Article

Patient Attitudes Regarding Audio-Only Telemedicine in Rural Minnesota

Samuel Nelson *, Nicholas Battis, Ryan Harden

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Patient Attitudes Regarding Audio-Only Telemedicine in Rural Minnesota.

Contributing Authors:

[1] Samuel Nelson, BS; University of Minnesota Medical School, Duluth Campus, 1035 University Drive, Duluth, MN 55812

[2] Nicholas Battis, BS; Contact Dermatitis Clinic, Park Nicollet Health System, 7550 34th Ave. S., Suite 101, Minneapolis, MN 55450

[3] Ryan M. Harden, MD, MS; University of Minnesota Medical School, Duluth Campus, 1035 University Drive, Duluth, MN 55812

Corresponding Author:

* Samuel Nelson, BS; University of Minnesota Medical School, Duluth Campus, 1035 University Drive, Duluth, MN 55812; 320-223-9258; nels9214@d.umn.edu

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Credentials:

[1] Samuel Nelson is a current second-year student at the University of Minnesota Medical School, Duluth Campus.

[2] Nicholas Battis is currently serving as a research fellow in the department of Dermatology with the Health Partners Contact Dermatitis fellowship. He is on a leave-of-absence from medical school and will be returning as an MS4 in the fall of 2023.

[3] Dr. Ryan Harden is a practicing family medicine physician and an assistant professor at the University of Minnesota Medical School, Duluth Campus.

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Abstract: *Purpose*: This study aims to provide a foundational understanding of patient-centric perceptions of telemedicine implementation in rural Minnesota. *Methods*: This retrospective cohort study utilized a mail questionnaire to assess patient attitudes and behaviors regarding telemedicine during the emergency response to COVID-19. The target population was patients of a Primary Care clinic in eastern Minnesota. Descriptive statistics were used to assess respondents' level of agreement with survey items scored on a 0-10 scale. *Results*: A majority of the respondents indicated that they were satisfied with using telemedicine (73.96%); that they gained an additional sense of control over their health condition due to the availability of telemedicine (52.08%); that they would support the use of telemedicine in the future (61.05%); that telemedicine increased access to care (65.63%); telemedicine was preferred over the clinic (61.46%), and that they would purchase new equipment to increase the utility of telemedicine services (54.17%). 51.04% of the respondents indicated a 10/10 level of satisfaction with telemedicine services. 48.96% indicated the strongest level of disagreement related to difficulty using telemedicine or a preference for in-person clinical appointments. *Conclusions*: Patients were found to have favorable perceptions of telemedicine overall. Though providers continue to recognize the benefit of face-to-face visits, their patients show an increased predilection for virtual care and telemedicine will likely remain an essential tool for providers to reach patients who would otherwise choose not to seek care.

Introduction:

The use of information technologies (IT) in healthcare has been a controversial topic for decades [1–5]. The recent surge in the adoption of telemedicine has brought many historical debates to public attention. As the atmosphere surrounding remote healthcare delivery begins to stabilize, many questions arise as to systems for maintaining telemedicine technologies and programs that improve the human condition. The pace of technology innovation dramatically exceeds the capacity of traditional healthcare systems to implement new tools in a safe and effective manner [6,7]. This leads

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to a vicious cycle of patients and providers being inundated with cutting-edge solutions for healthcare, while regulators scramble to define the boundaries for vetting these solutions accordingly.

The first major spike in telemedicine utilization occurred in the 1960s when the United States government began investing in telecommunications to serve the healthcare needs of isolated populations [8,9]. A bias toward isolated and underserved populations persists today, and telemedicine has been frequently cited as a solution for confronting health disparities in rural and Native American communities [10].

Broader commoditization of telemedicine occurred with the establishment of telemedicine conferences in the latter half of the 1970s, and the introduction of the internet redefining standards for IT in 1983 [3,7,9]. However, up to the present day, the global adoption of telemedicine remains relatively slow. Commonly cited barriers to the widespread implementation of telemedicine include the lack of reimbursement and reliability [8,11–12]. These two issues can go hand-in-hand with each other. For example, at this moment, we do not have separate accreditation processes for providers who wish to offer virtual medical services, including telemedicine [8,12–13]. If it has not been validated that telemedicine appointments are performed to the same standards of care as traditional, in-person practice, then why impose equal reimbursement? In many ways, reimbursement can affect incentives pertaining to research or implementation of a clinically validated model.

