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Original articles

Telemedicine, safe medication stewardship, and COVID-19: Digital transformation during a global pandemic

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ABSTRACT

Telemedicine may provide equitable, accessible, and affordable healthcare to individuals globally. Recently telemedicine has emerged as a vital resource for interdisciplinary healthcare professionals to provide critical medical care on the frontlines during the combined COVID-19 pandemic and the drug and opioid crisis. With the recent 2020 expansion of insurance coverage of telemedicine services by the United States Centers for Medicare & Medicaid Services, there has been an uptick in the need to understand how to comprehensively train physicians and health care professionals on telemedicine during a public health crisis. This study gathered 98 survey responses from interdisciplinary healthcare professionals regarding their telemedicine experience, focusing on trends of use with the drug and opioid crisis during the COVID-19 pandemic. The results demonstrate that during the COVID-19 pandemic, telemedicine provided a novel, innovative way to address an unmet need in healthcare and may aid to improve safe medication stewardship (SaMS) practice guidelines. Further expanded population-based research and randomized clinical trials are necessary to confirm these preliminary recommendations and form best practices for use in digital health and telemedicine. In addition, further studies will confirm the benefits of interdisciplinary healthcare professionals' engagement in harm reduction strategies via telemedicine to address improving safe medication use.

1. Background

During the COVID-19 pandemic, the drug and opioid crisis has continued to impact public health in the United States (US). A public health contributor to the ongoing crisis is the escalating workplace stress, burnout, and isolation created by the COVID-19 pandemic, as many have limited equitable access due to widespread program cancellations.

While the COVID-19 pandemic has continued, the drug and opioid crisis has also silently escalated in communities throughout the US. Synthetic opioids, including fentanyl, have contributed to an increase in an immediate rise in overdose deaths, which have increased by 38.4% from the 12 months leading up to June 2019 compared to the 12 months leading up to May 2020.¹ The total economic burden of prescription opioid misuse alone is approximately \$78.5 billion a year, including lost productivity, healthcare costs, and treatment costs.^{2,3}

Around 97% of US jurisdictions that possessed opioid data found that overdose deaths involving synthetic opioid use increased, with around 47% of those jurisdictions reporting increases of more than 50%. The US Centers for Disease Control and Prevention (CDC) also reported that during the COVID-19 pandemic, 10 western states faced more than a 98% increase in overdose deaths involving synthetic opioids.¹ Thus, there is an urgent need to find highly effective methods for treating pain and the opioid crisis, all while improving education on safe medication use broadly during the COVID-19 pandemic.

Given these challenges and public health crises, telemedicine may be a digital, transformative tool to address pressing issues of equitable healthcare access. Patient-healthcare professional relationships have begun to change as telemedicine becomes more widespread during the pandemic (Fig. 1).⁴ Telemedicine can help maintain social distancing and minimize the potential risk of COVID-19, while still providing adequate patient care.^{5,6} The challenge that continues to be at the

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forefront is how to best improve patient communication during telemedicine healthcare visits.

The COVID-19 pandemic has tested global health competencies, pushing US state and federal policymakers to remove restrictions and advance reimbursement for telemedicine at the highest rate in history.^{5,8,9} With the adoption and increased usage of telemedicine services, best practices continue to integrate into the healthcare delivery system.^{5,10} From the end of June 2020 to the beginning of November 2020, one-third of all medical visits were conducted via telemedicine platforms.⁸ There has been approximately a 154% increase in telemedicine visits, which can be seen when comparing telemedicine visits during early 2020 to the same period in 2019. At the same time, the number of urgent and emergency department visits significantly decreased during March 2020 compared to March 2019.¹⁰

From January through March 2020, 93% of telemedicine visits were for conditions other than COVID-19. However, this number significantly increased upon the acute emergence of COVID-19 in the US in March 2020, with 16.2% of all patients seeking telemedicine care desiring attention for COVID-19 concerns.¹⁰ As the number of cases related to COVID-19 decreased from April to June 2020, the number of telemedicine visits decreased as more patients went back to in-person visits. However, as the number of COVID-19 cases spiked again in September 2020, so did the number of telemedicine visits. 95% of health centers have reported capabilities to provide telemedicine services during the COVID-19 pandemic.⁸ With the use of telemedicine, these services have also evolved to better suit the needs of the public, although challenges continue to exist in clinical care and proper implementation.¹¹

In this survey study, we evaluated interdisciplinary healthcare professionals and physicians on the use of telemedicine during the COVID-19 pandemic and the opioid crisis. Specifically, we queried on a broad subset of questions to assess the following: (1) their level of clinical competency on public health crisis training, (2) digital communication training to provide telemedicine, specifically focused on harm reduction, medication safety, drug overdoses, opioid use, and general pain care, and (3) the general ability to counsel patients on safe and responsible medication practices and opioid use.

