

ASSESSMENT OF VIRTUAL HEALTHCARE: PREDICTORS OF ACCESS AND UTILIZATION BEFORE, DURING, AND AFTER THE COVID-19 PANDEMIC

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ABSTRACT

Background: Societal needs highlighted by the ongoing COVID-19 pandemic have resulted in rapid tele-health development and implementation. The broadening of guidelines for practice by regulatory bodies have allowed providers to employ video-capable devices in the virtual delivery of services to physical- and mental-health clients located across a broad range of settings.

Aim of the study: This study examined use of synchronous, video-based, virtual healthcare before and during the COVID-19 pandemic. This included a comparison of: access for physical and mental health needs; differential assessment of service provision by professionals; consumer satisfaction; and, anticipated future use of virtual healthcare.

Material and methods: An online survey link was sent to three participant groups: college-aged students, adults, and retirement-aged persons. A total of 685 participants, varying in age, gender, ethnicity, and experience using tele-healthcare provided usable data for this study.

Results: Half of participants (49.2%; $n=337$) used virtual healthcare; more people used it during the pandemic (87.2%; $n=294$) than before (26.4%; $n=89$). Physical services (86.8%; $n=291$; primarily physicians) were more common than mental health services (25.6%; $n=86$; primarily counselors). Access was most common through laptop computers (60.7%; $n=204$). Participants were satisfied with virtual healthcare experiences ($Mdn=5$). Almost all participants (94.2%; $n=645$) believed that virtual healthcare would continue after the pandemic, but only two-thirds (61.3%; $n=420$) reported they would use virtual healthcare if available in the future. Both previous experience with ($p<0.001$) and satisfaction with ($p<0.001$) virtual healthcare positively predicted anticipated future use.

Conclusions: Tele-healthcare has experienced significant growth in the COVID-19 era. Emergency policy changes have resulted in services being developed and offered in the medical and mental health realms in conjunction with ongoing empirical evaluations of what does and does not work.

KEYWORDS: tele-healthcare, tele-medicine, virtual care, tele-mental healthcare

BACKGROUND

When someone thinks of tele-health today, it is likely that their conceptualization is much different

than that of just a couple years ago. Safety needs produced and highlighted by the ongoing COVID-19 pandemic have resulted in rapid tele-health development and implementation [1]. Supported by U.S.

federal emergency measures approved to assure continuity of healthcare [2], regulatory agencies and insurers have over the past year pushed toward broader definitions for scope of practice, reimbursement, and licensure [3,4]. Tele-techniques are now being used in most if not all areas of patient- and client-based healthcare service provision [5].

A flood of research on viability of health-service tele-practices has recently filled the pages of science journals, providing empirical insight into what works and what is probably still best handled in traditional face-to-face interactions. Tele-healthcare research has been available in the literature since the 1970s, but very few early reports constituted data-driven studies. Most articles appeared as commentaries and editorials, with anecdotal descriptions of telephone service delivery presented side-by-side with discussions of proof of concept and barriers to cross for tele-health to develop to implementation standards [6,7]. A review of the available research through the latter part of the twentieth century shows little movement by medical professionals toward developing and adopting tele-practices: research to support the viability of tele-care had not been undertaken for many areas of practice, and most physicians were not convinced that significant alterations of traditional face-to-face interactions in brick and mortar establishments were warranted [8]. This all began to change through the early 2000s, however, with the pairing of enhanced broadband access and the ubiquitous distribution of video-capable communication devices. Just as smartphone usage and video chats were becoming routinized parts of our lives, virtual capabilities increasingly reached into the healthcare realm to expand the range of service delivery options for healthcare providers. A literature search of a leading biomedical database – Pubmed.gov – shows an increasing availability of tele-healthcare research during this period, with 300+ articles published in 1995, 800+ in 2005, 2,500+ in 2015, and 3,800+ in 2019. A further big acceleration was seen in 2020, with the advent of COVID-19 and increased needs to quarantine and social distance, when close to 7,000 empirical studies examining tele-healthcare practices appeared in the medical and life sciences literature. This evidence of shifting priorities produced by the eminent challenges of the pandemic – from ‘Does this work?’ to ‘Let’s see how we can make this work.’ – has continued into 2021, with tele-health citations on pace to exceed those of 2020.

