



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



JAMDA

journal homepage: [www.jamda.com](http://www.jamda.com)

## Original Study

# Spillover Effects of COVID-19 on Essential Chronic Care and Ways to Foster Health System Resilience to Support Vulnerable Non-COVID Patients: A Multistakeholder Study



Sungwon Yoon MPH, PhD<sup>a,\*</sup>, Hendra Goh MPH<sup>a</sup>, Angelique Chan PhD<sup>a,b</sup>,  
 Rahul Malhotra MBBS, MD, MPH<sup>a,b</sup>, Abhijit Visaria PhD<sup>b</sup>, David Matchar MD<sup>a,c</sup>,  
 Elaine Lum PhD<sup>a</sup>, Bridget Seng BSc<sup>b</sup>, Chandrika Ramakrishnan MBBS, MPH<sup>a</sup>,  
 Stella Quah PhD<sup>a</sup>, Mariko S. Koh MBBS<sup>d,e</sup>, Pei Yee Tiew MBBS, PhD<sup>d,e</sup>,  
 Yong Mong Bee MBBS<sup>d,f</sup>, Hairil Abdullah MBBS, MMed, MSc<sup>g</sup>,  
 Gayathri Devi Nadarajan MBBS<sup>h</sup>, Nicholas Graves PhD<sup>a</sup>, Tazeen Jafar MBBS, MPH<sup>a</sup>,  
 Marcus E.H. Ong MBBS, MPH<sup>a,h</sup>

<sup>a</sup> Health Services and Systems Research, Duke-NUS Medical School, Singapore

<sup>b</sup> Centre for Ageing Research and Education (CARE), Duke-NUS Medical School, Singapore

<sup>c</sup> Department of Medicine (General Internal Medicine), Duke University Medical Center, Durham, NC, USA

<sup>d</sup> Duke-NUS Medical School, Singapore

<sup>e</sup> Department of Respiratory and Critical Care Medicine, Singapore General Hospital, Singapore

<sup>f</sup> Department of Endocrinology, Singapore General Hospital, Singapore

<sup>g</sup> Department of Anesthesiology, Singapore General Hospital, Singapore

<sup>h</sup> Department of Emergency Medicine, Singapore General Hospital, Singapore

## A B S T R A C T

**Keywords:**  
 COVID-19  
 chronic diseases  
 health system  
 non-COVID patients  
 stakeholders

**Objectives:** Little empirical research exists on how key stakeholders involved in the provision of care for chronic conditions and policy planning perceive the indirect or “spillover” effects of the COVID-19 on non-COVID patients. This study aims to explore stakeholder experiences and perspectives of the impact of COVID-19 on the provision of care for chronic conditions, evolving modalities of care, and stakeholder suggestions for improving health system resilience to prepare for future pandemics.

**Design:** Qualitative study design.

**Setting and Participants:** This study was conducted during and after the COVID-19 lockdown period in Singapore. We recruited a purposive sample of 51 stakeholders involved in care of non-COVID patients and/or policy planning for chronic disease management. They included health care professionals (micro-level), hospital management officers (meso-level), and government officials (macro-level).

**Methods:** In-depth semi-structured interviews were conducted. All interviews were digitally recorded, transcribed verbatim, and thematically analyzed.

**Results:** Optimal provision of care for chronic diseases may be compromised through the following processes: lack of “direct” communication between colleagues on clinical cases resulting in rescheduling of patient visits; uncertainty in diagnostic decisions due to protocol revision and lab closure; and limited preparedness to handle non-COVID patients’ emotional reactions. Although various digital innovations enhanced access to care, a digital divide exists due to uneven digital literacy and perceived data security risks, thereby hampering wider implementation. To build health system resilience, stakeholders suggested the need to integrate digital care into the information technology ecosystem, develop strategic public-private partnerships for chronic disease management, and give equal attention to the provision of holistic psychosocial and community support for vulnerable non-COVID patients.

S.Y. and H.G. are co-first authors.

This work was supported by the Ministry of Health, Singapore [COVID19RF2–0028].

\* Address correspondence to Sungwon Yoon, MPH, PhD, Health Services and Systems Research, Duke-NUS Medical School, 8 College Road, Singapore 169857.  
 E-mail address: [sungwon.yoon@duke-nus.edu.sg](mailto:sungwon.yoon@duke-nus.edu.sg) (S. Yoon).

<https://doi.org/10.1016/j.jamda.2021.11.004>

1525–8610/© 2021 The Authors. Published by Elsevier Inc. on behalf of AMDA – The Society for Post-Acute and Long-Term Care Medicine. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

*Conclusions and Implications:* Findings highlight that strategies to deliver quality chronic care for non-COVID patients in times of public health crisis should include innovative care practices and institutional reconfiguration within the broader health system context.

© 2021 The Authors. Published by Elsevier Inc. on behalf of AMDA – The Society for Post-Acute and Long-Term Care Medicine. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Globally, millions of people have been infected with the COVID-19 virus. Current evidence suggests that people with underlying chronic conditions are more susceptible to the infection due to weakened immunity.<sup>1</sup> For example, a meta-analysis found that patients with diabetes had about 2.4 times higher odds of being infected.<sup>2</sup> Similarly, patients with pulmonary diseases were found to have a fourfold increased risk of contracting the COVID-19 virus.<sup>3</sup> What is more alarming is that underlying chronic conditions are strongly associated with disease severity. Studies consistently demonstrate that the COVID-19 fatality rate is much higher in patients with more than 1 chronic condition.<sup>4,5</sup>

Patients with underlying chronic conditions are not only affected directly by the COVID-19 pandemic but also indirectly. The unprecedented scale of the pandemic prompted a collective shift toward immediate care for patients with COVID-19, resulting in considerable reorganization of health care services for non-COVID patients. At the peak of the pandemic, health care professionals (HCPs) from various specialties were deployed to the frontline to increase full crisis capability.<sup>6</sup> In-person clinic appointments and ancillary services were either postponed, or operated with minimum human resources to limit the chance of infection.<sup>7</sup> Such disruptions to routine services could have a spillover effect on continuity of care for vulnerable patients with chronic conditions who require long-term follow-up management. Patients may also have lesser community-based support due to the suspension of social services.<sup>8</sup> Indeed, a recent World Health Organization survey of 134 countries shows that the pandemic had a profound impact on the delivery of health care, with services for chronic care and psychosocial services severely compromised in at least 44% of the countries studied.<sup>9</sup>