The key objectives of this study included the following: (1) to determine how best to improve telemedicine care and pain care during the COVID-19 pandemic, (2) to provide innovative telemedicine care during a rapidly emerging crisis and a reducing workforce, and (3) to address best practices and guidance regarding telemedicine educational competencies and future training.

2. Methods

This survey study was independently reviewed for survey participant risk and reflected minimal risk to the survey participants. The research was determined to be exempt by Scripps Health Institutional Review Board (IRB) #21-7790. This manuscript adheres to the best practices by the American Association for Public Opinion Research reporting guidelines for survey studies.¹²

2.1. Sampling

This study was performed through a virtual and anonymous online trackable link to assess healthcare professionals' attitudes and behaviors related to telemedicine. The survey was administered over a 12-week period during 2021 using a river sampling strategy. The survey is available for review in the **Appendix**.

2.2. Statistical analysis

The collected data were coded, tabulated, and statistically analyzed using R Studio (RStudio Team (2020). Integrated Development for R. RStudio, PBC, Boston, MA, v1.3.1073) and qualitative data were described as number and percentage and were compared using Chi-square test for differences between proportions. Quantitative normally

Distributed data were described as mean (M) ± standard deviation (SD) and minimum and maximum of the range and the level of significance was considered significant if $p < 0.010$. The strength of the relationship between variables was further analyzed using correlation coefficients.

3. Results

3.1. Demographics

This survey study involved the following demographic characteristics (Table 1) of the interdisciplinary healthcare professionals: 98 healthcare professionals (68 = physicians, 28 = nurses, 2 = physician assistants). The participants' ages ranged from 28 to 70 years of age (M = 47, SD = 10.7). 28.6% of participants were male, and 70.4% were female, with one individual not identifying with the male or female gender.

3.2. Education

41.8% of participants reported receiving training regarding

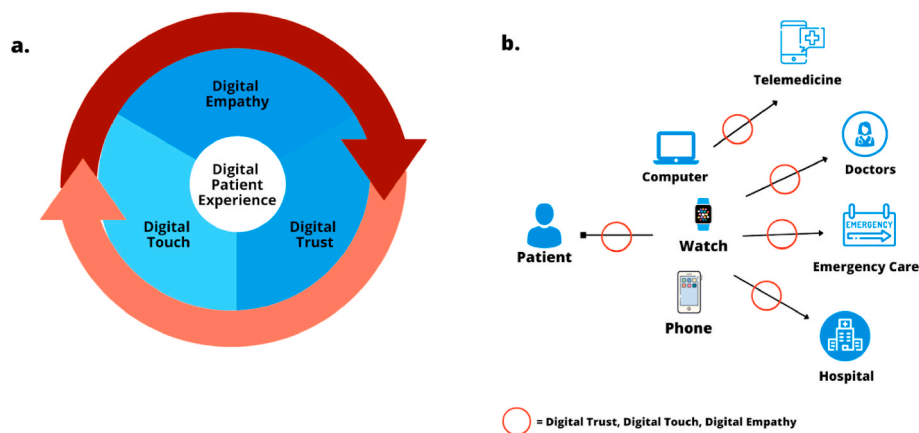


Fig. 1. Digital Patient Experience.

(a) The digital patient experience is connected by empathy, touch, and trust.⁷ (b) The digital patient journey is complex, involving digital devices at every point in time, and requiring increasing competency training along each corresponding journey for healthcare professionals.

Table 1a
Enrollment of study participants (n = 98).