Funding and support for digital health innovation have remained quite strong over the last decade and a half [14]. In 2009, following the burst of the U.S. housing bubble and global financial crisis, the American Recovery and Reinvestment Act allocated over $25 billion in funds for digital healthcare and other health technologies [15]. In 2016, the Health Resources and Services Administration (HRSA) awarded $16 million in funding for the expansion of telehealth and other rural healthcare programs specifically [16]. Beyond capital contributions, the overall sentiment of patients and providers suggest that telemedicine is here to stay. The 2021 Survey of America's Physicians by the Physicians Foundation shows that 70% of respondents intend to incorporate telehealth as a regular part of their practice in the future [17]. A survey published by Amwell in 2020 suggested that almost all providers intend to use telemedicine even when it is safe to see patients in person. Over half of the patients who responded to the survey expected to continue to use telemedicine at a greater frequency as a result of the pandemic [18].

There is now an urgency to assure that valuable programs and technologies are recognized for the future of medicine. This is demonstrated by constant policymaking and a growing infrastructure surrounding the evaluation of telemedicine and other digital health technologies. The Center for Connected Health Policy publishes regular updates. Some of the most notable trends for 2022 include the expansion of services and types of providers that are eligible for reimbursement, implementation of practice standards, and licensure [12]. Furthermore, the FDA has established the Digital Health Center of Excellence which is dedicated to advancing safe and effective digital health innovation through knowledge, networks, and regulatory systems [19].

According to our review, very little work has been done to demonstrate end-users' perceptions of telemedicine implementation in rural MN. Previous works have cited age, level of education, eHealth or computer literacy, bandwidth of dwelling, unawareness of the existence of telemedicine, high expectations of users, apathy, lack of access to a phone, socioeconomic status, gender, and preference for personal visits as end-user barriers to telemedicine [4,10,20]. An additional systematic review further breaks down these barriers into internal (resistance, poor body language, and communication, negative perception of privacy and security) and external (slow internet speed, poor network signal, system difficulty to use, lack of organizational support, home obstructions), however, this review did not provide any insight to rural settings specifically [11]. Furthermore, there has been substantial speculation about the future benefits of remote medical technologies for increasing access and equity of healthcare for isolated populations [3,4,8]. Therefore, this study aims to provide a patient-centric view of emergency telemedicine implementation during the COVID-19 pandemic at a Primary Care clinic in rural MN. At this clinic, telemedicine services were rapidly implemented and then scaled back according to the severity of the situation surrounding COVID-19. Our research

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pertaining to the sudden shift to remote patient care during the pandemic will create a foundation for future studies regarding the remote provision of healthcare services. Additionally, the results may inform strategic changes to practice at this site and others throughout the state.

Methods:

This retrospective cohort study utilized a mail questionnaire to assess patient attitudes and behaviors regarding telemedicine during the emergency response to COVID-19. The target population was patients of a Primary Care clinic in eastern Minnesota. Descriptive statistics were used to assess respondents' level of agreement with survey items scored on a 0-10 scale.

Setting: The host clinic is located in a rural town of about 2700 people in eastern Minnesota. The population is predominantly white with a median age of 40 years old and a median household income of about $40,000. Most people drive themselves to work and experience an average commute time of 23 minutes which is comparable to the national average. The most common industries include manufacturing, accommodation and food services, and other service professions. Over 90% of the population has health coverage with about 30% covered by public assistance. Aside from the COVID-19 pandemic, mental health, obesity, and substance use are the leading public health issues with a lack of social connection and economic security indicated as additional areas of concern [21,22].

Participants: Individuals from this population were invited to participate in the study according to the inclusion criteria: Over 18 years of age and completed an audio-only telehealth appointment between January 2020 and March 2022. Patients with a diagnosis of Alzheimer's Disease and Related Dementia (ADRD) were excluded from participating due to concerns about their capacity to engage with the study. A preliminary report of prospective participants was generated from the Electronic Medical Record (EMR) and filtered down to a final sample of 766 by eliminating patients with repeat listings, as well as those who were pronounced dead. Individuals from the final sample were mailed a research packet for enrollment via self-selection.