Experiencing delays in much-needed diagnostics, therapeutics, and surgeries could have dire consequences for patients with underlying chronic conditions. Even as regular health care services have gradually resumed over time in some countries, evidence suggests that the pandemic has a far-reaching effect on health-seeking behaviors of patients with underlying chronic conditions. A survey in the United States found that approximately 42% of patients with chronic diseases have defaulted attending regular follow-ups, which may in turn lead to delay in timely detection and treatment.<sup>10</sup> Another study observed that urgent or emergency care avoidance was significantly higher in adults with 2 or more underlying medical conditions compared with those with a single condition.<sup>11</sup> An increased rate of exacerbations such as stroke, heart attack, and falls due to poorly managed chronic conditions also have been reported amid COVID-19.<sup>12–14</sup> Often, these complications would require an extended period of treatment and rehabilitation, which may add to the already strained health care system. In short, the literature invariably indicates that with the COVID-19 pandemic placing demands on the health care system, deferred essential chronic care may constitute what some have referred to as a “hidden harm” that could disproportionately impact health outcomes of non-COVID patients with underlying chronic conditions.

Although the existing literature provides an essential insight into the implications of the COVID-19 pandemic for non-COVID patient care, it is primarily characterized by a large volume of nonempirical publications (eg, letters, opinion pieces, commentaries) based on anecdotal cases. In addition, few empirical studies

that used existing health care data or cross-sectional surveys tended to focus on a single chronic condition (eg, cancer, cardiovascular condition) or practice (eg, primary care) in isolation.<sup>15–17</sup> We aimed to fill this gap by exploring the experience and views of stakeholders involved in direct care of patients with underlying chronic conditions and/or policy planning for chronic disease management regarding the impact of COVID-19 control measures on non-COVID patients. We also sought to understand the stakeholders’ experience of evolving modalities of care and their suggestions for increasing health system resilience to prepare for future pandemics.

## Methods

### *Setting and Study Population*

Singapore is a multi-ethnic city-state located in Southeast Asia, where more than 15% of its total population is 65 years or older. This study was conducted within the SingHealth Regional Health System. SingHealth is the largest regional health care system in Singapore, serving more than 50% of the country’s population by offering a complete range of medical care through a network of 5 national specialty centers, 3 hospitals, and 9 public primary care clinics.<sup>18</sup> To better meet the increasing demands of an aging population, the government has actively expanded step-down care services in the past decade to mitigate the burden on restructured hospitals while ensuring optimal care for older adults discharged into the community. The concept of step-down care refers to the provision of “slow health care” for older persons who may need more dedicated long-term care, and it can be broadly categorized into 3 main groups: center-based services (day-care and community rehabilitation centers), residential-based services (nursing homes and community hospitals), and home-based services (home nursing and home hospice care).<sup>19</sup> In terms of health care financing, government subsidies form the bulk of the support to ensure that health care services remain affordable and accessible for all, with subsidies dependent on income levels.<sup>20</sup> To sustain long-term financing, every citizen is automatically enrolled into government-run health care insurance schemes based on the principle of self-reliance: MediShield is designed to meet hospitalization cost for catastrophic illnesses through copayment, and MediSave is a mandatory savings account scheme to offset general health care costs. Finally, MediFund is an endowment scheme to assist individuals who are unable to afford health care expenses despite the existing schemes.<sup>21</sup>

Despite the excellent provision of specialized services and extensive network of health care financing, the surge in COVID-19 infections placed considerable strains on the health system. Mass outbreaks in foreign worker dormitories in April 2020 spurred the government’s decision to impose a 2-month lockdown known as the Circuit Breaker (CB) to contain the transmission of the COVID-19 virus.<sup>22</sup> During this period, most of the regular chronic care services were suspended. Following emergent signals of an increasing burden on emergency visits by non-COVID-19 patients, possibly due to postponed care, guidelines were subsequently amended to allow general practices to provide nonurgent care, provided that strict safety measures were adhered to. Clinicians were also expected to triage patients before

scheduling their visits, using teleconsultation (video or phone) to manage the patient load while ensuring continuity of care.<sup>23</sup> Against this background, this study was conducted during and after the CB period to understand the impact of service disruptions on chronic care for non-COVID patients.

The study was introduced to various clinical teams in the SingHealth health care institutions. Eligible participants were (1) doctors, nurses, allied health professionals (AHP)/government officials, and hospital management officials; (2) involved in the provision of care for chronic services or related policy planning. Participants were also identified from the study team's professional networks and recommendations by other study participants. Potential participants were invited by e-mail and provided with background information. We used a purposive sampling approach based on profession and area of expertise to maximize the diversity of experiences and opinions. In addition to micro-level stakeholders (HCPs on the ground), we engaged with stakeholders responsible for policy planning and implementation at the macro-level (government officials) and those who operated policies at the meso-level (hospital management). As data collection and concurrent analyses progressed, the variation in emergent themes was explored by recruiting subsequent participants for interviews to improve our understanding of specific aspects of the studied phenomenon. Informed consent was sought via e-mail, in addition to audio-recorded verbal consent that was taken before commencing the interview.

#### Data Collection

A semi-structured interview guide was developed based on the study team's expert knowledge and relevant literature.<sup>24,25</sup> Specifically, the Chronic Care Model by Wagner and colleagues<sup>26,27</sup> was considered when developing particular questions for different stakeholders to understand multifaceted aspects of care delivery for chronic conditions encompassing from the health care system and organization to community and policies. Major topics included changes in health care services and patient outcomes during the pandemic, new models of care being considered or implemented during the pandemic, and suggestions to improve health system resilience. Self-reported demographic information, such as gender, ethnicity, and profession, was collected. Because of constraints of participants' working hours, consented individuals took part in a one-to-one interview. For infection control reasons, all interviews were conducted virtually over Zoom by interviewers trained in qualitative research (SY, HG, BS, EL). Reflections and field notes were written after each interview to capture key features of the interview. Interviews lasted 30 to 50 minutes.

