

Patient-Clinician Communication During Cardiology Telemedicine Consultations: A Feasibility Study

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Abstract

While studies have evaluated the utility of telehealth in replacing in-person clinical encounters, there is a dearth of literature examining the quality of patient-physician communication with telehealth encounters. Accordingly, this study assessed the feasibility of using virtual cardiology clinical encounters to examine patient-physician interaction, communication, and perceptions of the clinical encounter. Telemedicine cardiology clinical encounters were audio- and video-recorded following the encounter, patients, and cardiologists completed an electronic survey to assess perceptions of the encounter. Qualitative analysis of the communication and statistical analysis of the survey data was conducted, providing descriptive data. The study included 11 patient-physician dyads; all patients were non-Hispanic White. Cardiologists were more racially and ethnically diverse (63% Asian). Most patients agreed telemedicine was comparable to in-person encounters (85.7%), with all cardiologists reporting that patients appeared satisfied with the encounter. We utilized an assessment tool to examine patient-physician communication in the recorded virtual encounters. This study suggests examining patient-physician communication using virtual clinical encounters is feasible, although there are barriers that need addressing for larger studies.

Keywords

patient-physician communication, Calgary Cambridge Global Consultation Rating Scale, telemedicine, health literacy, patient-centered care

Introduction

Effective communication between patients and their clinicians is essential to sustain a successful, trusting patient-physician relationship.¹ Delivering patient-centered care requires a fundamental understanding of the person beyond their medical condition, encompassing experiences, values, and preferences.² Good patient-physician communication has been associated with improved health outcomes, fewer malpractice complaints, improved medication adherence, and reduced healthcare costs.²⁻⁴ Additionally, tailored training in communication skills yields improved patient satisfaction and outcomes.⁵ However, there is a notable contrast between physicians' and patients' perceptions regarding communication; in fact, the majority of physicians thought their communication skills with patients were effective, while only 21% of patients were satisfied with the communication with their doctors.⁶ Evaluation of patients' satisfaction in communication has consistently emphasized the desire for improved communication with physicians.⁴

As the dynamics of healthcare delivery continue to shift, the depth of patient-physician interaction and overall quality of care have been impacted.⁵ Some of these changes have led clinicians to experience reduced satisfaction, a diminished focus on patient care, and potentially elevated risks of burnout and malpractice, which can

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Table 1. Patient Demographics and Perceptions Regarding Telehealth Visit.

Patient characteristics	n (%)
Race and Ethnicity	
Non-Hispanic White	11 (100.0%)
Hispanic	0 (0.0%)
African American	0 (0.0%)
Asian	0 (0.0%)
Other	0 (0.0%)
Unknown	0 (0.0%)
Sex at birth	
Female	6 (54.5%)
Male	5 (45.5%)
Age	
Mean age (SD), in years	56.636 (14.590)
Range, in years	30-76
Patient Survey	n = 11
How did you connect for your cardiology telemedicine visit today?	
Mobile Device	5 (45.5%)
Laptop	4 (36.4%)
Desktop	2 (18.2%)
Have you had a previous in-person visit with the cardiologist that care for you today?	
Yes	4 (36.4%)
No	7 (63.6%)
The telemedicine cardiology visit made it easy to get the care I needed.	
Agree/Strongly Agree	10 (90.9)
Neutral	0 (0.0%)
Disagree/Strongly Disagree	1 (9.1%)
The wait time to see my cardiologist was reasonable.	
Agree/Strongly Agree	10 (90.9)
Neutral	1 (9.1%)
Disagree/Strongly Disagree	0 (0.0%)
The technology for the telemedicine visit was easy to use.	
Agree/Strongly Agree	11 (100.0%)
Neutral	0 (0.0%)
Disagree/Strongly Disagree	0 (0.0%)
I was comfortable using the patient portal for the telemedicine visit.	
Agree/Strongly Agree	11 (100.0%)
Neutral	0 (0.0%)
Disagree/Strongly Disagree	0 (0.0%)
It was easy to see my cardiologist during my telemedicine visit.	
Agree/Strongly Agree	11 (100.0%)
Neutral	0 (0.0%)
Disagree/Strongly Disagree	0 (0.0%)
It was easy to hear my cardiologist during my telemedicine visit.	
Agree/Strongly Agree	10 (90.9)
Neutral	1 (9.1%)
Disagree/Strongly Disagree	0 (0.0%)
It was easy to talk with my cardiologist during my telemedicine visit.	
Agree/Strongly Agree	11 (100.0%)
Neutral	0 (0.0%)
Disagree/Strongly Disagree	0 (0.0%)
The technology for the telemedicine visit was easy to navigate	
Agree/Strongly Agree	10 (90.9)
Neutral	1 (9.1%)
Disagree/Strongly Disagree	0 (0.0%)
My cardiologist was interested in me as a person.	
Agree/Strongly Agree	10 (90.9)
Neutral	1 (9.1%)
Disagree/Strongly Disagree	0 (0.0%)
My cardiologist fully understood my health concern.	

