factors associated with telehepatology use and 2

important dimensions of patient satisfaction (systems- and visit-level) among vulnerable populations receiving care for cirrhosis at 3 distinct urban sites including 2 VA medical centers and a safety-net healthcare system in Northern California, we found that while patients had high capacity for telehepatology use, certain patient demographics and alcohol-related symptoms or the presence of alcohol-associated cirrhosis influenced telehepatology use and satisfaction.

Telehepatology has emerged as an important mode of cirrhosis care especially since the COVID-19 epidemic, but whether this will widen the disparities in satisfaction and

Table 2. Telehepatology Capacity, Use, and Satisfaction

Capacity	N = 256
Has any device that could be used for telehealth (phone, tablet, computer)	256 (100.0%)
Has a smart phone	229 (89.5%)
Has a device to use in private	255 (99.6%)
Used a device for any phone/internet tasks or activities	254 (99.2%)
Mean (SD) # of phone/internet tasks/activities (of 8)	4.30 (1.94)
Phone/internet tasks/activities	
Phone calls	253 (98.4%)
Video calls/meetings	183 (71.2%)
Listen to music	175 (68.1%)
Watch movies, videos, or television	140 (54.5%)
Social media	139 (54.1%)
Order groceries, products, services	115 (44.8%)
Religious services	55 (21.4%)
Remote work	36 (14.0%)
Used telehepatology within prior 6 mo	192 (75.0%)
Satisfaction	
Mean (SD) TSUQ use and impact scale score (1–5, higher = greater satisfaction)	3.68 (0.68)
Mean (SD) TSUQ telehealth visit scale score (1–5, higher = greater satisfaction)	3.77 (0.66)

SD, standard deviation; TSUQ, Telemedicine Satisfaction and Usefulness Questionnaire.

use among vulnerable populations with cirrhosis is not known.¹³ Potential disparities in telehealth based on demographic and socioeconomic factors are therefore critical to investigate. Prior studies have found that older age, speaking a primary language other than English, lower socioeconomic status as well as non-White race/ethnicity are associated with less satisfaction with telehepatology.^{29,30} However, the majority of these studies were performed in broad populations of patients with cirrhosis receiving care at tertiary hospital systems and did not utilize validated survey instruments to measure patient satisfaction. In our study using the validated TSUQ instrument, similar to prior studies, older age was associated with lower satisfaction with the telehealth system, but not the telehepatology visit.³⁰ Moreover, in the current study, Latino ethnicity was associated with higher telehealth visit satisfaction than other groups. Other social determinants of health factors, including education and socioeconomic status, were not independently associated with either telehepatology use or satisfaction. The discrepancy observed in satisfaction based on age and ethnicity compared to prior studies may reflect the fact that in the current study telehepatology was delivered either by video or telephone visits, as guided by patient preference. Indeed, other studies have demonstrated that older patients with chronic liver disease are less likely to use video visits.^{29–31} Moreover, unmeasured factors including availability and ease of access to interpreters and increased cultural concordance and competency of providers, and potential differences in adaption of and familiarity with telehepatology services across the 3 sites in the current study may account for the observed enhanced satisfaction among the Latino population.

Several studies have shown that telehealth use and satisfaction is high among patients with alcohol use disorder, in the context of substance use disorder management.^{32–34} However, limited studies have specifically assessed telehealth use and satisfaction in patients with alcohol-associated liver disease. A novel finding of our study was that participants with alcohol-associated cirrhosis were less likely to use telehepatology. In addition, those with worse alcohol use disorder symptoms as reflected by higher AUDIT scores were less satisfied with telehealth visits. These findings were independent of the effect of the COVID-19 pandemic on the participant, as captured by the Pandemic Stress Index. As expected, those with a higher Pandemic Stress Index score and those with better quality of life had more satisfaction with the telehealth system. Lower use and satisfaction among patients who use alcohol could be contributed to by technical challenges with accessing telehealth in the setting of advanced liver disease, alcohol-induced or cirrhosis-related cognitive impairment, or potential for perceived stigma related to alcohol use in managing cirrhosis care in this population.^{35,36} Moreover, a focus on management of liver disease rather than alcohol treatment within the telehepatology specialty setting or lack of linkage to addiction services may have contributed to lower use and satisfaction. Indeed, management of alcohol use represents a public health priority in recent years with national societies advocating to enhance alcohol treatment services and expertise within the liver specialty setting.²⁰

This study has several limitations. The health system populations studied were from Northern California and may not be generalizable to other populations within the VA and safety-net health systems, or non-VA/safety net settings. VA