#### Data Analysis

All interviews were audio-recorded following consent and transcribed verbatim. Thematic data analysis was undertaken based on a grounded theory approach. This approach allowed emerging constructs and themes through iterations of data collection and analysis.<sup>28,29</sup> Three coders (SY, HG, and CR) reviewed the interview materials, summarized and extracted meaningful statements, and carried out open coding and axial coding using NVivo 12, a qualitative data analysis software. During open coding, transcripts were analyzed to develop categories of information. This allowed for subthemes to be derived from the data instead of preexisting ideas. During axial coding, common subthemes were grouped into unifying themes. The iterative process of independent coding and consensus meetings continued until no new emergent themes were identified. The codes were independently applied to all transcripts, and coding discrepancies were resolved by iterative discussions. For rigor and transparency, we

anchored our methodology according to the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist.<sup>30</sup>

## Results

### Characteristics of Participants

A total of 51 stakeholders participated in the one-on-one interview. The recruitment rate was 91% (5 individuals declined participation for reasons of lack of time and interest). Efforts were made to ensure that participants were of different designations and seniority levels to better capture a holistic view of the spillover effects of the COVID-19 control measures on chronic care for non-COVID patients. For HCPs, participants' clinical home departments included cardiology, oncology, pulmonology, endocrinology, surgery, emergency medicine, primary care, family medicine, and nursing among others. Data saturation was reached after the 48th interview, with no new themes emerging from subsequent interviews. We conducted 3 additional interviews beyond data saturation to ensure that point of information redundancy was achieved. Table 1 shows the characteristics of participants.

### Spillover Effects of COVID-19 Control Measures on Routine Chronic Care

Table 2 shows the stakeholders' experience of how the COVID-19 control measures indirectly affected routine chronic care. Based on the stakeholders' experiences, "spillover effects" can be defined as disruptions caused by COVID-19 on 3 aspects of routine clinical practices in chronic care: *workforce adjustment and its effect on routine clinical practices; diminished support for and management of patients; and adverse patient outcomes*. Most of all, redeployment of HCPs from different specialties to COVID-19 response duties disrupted "direct" communication between colleagues on patient cases that "cannot be resolved simply by a video or phone consult," thereby leading to inefficient patient care and potential negative health outcomes. In addition, revised protocols and limited diagnostics posed uncertainty in clinical decision making. As one participant noted, closure of the lung function laboratory hindered clinicians from making a confirmed diagnosis, treating patients based on "clinical signs" (#24 Doctor, F). Access to clinical services was reported to be limited because of a reduction in staffing and team segregation. The effects seem to have been more pronounced in patients who required physiotherapy as AHPs could not move between institutions to provide care. Notably, some participants recounted how they felt unprepared for managing non-COVID patients' emotional reactions and behaviors (eg, anger,

**Table 1**  
Characteristics of Participants (n = 51)

Characteristics	n (%)
Ethnicity	
Chinese	35 (68.6)
Malay	9 (17.7)
Indian	7 (13.7)
Gender	
Female	29 (56.9)
Male	22 (43.1)
Profession	
Doctor	20 (39.2)
Nurse	17 (33.3)
Allied Health Professional	3 (5.9)
Hospital Management Official	6 (11.8)
Government Official	5 (9.8)
Stakeholder grouping	
Micro (program management)	37 (72.4)
Meso (organization)	7 (13.8)
Macro (policy)	7 (13.8)