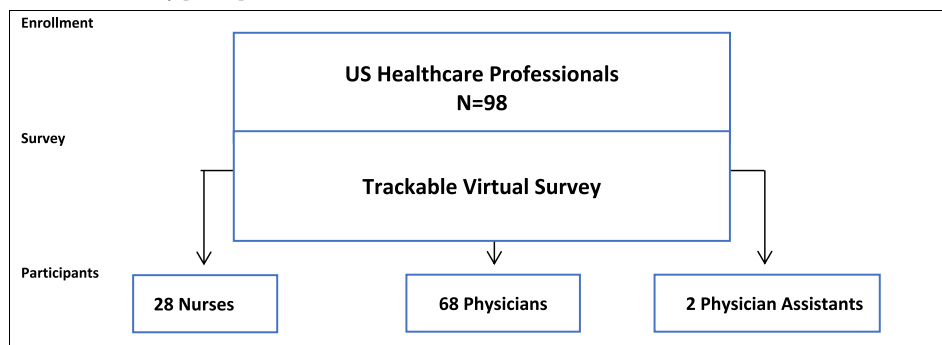


Table 1b
Baseline demographic and characteristics of study participants (n = 98).

Demographics and Telemedicine Usage % (N = 98)			
Age	Use During COVID-19	During the Last 5 Years	During the Last 10+ Years
20–29*	100% (3)	33% (1)	0% (0)
30–39	100% (24)	42% (10)	4% (1)
40–49	100% (21)	76% (16)	38% (8)
50–59	100% (36)	56% (20)	19% (7)
60–69	100% (12)	25% (3)	17% (2)
70+	100% (2)	0% (0)	0% (0)
Total	100% (98)	51% (50)	18% (18)
Gender			
Female	100% (69)	50.7% (35)	14% (69)
Male	100% (28)	50% (14)	11.1% (3)
Other	100% (1)	100% (1)	100% (1)
Total	100% (98)	51% (50)	18% (18)

^a The youngest participant was 28-years-old.

telemedicine, with 22.4% receiving this education prior to the COVID-19. 31.6% obtained training at the beginning of the COVID-19 pandemic. There was no statistical significance between a healthcare professional’s perceived patient’s attitudes and whether the healthcare provider received telemedicine training or not. 48.2% of participants admitted to never receiving telemedicine-specific training during their medical careers. 50% of the subject pool believed telemedicine training to be adequate, with 13.2% of those who received telemedicine training believing that training to be inadequate. The gender and age of the healthcare professional did not have a significant impact on telemedicine use as all healthcare providers used telemedicine in the past 1.5 years. Moreover, healthcare professionals perceived patients’ attitudes and habits strongly correlated with that of their healthcare provider in a telemedicine setting (Table 2).

Table 2
Healthcare providers’ perception of patients’ qualities associated with telemedicine use.

Quality	Eye Contact		Communication		Active Listening		Shared Discussion and Decision-making		Attentiveness	
	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value
Eye Contact	0.813	<0.0001****	0.551	<0.0001****	0.438	<0.0001****	0.417	<0.0001****	0.563	<0.0001****
Communication	0.492	<0.0001****	0.707	<0.0001****	0.706	<0.0001****	0.589	<0.0001****	0.700	<0.0001****
Active Listening	0.481	<0.0001****	0.650	<0.0001****	0.714	<0.0001****	0.569	<0.0001****	0.719	<0.0001****
Shared Discussion and Decision-making	0.426	<0.0001****	0.691	<0.0001****	0.712	<0.0001****	0.559	<0.0001****	0.798	<0.0001****
Attentiveness	0.432	<0.0001****	0.569	<0.0001****	0.573	<0.0001****	0.506	<0.0001****	0.631	<0.0001****

Level of significance = p-value < 0.010.

3.3. Clinical competency

The participants were asked to score their ability to treat certain health conditions in a telemedicine setting compared to an in-person environment. Similarly, they were asked to assess and score their ability to demonstrate different skills, such as active listening, in a telemedicine setting compared to an in-person environment. Healthcare professionals and physicians in the survey were also asked to score their perceived patients’ habits, such as sharing information, in a telemedicine environment compared to an in-person setting. According to the survey results, a healthcare professional’s ability to evaluate, diagnose, and treat various health conditions through telemedicine is highly correlated with their habits (Table 3).