Data Collection: Each participant was mailed a research packet containing a study information sheet (Figure 1), a survey (Figure 2), and a return envelope with pre-addressed postage for the University of Minnesota Medical School (UMMS) - Duluth Campus. Return envelopes were unpacked in a designated office for the researchers at the UMMS - Duluth Campus. Data values from the survey forms were entered into an Excel spreadsheet stored on the University Box Secure Storage system. All policies and procedures were reviewed and approved by the University of Minnesota IRB and host site administration.

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INFORMATION SHEET FOR RESEARCH

[Patient perspectives and prospective utility of telemedicine for addressing issues of healthcare delivery in rural MN]

You are invited to participate in a research study investigating telemedicine services provided by physicians at Gateway Family Health Clinic. Please read this form and address any questions that you may have before agreeing to be in the study.

This study is being conducted by Dr. Ryan Harden, Gateway Family Medicine physician and instructor at the University of Minnesota Medical School (UMMS) - Department of Family Medicine and Biobehavioral Health. You were selected as a possible participant in this study because Gateway Clinic has indicated that you used telemedicine services in a way that aligns with the aims of our research. **Telemedicine is defined as any medical care provided by phone or video call**. Gateway Clinic introduced telemedicine services to reduce disease transmission during the COVID-19 pandemic.

Procedures:

We would like your response to a few questions that will help Gateway Clinic improve patient care. This should take no more than ten minutes of your time, and your participation is completely voluntary.

If you agree to participate in this study, we ask that you do the following things:

Please refer to the questionnaire that is included with this letter. To participate, simply return your completed questionnaire using the enclosed envelope by March 31. Do not write your name on the questionnaire or provide any other information that could be used to identify you by your return letter.

Please acknowledge that your participation in this study is completely voluntary. If you would like to exclude a question, simply leave that item blank on your questionnaire.

You can also withdraw from this study at any time by refusing to submit your questionnaire. In this case, simply discard the document.

Confidentiality:

Your response to this research is confidential. Please return your questionnaire using the enclosed envelope, with no indication of the sender.

Records of your participation or eligibility to participate in this study will be kept private. In any sort of report we publish, we will not include any information that will make it possible to identify you or any other participants. Research records will be stored securely and only researchers will have access to the records.

HRP-587 Template Version: 2/28/2019

Our analysis will be conducted on an aggregate of numerical data provided by all participants in the study. It will be impossible to identify individual participants in this project based on the information that they provide.

Voluntary Nature of the Study:

Once again, participation in this study is completely voluntary. Your decision of whether or not to participate will not affect your current or future relations with the University of Minnesota or Gateway Family Health Clinic.

Contacts and Questions:

Medical students Samuel Nelson and Nicholas Battis are conducting this research under the supervision of Dr. Ryan Harden at Gateway Family Health Clinic.

You may ask any questions you have now. If you have questions later, **you are encouraged** to contact the researchers at rharden@d.umn.edu (218-726-7695)

This research has been reviewed and approved by an IRB within the Human Research Protections Program (HRPP). To share feedback privately with the HRPP about your research experience, call the Research Participants' Advocate Line at 612-625-1650 (Toll-Free: 1-888-224-8636) or go to z.umn.edu/participants. You are encouraged to contact the HRPP if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research participant.
- You want to get information or provide input about this research.

Please keep this form for your records.

HRP-587 Template Version: 2/28/2019

Figure 1. Study information sheet mailed to all possible participants.

Please indicate your level of agreement with the following statements on a scale of 0-10, with "10" indicating that you completely agree with the provided statement and "0" indicating that you completely disagree. Clearly circle your responses below.

Overall, I was satisfied using telemedicine to manage my health concerns.

Disagree 0 1 2 3 4 5 6 7 8 9 10 Agree

Telemedicine has provided me with a better sense of control over my health and wellbeing.

Disagree 0 1 2 3 4 5 6 7 8 9 10 Agree

My physicians should begin to use telemedicine more broadly in their practice.

Disagree 0 1 2 3 4 5 6 7 8 9 10 Agree

I sometimes fail to seek care because traveling to the clinic is hard.

Disagree 0 1 2 3 4 5 6 7 8 9 10 Agree

The availability of telemedicine makes it easier for me to access healthcare.

Disagree 0 1 2 3 4 5 6 7 8 9 10 Agree

I would use telemedicine as much as possible to reduce the need for visiting a clinic.