**Table 2**  
Spillover Effects of COVID-19 Control Measures on Routine Chronic Care

Theme	Subtheme	Illustrative Quotes
Workforce adjustment and its effects on routine practices	Disruption to communication and teamwork rendering less efficient patient care and rescheduling	<p>“My clinic was taken over by other consultants as I was deployed [elsewhere]. So, I think this would invariably have much effect on patient care. Every time, when there is a change in the provider in the clinic, it causes a bit of service disruption.” #23 Doctor, F</p> <p>“Let’s say if I want my colleague to see this patient for a second opinion, it can be very challenging because my colleague may belong to another team [due to redeployment], so communication is disrupted. And most of the time, the case cannot be resolved simply by a video or phone consult, so we have to get the patient to come back another day just to see someone else. Some patients do have a poorer outcome on their next visit, but not all.” #15 AHP, M</p>
	Uncertainty in clinical decision making due to revision of treatment protocol and suspension of laboratory services	<p>“Nebulizing procedure was straightaway stopped in the department. If the patients did require nebulizer, we started giving them via a spacer. How effective that was, I’m not very sure, but we have to make some adjustment during that [Circuit Breaker] period.” #19 Nurse, F</p> <p>“Some diagnostic tests cannot be done during this pandemic. For instance, when diagnosing asthma, we will need to perform a lung function test, but the lung function lab was closed during that time, so we could not do a proper diagnostic test. Hence, we had to treat the patient based on clinical signs and symptoms rather than confirming the diagnosis.” #24 Doctor, F</p>
	Unprepared to handle patients’ emotional responses	<p>“There was also a lot of anger involved because appointments and surgeries were postponed. So, in general, I feel that patients are a little bit more angsty nowadays, especially when they are informed having to repeat tests because the waiting time is certainly longer now. But, that is because we are understaffed at this moment due to redeployment.” #2 Doctor, F</p> <p>“[From the ground] there was quite a lot of distress during that time, especially among elderly [with chronic diseases] when they could not get the services required in the hospital due to changes in protocols and they [doctors] could not do much either as they had to follow these guidelines stipulated [by the Ministry].” #14 Government Official, M</p>
Diminished support and management of patients	Reduced access to routine therapy and diagnostics	<p>“We used to have physiotherapists that come to our clinic to help with chronic diseases–related rehabilitation. But now we don’t have physiotherapists anymore. The inability to receive regular chronic care makes it difficult for the patients to control their disease at home, so they end up getting admitted because of this.” #21 Doctor, F</p> <p>“Before COVID-19, we [respiratory technologists] used to go to private hospitals if there is a referral. However, this practice is suspended to avoid cross-institutional transmission. So patients from the private hospital cannot obtain the required services [lung function tests]” #5 AHP, M</p>
	Limited access to community social services	<p>“As the Senior Activity Centers were closed, the seniors stopped coming to the day-care center, and many of them started to deteriorate in their health due to reduced physical activities and movement.” #16 Hospital Management Officer, M</p> <p>“Medical Escort Transport services and community nursing [were listed as nonessential by the Ministry] have to stop during circuit breaker. As a result, many elderly patients cannot come for their appointments or receive nursing visits, making them even more vulnerable. But it was necessary as our main aim at that time was to break the transmission chain.” #14 Government Official, M</p>
	Longer waiting time for treatment or surgery and rejection of admissions	<p>“Let’s just say for malignancies; usually we don’t stop surgeries for malignancy. However, sometimes because of the decrease in slots due to lessened manpower, some may get pushed back by 1 or 2 weeks. Then some of them are not comfortable coming to the hospital, so they postpone it by themselves a little bit more. But all these add up to delays for about a month, and sometimes when they come in, their physical condition is a lot worse.” #43 Nurse, F</p> <p>“There was some not so necessary hospitalization that was avoided. However, we do see that it results in poorer disease outcome in such patients.” #16 Hospital Management Officer, M</p>
Adverse patient outcomes	Discontinuity of care between hospital and community	<p>“Usually, we also provide podiatry services to patients in the community; about once a week, one of us will go down to the polyclinic. However, as most of us were deployed during the Circuit Breaker period, podiatry services in the polyclinic were suspended to prevent different podiatrists visiting [the polyclinic] each week. As a result, residents in the community who need services like diabetic foot screening have to specifically come back to the hospital, causing them a bit of inconvenience.” #13 AHP, M</p> <p>“Community nursing services were decreased during the Circuit Breaker period. Before that, community nurses do visit the homes of my patients who are discharged from the wards to manage their chronic diseases. But home visits and nursing services were suspended because of the pandemic.” #24 Doctor, F</p>
	Deterioration of existing conditions	<p>“I have also seen patients with abnormal chest X-rays that were delayed with subsequent follow-ups, or did not make subsequent follow-ups, resulting in some diagnoses getting delayed, including that of possible cancer.” #2 Doctor, F</p> <p>“As appointments are cancelled, by the time patients come to see us, some damage to their heart has already occurred.” #12 Hospital Management Officer, M</p>
	Social isolation	<p>“Another impact of COVID-19 on the elderly is undeniably social isolation. They don’t really go exercise or go out as usual anymore. It becomes harder for them to communicate and interact with one another, especially when movement and social activities are restricted. This caused distress and had profound impact on their well-being” #29 Nurse, F</p> <p>“As their movement was restricted, elderly who are living alone tend to experience social isolation, especially when senior activities centers are closed.” #30 Hospital Management Officer, M</p>

frustration, and anxiety) due to cancellation or postponement of chronic care services.

In the context of care in the community, it was commonly mentioned that access to health and social services, such as elder day-care centers, medical escort transportation, and community nursing

services, was significantly curtailed or suspended. Participants narrated how care disruption between the hospital and the community put some older patients at greater health risk. Social isolation during the lockdown period was one of the key issues pointed out. A ban on home visits by community nurses and the closure of senior

**Table 3**  
Evolving Modalities of Care Amid the COVID-19 Pandemic

Modalities of Chronic Care	Opportunities	Challenges
Self-management support for patients with chronic diseases ( <i>Phone consultation; Medication delivery service; Joint video consultation</i> )	<p>“With the joint video consultation, nurses and social workers are able to come together on the same platform during the consult. They can give the doctor feedback on the patient’s condition, and then together with the doctor, devising a more comprehensive care plan for the patient. Most importantly, they can do it at the comfort of their homes, without having to come to the hospital, and the patients like it a lot as it is very convenient.” #6 Nurse, F</p> <p>“We started to do more medicine delivery during the Circuit Breaker [lockdown period] for patients with stable conditions. They are happy because they didn’t want to come to the hospital anyway just to collect their medication.” #11 Nurse, F</p>	<p>“I think the first challenge [for teleconsultation] seems to be cybersecurity. We have zero-tolerance for data breach. We are not so keen to use the usual Zoom platform as it might not be secure enough; we need to have a special platform that is cleared by hospital or Ministry. So that’s a limiting factor. And I suppose following the previous cyber-attack on our institution, vigilance is very high, and the tolerance for lapses is zero.” #50 Doctor, M</p> <p>“We are having difficulty to get patients on board with the idea, because a lot of patients they come to us for treatment. That means they come to us for in-person procedure, not only for consultation. Often, we need to do physical assessments as well, which cannot be done via teleconference.” #15 AHP, M</p>
Novel delivery system to improve chronic care ( <i>Nurse-led platform for real-time communication; Remote monitoring; Telehealth Kiosk in the community</i> )	<p>“We started tele-vital signs monitoring during the pandemic. We started off first with hypertension, so it was tele-blood pressure monitoring. We are now moving on into diabetes, which includes both tele-blood sugar monitoring and glycated haemoglobin A1c monitoring. The idea is to empower patients to care for their chronic conditions by themselves at home, with the support from the health care team, without them visiting the clinics unnecessarily.” #25 Hospital Management Officer, M</p> <p>“We launched the telehealth kiosk initiative at the peak of COVID-19 infection. So, we placed electronic devices like tablets at community centers. This allows residents with low SES to have a video consultation with the doctors and nurses in the hospital. Residents like this because services are provided free-of-charge.” #6 Nurse, F</p>	<p>“The Nursing Department has launched <i>AskMissy</i>, an enquiry platform for the public to address any health care-related queries they may have. The nurse on duty will address questions and make clinically sound suggestions to the enquirer. So far, it is well received by the public, but we are still thinking about ways to reach the not so tech-savvy elderly patients.” #31 Nurse, F</p> <p>“For patients who are not IT savvy, or IT connected, who do not have access to video conferencing or devices, or even Internet at their home, they are basically shut off from the virtual health care system such as teleconsulting and tele-vital signs monitoring.” #25 Hospital Management Officer, M</p>

activity centers during the lockdown appeared to have “a profound impact on well-being” of the older patients with restricted mobility who lived alone (#29 Nurse, F). It was also not uncommon to observe deterioration of health status in patients with underlying chronic conditions. Some health care participants acknowledged that there were inevitable exacerbations because of the cancellation of appointments and screening or delayed surgeries. One participant recounted that suspension of the cancer screening program for an asymptomatic patient resulted in delayed diagnosis and treatment.