(continued)

Table 1. (continued)

Patient characteristics	n (%)
Agree/Strongly Agree	10 (90.9)
Neutral	1 (9.1%)
Disagree/Strongly Disagree	0 (0.0%)
My cardiologist and I made a plan of action to resolve my health concern.	
Agree/Strongly Agree	10 (90.9)
Neutral	1 (9.1%)
Disagree/Strongly Disagree	0 (0.0%)
I believe that the plan of action my cardiologist recommended will improve/address my health concern.	
Agree/Strongly Agree	9 (81.8%)
Neutral	2 (18.2%)
Disagree/Strongly Disagree	0 (0.0%)
I understand what I need to do next to improve/address my health concern.	
Agree/Strongly Agree	9 (81.8%)
Neutral	2 (18.2%)
Disagree/Strongly Disagree	0 (0.0%)
I had enough time with my cardiologist during my telemedicine visit.	
Agree/Strongly Agree	11 (100.0%)
Neutral	0 (0.0%)
Disagree/Strongly Disagree	0 (0.0%)
My privacy was respected during my telemedicine visit.	
Agree/Strongly Agree	11 (100.0%)
Neutral	0 (0.0%)
Disagree/Strongly Disagree	0 (0.0%)
For my health concern, the telemedicine visit was as good as an in-person visit with a cardiologist.	
Agree/Strongly Agree	9 (81.8%)
Neutral	0 (0.0%)
Disagree/Strongly Disagree	2 (18.2%)
For my health concern, the telemedicine visit was better than an in-person visit with a cardiologist.	
Agree/Strongly Agree	3 (27.2%)
Neutral	4 (36.4%)
Disagree/Strongly Disagree	4 (36.4%)
The telemedicine visit saved me time.	
Agree/Strongly Agree	10 (90.9)
Neutral	0 (0.0%)
Disagree/Strongly Disagree	1 (9.1%)
The telemedicine visit is worth the money I spent on the visit.	
Agree/Strongly Agree	9 (81.8%)
Neutral	2 (18.2%)
Disagree/Strongly Disagree	0 (0.0%)
I would schedule a telemedicine visit again.	
Agree/Strongly Agree	10 (90.9)
Neutral	1 (9.1%)
Disagree/Strongly Disagree	0 (0.0%)
I would recommend telemedicine visit to others.	
Agree/Strongly Agree	9 (81.8%)
Neutral	2 (18.2%)
Disagree/Strongly Disagree	0 (0.0%)
Did you have any technical difficulties during your telemedicine visit?	
Yes	1 (9.1%)
No	10 (90.9)

ultimately contribute to negative perceptions of patients.⁶⁻⁹ Consequently, patients find themselves playing a diminished role in the relationship, experiencing a sense of disconnection, frustration, and even self-blame.^{10,11}

Digital transformations such as patient portals, remote monitoring at home, and telemedicine have aimed to enhance communication between patients and health professionals, provide

patients with the means for self-care, facilitate self-education, and thus foster patient-centered healthcare.¹⁰⁻¹³ Comparisons of synchronous video consultations to in-person encounters find the majority of patients express satisfaction with the quality of healthcare they received through telemedicine as well as a strong willingness for future engagement in telemedicine visits.¹³⁻¹⁵