This rapid expansion of virtual care is a product of three ongoing trends in patient-centered healthcare [1,9]. The first recognizes that tele-health offers convenience and the possibility of reduced costs for both providers and consumers [10]. Discussions of barriers for tele-health implementation prior to the

advent of COVID-19 focused largely on service provider concerns [11,12,13]. Consumers, in turn, were limited by what healthcare professionals offered and made available in their geographic areas, but were nonetheless focused on cost and access; these barriers are arguably now less prohibitive given the wide implementation and availability of tele-care resulting from the pandemic. For a working parent, the advantages of lower costs for transportation and childcare, less time away from work for scheduled healthcare visits, flexibility for scheduling with tight time constraints, and less exposure to contagion have all made virtual appointments preferable and convenient [14]. The second trend promoting virtual care is the ongoing shift in healthcare from treatment of acute conditions to management of chronic ailments, which often involve close consultations and monitoring through follow-up care after initial diagnoses and treatments [9]. This is particularly relevant in long-term care for older adults [15,16], and especially important for those who are homebound [17], but has also figured prominently in chronic treatments for disease conditions defined as leading causes of disability and death [18,19,20,21]. Virtual treatments of chronic conditions have also become critically important in mental health care, which has now been convincingly demonstrated through empirical research to be associated with medical healthcare outcomes [22]. The third trend in healthcare promoting use of virtual technologies can be found in its potential reach into rural areas, where there are few physicians and often no mental health providers [22,23]. This expansion of services into underserved areas using the tools of tele-healthcare has long been considered desirable, but the slow adoption of tele-care prior to the pandemic left this goal largely unrealized [24,25]. There had been some development of tele-mental services prior to the pandemic, particularly among psychologists and behavioral health providers, and especially in rural areas and among young adults and persons with restricted access to counseling provided by mental health practitioners [26]. This overall pre-covid movement toward broader provision of virtual mental health treatments was slow but nonetheless outpaced tele-service development by physicians [22]. The rapid increases in development now ongoing for both telemedicine and tele-mental healthcare did not really begin on a wide scale until the early months of the pandemic [1,27]. Research reports demonstrating efficacy and guidelines for medical care across practice settings [28,29] and similarities of mental health treatments received in clinics, in homes, and in person [30] have helped in this regard, and suggest that a continuation of tele-services beyond the pandemic may yet reach into remote areas to impact disparities in urban and remote healthcare services [26].

It now appears that, just as COVID-19 has presented healthcare challenges that are unprecedented, a true transformation of the tele-healthcare landscape in the U.S. is occurring. Indeed, editorials and commentaries now speak of the rapidly changing tele-health landscape, and how further growth of tele-health is expected to continue well into the future [1,31]. The question arises for whether the development of tele-healthcare prior to the pandemic had reached the critical mass necessary for widespread innovation diffusion or whether the safety-driven needs of the pandemic affected the prioritization and rapid development and dissemination of virtual healthcare information and opportunities [32]. Perhaps the pandemic has forced the issue: In an effort to maintain support for healthcare needs of vulnerable persons during a time of societal crisis, providers quickly adapted their practices to develop and scale-up tele-healthcare options [33,34]; consumers, in turn, with tele-healthcare options increasingly available, were made aware of and used virtual services and have now developed expectations for what they will and will not consider when seeking healthcare as time moves forward [35]. In any case, evidence specifically addressing this question will help determine what the tele-healthcare market for services will look like following the pandemic.

AIM OF THE STUDY

The aim of the current study was to examine synchronous, video-based, virtual healthcare access and use before and during the COVID-19 pandemic. This included a comparison of virtual access for physical and mental health needs, differential assessment of service provision by healthcare professionals, consumer satisfaction with virtual healthcare experiences, and anticipated future use of virtual healthcare by consumers following the pandemic.

MATERIAL AND METHODS

Participants

A total of 685 participants, varying in age, gender, ethnicity, and experience using tele-healthcare provided usable data for this study. All research participants were 18 years of age or older and accessed using a convenience sampling method. A summary of descriptive data for participants is shown in Table 1.