#### *Evolving Modalities of Care Amid the COVID-19 Pandemic*

Participants described their experience of the modalities of care rolled out during the COVID-19 pandemic for non-COVID patients with chronic conditions and related opportunities and challenges. They can be grouped into *self-management support for patients with chronic diseases* and *novel delivery systems to improve regular care* (Table 3). Self-management support clustered around a few modalities, including video consultation, phone consultation, and medication delivery, that were available pre-COVID but used significantly more during the pandemic. As noted by the participants, video consultations have been adopted by many clinical specialties during the pandemic to enable continued service provision. Participants commonly mentioned that video consultations were well received by patients and showed promise for wider implementation. The virtual platform supported joint consultation, allowing HCPs from multidisciplinary teams such as social workers and dietitians to come on board with the clinician during the session to formulate “a more comprehensive care plan for the patient” (#6 Nurse, F). However, many participants raised concerns about potential data breach when consultations were conducted on digital platforms and felt cybersecurity concerns may hinder the wider implementation of digital consultations. In addition, some HCP participants from certain clinical specialties (ie, surgery, podiatry, and physiotherapy) expressed a low sense of receptiveness for digital health, as they perceived that the

quality of medical advice might be compromised by the lack of direct interactions with patients, which could result in unintended negative patient outcomes.

Participants also described novel ways of providing care that emerged during the COVID-19 pandemic. Some of the models depicted by the participants included a nurse-led platform for real-time communication for general health information/community resources, remote monitoring of patients using telehealth kits (eg, blood pressure monitors, pulse oximeters) sent to patients, and telehealth kiosks. One of the notable developments was the telehealth kiosk launched in the community centers. Recognizing that video consultation might not reach the underserved and non-tech-savvy older patients, the kiosk featured multiple touchscreen devices capable of supporting video consultation with a primary care doctor or specialist, supported by on-site staff for the set-up. Participants’ descriptions reflected general satisfaction with the convenience afforded by the new model among older patients with low socioeconomic status living in the community. Nevertheless, implementing new care models seemed to be fraught with challenges: participants commonly stressed a continued “digital divide” that often signified economic and digital literacy differences, with certain segments of patients being left behind from potential benefits of technologies in the context of rapid changes in health services provision during the COVID-19 pandemic.

#### *Strengthening Health System Resilience Beyond the COVID-19 Pandemic*

Table 4 shows the suggestions by participants on how the health system might be strengthened to better prepare for the next pandemic. On top of the current care modalities, most participants expressed an urgent need to harness health information technology to enhance access to chronic care and system resilience. Despite the perceived usefulness of the virtual consultations, additional administrative workload was noted by several participants, for example, having to use 2 computers, “one for consultation and another for

**Table 4**  
Strengthening Health System Resilience Beyond the Pandemic

Theme	Subtheme	Illustrative Quotes
Leveraging on health IT	<ul style="list-style-type: none"> <li>Integration of digital care models into hospital IT ecosystem</li> <li>Development of mHealth apps to diversify services</li> <li>Artificial intelligence-enabled hospital platforms that allow for the acquisition of reliable health information</li> </ul>	<p>“Inter-linkages between IT systems need to be improved. As of now, the Clinic Management System, or whatever data management system the hospital is using, is not directly linked to the video consult platforms. So, clinicians often need to have 2 computers, one for them to type in the case note, and then another for video consultations. It might be more efficient if there is an integrated platform.” #18 Government Official, M</p> <p>“...mHealth app should allow patients to view, request, and reschedule their appointments. Not only it offers convenience at their fingertips, but it also frees up the workload from clerical staff. Within the app, if we can arrange for medication delivery and e-counseling with the pharmacist, that would be great too.” #50 Doctor, M</p> <p>“Through AI-based platforms, patients can ask the pandemic or non-pandemic-related questions on hospital forum or other platforms like that, and then a moderator can answer their queries and try to match them to the right services if required. At least they don't obtain medical information from unverified sources.” #19 Nurse, F</p>
Reconfiguring existing institutional arrangements	<ul style="list-style-type: none"> <li>Public-private partnerships</li> <li>Close coordination between primary and tertiary care</li> <li>Round-the-clock support for urgent care</li> </ul>	<p>“What Singapore has tried to do was to see how we can arrive at public-private partnerships where we can work directly with private health care providers in providing care. For example, at the community isolation facilities, medical care over there comes under the oversight and provision of a private hospital. Exploring this partnership for non-COVID care will not only reduce the strain on public hospitals during a pandemic but also to maximize efficiency in the delivery of care for chronic patients.” #1 Doctor, M</p> <p>“I think the collaboration between the primary care and tertiary care can be better, for example, some chronic diseases that are being managed at the hospitals can be outsourced to the GPs. I believe this would greatly reduce the hospital's workload during the pandemic.” #11 Doctor, F</p> <p>“We also wanted to provide silent hour support. So silent hour is when the medical teams are not there during off-office hours from 6 PM to the next day 8 AM. During the Circuit Breaker period, we saw many urgent yet not emergency cases coming in and choking up the A&amp;E. So, by having 24/7 access to teleconsultation either with a doctor or nurse will help triage and bring in only patients who really need emergency care. This will be very beneficial in the next pandemic by lessening the workload of the hospital.” #18 Government Official, M</p>
Holistic care	<ul style="list-style-type: none"> <li>Continuity of social services for selected vulnerable patients</li> <li>Safeguarding mental health of non-COVID patients</li> </ul>	<p>“Because of the cessation of activities, many older patients dare not to go out to exercise anymore. In the past, they used to exercise in groups in the morning. So I think the sudden shift to a sedentary lifestyle worsens their medical and mental health. I think safeguarding the patient's psychological health during a pandemic is equally important too. Maybe the senior activity centers can organize video chatting sessions for the residents to catch up with one another even when they cannot gather physically.” #28 Doctor, F</p> <p>“Social services such as medical escort and befriending services should be allowed to continue to operate even during the Circuit Breaker [period]. Missing out on an appointment or loneliness during lockdown contributes to deterioration of overall well-being in these patients.” #43 Nurse, F</p>