Disagree 0 1 2 3 4 5 6 7 8 9 10 Agree

I would purchase new equipment, such as an automatic blood pressure monitor, to participate in regular telemedicine visits and reduce in-person clinic appointments.

Disagree 0 1 2 3 4 5 6 7 8 9 10 Agree

I had difficulty understanding my physician or communicating my health concerns during telemedicine visits.

Disagree 0 1 2 3 4 5 6 7 8 9 10 Agree

Using videoconferencing, so that my physician and I can see each other, would improve telemedicine appointments.

Disagree 0 1 2 3 4 5 6 7 8 9 10 Agree

I would use telemedicine for some follow-up care, but I prefer visiting the clinic for most of my care.

Disagree 0 1 2 3 4 5 6 7 8 9 10 Agree

I prefer visiting the clinic and would not use telemedicine at all.

Disagree 0 1 2 3 4 5 6 7 8 9 10 Agree

Figure 2. Questionnaire mailed to all possible participants as part of the research packet.

Statistical Methods: This study employed descriptive statistics to assess respondents' level of agreement with survey items. The survey consisted of 11 items, each with response options on a 0-to-10 scale where "10" indicated complete agreement with a proposed item, and "0" indicated complete disagreement. The items were generated from a combination of literature review and clinical experience. These were grouped into descriptive categories: In support of telemedicine; against telemedicine; tangent/neutral. Response values were first grouped as follows: 0-3 (disagree);

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4-6 (neutral); 7-10 (agree). Otherwise: 0 (strongest disagreement); 1-3 (disagree); 4-6 (neutral); 7-9 (agree); 10 (strongest agreement).

Bias: Acquiescence bias was adjusted for by inclusion of both positive and negative perception questions about telemedicine. Nonresponse bias was adjusted for by utilizing a mailing survey to capture attitudes of patients without access to computing technology. Self-selection bias was present and unadjusted for due to the voluntary nature of the study.

Results:

Of the 766 individuals provided with a research packet, 111 (14.5%) returned the packet. Responses were assessed for completeness and validity using the following criteria: More than 20% of survey items were left blank; a straight-lining pattern of responses; and contradictory items #6 and #11 had non-neutral scores that were similar (within 3 points). Fifteen surveys met these criteria and were excluded from the final analysis. For all of the others included in the analysis, descriptive summaries were generated (counts and percentages) for each item.

We observed a trend that the respondents agreed with the positive items and disagreed with the negative items (Tables 1–3). Specifically, a majority of the respondents indicated that they were satisfied with using telemedicine (73.96%); that they gained an additional sense of control over their health condition due to the availability of telemedicine (52.08%); that they would support the use of telemedicine in the future (61.05%); that telemedicine increased access to care (65.63%); telemedicine was preferred over the clinic (61.46%), and that they would purchase new equipment to increase the utility of telemedicine services (54.17%). 51.04% of the respondents indicated a 10/10 level of satisfaction with telemedicine services. 48.96% indicated the strongest level of disagreement related to difficulty using telemedicine or a preference for in-person clinical appointments.

Table 1. Descriptive statistics of the aggregate responses to each survey item. The table above shows data after cleaning according to the criteria listed in the "Results" section which removed surveys from 15 respondents.

Summary of each question

Variable	Label	N	Mean	Std Dev	Median	Minimum	Maximum
Q1	Q1: Overall, I was satisfied using telemedicine to manage my health	96	7.9	2.9	10.0	0.0	10.0
Q2	Q2: Telemedicine has provided me with a better sense of control over my health and wellbeing	96	6.8	3.0	7.5	0.0	10.0
Q3	Q3: My physicians should begin to use telemedicine more broadly in their practice.	95	7.0	3.3	8.0	0.0	10.0
Q4	Q4: I sometime fail to seek care because traveling to the clinic is hard.	96	5.0	4.1	5.0	0.0	10.0
Q5	Q5: The availability of telemedicine makes it easier for me to access healthcare.	96	7.5	3.2	9.0	0.0	10.0
Q6	*Q6: I would use telemedicine as much as possible to reduce the need for visiting a clinic.	96	6.9	3.8	9.0	0.0	10.0
Q7	Q7: I would purchase new equipment, such as an automatic blood pressure monitor, to participate in regular telemedicine visitis and reduce in-person clinic appointments.	96	6.4	3.8	8.0	0.0	10.0
Q8	Q8: I had difficulty understanding my physician or communicating my health concerns during telemedicine visits.	96	2.2	3.0	1.0	0.0	10.0
Q9	Q9: Using videoconferenceing, so that my physician and I can see each other, would improve telemedicine appointments.	95	5.7	3.5	6.0	0.0	10.0
Q10	Q10: I would use telemedicine for some follow-up care, but I prefer visiting the clinic for most of my care.	96	5.7	3.5	6.0	0.0	10.0
Q11	*Q11: I prefer visiting the clinic and would not use telemedicine at all.	96	2.6	3.3	1.0	0.0	10.0