3.4. Pain and substance use disorders

No statistical significance was established in receiving telemedicine training and better caring for pain or substance use disorders. There was statistical significance noted on the healthcare professionals’ ability to aid in pain and opioid management and their attitudes (Table 4). Participants also scored themselves on their ability to care for different patient conditions, such as opioid management and perioperative care, in a telemedicine environment compared to their ability to care in an in-person setting.

3.5. Empathy, eye contact, and distractions

The survey participants were asked to assess themselves regarding certain qualities and attributes shown during patient telemedicine appointments, such as eye contact and empathy. The average scores of these qualities are depicted in Fig. 2. The averages of all qualities are within one point of being the same as in-person care. Participants rated themselves on a 0–10 scale, where a rating of 5 is the same as in-person care, 0 is much worse than in-person care, and 10 is much better than in-person care.

Table 3
Healthcare providers' perceived qualities to diagnose health conditions associated with telemedicine use.

Quality (Physician)	Comfort Using Telemedicine		Allocating Time for Questions		Understanding Verbal and Nonverbal Cues		Active Listening		Shared Discussion and Decision-making	
	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value
Ability to Diagnose Pain	0.175	0.111	0.359	<0.001***	0.600	<0.0001****	0.482	<0.0001****	0.407	0.001***
Ability to Aid in Opioid Management	0.098	0.495	0.368	0.008**	0.731	<0.0001****	0.698	<0.0001****	0.613	<0.0001****
Ability to Aid in Opioid Care	0.217	0.109	0.392	0.003**	0.651	<0.0001****	0.611	<0.0001****	0.561	<0.0001****

Level of significance = p-value < 0.010.

Table 4
Healthcare providers' perception on patients' qualities associated with healthcare providers' ability to diagnose health conditions.

Quality (Patient)	Understand Recommendations		Share Information		Preparedness		Active Listening		Shared Discussion and Decision-making	
	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value
Ability to Diagnose Pain	0.620	<0.0001****	0.587	<0.0001****	0.457	<0.0001****	0.573	<0.0001****	0.526	<0.0001****
Ability to Aid in Opioid Management	0.678	<0.0001****	0.513	<0.0001****	0.417	0.002**	0.648	<0.0001****	0.554	<0.0001****
Ability to Aid in Opioid Care	0.635	<0.0001****	0.480	<0.0001****	0.460	<0.0001****	0.581	<0.0001****	0.542	<0.0001****

Level of significance = p-value < 0.010.

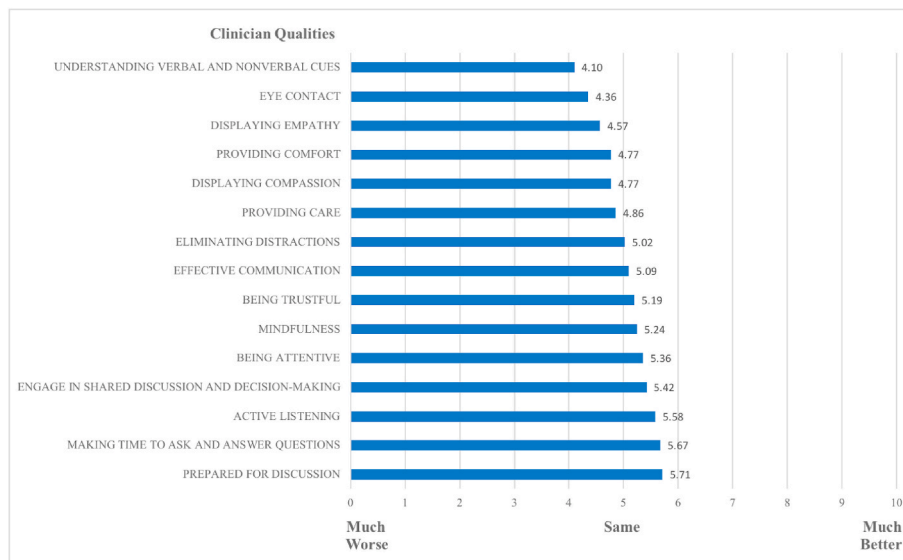


Fig. 2. Healthcare professionals' self-assessment on qualities and attributes with telemedicine use. Data is represented as mean (n = 98).

