

Promoting Telehealth Adoption by Capitalizing on Lessons from the COVID-19 Pandemic

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Telehealth can significantly reduce healthcare costs and broaden specialized treatment access to remote areas, yet adoption was very low until the COVID-19 pandemic triggered an unprecedented demand in telecommunication technologies. We leverage this unique time in history and study the use of synchronous telecommunication technologies in healthcare during COVID-19 through a large online survey (N=100) and followup interviews (N=10). We find that current technologies have major limitations, such as X and Y; although healthcare providers found new benefits, mainly A and B. Based on these empirical results, we develop sociotechnical guidelines for the development of future telehealth technology, including A), B), and C). . Most importantly, healthcare providers want to keep using telehealth for part of their work, showing the latent need to move forward development.

CCS Concepts: • **Human-centered computing** → *Empirical studies in collaborative and social computing*;

Additional Key Words and Phrases: telehealth, telecommunication, remote collaboration, survey

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1 INTRODUCTION

The concepts of Telehealth and Telemedicine have evolved through time with the changing needs in health and with new technology development. Yet there is growing consensus that Telemedicine is a subset of Telehealth, as Telemedicine is the provision of medical services at a distance, and Telehealth includes a broader set of activities, such as patient and provider education [6, 15]. We stand on these definitions for the purpose of this article. Telehealth has the potential for a profound social impact, not only by decreasing the cost of healthcare and increasing its quality, but most importantly by improving access to specialized treatments, which today remains far from egalitarian. This inequality spans many areas of healthcare, such as **[add areas with refs, like specialties or other transverse things like eg MRI]**. Access to surgery in particular remains far from equal: countries with a low expenditure per person undertake fewer than 4% of all surgical procedures world-wide, yet they account for one third of the global population [16]; and in developed countries the number of surgeons per population is declining and is predicted to continue this trend [13].

Telehealth was first envisioned in 1925 [11], it first appeared in research around the 1970's, and skyrocketed from a few articles in 1990 to more than 500 in 2000 [6]. However, adoption of Telehealth has not followed this trend, as before the COVID-19 pandemic, adoption was increasing but still very low compared to in-person consultations [5, 9]. This comes as no surprise, as technology has a history of slow adoption in medicine: the stethoscope for example,

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53 a technology taken for granted in the toolbox of all doctors today, took 90 years before adoption since its invention
54 in in 1816 by René Laennec [12]. Given that technological requirements such as real-time communication across the
55 world are well-advanced, it is surprising, if not alarming, that telehealth has not been adopted as a normal part of daily
56 healthcare.
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58 Our goal is to understand the limitations of telehealth tools, their benefits, and to open new research avenues that
59 will ultimately lead to an increase in its adoption. The COVID-19 pandemic surged the demand for telecommunication
60 technologies, as healthcare practitioners had to continue providing routine care while reducing the risk of exposure
61 from face-to-face contact with patients and colleagues, and governments around the world facilitated this move by
62 lifting barriers, including waiving regulations on which systems could be used, across which cities and regions and
63 by facilitating the coverage of telehealth consultations. The sudden shift in adoption of synchronous communication
64 during the pandemic, across the broad spectrum of specializations and types of care, created a unique opportunity
65 to study what are the benefit of remote consultations as well as limitations. We carry out a survey to study the use
66 of remote communication technologies during COVID-19. Responses (N=100) include a wide spectrum of medical
67 practitioners, including general doctors, surgeons from 4 specialties, mental health practitioners, psychiatrists, blah
68 and bleh. Our findings show that almost all practitioners used commercially available tools, such as Skype or Google
69 Meet, and very few had official tools made available by their institutions. Most importantly, we find how practitioners
70 overcome the most notable limitation of not being able to perform physical checkups, through a new strategy of relying
71 on a nearby family member or even the patient themselves as a proxy to check for vital signs. Finally, we show how
72 remote communication technologies allowed doctors to create a closer bond with their patients, by “entering the
73 patient’s home”, which is surprising given that before COVID-19, a barrier to healthcare adoption was the belief that it
74 would create a distance between the patient and the doctor. **more findings when we have them**. Our work contributes
75 to a lack of evidence-based data on use for telemedicine [4].
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82 2 RELATED WORK