Table 3. Univariable and Multivariable Regression Models Identifying Factors Associated With Telehepatology Use and Satisfaction

Variable	Use of telehepatology				TSUQ use and impact scale				TSUQ telehealth visit scale			
	Univariable		Multivariable		Univariable		Multivariable		Univariable		Multivariable	
	OR (95% CI)	P	OR (95% CI)	P	β (95% CI)	P	β (95% CI)	P	β (95% CI)	P	β (95% CI)	P
Age	0.99 (0.96, 1.02)	.65	0.99 (0.95, 1.03)	.56	-0.01 (-0.02, 0.002)	.12	-0.01 (-0.02, -0.001)	.04	-0.01 (-0.01, 0.004)	.26	-0.01 (-0.02, 0.003)	.19
Male (vs female)	0.87 (0.40, 1.90)	.73	1.10 (0.45, 2.71)		0.23 (-0.04, 0.51)	.09	0.22 (-0.06, 0.50)	.12	0.24 (-0.03, 0.50)	.08	0.25 (-0.02, 0.52)	.07
Race/Ethnicity												
Latino vs white	0.65 (0.30, 1.40)	.40	0.77 (0.33, 1.78)		0.19 (-0.03, 0.40)	.09	0.17 (-0.05, 0.39)	.14	0.23 (0.02, 0.44)	.03	0.22 (0.01, 0.44)	.04
All other vs White	0.73 (0.32, 1.69)	.78	0.77 (0.32, 1.88)		0.09 (-0.15, 0.32)	.46	0.07 (-0.17, 0.31)	.59	0.05 (-0.18, 0.27)	.69	0.06 (-0.17, 0.29)	.61
# People in household												
1-2 vs 6+	0.65 (0.19, 2.23)	.51			-0.20 (-0.57, 0.18)	.30			-0.06 (-0.43, 0.30)	.73		
3-5 vs 6+	0.72 (0.20, 2.60)	.77			-0.06 (-0.46, 0.33)	.76			0.01 (-0.38, 0.40)	.96		
Paid employment	0.90 (0.44, 1.83)	.77			0.04 (-0.17, 0.25)	.68			0.02 (-0.18, 0.23)	.82		
Liver disease etiology												
Alcohol	0.44 (0.24, 0.81)	.009	0.46 (0.22, 0.95)	.04	-0.02 (-0.20, 0.16)	.86	-0.01 (-0.22, 0.19)	.90	0.04 (-0.13, 0.21)	.65	0.06 (-0.14, 0.26)	.57
Hepatitis B	1.72 (0.51, 5.75)	.38			-0.01 (-0.38, 0.36)	.95			-0.09 (-0.45, 0.27)	.61		
Hepatitis C	0.96 (0.50, 1.85)	.90			0.03 (-0.16, 0.21)	.77			0.03 (-0.15, 0.21)	.75		
NAFLD/NASH	1.29 (0.66, 2.54)	.46			-0.08 (-0.28, 0.12)	.41			-0.03 (-0.23, 0.16)	.74		
History of HCC	0.93 (0.34, 2.57)	.89	0.79 (0.27, 2.34)	.67	0.23 (-0.05, 0.51)	.10	0.25 (-0.04, 0.53)	.09	.03 (-0.24, 0.31)	.82	0.10 (-0.18, 0.37)	.49
Decompensated cirrhosis												
Current vs none	0.79 (0.38, 1.62)	.78			0.08 (-0.15, 0.30)	.50			0.01 (-0.22, 0.22)	.97		
Prior vs none	0.76 (0.33, 1.79)	.72			0.18 (-0.08, 0.43)	.17 ^a			0.05 (-0.20, 0.30)	.69		
LDQOL summary score (higher score reflects better quality of life)	1.00 (0.98, 1.02)	.74	1.00 (0.98, 1.02)	.90	0.01 (0.003, 0.01)	.002	0.01 (0.001, 0.01)	.02	0.01 (0.001, 0.01)	.01	0.005 (-0.001, 0.01)	.07
AUDIT score (higher score reflects higher levels of alcohol related problems)	0.97 (0.93, 1.01)	.09	0.98 (0.93, 1.03)	.39	-0.01 (-0.02, 0.004)	.16	-0.01 (-0.03, 0.003)	.11	-0.01 (-0.02, 0.004)	.18	-0.02 (-0.03, 0.001)	.04
PSI COVID-19 impact rating (higher score reflects greater impact)	1.35 (1.05, 1.73)	.02	1.41 (1.06, 1.88)	.02	-0.05 (-0.12, 0.02)	.13	-0.03 (-0.11, 0.04)	.39	-0.05 (-0.12, 0.02)	.14	-0.02 (-0.10, 0.05)	.51

Site was included as a fixed effect in all analyses to account for measured and unmeasured site differences.