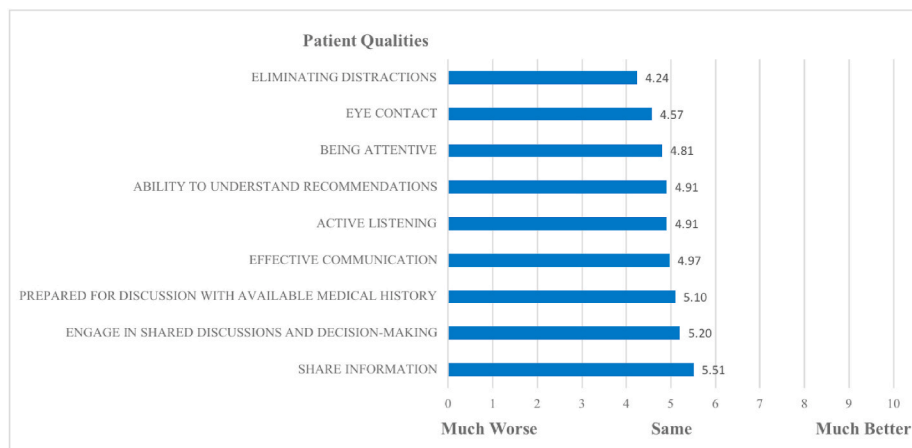


Fig. 3. Healthcare professionals' perceived assessment on various qualities and attributes patients demonstrate on telemedicine use. Data is represented as mean (n = 98).

3.6. In person versus telemedicine care

Participants were asked to rate patients on the same 0–10 scale, with 5 being the same as in-person care, 0 being much worse than in-person care, and 10 being much better than in-person care. Survey participants were asked to rate their patients on qualities displayed in telemedicine appointments, such as eye contact and eliminating distractions. The average scores on these qualities were calculated (Fig. 3). All qualities were within 1 point of 5 or the same as in-person care, with 6 qualities being deemed worse than in-person care and 3 as better than in-person visits.

The same scale was used in which a score of 5 is the same as in-person care, a score of 0 is much worse than in-person care, and a score of 10 is much better than in-person care. The average scores of each assessment were calculated (Fig. 4). Most diagnoses were given a score close to 5, signifying clinicians' ability to care for patients with telemedicine compared to traditional in-person settings. Common responses regarding telemedicine trends and advice were gathered and summarized (Table 5).

4. Discussion

As telemedicine becomes more commonly utilized as a method for providing healthcare services, emphasis on meeting the needs of patients is crucial. Patient-centric care must satisfy patients' preferences, wishes, and values,¹³ and research shows that patient-centered care communication increases patient satisfaction.¹⁴ It is essential to consider how telemedicine technology can meet patients' treatment expectations, match their specific treatment needs, and provide content accessible and useable for patients.¹⁵ Although receiving telemedicine training does not seem to affect the ability of healthcare providers to care for pain and opioid use disorder or the patients' behavior, telemedicine training is still crucial, especially when considering bioethical standards. Several participants noted the need for improved equitable access to healthcare.

4.1. Regulatory considerations

For proper telemedicine training and telemedicine technology, Health Insurance Portability and Accountability Act of 1996 (HIPAA)

Table 5

Common optional survey responses from healthcare professionals on telemedicine use.

How did telemedicine change during the COVID-19 Pandemic?	In your opinion, what has been the greatest challenge from transitioning from in-person care to telemedicine?	What advice do you have for other medical professionals to achieve the best telemedicine experience?
"The COVID-19 era made telemedicine mainstream"	"Technology limitations/ challenges (self and patient)"	"Support patient education on how to use"
"Increased usage"	"Accessing the platform"	"Document well"
"Allowed broader reach to more patients"	"Not able to do much of a traditional/physical exam"	"Have patients use a quiet well-lit room without other distractions"
"It became a necessity in order to provide care to our patients"	"Completing good assessment is a problem"	"Get training and practice with colleagues and technology first; ensure meeting HIPPA guidelines"
"Better for providers and patients more willing to utilize"	"The loss of the physical exam, the direct eye contact and attentive nature of the in-person exam"	"Ensure you have excellent internet and a system that is easy for patients to access/use"
"Became more established in the culture but the actual application of telemedicine did not change"	"Lack of education on telemedicine from clinical and legal perspective"	"Be very vigilant in checking Patient body movements"
"Better use of time for avoiding on the road for patients [especially] for simpler follow up care "	"Self-anxiety secondary to a learning curve"	"Know the limitations of telemedicine and what you may miss"
"Comfort level of patients. They are much happier now doing phone visits for minor problems"	"Lack of connection to the patient"	"Be open. Do some reading on ways to provide telemedicine in a trauma informed way"

