Resilience of Cardiac Care through Virtualized Services during COVID-19: A Case Study of a Heart Function Clinic

Amika Shah, Milena Guessi, Sahr Wali, Patrick Ware, Michael McDonald, Mary O'Sullivan, Juan Duero Posada, Heather Ross, Emily Seto

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Abstract

Background: Virtual care has historically faced barriers to widespread adoption. However, the COVID-19 pandemic has necessitated the rapid adoption and expansion of virtual care technologies. Although the intense and prolonged nature of the COVID-19 pandemic has renewed interest in health systems resilience, including how services adapt or transform in response to shocks, evidence documenting the role of virtual care technologies in health systems resilience is scarce.

Objective: At Toronto General Hospital in Ontario, Canada, the rapid virtualization of cardiac care began on March 9, 2020 as a response to the pandemic. The objective of this study was to understand the experiences, barriers, and facilitators of the rapid virtualization and expansion of cardiac care due to the pandemic.

Methods: A single-case study was conducted with three embedded units of analysis. Patients, clinicians, and staff were recruited purposively from an existing mobile phone-based telemonitoring program at a Heart Function Clinic in Toronto, Canada. Individual semi-structured phone interviews were conducted by two researchers and transcribed verbatim. An inductive thematic analysis at the semantic level was used to analyze transcripts and develop themes.

Results: A total of 29 participants were interviewed, spanning patients (n=16), clinicians (n=9), and staff (n=4). Five themes were identified: (1) patient safety as a catalyst for virtual care adoption; (2) piecemeal virtual care solutions; (3) confronting new roles and workloads; (4) missing pieces to virtual care; and (5) the inequity paradox. A motivation to protect patient safety and a piecemeal approach to virtual care adoption facilitated absorptive and adaptive resilience of cardiac care during COVID-19, while ad hoc changes to clinic roles and workflows, challenges building relationships virtually, and widened inequities were barriers threatening virtual care sustainment.

Conclusions: We contend that sustaining virtual care hinges upon transformative, rather than adaptive actions, to strengthen health systems to face the dynamic and emergent challenges associated with COVID-19 and other shocks. Based on the barriers and facilitators identified, we present lessons learned and recommended transformations to sustain virtual care during and beyond COVID-19.

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Keywords: telemedicine; telehealth; digital health; digital medicine; COVID-19; coronavirus; SARS-CoV-2; public health; surveillance; outbreak; pandemic; infectious disease; cardiology; patient; organizational innovation; organizational objectives; global health; resilience

Introduction

Virtual care adoption during COVID-19

Virtual care has long faced a perplexing paradox; despite enormous promise, widespread adoption has remained sparse [1]. However, amid the global COVID-19 pandemic, the rapid adoption and expansion of virtual care technologies have been widely reported [2,3]. Virtual care refers to "any interaction occurring remotely between patients and/or members of their circle of care, through any form of communication or information technology with the aim of facilitating or maximizing the quality and effectiveness of patient care" [4]. Such interactions may be synchronous or asynchronous and can be mediated through a variety of technologies, such as video consultations, telemonitoring, electronic medical records (EMR), among others. Virtual care has played a pivotal role to facilitate access to health care during the pandemic [5], especially for chronically ill patients who experience added vulnerability to COVID-19 [6,7]. As nations such as Canada plan for the provision of future healthcare services, what remains in question is: how can rapidly virtualized health care services be effectively sustained?

Health systems resilience

Inherent to both the response to COVID-19 and virtual care adoption is complexity, in that both are fraught with non-linearity, unpredictability, and interdependencies [8,9]. In the face of extreme stressors or challenges, also known as "shocks" [10], both acute and chronic [11,12], an imperative for health systems is to be resilient [13]. Health systems resilience is commonly characterized as "the capacity of health actors, institutions, and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and, informed by lessons learnt during the crisis, reorganize if conditions require it" [14]. Of importance is not only the ability to return to equilibrium from shocks but to create a new equilibrium, especially when shocks are persistent and intense. Blanchet, Diaconu, and Witter [15] outline resilience processes as absorptive, adaptive, and transformative. With suitable preparation, health systems may *absorb* some shocks without significant changes in the amount or allocation of resources. Greater demands, however, require systems to *adapt* policy and workflows and reallocate resources. As demands on the system increase in intensity or duration, systems may need to *transform* by fundamentally changing the services or procedures offered. With the increased reliance on virtual care during COVID-19, alignment between virtual care adoption in the building of health system resilience is critical. Yet, few studies emerging from the evolving literature on COVID-19 have discussed virtualization efforts from the perspective of health systems resilience.