Invitations for voluntary and anonymous participation in the study, consisting of a brief description of tele-healthcare and a link to an online survey specifically designed to assess experience with tele-

healthcare service(s), were made available to persons associated with Coastal Carolina University (CCU), a medium-sized, general comprehensive educational institution located on the Atlantic coast of South Carolina. Three types of persons were purposefully recruited through email send-outs: faculty and staff of CCU, selected from the university directory based on personal acquaintance with the researchers; university students, recruited initially through classes and mailing lists for majors and minors of the psychology department; and, members of the Osher Lifelong Learning Institute (OLLI), an organization administered through the CCU provost's office offering a wide-variety of on- and off-campus educational experiences for persons 55 and older. No incentives to participate were offered by the researchers, although it is possible that students of university classes were offered an incentive as extra-credit for a class assignment by a professor promoting the study. All invitations included an encouragement for participants to forward the survey link to additional parties, including family and friends who might have an interest in tele-healthcare. Feedback received via email from

Table 1. Demographic characteristics of the sample

Demographic Categories		n	%
Age (years)	College-Aged (18-25)	143	20.9
	Adult (26-59)	206	30.1
	Young-Old (60-74)	219	32.0
	Old-Old (75+)	85	12.4
	Did not identify	32	4.7
Gender Identity	Man / Male / Masculine	219	32.0
	Woman / Female / Feminine	454	66.3
	Gender Nonbinary	3	0.4
	Did not identify	9	1.3
Ethnicity	Asian American or Asian	19	2.8
	Black or African American	41	6.0
	Hispanic, Latinx, or Spanish Origin	9	1.3
	Middle Eastern, North African, or Mediterranean	1	0.1
	Native American or Native North American	3	0.4
	Native Hawaiian or Other Pacific Islander	0	0.0
	White, European American, or Other European	580	84.7
	Two or more ethnic identities	20	2.9
	Did not identify	12	1.8

The mean age of participants was 51.92±21.12, ranging from 18 to 94. Note: Ethnicity is not proportionally distributed across age categories. Caucasian participants have a wide distribution with a small majority in the Young-Old category, whereas non-Caucasian participants are predominantly college-aged.

participants to the researchers indicated that further respondent-initiated provision of the link for on-campus and off-campus recruitment did occur; the extent of this distribution is unknown. Numerous unsolicited emails were received from participants expressing general excitement and providing elaborate descriptions of virtual tele-healthcare experiences, leading the study authors to conclude that the research was timely and important in the era of the ongoing COVID-19 pandemic.

Data source/measurement

The survey instrument was designed and made available to participants through a dedicated link embedded in the invitation. Using a yes/no forced choice format, the first question asked respondents whether they had a virtual, video-based interaction with a healthcare professional before and/or during the pandemic. A 'yes' response to the first question produced additional questions for when the interaction occurred, before and/or during the pandemic; the type of issue(s) and provider(s) involved; the type of internet-based device(s) used for the virtual communication; and, a rating of satisfaction for the tele-healthcare service interaction. Satisfaction was evaluated using a 6-point Likert scale (from 1=very dissatisfied to 6=very satisfied). Participants were asked two additional questions: their belief for whether virtual healthcare services would be available following the pandemic, and whether they would seek and use virtual services to meet future healthcare needs. In conclusion, participants were asked to provide demographic data for age, gender identity, and ethnicity. An answer to the first question of 'no' bypassed the provider interaction questions and sent participants directly to the questions addressing the future of tele-healthcare and the request for demographic information. A hard copy of the complete survey is available from the authors upon request.

Due to the timely nature of the study, descriptive statistical analysis is used for a number of comparisons to establish a current baseline and do not explore several subgroup comparisons. Statistical analysis is used to make several key comparisons and predictions; *p*-values are reported in the text, and statistical tests are reported in tables.

Ethical considerations

Materials for the study, including research methodology and protocol, the survey, and informed consent-disclosure statement were approved by the Coastal Carolina University (CCU) Institutional Re-

view Board. There were no conflicts of interest for the authors in the planning and execution of the study.

RESULTS

Virtual healthcare use

Approximately half of participants (49.2%; *n*=337) had used virtual healthcare at the time of this study; among those who had used virtual healthcare, service use was more predominant during the COVID-19 pandemic (87.2%; *n*=294) than before the pandemic (26.4%; Table 2; *n*=89). This suggests that the majority of those who used virtual healthcare during the pandemic were new to these services.