writing down the case note” (#18 Government Official, M). It was stressed by many that integration of digital platforms into the hospital information technology (IT) ecosystem would be vital in improving work efficiency and data safety. In addition, participants suggested the development of a mobile health (mHealth) app with features such as medication delivery and app-based drug counseling to reduce crowding and waiting time in the pharmacy. This strategy was felt to free up the HCPs, allowing them to focus on core clinical functions.

Another area of improvement was related to the reconfiguration of existing institutional arrangements. Beyond advancing innovation, participants suggested the need for closer care coordination between primary and tertiary care. As one participant highlighted, general practitioners (GPs) in the private sector could act as gatekeepers to manage patients with long-term chronic diseases “to reduce doctor hopping and public hospitals' workload, especially during the peak of the pandemic” (#11 Doctor, F). Citing benefits of the public-private partnerships (PPPs) for the operation and management of the “COVID-19 Community Isolation Facilities,” many participants suggested creating similar PPP opportunities in support of strategic chronic care management to “not only reduce the strain on public hospitals during a pandemic but also to maximize efficiency in the delivery of care for chronic patients” (#1 Doctor, M). Last, participants felt that the overall well-being of non-COVID patients with chronic conditions needed to be safeguarded during and beyond the pandemic. Psychosocial and mental health in medically vulnerable patients with chronic conditions were perceived to have been often overlooked during the current pandemic, as resources were channeled away to provide acute care related to the COVID-19. Participants unequivocally maintained the need for holistic care of non-COVID

patients, including provision of psychosocial and community services through various medium during public health emergencies.

## Discussion

This study contributes to the literature by exploring spillover effects of the COVID-19 control measures on health system's management and care for non-COVID patients with long-term chronic conditions from the perspectives and experience of key stakeholders.

Our findings showed that stakeholders observed an unprecedented disruption in the provision of care for chronic conditions. In particular, the workforce adjustment to support acute COVID-19 care appeared to result in less optimal chronic care services. Although this finding is generally in line with commentaries published during the pandemic,<sup>31,32</sup> our study further elucidated the context in which optimal chronic care was compromised: disruption in “direct” communication between team members, uncertainty in clinical decisions, and underpreparedness to handle emotional responses of patients with chronic conditions. There was also an indication that reduced access to social services and discontinuity of care between the hospitals and the community engendered preventable adverse events. Notably, limited step-down care options resulting from pandemic measures disproportionately affected older patients with comorbidities and complex care needs when they transitioned from hospital to home; depression and functional decline seemed to feature prominently among those who live alone as a result of social isolation and absence of rehabilitation support. This finding sheds light on the need to critically assess care pathways and develop contingency plans to ensure continuity of care for patients in need of post-acute and long-

term care. A few systematic reviews conducted during the COVID-19 pandemic demonstrated that delayed or marginalized chronic care could lead to a higher risk of complications and poorer health outcomes. For example, studies noted a marked increase in cardiovascular events during the pandemic,<sup>33,34</sup> and a threefold increase in crude mortality rate associated with acute myocardial infarction compared with pre-COVID. Similarly, Matsuo et al.<sup>35</sup> showed an association between oncologic outcome and adjuvant radiotherapy wait-time amid COVID-19, with patients having to wait longer for treatment and experiencing unsatisfactory results. It has also been estimated that the amount of resources spent on emergency care for patients with chronic diseases would have significantly surpassed the initial cost if health care services for chronic diseases were not suspended, not to mention the loss of lives entailed.<sup>36</sup> Together with prior literature, our findings underscore the importance of safeguarding access to care for patients with underlying chronic conditions to preempt the deleterious health impacts posed by the COVID-19 control measures.

We found that the provision of care for chronic conditions has transformed in many ways as a result of COVID-19 control measures and evolving health-seeking behaviors in the current pandemic. Traditional chronic care services have increasingly moved to new models of care by harnessing information and communication technologies to enable self-care. Participants commonly noted an increase in medication delivery service (ie, order medicines online and get free home delivery) and multidisciplinary video consultations as new ways of supporting self-management for patients with underlying chronic conditions. In addition, novel care models such as a real-time 2-way communication platform between patients and nurses and community telehealth kiosks emerged in an effort to meet the needs of older patients who may lack digital literacy. There was consensus that these new initiatives helped the timely delivery of quality care for patients while minimizing the risk of exposure to COVID-19 infection. However, limited digital literacy in vulnerable older patients and concerns about data security were found to be the key barrier to successful scaling-up. This finding is reminiscent of literature published before or during the COVID-19 pandemic in other health care settings where using digital technology for health care delivery presented several challenges. They included inadequacy in formulating a diagnosis and therapeutic regimen, lack of IT infrastructure, data security concerns, and limited relationship building between HCPs and patients.<sup>37–41</sup> Future implementation of new models of care should consider these challenges fully in order to realize the full potential of novel digital health solutions.