As the global COVID-19 pandemic shifts from an acute to a chronic shock, health systems will need to demonstrate continued resilience. To facilitate learning from the initial phase of the pandemic [13], the objective of this paper was to report the emergent experiences with the virtualization of cardiac care, and the perceived sustainability of the virtual care model during and after the pandemic. The research question was: *What were the experiences, barriers, and facilitators related to the rapid virtualization of cardiac care during the COVID-19 pandemic?*

Methods

Setting

The Peter Munk Cardiac Centre Heart Function Clinic at Toronto General Hospital in Ontario, Canada, began a marked expansion of virtual care delivery on March 9th, 2020, two days before the World Health Organization declared the COVID-19 global pandemic [16]. Between April and

September 2020, 1113 scheduled in-person visits were converted to virtual visits through the Ontario Telemedicine Network (12%) or the phone (88%). Clinicians affiliated with the clinic also have remote access to the hospital EMR, which centralizes the documentation and decisions related to the patient's care. Clinicians also have the option to enroll patients in the "Medly" program, a mobile phone-based telemonitoring program for heart failure patients consisting of a rules-based algorithm [17] that delivers tailored self-care messages to patients and clinical decision support based on daily inputs of weight, blood pressure, heart rate, and symptoms. The program, described elsewhere [18], was designed to support patient self-management and promptly catch symptom deterioration between regularly scheduled in-person visits and became part of standard care in 2016. Clinical alerts are largely managed by a Medly Coordinator, a registered nurse within the Heart Function Clinic, with alerts being escalated to the cardiologists as required. To support the clinic's rapid virtualization, two nurses from another cardiology department within the hospital were seconded to the Medly team on a part-time and temporary basis. No limits were established for the duration of enrollment in the Medly program. Most patients in the Medly program use their existing devices (phone, weight scale, blood pressure monitor); however, equipment is made available to patients who do not have the means to supply their own.

Study design

This study used a single-case study design, with the case defined as the Heart Function Clinic [19]. Three embedded units of analysis, the use of virtual care by patients, clinicians, and operational staff, were selected to understand the experiences, barriers, and facilitators of the rapid virtualization of cardiac care. This was a qualitative study centered on semi-structured interviews with the three participant groups.

Recruitment of participants

Patients, clinicians, and operational staff were recruited as part of an existing quality improvement study of the Medly telemonitoring program (University Health Network Research Ethics Board 16-5789 and University of Toronto Research Ethics Board 39449). All 12 clinical staff and 4 operational staff of the telemonitoring program were invited to participate. Patient participants were identified based on demographic characteristics collected from a self-report questionnaire for the Medly quality improvement study. Efforts were made to recruit participants with a range of demographic characteristics including age, sex, location of residence (urban, suburban, rural), ethnicity, income, and comfort with technology. Eligible patients were English speaking and current patients of the Medly telemonitoring program. Recruitment continued until data saturation was achieved, wherein the collection of additional data did not generate new findings or themes.

Data collection and analysis

Interview guides, consisting of semi-structured, open-ended questions were developed based on the Benefits Evaluation Framework [20]. Separate interview guides were developed and tailored to patients, clinicians (nurses and cardiologists), and operational staff. To accommodate physical distancing measures, in-depth semi-structured interviews were conducted over the phone by two authors experienced in qualitative research (AS, SW). Phone interviews were conducted between May 4, 2020 and June 18, 2020 and lasted approximately 30 mins. Participants were asked to comment on their experiences managing heart failure, as well as their experiences with virtual care technologies during the COVID-19 pandemic (including but not limited to virtual consultations and telemonitoring). All interviews were digitally recorded and professionally transcribed verbatim for analysis.