Bold represents $P < .05$.

AUDIT, Alcohol Use Disorders Identification Test; HCC, hepatocellular carcinoma; LDQOL, Liver Disease Quality of Life; NAFLD/NASH, nonalcoholic fatty liver disease/nonalcoholic steatohepatitis; PSI, Pandemic Stress Index.

^aStatistically significant pairwise comparisons were not considered if the overall relationship between the independent and dependent variables did not meet the significance threshold.

patients enrolled, as expected, had reported English as their preferred language, whereas 52% of the safety-net population reported Spanish as their preferred language. In addition, patient-provider language concordance was not measured in this study. However, only 18% of participants reported speaking English less than well and the study was conducted using Spanish translated materials when possible and interpreters were used as needed and all multivariable models also adjusted for enrollment site. While validated survey measures were used, survey studies are subject to reporting and recall bias. We also supplemented patient self-report data with EMR information. Furthermore, unmeasured confounders may have contributed to our findings, and qualitative studies would be helpful to add to our understanding of the reasons for lack of telehealth use and satisfaction. Moreover, this analysis was cross-sectional and conducted during the COVID-19 pandemic. Longitudinal evaluation during the postpandemic era may improve the ability to assess patient reported experiences with telehealth. Nevertheless, this study represents a large and diverse vulnerable population across multiple health systems and identified gaps in patient-reported experiences with hepatology relevant both to telehealth systems and to the content of telehealth visits.

Conclusion

This multi-site study of vulnerable patients with cirrhosis examined key factors associated with both use of telehepatology and patient satisfaction during the COVID-19 pandemic. We found that use or satisfaction with telehepatology was associated with age, ethnicity, liver disease specific quality of life, pandemic stress, and alcohol use problems. This study highlights the importance of provider and health system awareness of these factors to target resources for improved care. Because it is expected that telehealth will remain an important mode of healthcare delivery, expanding the reach of specialty care in the post-COVID-19 era, this study underscores the importance of finding ways to make telehealth more accessible and satisfactory for some patient groups such as older individuals and those with advanced alcohol associated liver disease as well as integration of alcohol use and cirrhosis management services within hepatology settings to lessen inequities in liver disease care.

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Priyanka Athavale: wrote, reviewed and edited the manuscript, approved final submission. Robert J. Wong: conceptualization of research, investigative support, administration, resources, reviewed statistical analyses, supervision, edited the manuscript, approved final submission. Derek D. Satre: conceptualization of research, investigative support, administration, resources, reviewed statistical analyses, supervision, edited the manuscript, approved final submission. Alexander Monto: conceptualization of research, investigative support, administration, resources, reviewed statistical analyses, supervision, edited the manuscript, approved final submission. Ramsey Cheung: conceptualization of research, investigative support, administration, resources, reviewed statistical analyses, supervision, edited the manuscript, approved final submission. Jennifer Y. Chen: reviewed and edited the manuscript, approved final submission. Steven L. Batki: reviewed and edited the manuscript, approved final submission. Michael J. Ostacher: reviewed and edited the manuscript, approved final submission. Hannah R. Snyder: conceptualization of research, investigation, resource support, reviewed and edited the manuscript, approved final submission. Brigita D. Widiarto: collected data, reviewed and edited the manuscript, approved final submission. Seo Yoon Oh: collected data, reviewed and edited the manuscript, approved final submission. Meimei Liao: collected data, reviewed and edited the manuscript, approved final submission. Adele M. L. Viviani: collected data, reviewed and edited the manuscript, approved final submission. Mandana Khalili: designed the study, conceptualization of research, investigative support, administration, resources, reviewed statistical analyses, supervision, edited the manuscript, approved final submission.
- Conflicts of Interest:**
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- Ethical Statement:**
The study was approved by the Institutional Review Boards of the University of California, San Francisco and Stanford University as well as by ZSFSG (Zuckerberg San Francisco General), SFVA (San Francisco Veterans Affairs), PAVA (Palo Alto Veterans Affairs) local review committees.
- Data Transparency Statement:**
The data and methods that support the findings of this study will be publicly available through the National Institute on Alcohol Abuse and Alcoholism Data Archive (NIAAADA) data repository.
- Reporting Guidelines:**
STROBE.