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Table 2. Data indicating level of agreement with individual survey items with the percentage of respondents falling into each response category. Frequency indicates the number of respondents who provided an answer for the survey item within each category. Categories were unknown to the participants at the time they completed the survey.

Level of agreement of each question

Q1: Overall, I was satisfied using telemedicine to manage my health		
Q1	Frequency	Percent
Disagree (0-3)	8	8.33
Neutral (4-6)	17	17.71
Agree (7-10)	71	73.96

Q2: Telemedicine has provided me with a better sense of control over my health and wellbeing		
Q2	Frequency	Percent
Disagree (0-3)	12	12.50
Neutral (4-6)	34	35.42
Agree (7-10)	50	52.08

Q3: My physicians should begin to use telemedicine more broadly in their practice.		
Q3	Frequency	Percent
Disagree (0-3)	16	16.84
Neutral (4-6)	21	22.11
Agree (7-10)	58	61.05
Frequency Missing = 1		

Q4: I sometime fail to seek care because traveling to the clinic is hard.		
Q4	Frequency	Percent
Disagree (0-3)	39	40.63
Neutral (4-6)	18	18.75
Agree (7-10)	39	40.63

Q5: The availability of telemedicine makes it easier for me to access healthcare.		
Q5	Frequency	Percent
Disagree (0-3)	14	14.58
Neutral (4-6)	19	19.79
Agree (7-10)	63	65.63

*Q6: I would use telemedicine as much as possible to reduce the need for visiting a clinic.		
Q6	Frequency	Percent
Disagree (0-3)	18	18.75
Neutral (4-6)	19	19.79
Agree (7-10)	59	61.46

Q7: I would purchase new equipment, such as an automatic blood pressure monitor, to participate in regular telemedicine visitis and reduce in-person clinic appointments.		
Q7	Frequency	Percent
Disagree (0-3)	23	23.96
Neutral (4-6)	21	21.88
Agree (7-10)	52	54.17

Q8: I had difficulty understanding my physician or communicating my health concerns during telemedicine visits.		
Q8	Frequency	Percent
Disagree (0-3)	69	71.88
Neutral (4-6)	17	17.71
Agree (7-10)	10	10.42

Q9: Using videoconferenceing, so that my physician and I can see each other, would improve telemedicine appointments.		
Q9	Frequency	Percent
Disagree (0-3)	23	24.21
Neutral (4-6)	26	27.37
Agree (7-10)	46	48.42
Frequency Missing = 1		

Q10: I would use telemedicine for some follow-up care, but I prefer visiting the clinic for most of my care.		
Q10	Frequency	Percent
Disagree (0-3)	28	29.17
Neutral (4-6)	24	25.00
Agree (7-10)	44	45.83

*Q11: I prefer visiting the clinic and would not use telemedicine at all.		
Q11	Frequency	Percent
Disagree (0-3)	64	66.67
Neutral (4-6)	18	18.75
Agree (7-10)	14	14.58

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Table 3. Level of agreement with individual survey items with a broader range of response categories compared to Table 2. Categories were unknown to the participants at the time they completed the survey.