An inductive thematic analysis was conducted at the semantic level according to the iterative six-

phase approach outlined by Braun and Clarke [21]. Three authors were involved in the data analysis process (MG, AS, SW). To improve the trustworthiness of the analysis, all authors engaged in both procedural and analytical memoing throughout the research process [22]. To facilitate the organization and analysis of data, transcripts and analytic memos were entered into NVivo 9 (QSR International). One author (MG) independently analyzed all interview transcripts to gain a holistic perspective on all the data collected. In parallel, two authors independently analyzed either patient (AS) or clinicians/staff (SW) transcripts. Authors initially met to compare and discuss codes for each participant group. At this stage, codes were clustered into categories to identify predominant themes for each participant group. After a series of four analytic discussions, the research team collectively developed five themes. The final set of themes was reviewed for internal coherence, consistency, and distinctiveness by the wider research team [21].

Results

Participant characteristics

A total of 29 participants were interviewed: 16 patients, 5 cardiologists, 4 Medly nurse coordinators (including new, temporary nurses), and 4 operational staff. The characteristics of interviewed patients are presented in .

Table 1. Characteristics of patient interview participants

Characteristic (N=16)		n
Age mean (SD), range		54.5 (SD 19.9), 23-78
Sex		
	Male	8
	Female	8
Ethnicity		
	White (Caucasian)	10
	Black	1
	Filipino	1
	South Asian	1
	Southeast Asian	2
	Not declared	1
Place of birth		
	Canada	12
	Other	3
	Not declared	1
Higher education achieved		
	High school	2
	Trade or technical training	4
	College or university	8
	Postgraduate	1
	Not declared	1
Rurality		
	Urban	4
	Suburban	8
	Rural	3
	Not declared	1

Living arrangement		
	Living with family/partner	13
	Living alone	2
	Not declared	1
Income in CAN $		
	< 15,000	4
	$15,000-$49,999	3
	$50,000-$74,999	6
	>75,000	1
	Not declared	2
Comfort with technology		
	Very comfortable	3
	Somewhat comfortable	2
	Comfortable	4
	Not comfortable	2
	Not declared	5

Interview Findings

Five themes were identified in the analysis of interview data: (1) patient safety as a catalyst for virtual care adoption; (2) piecemeal virtual care solutions; (3) confronting new roles and workloads; (4) missing pieces to virtual care; and (5) the inequity paradox.

Patient safety as a catalyst for virtual care adoption

As fears of COVID-19 heightened and widespread physical distancing measures were established, patients and clinicians questioned the safety of the hospital environment. Patients and clinicians were acutely aware that individuals with pre-existing conditions were at increased risk of severe illness from COVID-19. Maintaining patient safety through hospital avoidance was thus a key motivation for patients and clinicians to reassess the role of virtual care in heart failure management. Virtual care was no longer seen as an option to complement in-person care, but rather as the sole care option for many patients in non-urgent circumstances.

> *"...[going to the hospital] could be a little bit worse knowing my situation and maybe I could get close to someone and get this COVID, and maybe it could even be the opposite. So that's why as much as I'm [wanting] to see the doctor, I wanted to stay away also."* [Patient 1]

> *"...in large part, because we don't want patients unnecessarily exposed to potential COVID, we have moved to a virtual care environment to improve the safety of patients."* [Clinician]

When newly adopting or expanding their use of virtual care, patients and clinicians weighed the perceived benefits of virtual care against its burden. For many, maintaining patient safety by facilitating hospital avoidance presented a new benefit to virtual care that outweighed previous reservations. For example, enrolling patients in the Medly program gave clinicians comfort in postponing clinic visits for stable patients knowing that symptom deterioration would be identified early. This was done to create clinician capacity such that their attention

could be focused on the most at-risk patients and planning service restructuring at the peak of the pandemic's first wave.

> *"...with the volume of patients that we're now seeing virtually – right at the beginning it was very helpful to onboard some of my sickest patients and then I knew at least they were being tracked by [telemonitoring]."* [Clinician]

Although new benefits to virtual care emerged during COVID-19, these did not sufficiently outweigh the burden involved for a small minority of patients interviewed. For these patients, the personal benefits of virtual care were unclear and thus did not justify the new work involved, even when the monetary costs of participation were covered by the healthcare system (i.e., equipment provided by the program).