As the COVID-19 pandemic exposed the vulnerability of the health system in the management of chronic diseases, there was strong consensus among participants on the need for increasing resilience of the health system to prepare for future exigencies. At the service level (micro), stakeholders advocated for stronger and closer care coordination at different levels of the health system during pandemic times. As they are often the first point of contact with patients, disruptions of care continuity may have been more deeply felt. Technological innovations such as “fit” of virtual consultations with the current IT system and mHealth-based chronic care management were perceived to be of importance to minimize the risk of disruption to chronic care. At the meso and macro levels, institutional reconfiguration such as PPPs was recognized by stakeholders as a new way to mitigate burdens on public health care infrastructure and improve the provision of chronic care for non-COVID patients. A body of literature has demonstrated that PPPs played a critical role in response to epidemics such as H1N1, Ebola, and Middle East Respiratory Syndrome, through raising awareness, strengthening disease surveillance, and developing diagnostics and vaccines.<sup>42–44</sup> Our finding similarly noted that COVID-19 was the impetus to building collaboration between the government and private sectors to manage patients with COVID-19; however, evidence of the role of PPPs in chronic disease management amid fast-moving disease outbreaks is largely absent. Arguably, from a health

system perspective, the pandemic response cannot be effective without a holistic approach to supporting quality care for both COVID and non-COVID patients alike. More work needs to be done to develop a robust and sustainable framework of PPPs that addresses the needs of patients with underlying chronic conditions and maintains service efficiency during a large-scale pandemic. An illuminating example is a national initiative in which a network of private GP clinics provides multidisciplinary team-based care for patients with complex care needs through government funding and administrative support. A defining feature of this initiative is to mobilize more private care sector resources to move care beyond the hospital to the community. Amid the pandemic, an expansion of such PPP models may help acute hospitals clear the backlog and build capacity for pandemic surges while vulnerable non-COVID patients with chronic conditions are safely managed closer to home.<sup>45</sup>

At the time of writing, very few empirical studies explored the experience and impacts of the COVID-19 control measures on chronic care management.<sup>15</sup> This study adds to the knowledge gap by providing a detailed account of how COVID-19 affected the delivery of health care services for non-COVID patients with underlying chronic conditions. Our study also illuminates the current opportunities and challenges pertaining to the emerging modalities of care and suggestions for improving a robust and resilient health system during and beyond the pandemic. Notwithstanding its strengths, the study has a few limitations. Despite efforts to engage a wide range of stakeholders, workforce deployment during the peak of the COVID-19 outbreak limited our ability to recruit a balanced number of stakeholders at 3 levels of involvement (ie, macro, meso, and micro). In particular, the voice of direct bedside care providers was largely absent; because of manpower shortages resulting from the deployment, we did not take an active approach to recruit these care workers in order to avoid further disruption to inpatient care. Taken together, we acknowledge that these might have influenced the themes generated. Last, we did not explore the views and experience of vulnerable non-COVID patients with chronic conditions as the important end-users of the health system, which will be presented in a separate study. Incorporating perspectives from other stakeholders involved in the health system, such as patient advocacy groups, clinic managers, and medical insurance companies, may have strengthened the credibility of the findings and contributed richer understanding.

## Conclusion and Implications

Although the COVID-19 control measures had spillover effects on chronic care in the areas of team communication, clinical decision making, and the care continuum between hospitals and the community, various digital innovations supported chronic care for some non-COVID patients. There were concerns that the “digital divide” would remain, leaving the most vulnerable patients with long-term chronic conditions behind. To prepare for the challenges posed by future public health emergencies, efforts should be made to support integration of digital care into the IT ecosystem, strategic partnerships between the public and private sectors for chronic disease management, and a holistic approach to the provision of psychosocial and community support for the vulnerable non-COVID patients.

## Acknowledgments

The authors thank all participants who provided valuable insights for the study.

## References

1. Sanyaolu A, Okorie C, Marinkovic A, et al. Comorbidity and its impact on patients with COVID-19. *SN Compr Clin Med* 2020;2:1069–1076.