Table 2. Provider Demographics and Perceptions Regarding Telehealth Visit.

	n = 12
Provider Characteristics	n (%)
Race and Ethnicity	
Non-Hispanic White	4 (33.3)
Asian	8 (66.7)
Gender	
Female	6 (50.0)
Provider Survey	
How comfortable do you feel with telehealth visits?	
Comfortable/Very Comfortable	12 (100.0)
The patient seemed satisfied with how things went.	
Agree/Strongly Agree	12 (100.0)
Emotionally, I was very comfortable during this visit.	
Agree/Strongly Agree	10 (83.3)
I felt frustrated by this encounter.	
Disagree/Strongly Disagree	10 (83.3)
Other things were on my mind during this encounter.	
Disagree/Strongly Disagree	10 (83.3)
This visit made me feel good about being a doctor.	
Agree/Strongly Agree	10 (83.3)
I was too busy today to spend enough time with this patient.	
Disagree/Strongly Disagree	11 (91.7)
I don't believe the patient appreciated my efforts at all.	
Disagree/Strongly Disagree	12 (100.0)
I am having a terrible day.	
Disagree/Strongly Disagree	11 (91.7)
After this encounter, I think I have a good understanding of what is going on.	
Agree/Strongly Agree	11 (91.7)
I felt pressed by other commitments during this visit.	
Disagree/Strongly Disagree	7 (58.3)
Overall rapport with this patient was very high.	
Agree/Strongly Agree	11 (91.7)
Things have been going smoothly for me today with nurses, secretaries, and other physicians.	
Agree/Strongly Agree	11 (91.7)
I was disappointed with the how things went.	
Disagree/Strongly Disagree	11 (91.7)
Overall, I was satisfied with this patient encounter.	
Agree/Strongly Agree	11 (91.7)
The patient is generally adherent to the recommendations I make.	
Agree/Strongly Agree	8 (66.6)

The importance of assessing effective communication skills in doctor-patient relationships has been emphasized throughout medical education as well as postgraduate clinical practice.¹⁶ However, clinicians may not be equipped to adapt these skills to telemedicine encounters and may have concerns about the efficacy of telemedicine. While there has been a focus on evaluating patients' perception of telehealth visits,¹⁷ little has been done to objectively examine patient-clinician communication during telehealth visits. This study sought to assess patient-provider communication during cardiology telemedicine clinical encounters (Tables 1 and 2).

Methods

The Mayo Clinic Institutional Review Board approved this study (#22-010489). Participating cardiologists were selected based on the monthly telemedicine visit volume at the Mayo

Clinic Department of Cardiovascular Medicine. Any cardiologist with more than 5 telemedicine visits per month was approached by the study team to introduce the study. If the cardiologist expressed interest, they were recruited by the study team. Participants with upcoming telemedicine visits scheduled with one of the consented physicians were phoned by the study coordinator and asked to participate in the study. A notification email was sent to the practicing physician upon consent, and a reminder email was sent the day prior and the day of the appointment. A video recording of the telemedicine visit was performed. Following the visit, the physicians and patients completed an electronic survey to assess perceptions of the clinical encounter (Appendix Tables A1 and A2). The patients and physicians received weekly reminders to complete the survey for 3 weeks. The survey data and Calgary-Cambridge Global Consultation Rating Scale

Table 3. CC-GCRS Scores.