The majority of participants used virtual healthcare exclusively for physical health services (74.3%; *n*=249), a smaller proportion exclusively for mental health services (13.1%; *n*=44), or for both physical and mental health services (12.5%; *n*=42; Table 2).

Table 2. Use of virtual healthcare before and during the pandemic, types of services and professionals, and types of devices used to access virtual healthcare

Variables		n	%
Use of Virtual Healthcare	Exclusively Before COVID	43	6.3
	Exclusively During COVID	248	36.2
	Both Before and During COVID	46	6.7
	Never	348	50.8
Types of Virtual Healthcare Services Used	Exclusively Physical Services	249	74.3
	Exclusively Mental Services	44	13.1
	Both Physical and Mental Services	42	12.5
Physical Health Professionals	Physician	228	78.4
	Physician Assistant	58	19.9
	Nurse	30	10.3
	Nurse Practitioner	41	14.1
	Other	9	3.1
	Don't Know	11	3.8
Mental Health Professionals	Psychologist	20	23.3
	Counselor	37	43.0
	Behavioral Health Provider	6	7.0
	Clinical Social Worker	8	9.3
	Psychiatrist	29	33.7
	Other	7	8.1
	Don't Know	3	3.5
Types of Devices	Laptop Computer	204	60.7
	Tablet	46	13.7
	Smartphone	134	39.9
	Other	7	2.1

* Note: Frequencies and percentages are not mutually exclusive; participants could choose multiple options.

Professionals consulted virtually for physical health services included physicians (identified by 78.4% of participants; $n=228$), physicians' assistants (19.9%; $n=58$), nurses (10.3%; $n=30$), nurse practitioners (14.1%; $n=41$), and other practitioners (3.1%; $n=9$; e.g., specialists; Table 2). A small number of participants did not know the specific occupation of their physical health practitioner (3.8%; $n=11$). About one-fourth of participants (24.1%; $n=70$) who used virtual healthcare for physical health services consulted with multiple types of professionals.

Professionals consulted virtually for mental health services included counselors (43.0%; $n=37$), psychiatrists (33.7%; $n=29$), psychologists (23.3%; $n=20$), behavioral health providers (7.0%; $n=6$), clinical social workers (9.3%; $n=8$), and other practitioners (8.1%; $n=7$; e.g., primary care physician; Table 2). A small number of participants did not know the specific occupation of their mental health practitioner (3.5%; $n=3$). Again, about one-fourth of participants (24.4%; $n=21$) who used virtual healthcare for mental health services consulted with multiple types of professionals.

Participants virtually consulted with practitioners using laptop computers (60.7%; $n=204$), smartphones with video capabilities (39.9%; $n=134$), tablets (13.7%; $n=46$), or other means (2.1%; $n=7$; e.g., texting, remote examination stations, hospital internal communication systems; Table 2). Some participants (14.9%; $n=50$) used multiple types of devices.

Virtual healthcare satisfaction

Overall, participants were satisfied with their experiences with virtual healthcare services (Table 3). Based on participant satisfaction rating (or the median of their two ratings for participants who experienced virtual healthcare both before and during the COVID-19 pandemic), the median satisfaction rating was a 5, corresponding to a rating of 'satisfied' on our 6-point Likert scale.

Table 3. Satisfaction with virtual healthcare services

Time Period	Median Satisfaction	Test Statistic	<i>z</i>	<i>p</i>
Exclusively Before Pandemic	4	3982.5 a	2.72	0.007*
Exclusively During Pandemic	5			
Both Before and During Pandemic	5	66 b	0.87	0.384

* Statistically significant result.

^a Mann-Whitney *U* Test.

^b Wilcoxon Signed Ranks Test.

Participants who experienced virtual healthcare only during the pandemic had a statistically-signifi-

cant higher median satisfaction rating (Mdn=5) than participants who experienced virtual healthcare only before the pandemic (Mdn=4; Table 3), as shown by a Mann-Whitney *U* test ($p=0.007$). However, for participants who experienced virtual healthcare both before and during the pandemic, there was no significant difference in median satisfaction rating (Mdn=5), as shown by a Wilcoxon Signed Ranks Test ($p=0.384$).