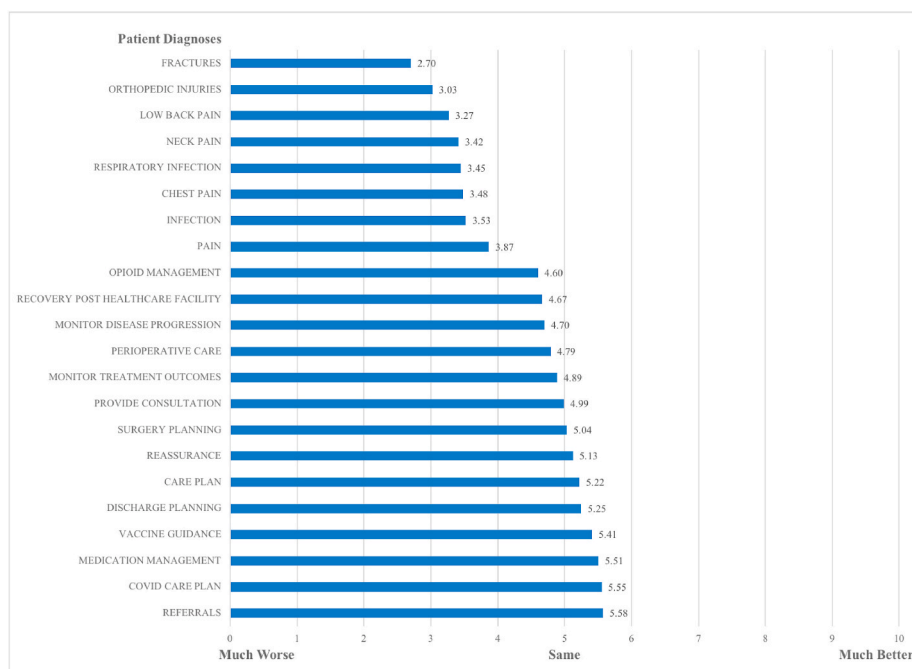


Fig. 4. Healthcare professionals' perceived assessment on their perceived abilities to treat and diagnose various conditions. Data is represented as mean (n = 98).

and legal guidelines are necessary (Table 5). The benefits of telemedicine (e.g., increased accessibility to healthcare, decrease in costs, etc.) seem to outweigh its disadvantages, but ethical telemedicine health care practices, digital security, and proper training of the use of telemedicine platforms (e.g., video calling programs) for both providers and patients is crucial.¹⁶

Consequently, HIPAA regulations for telemedicine should be reevaluated to incorporate better security measures and reflect the needs of both healthcare professionals and patients when using telemedicine. The allowance of general video calling platforms, such as Zoom, Skype, etc., is crucial for pain services and during the COVID-19 pandemic.¹⁷

4.2. Study limitations

This study has several limitations. First, there is a potential for convenience sampling due to the survey design, which can impact the generalizability of the findings. Second the design is a cross-sectional design, impacting the potential for establishing causation. Third, our sample only involved 98 interdisciplinary healthcare professionals, affecting the overall broad generalizability for a large population. Fourth, healthcare professionals were asked to answer questions about their perceptions of themselves and their patients, which may introduce survey bias.

5. Conclusions

This study examined interdisciplinary health care professionals' perceived competencies, behaviors, and abilities to evaluate, diagnose and treat pain-related diseases through a digital, telemedicine platform during a combined COVID-19 pandemic and opioid crisis. According to this study, telemedicine has become increasingly prevalent (32.6% increase from the last 10 to 5 years) and has only become more widely used due to the global COVID-19 pandemic (49% increase, resulting in all studied physician and healthcare providers surveyed using telemedicine).