Strongest level of agreement of each question

Q1: Overall, I was satisfied using telemedicine to manage my health		
Q1	Frequency	Percent
Strongest disagreement (0)	6	6.25
Disagree (1-3)	2	2.08
Neutral (4-6)	17	17.71
Agree (7-9)	22	22.92
Strongest agreement (10)	49	51.04

Q2: Telemedicine has provided me with a better sense of control over my health and wellbeing		
Q2	Frequency	Percent
Strongest disagreement (0)	7	7.29
Disagree (1-3)	5	5.21
Neutral (4-6)	34	35.42
Agree (7-9)	20	20.83
Strongest agreement (10)	30	31.25

Q3: My physicians should begin to use telemedicine more broadly in their practice.		
Q3	Frequency	Percent
Strongest disagreement (0)	7	7.37
Disagree (1-3)	9	9.47
Neutral (4-6)	21	22.11
Agree (7-9)	19	20.00
Strongest agreement (10)	39	41.05
Frequency Missing = 1		

Q4: I sometime fail to seek care because traveling to the clinic is hard.		
Q4	Frequency	Percent
Strongest disagreement (0)	24	25.00
Disagree (1-3)	15	15.63
Neutral (4-6)	18	18.75
Agree (7-9)	12	12.50
Strongest agreement (10)	27	28.13

Q5: The availability of telemedicine makes it easier for me to access healthcare.		
Q5	Frequency	Percent
Strongest disagreement (0)	7	7.29
Disagree (1-3)	7	7.29
Neutral (4-6)	19	19.79
Agree (7-9)	18	18.75
Strongest agreement (10)	45	46.88

*Q6: I would use telemedicine as much as possible to reduce the need for visiting a clinic.		
Q6	Frequency	Percent
Strongest disagreement (0)	16	16.67
Disagree (1-3)	2	2.08
Neutral (4-6)	19	19.79
Agree (7-9)	16	16.67
Strongest agreement (10)	43	44.79

Q7: I would purchase new equipment, such as an automatic blood pressure monitor, to participate in regular telemedicine visitis and reduce in-person clinic appointments.		
Q7	Frequency	Percent
Strongest disagreement (0)	14	14.58
Disagree (1-3)	9	9.38
Neutral (4-6)	21	21.88
Agree (7-9)	15	15.63
Strongest agreement (10)	37	38.54

Q8: I had difficulty understanding my physician or communicating my health concerns during telemedicine visits.		
Q8	Frequency	Percent
Strongest disagreement (0)	47	48.96
Disagree (1-3)	22	22.92
Neutral (4-6)	17	17.71
Agree (7-9)	6	6.25
Strongest agreement (10)	4	4.17

Q9: Using videoconferenceing, so that my physician and I can see each other, would improve telemedicine appointments.		
Q9	Frequency	Percent
Strongest disagreement (0)	18	18.95
Disagree (1-3)	5	5.26
Neutral (4-6)	26	27.37
Agree (7-9)	28	29.47
Strongest agreement (10)	18	18.95
Frequency Missing = 1		

Q10: I would use telemedicine for some follow-up care, but I prefer visiting the clinic for most of my care.		
Q10	Frequency	Percent
Strongest disagreement (0)	12	12.50
Disagree (1-3)	16	16.67
Neutral (4-6)	24	25.00
Agree (7-9)	20	20.83
Strongest agreement (10)	24	25.00

*Q11: I prefer visiting the clinic and would not use telemedicine at all.		
Q11	Frequency	Percent
Strongest disagreement (0)	47	48.96
Disagree (1-3)	17	17.71
Neutral (4-6)	18	18.75
Agree (7-9)	7	7.29
Strongest agreement (10)	7	7.29

Discussion:

Despite long-standing support for telemedicine and slow, but steady, adoption, its role in the broader healthcare ecosystem is largely speculative [1,3,8]. Telemedicine has been touted as a viable solution for addressing health disparities in rural populations. This is largely through its presumed role in leveling barriers to healthcare access and equity [10]. Current research has also demonstrated that general perceptions of telemedicine are favorable to the continued expansion of services [23]. If this is the case, then more work needs to be done to understand exactly what services are valued by

the patient population, as well as how to implement innovative telemedicine practices into highly effective healthcare systems.

Our study is aimed at elucidating some of the major factors affecting patients' perceptions of telemedicine in a rural primary care setting in Minnesota. It provides useful context for buyers, regulators, researchers, and changemakers concerned with health IT. Our primary aim was to supply foundational information to encourage additional research, development, and strategic changes in practice.