2. Wang B, Li R, Lu Z, Huang Y. Does comorbidity increase the risk of patients with COVID-19: evidence from meta-analysis. *Aging (Albany NY)* 2020;12:6049–6057.
3. Zhao Q, Meng M, Kumar R, et al. The impact of COPD and smoking history on the severity of COVID-19: a systemic review and meta-analysis. *J Med Virol* 2020;92:1915–1921.
4. Arentz M, Yim E, Klaff L, et al. Characteristics and outcomes of 21 critically ill patients with COVID-19 in Washington State. *JAMA* 2020;323:1612–1614.
5. Huang C, Huang L, Wang Y, et al. 6-month consequences of COVID-19 in patients discharged from hospital: a cohort study. *Lancet* 2021;397:220–232.
6. Chua AQ, Tan MMJ, Verma M, et al. Health system resilience in managing the COVID-19 pandemic: lessons from Singapore. *BMJ Glob Health* 2020;5:e003317.
7. Sezgin E, Huang Y, Lin D, Ramtekkar U, Pauline L, Lin S. Documented reasons of cancellation and rescheduling of telehealth appointments during the pandemic. *Telemed J E Health* 2020;27:1143–1150.
8. Chou WP, Wang PW, Chen SL, et al. Voluntary reduction of social interaction during the COVID-19 pandemic in Taiwan: related factors and association with perceived social support. *Int J Environ Res Public Health* 2020;17:8039.
9. Team W. Second Round of the National Pulse Survey on Continuity of Essential Health Services During the COVID-19 Pandemic. World Health Organization; 2021.
10. Hamel L, Kirzinger A, Lopes L, Muñana C, Brodie M. KFF Health Tracking Poll - June, 2020. Kaiser Family Foundation; 2020.
11. Czeisler MÉ, Marynak K, Clarke KEN, et al. Delay or avoidance of medical care because of COVID-19-Related Concerns - United States, June, 2020. *Morb Mortal Wkly Rep* 2020;69:1250–1257.
12. De La Cámara MÁ, Jiménez-Fuente A, Pardos AI. Falls in older adults: the new pandemic in the post COVID-19 era? *Med Hypotheses* 2020;145:110321.
13. Requena M, Olivé-Gadea M, Muchada M, et al. COVID-19 and stroke: incidence and etiological description in a high-volume center. *J Stroke Cerebrovasc Dis* 2020;29:105225.
14. Srivastava K. Association between COVID-19 and cardiovascular disease. *Int J Cardiol Heart Vasc* 2020;29:100583.
15. Danhieux K, Buffel V, Pairen A, et al. The impact of COVID-19 on chronic care according to providers: a qualitative study among primary care practices in Belgium. *BMC Fam Pract* 2020;21:255.
16. Javanparast S, Roeger L, Kwok Y, Reed R. The experience of Australian general practice patients at high risk of poor health outcomes with telehealth during the COVID-19 pandemic: a qualitative study. *BMC Fam Pract* 2021;22:69.
17. Roy CM, Bollman EB, Carson LM, Northrop A, Jackson E, Moresky J. Assessing the indirect effects of COVID-19 on healthcare delivery, utilization and health outcomes: a scoping review. *Eur J Public Health* 2021;31:634–640.
18. SingHealth. About SingHealth. 2021. <https://www.singhealth.com.sg/>. Accessed April 21, 2021.
19. MOH. Intermediate And Long-Term Care (ILTC) Services. 2020. [moh.gov.sg/home/our-healthcare-system/healthcare-services-and-facilities/intermediate-and-long-term-care-\(iltc\)-services](http://moh.gov.sg/home/our-healthcare-system/healthcare-services-and-facilities/intermediate-and-long-term-care-(iltc)-services). Accessed April 21, 2021.
20. Finkelstein E, Malhotra C, Chay J, Ozdemir S, Chopra A, Kanesvaran R. Impact of treatment subsidies and cash payouts on treatment choices at the end of life. *Value Health* 2016;19:788–794.
21. Wong A, Goh SN, Sowa PM, Bauer JD. A narrative review of healthcare financing and reimbursement of nutritional support for patients in Singapore. *Health Policy* 2020;124:1146–1154.
22. Lim MZ. Circuit breaker to be lifted, Singapore to reopen gradually in 3 phases. *The Straits Times*. Singapore Press Holdings; 2020.
23. On PA. Telehealth gets a boost from COVID-19 pandemic. CNA; 2020.
24. Danhieux K, Buffel V, Pairen A, et al. The impact of COVID-19 on chronic care according to providers: a qualitative study among primary care practices in Belgium. *BMC Fam Pract* 2020;21:255.
25. Howells K, Burrows M, Amp M, et al. Exploring the experiences of changes to support access to primary health care services and the impact on the quality and safety of care for homeless people during the COVID-19 pandemic: a study protocol for a qualitative mixed methods approach. *Int J Equity Health* 2021;20:29.
26. Wagner EH, Austin BT, Davis C, Hindmarsh D, Schaefer J, Bonomi A. Improving chronic illness care: translating evidence into action. *Health Aff (Millwood)* 2001;20:64–78.
27. Wagner EH, Austin BT, Von Korff M. Organizing care for patients with chronic illness. *Milbank Q* 1996;74:511–544.
28. Strauss AL, Glaser B. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Aldine Publishing; 1967.
29. Strauss A, Corbin J. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. 2nd ed. Sage Publications, Inc; 1998.
30. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 2007;19:349–357.
31. Ahmed S, Tan WLG, Chong Y-L. Surgical response to COVID-19 pandemic: a Singapore perspective. *J Am Coll Surg* 2020;230:1074–1077.
32. Sek KSY, Tan ATH, Yip AWJ, Boon EME, Teng GG, Lee CT. Singapore's experience in ensuring continuity of outpatient care during the COVID-19 pandemic. *Int J Clin Pract* 2020;74:e13573.
33. Schirmer CM, Ringer AJ, Arthur AS, et al. Delayed presentation of acute ischemic strokes during the COVID-19 crisis. *J Neurointerv Surg* 2020;12:639–642.
34. Driggin E, Madhavan MV, Bikdeli B, et al. Cardiovascular considerations for patients, health care workers, and health systems during the COVID-19 pandemic. *J Am Coll Cardiol* 2020;75:2352–2371.
35. Matsuo K, Shimada M, Matsuzaki S, Enomoto T, Mikami M. Wait-time for adjuvant radiotherapy and oncologic outcome in early-stage cervical cancer: a treatment implication during the coronavirus pandemic. *Eur J Cancer* 2021;148:117–120.
36. Cosentino N, Assanelli E, Merlino L, Mazza M, Bartorelli AL, Marenzi G. An in-hospital pathway for acute coronary syndrome patients during the COVID-19 outbreak: initial experience under real-world suboptimal conditions. *Can J Cardiol* 2020;36:961–964.
37. Monaghesh E, Hajizadeh A. The role of telehealth during COVID-19 outbreak: a systematic review based on current evidence. *BMC Public Health* 2020;20:1193.
38. Hall JL, McGraw D. For telehealth to succeed, privacy and security risks must be identified and addressed. *Health Aff (Millwood)* 2014;33:216–221.
39. Kumar P, Huda F, Basu S. Telemedicine in the COVID-19 era: the new normal. *Eur Surg* 2020 Oct 8. [Epub ahead of print].
40. Perrone G, Zerbo S, Bilotta C, Malta G, Argo A. Telemedicine during Covid-19 pandemic: advantage or critical issue? *Med Leg J* 2020;88:76–77.
41. Blandford A, Wesson J, Amalberti R, AlHazme R, Allwihan R. Opportunities and challenges for telehealth within, and beyond, a pandemic. *Lancet Glob Health* 2020;8:e1364–e1365.
42. National Academies of Science, Engineering, Medicine. *Public–Private Partnership Responses to COVID-19 and Future Pandemics: Proceedings of a Workshop—in Brief*. The National Academies Press; 2020.
43. Parker LA, Zaragoza GA, Hernández-Aguado I. Promoting population health with public-private partnerships: where's the evidence? *BMC Public Health* 2019;19:1438.
44. Mudyarabikwa O, Tobi P, Regmi K. Public-private partnerships to improve primary healthcare surgeries: clarifying assumptions about the role of private provider activities. *Prim Health Care Res Dev* 2017;18:366–375.
45. Foo CD, Surendran S, Jimenez G, Anshah JP, Matchar DB, Koh GCH. Primary care networks and Starfield's 4Cs: a case for enhanced chronic disease management. *Int J Environ Res Public Health* 2021;18:2926.