Items	PPT1	PPT2	PPT3	PPT6	PPT7	PPT10	PPT13	PPT14	PPT15	PPT18	PPT20	Mean scores:
Item 1: Initiating the Session	4	3	4	4	4	3	3	4	4	4	4	3.72
Item 2: ID the Problem	4	4	4	4	4	4	4	4	4	4	4	4.00
Item 3: Explore the Problem	4	4	4	4	4	4	4	4	4	4	4	4.00
Item 4: Gather Pt. Perspective	4	4	4	4	4	4	4	4	4	4	4	4.00
Item 5: Nonverbal Communication	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Item 6: Developing Rapport	4	4	4	4	4	3	2	3	2	4	4	3.09
Item 7: Providing Structure	2	4	4	4	4	4	2	4	4	4	4	3.63
Item 8: Providing Correct information	4	4	4	4	4	4	4	4	4	4	4	4.00
Item 9: Aid accurate recall and understanding	3	4	4	3	2	3	2	3	3	4	4	3.18
Item 10: Achieved Shared Understanding	3	3	4	4	4	4	4	4	4	4	4	3.81
Item 11: Planned Shared Decision Making	4	4	4	4	4	4	4	4	4	4	4	4.00
Item 12: Closure	4	4	4	4	4	4	4	4	4	4	4	4.00
Total	40	42	44	43	42	41	37	42	41	44	44	3.76

Modified scoring convention from Iversen et al, 2020.

Table 4. Barriers and Solutions.

Barriers	Solutions
Technology Navigation	Offer navigation assistance to patients to become familiar with the technology.
Technology Connectivity	Offer telemedicine in which ever technology medium was available to the patients (smartphone, tablet, and computer).
Technology Usage Training	Ensure training and usability testing of the technology and associated equipment. Provide additional training to assist with troubleshooting potential problems.
Failures to Record the Encounter	Project coordinator sending reminders to participating cardiologists to record the encounters for assessment.

(CC-GCRS) data were collected and managed using the HIPAA-compliant Research Electronic Data Capture System (REDCap) hosted at Mayo Clinic Arizona.

Study Procedures

Before assessing clinical encounters, an understanding of the microskills was necessary, as the scoring system was based on the analyst's ability to identify microskills. To examine barriers and opportunities to improve the study, the core study team met weekly for debriefs and recorded meeting minutes. The study team also had a debrief at the end of data collection to identify barriers encountered during the study.

CC-GCRS and Assessments

The Global Consultation Rating Scale (CC-GCRS) is an assessment tool used to evaluate a physician's competency in communicating with patients during clinical encounters. The CC-GCRS evaluates effective patient-physician communication skills and to present an evidence-based structure for its analysis and teaching.³ The scale covers 9 domains:

initiating the session, gathering information, building a relationship, providing structure, providing the correct information, aiding accurate recall and understanding, achieving a shared understanding, planning shared decision making, and closure. The assessment scores adopted a modified scoring convention provided by Iversen et al,¹⁸ for the demonstrated microskills.

Appendix Table 3 represents the codebook with the overview of criteria for scoring based on the items in CC-GCRS. The item that assessed the nonverbal communication between the cardiologists and the patients was eliminated due to the difficulty in assessing nonverbal communication between 2 other people via video. The scores ranged from 0 to 44.

Perceptions of the Encounter

Following the visit, cardiologists and patients completed an electronic survey adapted from previously validated instruments to examine their perception of the encounter (see Appendix Table 2). The patient survey (27 total questions) included questions from Rose et al focusing on digital health and included 3 scales: overall satisfaction (eg, my

virtual visit made it easy to get the care I needed), comfort and ease using virtual technology (eg, I was comfortable using my virtual platform), patient-clinician engagement (eg, my online health care provider was interested in me as a person), with good psychometric properties (Cronbach's alpha 0.89-0.93). Additional items were included to assess technology equity (eg, "I have access to a smart mobile device or a laptop computer"; "I am proficient at using smart devices"). The survey for cardiologists (21 total questions) included questions from the Patient Satisfaction Scale (Shore and Frank, 1986) (eg, "The patient seemed satisfied with how things went"; "I helped this patient today") which also demonstrated good psychometric properties (Tables 3 and 4).¹⁹

Statistical Analysis

The qualitative analyst assessed patient-clinician communication using the existing coding systems described above. Following the assessment, the analyst conducted several rounds of active listening. The analyses included field notes of individual ideas and observations, other relevant ideas, and concepts. The analyst then identified significant statements within each encounter, which was instrumental in the development of the codes. Coding was done directly from the recordings without transcription. The themes that emerged from the encounters were the combination of field notes, brief codes, and observations, and the exerts that best fit those themes.