Our results show that patients do appreciate telemedicine and plan to use these services in the future. They also suggest that patients would choose telemedicine over the clinic and that audio-only telemedicine was sufficient for their needs. In our rural patient population, this trend likely reflects the ability of telemedicine to address barriers of travel time, travel costs, and scheduling difficulties. Additional studies specifically addressing patient barriers within each of these categories would be beneficial to further clarify what features will retain patients in telehealth for future visits. Given the option, the patients in our study would purchase additional equipment to avoid traveling to the clinic for care. For some, this may reflect a very real barrier to accessing care at all, versus the convenience of fitting healthcare into their schedules. Regardless, our data suggest that telemedicine makes it easier to access healthcare and provides many patients with an improved sense of control over their health.

These results are interesting in the current context because nearly all community health systems should be equipped to implement audio-only telemedicine services for their patients. If regulatory changes continue to support reimbursement of these services, then many clinics may experience an increase in service volume. As patients take advantage of their enhanced access to healthcare, regular assistance with health and wellness concerns could become more central to their lives.

Because this was a foundational study, there are several limitations and suggestions for future work. The rural setting and unique circumstances surrounding COVID-19 could certainly limit the generalizability of our findings. We also chose to study audio-only telemedicine services and the host site had limited experience with this modality of care. While these elements of the study may pose limitations to our work, they also provide an interesting perspective on the state of telemedicine in Minnesota. The fact that our sample has limited exposure to changes in health IT may provide an unbiased survey of the changes taking place. However, as it is inherent to all survey research, response bias affecting the results may diminish the proposed unique advantages of the niche population and reflect more positive or negative perceptions than appropriate. Knowing the demographic characteristics of individual participants could somewhat neutralize the effects of response bias and provide other useful insights. However, we were unable to gain approval for this data from the IRB within our project deadlines.

Future studies may replicate our timeline and design but employ a broader range of communities and personal data to provide more generalizable results. The questionnaire could also be expanded to address different technologies and programs. Outside of regular quality improvement initiatives locally, it is probably wise for researchers to address the evolution of health IT and widespread reactions to inform continued innovation. One insight that would be interesting to know is what health conditions or appointments are considered the most valuable for patients, and what features of those technologies are most desired. Also, as the health IT landscape expands, questions need to be answered regarding the roles that local providers and health systems should play in this inevitable decentralization of care.

The traditional model for healthcare, volume-based care delivered through siloed specialty practices, is less than ideal for managing many health concerns. The healthcare industry is also facing strain from workforce shortages and the growing prevalence of multimorbidity. Patients are often forced to forego healthcare due to issues of access, equity, cost, convenience, and overall satisfaction with available services, which contributes to insidious trends of declining population health and rising costs of care as patients eventually pursue treatment for more debilitating syndromes.

In the population addressed by this study, mental health, obesity, and substance abuse are priority health concerns with a lack of social connection cited as a principal contributor [21].

Regularly scheduled phone calls with a local healthcare provider aimed at cognitive behavioral interventions could be a useful strategy for confronting these issues in the near term. Eventually, this may be outsourced to commercial health and wellness platforms that use different modalities of telemedicine, artificial intelligence, and virtual reality. Otherwise, tertiary care centers that create their own virtual medicine programs to broaden access to specialty care. Local providers and larger health systems alike may choose to partner with virtual networks to sponsor events and services analogous to the community marathons and health fairs of today. Regardless of the degree of technological enhancement, the shift to remote care encourages a strategic pivot from reactive to proactive healthcare. Patients will have more immediate and regular contact with their local healthcare providers so that critical issues are recognized and addressed in a timely manner.

Conclusion:

This study provided important insight into the state of telemedicine in rural Minnesota, but much work remains to be done in the areas of telemedicine innovation and policy. The data in this study trends to an overall positive attitude toward telemedicine, with patients generally agreeing with positive statements and disagreeing with negative statements, however, agreement was far from 100% indicating a continued need for improvement and evaluation of telemedicine in practice. Some limitations of this study include the relatively small and niche sample, the historic circumstances of COVID-19, and inherent self-selection bias. A replicate study could employ several communities throughout the state or region to provide more generalizable results. The questionnaire could also be expanded to address different modalities of telemedicine, remote patient monitoring technology, and other virtual therapeutics. If possible, future work should include the demographic characteristics of individual participants.

The circumstances surrounding COVID-19 were certainly unique and bound to influence strategies for healthcare. As the landscape continues to evolve at a rapid pace, this study should provide a great context for changemakers and end users making strategic decisions about the future of remote healthcare delivery.

Conflicts of Interest: Samuel Nelson: Dose Health LLC; MobileMSK LLC.

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