Predictions of future use

The vast majority of participants anticipated that virtual healthcare would continue to be available after the pandemic (94.2%; $n=645$; Table 4). This finding was consistent regardless of whether participants had previously used virtual healthcare and regardless of their past satisfaction rating.

Participants were asked whether they anticipate using virtual healthcare after the pandemic (Table 4). The majority of participants (61.3%; $n=420$) anticipated that they will use virtual healthcare for some of their future healthcare needs; the remainder anticipated that they will not use any virtual healthcare services in the future (38.5%; $n=264$) or did not respond (0.1%; $n=1$).

Previous experience with virtual healthcare positively predicted anticipated future use of virtual healthcare (Table 4), as shown by a Chi-Square test ($p<0.001$). Participants who had previously used virtual healthcare anticipated they would use it in the future (70.6%; $n=238$); participants who had not previously used virtual healthcare anticipated less future use (52.4%; $n=182$). If participants had previous experience with virtual healthcare, they were more likely to anticipate using it in the future.

Previous satisfaction with virtual healthcare also positively predicted anticipated future use of virtual healthcare (Table 4), as shown by a point biserial correlation ($p<0.001$). The more satisfied participants were with past virtual healthcare experience, the more likely they were to anticipate using virtual healthcare in the future.

DISCUSSION

The 13% use of tele-healthcare prior to the pandemic reported here corresponds to a 2019 consumer survey [36] indicating that whereas 66% of Americans said they were willing to try tele-healthcare, only 8% had actually done so. Our data collected just two years later are similar, with 61.3% willingness, but show the percentage of participants with virtual experience rising to 49.2%. These data are also reflected in provider numbers reported by Pierce [37] showing

Table 4. Beliefs about future use and availability of virtual healthcare, and using past use and satisfaction to predict future anticipated use

Variables		n	%	Test Statistic	p	
Anticipated Future Use	Yes	420	61.3	—	—	
	No	264	38.5			
	Did not respond	1	0.1			
Predicted Future Availability	Yes	645	94.2	—	—	
	No	37	5.4			
	Did not respond	3	0.4			
Correlation Between Past Use and Future Anticipated Use	Used Virtual Healthcare in Past	Will Use in Future	238	70.6	23.83 ^a	<0.001*
		Will Not Use in Future	99	29.4		
	Did Not Use Virtual Healthcare	Will Use in Future	182	52.4		
		Will Not Use in Future	165	47.6		
Correlation Between Past Satisfaction and Future Anticipated Use	—	—	—	.30 ^b	<0.001*	
Correlation Between Past Use and Future Availability Beliefs	Used Virtual Healthcare in Past	Believe Will Be Available in Future	319	94.7	0.01 ^a	0.924
		Believe Will Not Be Available in Future	18	5.3		
	Did Not Use Virtual Healthcare	Believe Will Be Available in Future	326	94.5		
		Believe Will Not Be Available in Future	19	5.5		
Correlation Between Past Satisfaction and Future Availability Beliefs	—	—	—	.06 ^b	0.313	

* Statistically significant result.

^a Chi-Square Test for Independence.

^b Point-Biserial Correlation.

that just over 7% of licensed psychologists had previous experience with tele-psychology, a percentage which rose to 85.53% during the pandemic; 35% expected to continue using tele-psychology techniques after the pandemic. Given the safety and security issues prevalent from Spring 2020 to Spring 2021, these significant increases support the argument that many healthcare professionals responded rapidly during COVID to develop and use tele-healthcare options that had not previously been available for clients. In the U.S., the National Emergencies Act declared in March 2019 [2] allowed providers, under good faith provisions, to ramp up and offer tele-health services: through widely-available communication devices, to patients in their homes and local clinics, across state lines, using video and/or audio (e.g., telephone), and to receive reimbursement at rates comparable to traditional visits [4]. This loosening of regulations is still in effect as of August 2021.