> *"...it doesn't cost me anything...but it just is not beneficial to keep doing [telemonitoring]... I'm not the type of person that wants to measure everything—check my weight, and check this, and check that every single day. You know it diminishes the quality of life if you have to subject yourself to this sort of regimentation."* [Patient 2]

Piecemeal virtual care solutions

To accommodate physical distancing restrictions and the need to work from home, clinic appointments were either cancelled, deferred to a later date, or transformed into virtual visits. Multiple virtual care technologies, both existing and new, dedicated (e.g., EMR, telemonitoring system) and, where consented to, general-purpose (e.g., phone calls, FaceTime), were rapidly deployed using a piecemeal approach to facilitate virtual visits.

> *"...we'd had a good experience of [telemonitoring] already, so it was kind of a no-brainer to try and onboard as many patients as would be appropriate to the [telemonitoring] platform, and follow them that way, in conjunction with the telephone follow-ups or Ontario Telehealth visits to try and keep them physically out of the hospital."* [Clinician]

The adoption of multiple virtual care technologies by clinicians enabled many patients to newly engage with, or expand their use of, virtualized care. Using multiple virtual care technologies to connect with the health care system was perceived positively by patients as it was thought to help overcome the limitations of each virtual care technology individually. For instance, data collected through the Medly system, which originally was designed to bridge care between in-person appointments, was also used to provide additional context for virtual visits and enable safe and effective remote medication titration. With various types of information captured and communicated by different technologies, patients felt reassured that the quality of their care was maintained despite the reduced capacity of the healthcare system to see patients in-person.

> *"..it's weird because the doctor can't see me, right?...But my first appointment I didn't have a scale and I didn't have the blood pressure – it was pre-[telemonitoring]...it's definitely comforting to know that the [telemonitoring] program does exist."* [Patient 3]

For clinicians, however, the value of applying multiple virtual care technologies was mixed. A piecemeal approach to virtual care enabled clinicians to act rapidly, by allowing the flexibility to select technologies based on their needs and providing backup options when technical challenges occurred (e.g., switching to a phone call when a video call freezes). Yet, switching

between multiple siloed virtual care systems often duplicated administrative work that reduced care efficiency. To improve the sustainability of virtualized clinic services, clinicians expressed a strong desire for connectivity between virtual care systems.

> *"It is extremely important, I think, having [telemonitoring] connect with our online EMR system, so it does pull the blood work, but it doesn't pull other things. We have to manually input medications, which is very tricky...Everything in one system would allow us to work a lot more seamlessly and it would be more efficient, and it would be possible probably to look after more patients if everything was combined."* [Clinician]

Confronting new roles and workloads

As workspaces shifted from clinic to home, clinicians had to learn to work with reduced administrative capacity. Working efficiently from home without timely and convenient access to administrative, clinical, and lab systems posed a challenge to clinicians and staff.

> *"I'm a little bit more preoccupied about not having the paper trail and that things are going to fall through the cracks. We had very robust mechanisms in place to sort of make sure that things weren't missed and I'm a little bit more worried about that happening with virtual care."* [Clinician]

The reduced support when working from home, lack of clarity regarding transitioning roles, and compromised administrative safety net during clinic virtualization meant clinician workload unexpectedly increased with additional tasks in an ad hoc manner. As more patients were onboarded to the Medly program amid the pandemic, the program faced unique challenges to scale up its operations and delivery.

> *"...while we were also addressing this quick ramp up, we were also figuring out our roles in terms of how we would split up that person's responsibilities among the numbers who were left."* [Staff]

> *"The numbers of patients that I'm contacting on the phone are fewer than the patients we would see in the clinic. The reason for that is that the phone follow-ups and documentation and paperwork take longer. It's more cumbersome than if we were physically on-site at the clinic. The other reason is that – we're just one person."* [Clinician]

Concurrent with the added administrative duties, clinicians faced changed dynamics with patients. With virtual care, the onus was on clinicians to reach patients at home, instead of patients reaching clinicians at the clinic. Thus, barriers to the clinical encounter that were traditionally experienced by patients (e.g., delays, waiting times), were now experienced by the clinicians, generating new frustrations.

> *"Trying to find patients is a little bit more difficult than patients trying to find us. What I mean by that is that there's a lot of time that is wasted in chasing patients down when they don't pick up the phone."* [Clinician]

Changes to roles and patient-provider dynamics sometimes led clinicians to feel less satisfied with their job when working virtually. This negative impact on their job satisfaction impacted their perceptions of virtual visits as a sustainable option.