Survey data and CC-GCRS data were stored using REDCap hosted at Mayo Clinic (Harris et al, 2009).²⁰ Descriptive data is provided from the analyses of patient and clinician surveys, including overall patient and clinician perceptions of their encounters. All analyses were conducted using R version 4.0.3 or later (R Core Team, 2021).

Results

There were 11 patient-physician dyads included in the study. Of 21 clinicians contacted, 45% expressed interest in the project, and among these, 30% consented to participate. Of the 100 patients approached to participate, 24 (24%) patients consented. Six patients withdrew from the study: the first 4 patients due to recording issues at the beginning of the study, one patient due to the visit no longer being a telemedicine visit, and the last patient because the patient needed to reschedule outside the study timeline. All 11 patients were non-Hispanic White with a mean age of 57 years of age (SD = 15); with 6 (55%) identifying as female. Of the 11 cardiologists, 4 (33%) were non-Hispanic White, with 8 (67%) identifying as Asian, with 6 (50%) identifying as female.

Patient and Cardiologist Perceptions

Of the 11 patients, 7 (63%) completed the patient survey. Of those, 6 (86%) did not have a previous in-person visit with the cardiologist caring for them during the telemedicine visit. Five (71%) connected for the visit using a mobile device.

Six (86%) agreed or strongly agreed that the telemedicine visit made it easy to get the care they needed, and the same proportion agreed or strongly agreed the telemedicine visit was as good as an in-person visit for their health concern and saved them time. The overall perception of the telemedicine visit was positive: the technology was easy to use (n = 10; 90.9% strongly agreed), patients felt comfortable using the patient portal (n = 9; 81.8%), it was easy to see (n = 8; 72.7%) and hear the cardiologist (n = 9; 81.8%), and patients felt the cardiologist understood their health concerns (n = 9; 81.8%; Table 1). There were 8 cardiologists that responded to the survey. Of those who responded, all reported being comfortable or very comfortable with telemedicine visits and agreed or strongly agreed the patient seemed satisfied with how the visit went. Seven (88%) agreed or strongly agreed the patient had a good understanding of what was going on after the encounter, that overall rapport with the patient was high, and that they were satisfied with the patient encounter. A high proportion agreed or strongly agreed they were emotionally comfortable during the visit (n = 6, 75%) and disagreed or strongly disagreed that they felt frustrated by the encounter (n = 7, 86%). All respondents disagreed or strongly disagreed that they were too busy to spend enough time with the patient, and 4 (50%) disagreed or strongly disagreed they felt pressed by other commitments during the visit (Table 1).

Calgary-Cambridge Global Consultation Scale. The mean scores for each domain (with a potential range from 0 to 4, with higher scores indicating more skill) included initiating the session (3.72), identifying the problem (4.00), exploring the problem (4.00), gathering the patient's perspective (4.00), developing rapport (3.09), providing structure (3.63), providing the correct information for the individual patient (4.00), aiding accurate recall and understanding (3.18), achieved a shared understanding (3.81), planning shared decision making (4.00), and closure (4.00).

Telemedicine Encounters

The length of the 11 encounters varied from 6 to 84 min (median = 53.0 min; IQR = 27.8 min). Although there was variation in the length of encounters, conversations with the cardiologists allowed time for patients to ask questions and give their perspectives on integral parts of their individual patient histories, which became an essential part of the telemedicine encounter. The following excerpts from the telemedicine encounters allow the natural flow of conversation between the cardiologists and patients. Three of the major themes that were flushed from the telemedicine encounters were (1) patient-centered communication, (2) patient engagement, and (3) health literacy. Telemedicine encounter exerts that best fit the themes that have been selected.

Patient-Centered Communication. Patient-centered communication was apparent during the telemedicine encounters, with the participating cardiologists allowing the patients the

opportunity to drive the conversation and respond to questions, without the cardiologist leading or interrupting the conversation.

An example of patient-centered communication between the cardiologist and the patient is as follows:

Cardiologist: “I would like to make sure we go over all the questions that you have, so maybe we’ll start with that?”

Patient: “I have so many questions. The first is maybe just a procedural thing. I was wondering if you got the renal and carotid ultrasounds that were done in the hospital last November. I have so many questions I want to ask you, that I have them in categories, and then I flagged the ones that were most important.”