It is not surprising that services were used more often for physical health than mental health, but it is nonetheless interesting given increasing concerns over short-term and long-term mental health consequences of the pandemic [38]. The needs to feel safe and be safe may have created barriers for access to mental health and represent a disruption of treatment outcomes for consumers who need services but have been unable to maintain contact with providers [39]. Many mental health professionals in the U.S.

operate independently, outside of larger healthcare systems financially able to acquire and operate tele-technologies, and may have been unable to smoothly transition into tele-mental health [22,37]. Perhaps physical health problems are simply harder to ignore than mental health issues, prompting more persons to seek tele-medical care. Conditions of mental health, such as anxiety, depression, and responses to trauma, often include escape and avoidance behaviors, leading those suffering to engage in extensive self-isolation, which is often more extreme than the social distancing promoted during the pandemic. This potential disruption of connections for mental health providers with clients' needs to be thoroughly and quickly investigated, especially in light of the rapid escalation of mental health problems for children now being discussed in the literature [40,41].

Our data show that participants were satisfied with their experiences with virtual healthcare overall. Satisfaction is known to be a health-service performance measure of quality of care [42] and a key indicator for whether client expectations are met [43]. We surmise from this study that client expectations were met, at least in part, which is consistent with previously gathered data [44,45]. When considering satisfaction alongside predictions of personal behavior regarding tele-healthcare use after the pandemic, a useful analysis emerges. Almost all of our study participants reported a belief that virtual healthcare in-

teractions would be available following the pandemic. This suggests that use of virtual communication devices has become a common enough part of daily life to be regarded as inevitable for healthcare. However, only two-thirds of participants reported they would seek virtual care if more traditional face-to-face options were on offer. This effect was moderated by previous use and by satisfaction, as independent observations: people who had used a virtual service before and people who were more satisfied with a previous experience were more likely to predict using it in the future. This suggests that taking that first step to use a virtual service, perhaps for convenience or from having no other alternative during the pandemic, is critical to opening the door for future use. Satisfaction, as a multi-faceted variable, could be similarly influenced by convenience or from other aspects of treatments, such as outcome or cost. Future research can more specifically address convenience of services and which components of virtual healthcare interactions are most likely to lead to satisfaction.

A limitation of the study is that it uses a convenience sample of academic or academic-adjacent participants who have access to technology to complete an online study. This may bias results toward individuals already familiar with and comfortable with technology, and thus who are more likely to be favorable toward tele-health services. Although we find informative and meaningful patterns, future research should more directly investigate tele-health use in a more diverse population, including those who have more limited access to technology. This provides justification for directly investigating tele-healthcare use in rural populations and the differential service needs and technological access and availability in these populations [22,23].

REFERENCES

1. Zhang J, Boden M, Trafton J. Mental health treatment and the role of tele-mental health at the Veterans' Health Administration during the COVID-19 pandemic. *Psychol Serv* 2021, April 8: Advance online publication. Available from URL: <http://dx.doi.org/10.1037/ser0000530>.
2. Gostin LO, Hodge JG, Wiley LF. Presidential powers and response to COVID-19. *JAMA* 2020 Apr 28; 323(16): 1547–1548.
3. Centers for Medicare and Medicaid Services. Medicare telemedicine health care provider fact sheet. Available from URL: <https://www.cms.gov/newsroom/fact-sheets/medicare-telemedicine-health-care-provider-fact-sheet>: Accessed June 24, 2021.
4. Nielsen M, Levkovich N. COVID-19 and mental health in America: crisis and opportunity? *Fam Syst Health* 2020; 38(4): 482-485.
5. Gruber J, Prinstein MJ, Clark LA, Rottenberg J, Abramowitch JS, Albano AM, et al. Mental health and clinical psychological science in the time of COVID-19: challenges, opportunities, and a call to action. *Am Psychol* 2021; 76(3): 409-426.
6. Nickelsen DW. Behavioral health: emerging practice, research, and policy opportunities. *Behav Sci Law* 1996; 14: 443-457.
7. McClellan MJ, Florell D, Palmer J, Kidder C. Clinician telehealth attitudes in a rural community mental health center setting. *J Rural Ment Health* 2020; 44(1): 62-73.
8. Barnett ML, Ray KN, Souza J, Mehrotra A. Trends in telemedicine use in a large commercially insured population, 2005–2017. *JAMA* 2018; 320(20): 2147-2149.
9. Dorsey ER, Topol EJ. State of telehealth. *N Engl J Med* 2016; 375: 154-61.
10. Spring B. Sound health care economics: provide the treatment needed (not less, not more). *Health Psychol* 2019; 38(8): 701-704.
11. Chaet D, Clearfield R, Sabin JE, Skimming K. Ethical practice in telehealth and telemedicine. *J Gen Intern Med* 2017; 32(10):1136–40.