5.1. Improving comfort

Participants reported that telemedicine is a necessity to provide a better method for both patients and providers to increase access, comfort for patients at home, and convenience (Table 5). This supports other research where patient satisfaction with video appointments includes better access to appointments, shorter travel time, and less time in the waiting room.¹⁸ Subsequently, the telemedicine experiences of patients are shaped by convenience, efficiency, privacy, and comfort,¹⁹ which are crucial factors to consider, especially for chronic pain patients.

5.2. Reducing cost

Telemedicine allows patients to save significantly on travel costs for patients who must travel far to pain management centers and care facilities. For instance, the long drive that chronic pain patients have to make to their appointment often further aggravates their pain since many pain specialists practice in major medical centers, which are typically in urban locations.²⁰ Telemedicine, therefore, plays a crucial role in making care more accessible, minimizing the time it takes to go to physical clinics, avoiding the extra aggravation of pain, and achieving improved patient satisfaction.^{18–22} Moreover, our results suggest that current telemedicine technology, specifically those administered through telemedicine utilizing only face-to-face assessment, may be insufficient when diagnosing chronic pain (compared to an in-person setting), which often requires physical examinations to detect the source of pain correctly.

5.3. Telemedicine for triage

One potential method to incorporate telemedicine more effectively may be to use a telemedicine triage protocol, which would direct patients to the platform most suited for their needs.^{23,24} Russel et al. discovered that tele-rehabilitation technology resulted in a 93.3% agreement rate between in-person and telemedicine diagnoses of painful ankle disorders, even when a complex anatomical assessment was required,²⁵ suggesting that proper technology may improve diagnosing physical pain through telemedicine. Aside from the ability to diagnose physical pain, healthcare providers reported that their ability to administer other pain management care (including care and surgery planning, medication management, etc.) was similar when using telemedicine and in-person platforms (Fig. 4). Certain attitudes and behaviors that healthcare providers and their patients exhibited during telemedicine appointments were comparable to those during in-person appointments (Figs. 2 and 3).

5.4. Empathy with telemedicine

In addition to the comparability of behaviors and pain and opioid or drug-related diagnoses, our results show that there is a significant relationship between healthcare providers' abilities (e.g., diagnosing pain and aiding in opioid management and care) and their qualities (e.g., active listening, shared discussion, and decision-making, and understanding verbal and nonverbal cues) in a telemedicine setting ($p < 0.01$).

The attitudes and habits of patients also strongly correlate to those of healthcare providers in a telemedicine setting ($p < 0.01$), indicating that patients' engagement in telemedicine sessions may mirror that of their healthcare providers. These results suggest that telemedicine, digital healthcare, and fostering safe medication stewardship (SaMS) can still spawn important healthcare provider qualities, like empathic skills, non-verbal communication, and listening abilities, which significantly affect patient satisfaction.^{26–30}

Considering the growing interest in best practices in telemedicine and the increasing interest in digital health, further randomized clinical trials and population-based research are necessary to assess and minimize the risks of telemedicine. Ultimately, this will help ensure that patient care and safety is addressed and best practices to follow SaMS are implemented.

Implication statement

The investigators conducted a cross-sectional study of interdisciplinary healthcare professionals during the COVID-19 pandemic to assess the best practices of telemedicine innovation for pain, opioid stewardship, and drug related disorders.

Funding

KC received funding from Princeton University.

Authors' contributions

RJK and KC aided in the conception and design of the study, distributed and assessed surveys, collected and analyzed data, and wrote and revised the manuscript.

AG was responsible for the conception and design of the study and writing and revising the manuscript.

CM shared responsibility in writing and revising the manuscript and also aided in the development of graphic illustrations.

SRS helped to revise the manuscript, making contributions in technical design, data table development, and materials support.

All authors have read and approved the final manuscript.

Availability of survey, data, and materials

The survey, review, datasets, materials generated and analyzed during the present study are available from the corresponding author on reasonable request.

Declaration of competing interest

The authors of the manuscript have disclosed no relevant financial conflicts of interest at the time of conducting this research.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.xjep.2022.100524>.

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Further readings

31. Centers for Disease Control. Understanding the Epidemic.
32. Centers for Disease Control. Telehealth and Telemedicine the Use of Telehealth and Telemedicine in Public Health.