Cardiologist: “Awesome, so how about you give me kind of a sense of what the categories are, go through them, I’ll probably have to ask you some questions as well, then we’ll meet in the middle.”

Patient: “Ok, well so there are 3 categories: treatment and testing, odd symptoms I have that I want to see are related, then I have just a random set of questions.”

Effective Patient Engagement. Patient engagement was recognized during the encounters in the form of early and continuous integration of the patient’s understanding or perspectives on their individual health.²¹ An example of patient engagement between the cardiologist and the patient is as follows:

Cardiologist: “Are you physically active? What do you do on a weekly basis?”

Patient: “Well I walk. I do weights, I do some stretching, yoga, I swim a little bit.”

Cardiologist: “You try and do something active most days of the week?”

Patient: “Yeah, I would say almost 7 days a week. I went on a statin, 10 mg, and I went off for 6 months, and my doctor thought that I wouldn’t see a benefit and I just went back on it. When I came to Mayo, the doctor told me to go back on it. I’m interested in getting your advice on it cause I’ve done some studying and reading about statins, including this book that says that cholesterol isn’t the villain that everyone thinks it is.”

Patient: “When I switched a plant-based diet, inevitably a low-fat diet. I actually started cutting out and cutting back on oil and things like that. I’m just wondering if I should be concerned about healthy oils. I’m pretty disciplined in my diet, so I know that if there is something that I should be tweaking, I will do it.”

High Health Literacy. In each of the notes from the encounters, the analyst noted that there was clear use of medical

jargon by the cardiologists. However, the analyst also noted that this was acceptable due to the unsolicited use of medical jargon by each of the patients that assisted them in recall and understanding of their individual conditions. The patients within this study were very knowledgeable of their individual conditions and could ask and answer questions utilizing complex language. The high levels of health literacy exhibited by the patients during the telemedicine encounters were a mixture of understanding individual health and healthcare needs, using the health information to participate in the healthcare system, and maintaining a working relationship with the cardiologist during the telemedicine encounter.²² Examples of high health literacy during the telemedicine encounters were as follows:

Patient: “How to I increase my LDL? How do I increase that HDL particle size?”

Cardiologist: “I know that they have you on Coumadin, how long do they plan on keeping you on that?”

Patient: “They said at least 6 months, so that would bring us up to March. I know the one in my heart (blood clot) is gone now, and tomorrow I’m actually getting an updated ultrasound on the one in my femoral artery.”

Cardiologist: “With your family history and everything I was wondering had you been worked up for hypercoagulable state?”

Patient: “My clots they mentioned were a side effect of the ECMO, cause they were exactly where they thought they’d be.”

Discussion

Based on the assessment scores of the encounters, the clinicians were found to be utilizing a considerable patient-centered approach with patients. The patient-centeredness observed included respecting and responding to the patient’s care requirements, preferences, and beliefs in the clinical decision-making process, which are recognized values by the National Academy of Medicine.²³ Health literacy embodies the social and cognitive skills that establish the motivation and ability of individuals to acquire access to, understand, and use health information in ways that encourage and maintain good health.²⁴ Although there were some instances where medical jargon was used, the patient population was highly health literate and engaged, showing no confusion with the use of medical jargon, often driving the conversations reciprocating medical jargon during the telemedicine encounters.

Patient-centered communication is embraced as being vital to quality healthcare that centers patients’ preferences and values, and is associated with adherence to healthy lifestyles, improved clinical outcomes, better quality of life, and reduced rates of undesirable affects.²⁵ The investigative team also noted the patients’ understanding of their health history and condition, along with the communication skills to

verbally address comments, make suggestions, and ask questions allowed them to be active participants in the treatment and management of their conditions. That 2-way dialogue observed between the patients and cardiologists is essential for the cardiologists to be responsive to their patients' health concerns.²³ There is widespread agreement that patient engagement should be meaningful and impactful, and has been frequently used interchangeably with patient involvement, patient activation, and even patient-centered care.²⁶ When clinicians communicate in a patient-centered way, it fosters patient engagement in the information the patient and provider bring to the encounter and allows both parties to reach a shared understanding.²⁷