CONCLUSION

In the current study, tele-healthcare professionals responded to COVID-19 to develop virtually-delivered services that had been slow to develop prior to pandemic. About half the participants in this study had used virtual services, most for the first time during the pandemic, primarily for physical concerns, but also for mental health issues. Past use and satisfaction with virtual healthcare predicted a higher anticipated use of virtual healthcare in the future. The ongoing empirical evaluation of virtual service delivery is reshaping healthcare in the U.S.

12. Ohannessian R, Duong TA, Odone A. Global telemedicine implementation and integration within health systems to fight the COVID-19 pandemic: a call to action. *JMIR Public Health Surveill* 2020; 6(2): e18810.
13. Pierce BS, Perrin PB, McDonald SD. Pre-COVID-19 deterrents to practicing with videoconferencing telepsychology among psychologists who didn't. *Psychol Serv* 2020 November 30; Advance online publication. Available from URL: <http://dx.doi.org/10.1037/ser0000435>
14. Gonzalez MLS, McCord CE, Dopp AR, Tarlow KR, Dickey NJ, McMaughan DK, et al. Telemental health training and delivery in primary care: a case report of interdisciplinary treatment. *J Clin Psychol* 2019; 75: 260–270.
15. Martínez-Alcalá CI, Pliego-Pastrana P, Rosales-Lagarde A, Lopez-Noguerola JS, Molina-Trinidad EM. Information and communication technologies in the care of the elderly: systematic review of applications aimed at patients with dementia and caregivers. *JMIR Rehabil Assist Technol* 2016; 3(1): e6.
16. Hills WE. Behavioral health and new models of service delivery for an aging world: public/private partnerships to develop best practices of care for older adults. *Med Sci Pulse* 2019; 13(1): 29–33.
17. Cheng JM, Batten GP, Cornwell T, Yao N. A qualitative study of health-care experiences and challenges faced by ageing homebound adults. *Health Expect* 2020; 23: 934–942.
18. Koulaouzidis G, Charisopoulou D, Wojakowski W, Koulaouzidis A, Marlicz W, Jadczyk T. Telemedicine in cardiology in the time of coronavirus disease 2019: a friend that everybody needs. *Pol Arch Intern Med* 2020 Jun 25; 130(6): 559–561.
19. Garcia-Esperon C, Dinkelspiel FS, Miteff F, Gangadharan S, Wellings T, O'Brien B, et al. Implementation of multimodal computed tomography in a telestroke network: five-year experience. *CNS Neurosci Ther* 2020; 26: 367–37.
20. McGee JS, Meraz R, Myers DR, Davie MR. Telehealth services for persons with chronic lower respiratory disease and their informal caregivers in the context of the COVID-19 pandemic. *Pract Innov* 2020; 5(2): 165–177.
21. Glynn LH, Chen JA, Dawson TC, Gelman H, Zeliadt SB. Bringing chronic-pain care to rural veterans: a telehealth pilot program description. *Psychol Serv* 2020 Jan 16; Advance online publication. Available from URL: <http://dx.doi.org/10.1037/ser0000408>
22. Hills WE, Hills KT. Virtual treatments in an integrated primary care-behavioral health practice: an overview of synchronous telehealth services to address rural-urban disparities in mental health care. *Med Sci Pulse* 2019; 13(3): 54–59.
23. Hoefft TJ, Fortney JC, Patel V, Unutzer J. Task-sharing approaches to improve mental healthcare in rural and other low-resource settings: a systematic review. *J Rural Ment Health* 2018; 34: 48–62.
24. MacKinney AC, Dudley D, Schoepfoerster G. Aging well in rural America: the role and status of healthcare. *Generations* 2019; 43(2): 46–54.
25. Schroeder S, Roberts H, Heitkamp T, Clarke B, Gotham HJ, Franta E. Rural mental health care during a global health pandemic: addressing and supporting the rapid transition to tele-mental health. *J Rural Ment Health* 2021; 45(1): 1–13.
26. Weinzimmer LG, Dalstrom MD, Klein CJ, Foulger R, de Ramirez SS. The relationship between access to mental health counseling and interest in rural telehealth. *J Rural Ment Health* 2021 April 12: Advance online publication. Available from URL: <http://dx.doi.org/10.1037/rmh0000179>.
27. Phillips LA, Thompson TJ, Edelman SA, Ruiz TU. Independent mental health providers' experience in initial months of the COVID-19 pandemic. *Pract Innov* 2021 August 5: Advance online publication. Available from URL: <http://dx.doi.org/10.1037/pri0000153>.
28. Calton B, Abedini N, Fratkin M. Telemedicine in the time of coronavirus. *J Pain Symptom Manage* 2020; 60(1): e12–e14.
29. Schubert NJ, Backman PJ, Bhatla R, Corace KM. Telepsychiatry and patient-provider concordance. *Can J Rural Med* 2019; 24: 75–82.
30. Knowlton CN, Nelson KG. PTSD telehealth treatments for veterans: comparing outcomes from in-person, clinic-to-clinic, and home-based telehealth therapies. *J Rural Ment Health* 2021; 45(4): 243–255.
31. Ducharme J. The coronavirus outbreak could finally make telemedicine mainstream in the U.S. *Time* [online] 3.03.2020 [cit. 4.03.2020]. Available from URL: <https://time.com/5793535/coronavirus-telemedicine-telehealth/>.
32. Bakken S. Telehealth: simply a pandemic response or here to stay? *J Am Med Inform Assoc* 2020; 27(7): 989–990.
33. Ramsetty A, Adams C. Impact of the digital divide in the age of COVID-19. *J Am Med Inform Assoc* 2020; 27(7): 1147–1148.
34. Rood MN. COVID-19: "You're gonna need a bigger boat". *J Fam Pract* 2020; 69(4): 169–171.
35. Guinart D, Marcy P, Hauser M, Dwyer M, Kane JM. Patient attitudes toward telepsychiatry during the COVID-19 pandemic: a nationwide, multisite survey. *JMIR Ment Health* 2020; 7(12): e24761.
36. AmericanWell. Telehealth Index: 2019 Consumer Survey. Available from URL: <https://static.americanwell.com/app/uploads/2019/07/American-Well-Telehealth-Index-2019-Consumer-Survey-eBook2.pdf>: Accessed June 24, 2021.
37. Pierce BS, Perrin PB, Tyler CM, McKee GB, Watson JD. The COVID-19 telepsychology revolution: a national study of pandemic-based changes in U.S. mental health care delivery. *Am Psychol* 2021; 76(1): 14–25.
38. Park CL, Finkelstein-Fox L, Russell BS, Fendrich M, Hutchison M, Becker J. Americans' distress early in the COVID-19 pandemic: protective resources and coping strategies. *Psychol Trauma* 2021, January 28; Advance online publication. Available from URL: <http://dx.doi.org/10.1037/tra0000931>.
39. Stefana A, Youngstrom EA, Hopwood CJ, Dakanalis A. The COVID-19 pandemic brings a second wave of social isolation and disrupted services. *Eur Arch Psychiatry Clin Neurosci* 2020; 270: 785–786.