83 2.1 The Slow Technology Adoption in Medicine

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86 Technology adoption in healthcare has a history of being slow. Reason for this slow adoption include 1) the difficulties
87 of gaining a robust knowledge base about the technology, 2) hesitancy both from patients and physicians to put an
88 instrument between them, and 3) the sheer cost of the training needed to implement technology. The adoption of
89 the stethoscope is a prime example. It was invented in 1816 but only widely adopted 90 years later by physicians in
90 the United States because of the lack of formal education, the complexity of interpreting auscultatory information,
91 and the hesitancy to use an instrument rather than leaning the physician’s ear on the patient’s chest [12]. A more
92 recent example is Electronic Medical Records (EMR). EMRs are “a system that integrates electronically originated and
93 maintained patient-level clinical information, derived from multiple sources, into one point of access” and “replaces the
94 paper medical record as the primary source of patient information” [cite]. According to [1] only 83.8% of non-Federal
95 acute care hospitals have adopted a basic EMR system as of 2017 Many studies have found that there is no difference
96 in patient satisfaction with or without EMR [3, 10]. As more research into the matter has shown, the quality and
97 coordination of care is greatly improved which has substantially refined the efficiency of healthcare practice [2]. Many
98 physicians had a hard time justify the high costs of maintaining and updating EMRs which is close to \$40,000 per year
99 when there was a lack of robust training and knowledge on the technology.
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105 With COVID-19 being an abrupt change to the way healthcare spaces handle patients and appointments, now is
106 the time for HCI to do more research into the impact that audio and visual technology has on patient - practitioner
107 relationships. Since COVID-19, the issue of hesitancy of health practitioners to adopt technology has been put aside
108 as there is an immediate need to adapt to the pandemic. Prior studies have shown that one of the main issues with
109 adoption of technology in healthcare has been the lack of information on it [2]. This could mean that training for the
110 technology is less robust which makes it difficult for it to be universally adopted. Our work digs deeper into the ways
111 that audio and visual technology can be better utilized even after COVID-19.
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118 2.2 Telehealth Before and during COVID-19

119 Before the COVID-19 pandemic, trends showed some increased interest in use of telehealth services by both healthcare
120 professionals and patients [cite]. Technology that has been integrated into the healthcare system has been basic audio
121 and visual technology like Skype, Zoom, Webex, Google Hangouts etc. One study shows a growth of 52% from 2005 to
122 2014, and 261% from 2015 to 2017, but still at the end of 2017 telehealth consultations represented 6.57 out of 1000 of
123 consultations [5]. Another study found a growth of 46.4% each year between 2010 and 2015, but still telehealth claims
124 were 1.5 per 10000 consultations in those 5 years [9]. When the COVID-19 pandemic hit, adoption changed drastically.
125 One center in North Carolina (United States) went from 1% to 70% of consultations in just four week, reaching more
126 than 1,000 video visits per day [17]. [find another source](#). Since the pandemic, telehealth has been made mainstream by
127 necessity. Although studies prior to COVID-19 sought out more information on these audio and visual technologies,
128 our work aims build upon the foundation of existing studies and take advantage of the more universal use to build a
129 more diverse knowledge base. [Feedback from workshop: these numbers are hard to interpret](#).

130 COVID-19 surged the adoption of telehealth. Very few studies show concrete data on telehealth adoption, but these
131 illustrate that, before the pandemic, growth was steadily increasing but still extremely low.
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134 This rapid shift due to COVID-19 required a rapid reorganization of medical centers, for instance by creating a
135 centralized healthcare center and new training [17]. Moreover, COVID-19 reshaped uses for telehealth. During the
136 pandemic, telehealth was used in the front line through triage [cite], infectious disease diagnose (COVID-19) [cite],
137 providing mental health care [18], neurology consultations [7], post-surgery followups [8] and even inpatient care
138 inside an institution to reduce virus transmission, by for example mounting an iPad on a wheeled-stick and moving it
139 across rooms allowing for quarantined specialists to continue providing care [17].
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143 Research on the impacts of COVID-19 on telehealth are emerging, for example to look at the barriers of adoption
144 during the pandemic, including clinician acceptance, difficulties for reimbursement, or the lack of organization in
145 healthcare [14]. Our work also capitalizes on this time to learn about how to move telehealth forward, with a focus on
146 the limitations that health practitioners encountered during this time, and the benefits the technologies provided.
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152 3 HCI AND TELEHEALTH

153 [In surgery: works from Helena. Summarize what did we learn from a research perspective.](#)
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157 **4 METHOD**158 **5 RESULTS**159 **6 SOCIOTECHNICAL GUIDELINES FOR THE ADOPTION OF TELEHEALTH**160 **ACKNOWLEDGMENTS**

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