Limitations

There were several limitations in this study. The first limitation was the observed 45% response rate and 30% consenting rate among cardiologists. Retention also proved challenging despite patients and cardiologists receiving surveys immediately following the encounter electronically, along with automated reminders. Relatedly, patients and cardiologists do not reflect the demographics of the United States, and this study was conducted at a single institution, all limiting generalizability. In addition, there was the potential for selection bias, with those patients and clinicians most comfortable with technology perhaps being more likely to participate. The high levels of health literacy noted may also reflect selection bias. Future studies should consider how best to obtain a representative sample of patients (and clinicians) with varied technological expertise and health literacy. The completion rate for the surveys and recordings could also be improved. To successfully conduct this study on a larger scale, more time would be necessary to inform and consent cardiologists as well as more training and information will be needed for physicians to record and share recordings.

Future Directions

The investigative team is currently developing a more robust study that will address barriers to effective communication during telemedicine encounters for more diverse patient populations (race, ethnicity, age, SES, and primary language). Understanding how diverse patients interact and respond to physicians and other clinicians during telemedicine encounters will allow the study team to analyze the patient encounters at multiple points to determine the quality of communication between clinicians and patient populations with varying levels of communication styles and health literacy. This study will allow the investigative team to examine potential differences in patient-clinician relationships by patient demographics while minimizing the Hawthorne effect.

Conclusions

This study examined the feasibility of evaluating patient-centered patient-physician communication with experienced

cardiologists during telemedicine visits. Telemedicine added a level of complexity to creating and maintaining patient-centeredness but had little impact on the participating patients' satisfaction with the telemedicine visits. While this was a small feasibility study, the results uncovered and reinforced the added value of having engaged, highly health-literate patients as a benefit to effective patient-centered communication.

Authors' Contributions

All authors contributed to the preparation of the manuscript and approved the final version.

Declaration of Conflicting Interests

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Ethical Approval

Not applicable.

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Statement of Animal and Human Rights

All procedures in this study were conducted in accordance with the Mayo Clinic Institutional Review Board (22-101489) approved protocols.

Statement of Informed Consent

Informed consent for patient information to be published in this article was obtained under the Mayo Clinic Institutional Review Board (22-010489) approved protocols.

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Appendix

Appendix I: CC-GCRS Code Book

If there are 6 microskills:

- 1 micro-skill demonstrated: 1
- 2 or 3 micro-skills demonstrated: 2
- 4 micro-skills demonstrated: 3
- All micro-skills demonstrated: 4

If there are 4 micro-skills

- 1 micro-skill demonstrated: 1
- 2 micro-skills demonstrated: 2
- 3 micro-skills demonstrated: 3
- All micro-skills demonstrated: 4

If there are 3 micro-skills

- No micro-skill demonstrated: 1
- 1 micro-skill demonstrated: 2
- 2 micro-skills demonstrated: 3
- All micro-skills demonstrated: 4

If there are 2 micro-skills

- 1 skill initiated but not complete: 1
- 1 micro-skill demonstrated: 2
- 1 completed micro-skill demonstrated and the other initiated: 3

Appendix 2: Table 2 Patient Survey

Patient Survey

Validated Survey Questions for Patients

How did you connect for your cardiology telemedicine Laptop	Mobile Device visit today? Desktop
Have you had a previous in-person visit with the cardiologist that cared for you today?	Yes No
The telemedicine cardiology visit made it easy to get needed.	Strongly Agree the care I Agree Neutral Disagree Strongly Disagree
The wait time to see my cardiologist was reasonable.	Strongly Agree Agree Neutral Disagree Strongly Disagree
The technology for the telemedicine visit was easy to	Strongly Agree use. Agree Neutral Disagree Strongly Disagree
I was comfortable using the patient portal for the telemedicine visit.	Strongly Agree Agree Neutral Disagree Strongly Disagree
It was easy to see my cardiologist during my telemedicine visit.	Strongly Agree Agree Neutral Disagree Strongly Disagree
It was easy to hear my cardiologist during my telemedicine visit.	Strongly Agree Agree Neutral Disagree Strongly Disagree
It was easy to talk with my cardiologist during my telemedicine visit.	Strongly Agree Agree Neutral Disagree Strongly Disagree