40. Browne DT, Wade M, May SS, Maguire N, Wise D, Estey K, et al. Children's mental health problems during the initial emergence of COVID-19. *Can Psychol* 2021; 62(1): 65-72.
41. Zhou X, Snoswell CL, Harding LE, Bambling M, Edirippulige S, Bai X, et al. The role of telehealth in reducing the mental health burden from COVID-19. *Telemed JE Health* 2020; 26(4): 377-379.
42. Serhal E, Kirvan A, Sanches M, Crawford A. Client satisfaction and experience with telepsychiatry: development and validation of a survey using clinical quality domains. *J Med Internet Res* 2020; 22(9): e19198.
43. Kruse CS, Krowski N, Rodriguez B, Tran L, Vela J, Brooks M. Telehealth and patient satisfaction: a systematic review and narrative analysis. *BMJ Open* 2017; 7: e016242.
44. Polinsky JM, Barker T, Gagliano N, Sussman A, Brennan TA, Shrank WH. Patients' satisfaction with and preference for telehealth visits. *J Gen Intern Med* 2015; 31(3): 269-75.
45. Ramaswamy A. Patient satisfaction with telemedicine during the COVID-19 pandemic: retrospective cohort study. *J Med Internet Res* 2020; 22(9): ArtID: e20786.

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