"I think most physicians didn't sign up to make 50 phone calls a day. None of us trained to [be] sort of… telemarketers. It's kind of what you feel like, right? Making call, after call…It's not that much fun. Now clinic is clinic, but it's the interaction with the patients in person that kind of like make it worth it and I don't think any of us really signed up for this." [Clinician]

Missing pieces to virtual care

Patients and clinicians expressed the need to make virtual care interactions more clinically and personally meaningful. Structured information collection in certain virtual care technologies was thought to limit what patients can communicate to the health care team. Moreover, routine diagnostic exams took longer to complete during the pandemic, further delaying decisions about the patient's care. Visual assessment, touch, and diagnostic exams were some of the elements missing in virtual care that hampered a comprehensive and timely assessment.

> *"You miss the physical examination to see the patient, like the things that we do with our eyes. Because there are some patients that complain about everything and there are some patients that don't say anything. So those two cases are very difficult to assess if you don't have objective assessment…We have [objective assessment] with a delay, which is annoying."* [Clinician]

Patients and clinicians also had fewer opportunities to interact directly with each other in this new setting. For example, clinicians mentioned speaking with a patient's caregiver (e.g., family member) instead of the patient. Patients participating in the telemonitoring program would only be contacted by the health care team if they reported worsening or severe symptoms. Consequently, stable patients presenting only mild heart failure symptoms were less satisfied with their relationship because they did not know how the program was impacting their care management.

> *"Many times, we talk to one person, whereas in clinic, usually if the patient comes with someone else, we'll talk to both…I always like to interact with my patients directly and you miss that with virtual care."* [Clinician]

> *"But to me, it's just stated that I'm feeding [information] automatically to some black hole. And I don't know what's coming out of it or what will ever come out of it except if they go out of the parameters."* [Patient 4]

One clinician reflected upon how the COVID-19 pandemic changed their perceptions of their previous experiences implementing virtual care at another clinic. From the COVID-19 pandemic, they learned that asking how virtual care could meet limitations to in-person care was more useful than comparing virtual care to in-person visits.

> *"[The clinicians at the other clinic] didn't even ask the patients; they asked the doctors. "Do you think the video was as good as in-person?" And they said no. and so we said "OK, we're going to scrap this approach." In my opinion that was the wrong question to ask because, of course, in person is better. But the question was "Is this better than not any visits? And was it adequate?" And the answer would've been certainly yes."* [Clinician]

The inequity paradox

It was widely accepted among participants that virtual care technologies were integral in

facilitating access to cardiac care during the COVID-19 pandemic. However, clinicians had different views about how these technologies would impact access to care after the pandemic.

"I don't foresee clinics going back to the way they were. I think they'll be reserved for people who are unwell or who need their diagnostics done" [Clinician]

"The ones that can afford it, the ones that want to see their doctor, they're going to want to come see their doctor again even if they could do that virtually. But for [some of] the patients ... the risk/benefit ratio really favors just sitting and doing it from home." [Clinician]

A critical barrier of sustaining virtual care was its paradoxical impact on inequities: while virtual care technologies could potentially improve the distribution of health care services, they often targeted patients who already had access to health care. Thus, as populations with access to care enjoyed faster and more convenient care, inequities were widened.

"I'll give you examples of patients that are the highest risk patients – and I see a lot of patients that were recently admitted – but you take the homeless people, the people that are under-housed with a touch of dementia...Like [telemonitoring] is not going to work for them. And those are exactly who you need it to work for" [Clinician]

Clinicians rejected the notion that a single virtual care technology could serve the needs of all patients. Instead, a dynamic approach to virtual care, involving an ecosystem of technologies that are allocated based on the needs and means of patients, was envisioned for the future.

"...not losing humanism and not losing the patient perspective about what things should or shouldn't be pushed versus pulled by [patients] is part of what we need to figure out as we move digital health forward...We're still pushing things at patients; we haven't been able to provide a venue of tools and an explanation of what those tools are" [Clinician]

Discussion

Principal Findings

Scholars have argued that pandemics are opportune times for health systems strengthening [23]. Yet, few have explored the role of virtual care in health systems resilience amidst shocks, especially in high resource settings. In this study, we sought to understand the experiences, barriers, and facilitators of the rapid virtualization of cardiac care during the COVID-19 pandemic. Through a lens of health systems resilience, we observed that the large and likely prolonged disruption to the Heart Function Clinic introduced by COVID-19 prompted resilience processes to maintain cardiac care services. This research illustrates how virtual care can facilitate health systems resilience despite shocks that hinder or constrain health care delivery.