(continued)

Appendix Table 2. (continued)

The technology for the telemedicine visit was easy to navigate	Strongly Agree Agree Neutral Disagree Strongly Disagree
My cardiologist was interested in me as a person.	Strongly Agree Agree Neutral Disagree Strongly Disagree
My cardiologist fully understood my health concern.	Strongly Agree Agree Neutral Disagree Strongly Disagree
My cardiologist and I made a plan of action to resolve my health concern.	Strongly Agree Agree Neutral Disagree Strongly Disagree
I believe that the plan of action my cardiologist recommended will improve/address my health concern.	Strongly Agree Agree Neutral Disagree Strongly Disagree
I understand what I need to do next to improve/address my health concern.	Strongly Agree Agree Neutral Disagree Strongly Disagree
I had enough time with my cardiologist during my telemedicine visit.	Strongly Agree Agree Neutral Disagree Strongly Disagree
My privacy was respected during my telemedicine visit.	Strongly Agree Agree Neutral Disagree Strongly Disagree
For my health concern, the telemedicine visit was as good as an in-person visit with a cardiologist.	Strongly Agree Agree Neutral Disagree Strongly Disagree
For my health concern, the telemedicine visit was better than an in-person visit with a cardiologist.	Strongly Agree Agree Neutral Disagree Strongly Disagree
The telemedicine visit saved me time.	Strongly Agree Agree Neutral Disagree Strongly Disagree
The telemedicine visit is worth the money I spent on the visit.	Strongly Agree Agree Neutral Disagree Strongly Disagree

(continued)

Appendix Table 2. (continued)

I would schedule a telemedicine visit again.	Strongly Agree Agree Neutral Disagree Strongly Disagree
I would recommend telemedicine visit to others.	Strongly Agree Agree Neutral Disagree Strongly Disagree
Did you have any technical difficulties during your telemedicine visit?	Yes No
Please let us know what you liked best about your telemedicine visit	_____
Please let us know what we can improve our online platform/technology for telemedicine visits	_____

Appendix 3: Physician Survey

Physician Survey

Validated Survey Questions for Physicians

The patient seemed satisfied with how things went.	Strongly Disagree Disagree Neutral Agree Strongly Agree
Emotionally, I was very comfortable during this visit.	Strongly Disagree Disagree Neutral Agree Strongly Agree
I felt frustrated by this encounter.	Strongly Disagree Disagree Neutral Agree Strongly Agree
Other things were on my mind during this encounter.	Strongly Disagree Disagree Neutral Agree Strongly Agree
This visit made me feel good about being a doctor	Strongly Disagree Disagree Neutral Agree Strongly Agree
I was too busy today to spend enough time with this patient.	Strongly Disagree Disagree Neutral Agree Strongly Agree
I don't believe the patient appreciated my efforts at all.	Strongly Disagree Disagree Neutral Agree Strongly Agree

(continued)

Appendix Table 3. (continued)

I am having a terrible day.	Strongly Disagree Disagree Neutral Agree Strongly Agree
After this encounter, I think I have a good understanding of what is going on.	Strongly Disagree Disagree Neutral Agree Strongly Agree
I felt pressed by other commitments during this visit.	Strongly Disagree Disagree Neutral Agree Strongly Agree
Overall rapport with this patient was very high.	Strongly Disagree Disagree Neutral Agree Strongly Agree
Things have been going smoothly for me today with nurses, secretaries, and other physicians.	Strongly Disagree Disagree Neutral Agree Strongly Agree
I was disappointed with the how things went.	Strongly Disagree Disagree Neutral Agree Strongly Agree
Overall, I was satisfied with this patient encounter.	Strongly Disagree Disagree Neutral Agree Strongly Agree
The patient is generally adherent to the recommendations I make.	Strongly Disagree Disagree Neutral Agree Strongly Agree