This research reveals that the adoption and expansion of virtual care within the Heart Function Clinic enabled absorptive (i.e., new uses of existing virtual care technologies) and adaptive resilience (i.e., reduced in-person appointments) to mitigate the impacts of COVID-19. We observed that COVID-19 created conditions in which a motivation to protect patient safety acted as an organizing vision to promote the adoption, and expanded use of, virtual care technologies [24]. Although reduced rates of emergency department visits and hospitalizations for heart failure have been documented early in the pandemic [25], patient and clinician

perceptions of risk may shift as the pandemic progresses. Consequently, the comparative advantage of virtual care may be less as circumstances improve. Continued framing of virtual care as a safety net to traditional in-person care (regardless of whether in-person delivery has been restricted), may facilitate sustained use by patients and clinicians.

A piecemeal approach using dedicated and general-purpose technologies was critical for a rapid response. However, this approach must always follow organizational and jurisdictional policies around patient privacy, such as the need for patient consent and compliance with the Personal Health Information Protection Act. The use of general-purpose tools within clinical care might reflect that robust telehealth tools were not yet available in settings that did not have existing virtual care options to absorb shocks to in-person delivery. Alternatively, it may reflect the unanticipated technical challenges (e.g. poor quality, dropped calls) clinicians faced with dedicated technologies. Other studies have documented a widespread adoption of general-purpose video conferencing tools, such as FaceTime, Skype, and Zoom during COVID-19 [26]. While leveraging these off-the-shelf technologies enabled the clinic to act rapidly, our findings suggest that it inadvertently introduced or duplicated tasks that hindered clinician efficiency. Tailored virtual workflows bridging multiple platforms were strongly desired by clinicians to perform in a virtual care environment.

While the rapid virtualization efforts instated by health care settings are to be celebrated, we argue that they remain fragile to the prolonged and intense nature of COVID-19 and future shocks placed on health systems. Long-term reliance on adaptations to COVID-19, or as Lee et al. [27] term as "coping", will likely prove to be insufficient without appropriate transformations to roles, clinical workflows, and infrastructure. Indeed, in this study, the adaptations to cardiac care were perceived as inadequate to sustain virtualized clinic services. The drastic loss of administrative infrastructure when working in a virtual care environment led to perceptions of reduced productivity and increased workload from clinicians. Similar impacts on clinician productivity have been well-documented [28] and emerging research has reported a significant decline in the overall number of appointments during COVID-19 despite virtualized clinical services (e.g., a decrease of 25%) [26]. Revisiting clinic roles and designing workflows tailored to virtual care were desired.

Workflow challenges were compounded by the limited data sources currently captured by virtual care technologies, which made meaningful patient-clinician interactions difficult. Patients in this study perceived relationship quality based on the frequency and content of feedback (both automatic and on-demand) they received from virtual care technologies. When feedback fell short of expectations, patient perceptions of virtual care were negatively impacted. We posit that unclear expectations about virtual care may stem from the fact that dedicated virtual care technologies deployed during COVID-19 were designed and implemented to fulfill a purpose different from their current role in the COVID-19 context. For example, virtual visits were previously considered a care option; however, are now regarded as essential during the pandemic. As many virtual care technologies are currently being used in expanded ways (e.g., replacing care visits instead of complimenting them), adaptations are needed to existing virtual care technologies to continue to operate within this new context.

While we observed that virtual care provided patients of this clinic with an essential health care service during the pandemic, only a small portion of patients could participate in virtual care. Clinicians in this study reported that barriers to virtual care and in-person care were largely the same. Although, by improving the convenience and speed in which care is delivered

for those who could access virtual care, it widened inequities. Similar findings have emerged about the digital divide during the pandemic [29]. Characterization of and adaptations for various underserved groups is essential to prevent further widening of gaps due to virtual care. It is important to note that this study occurred within a context of strong research and quality improvement leadership. Strong leadership not only enabled resilience capacities for clinical purposes but also for rapid evaluation of interventions. Health systems facing similar shocks may benefit from facilitating similar leadership commitments to research and quality improvement during the COVID-19 pandemic. Such capacities will facilitate the oft-forgotten component of learning that is integral to continued health system resilience [13]. This rapid evaluation serves as an indicator of learning from the early stages of the COVID-19 pandemic and will continue to guide efforts throughout the pandemic and beyond.

Recommendations

Our research highlights opportunities for transformative resilience which, if realized, will assist in the sustainment of virtualized clinic services throughout the pandemic and beyond. In light of the lessons learned, we offer recommendations to promote virtual care sustainment.

1. Invest in a virtual care ecosystem as a safety net for in-person care

Curate resources and technologies for virtual care that will support clinical management from afar. Design context and patient-specific recommendations for patients experiencing worsening symptoms.

2. Streamline tasks that rely on multiple technologies

Minimize interruptions from multitasking and enable cross-publishing of information across virtual care technologies. Back-up options should be established to limit the impact of technical issues (e.g., allow clinicians to switch platforms on the fly).

3. Re-design roles and workflows to support collaboration

Consult with clinicians, staff, and patients to devise innovative workflows that take advantage of task-sharing to increase provider efficiency. Maintain some level of redundancy between roles and tasks (e.g., co-sharing responsibility for patient education, education, and follow-up) to reduce the impact of single points of failure in a virtual workflow.

4. Personalize systems of follow-up to achieve the desired intensity of care

Consult with patients and clinicians to identify their preferences in terms of mode (e.g., video, voice, or text), frequency (e.g., how often should the patient be contacted by the health care team), and delivery (e.g., synchronous or asynchronous) of messages with the health care team.

5. Revisit patient groups served by virtual care

Characterize the population served by the clinic in terms of age, ethnicity, gender, and geographical location, to identify potentially underserved groups. Revisit affordability, usability, and availability requirements to ensure that patients in communities without high-speed internet connection can have access to virtual care [30].

Limitations

There are several limitations to note. Firstly, as all patient participants were current enrollees

of a telemonitoring program, our findings may not reflect the views of individuals who solely used video and/or phone visits. Secondly, due to physical distancing measures, in-person interviews were not possible at time of data collection. As such, phone-based recruitment and data collection may have led to a greater representation of patients who feel comfortable with technology. Thirdly, while health systems resilience is a global health priority, this study was conducted in a high resource setting. As resilience capacities may differ in low resource settings, the role of virtual care in these contexts warrant further exploration. Fourthly, three cardiologists of the Heart Function Clinic were not represented largely due to scheduling challenges. Finally, despite our efforts to recruit purposefully across a range of demographic factors, the patients interviewed were predominately relatively young, white, suburban, and/or college educated. Although we see our sample as representative of the largely white and educated patient population of the Heart Function Clinic, our sample is unlikely to be reflective of the broader heart failure population in relation to age, ethnicity, rurality, and education. As such, this research may have potentially overestimated patient utility and experience of virtual care. Further research with more diverse samples is needed.

Conclusions

As health systems face shocks, such as the global COVID-19 pandemic, virtual care technologies have been critical enablers of health systems resilience. In this study, we report that the adoption and expansion of virtual care enabled absorptive and adaptive resilience in cardiac care. This transition was largely motivated by a need to maintain patient safety and facilitated by a piecemeal approach to virtual care adoption. Despite the absorptive and adaptive resilience demonstrated by cardiac care services, this research identified barriers experienced by patients, clinicians, and staff when working within a virtual care environment including a lack of administrative support, use of ad hoc virtual care roles and workflows, difficulties building patient-clinician relationships, and widened inequities. If left unaddressed, these barriers threaten the sustainment of virtual care, leaving the opportunity to strengthen health systems through virtual care unrealized. We argue that resilience processes in the context of COVID-19 will need to be transformative, involving the reconsideration of clinical roles and workflows, redesign of virtual care systems, and active efforts to engage populations that continue to be underserved. To assist health settings, we present recommendations to promote virtual care sustainment, helping to build resilience to the shocks inherent in, and created by, complex processes within complex adaptive systems, such as the health care system. Through such transformations, health systems enduring shocks may emerge strengthened and more resilient than before.

Acknowledgements

Conflicts of Interest

Members of the research team (ES and HR) have intellectual property rights of the Medly system.

Abbreviations

EMR: Electronic medical records

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