

Background and Introduction

The COVID-19 pandemic has disrupted the traditional healthcare system globally by overwhelming hospital bed capacity and scarce resources. This huge resource strain threatens the safety and quality of healthcare delivery (Sitammagari et al., 2021) in Singapore and beyond.

This qualitative study seeks to engage **key implementation stakeholders** such as healthcare professionals, staff members of the Sandbox Model and policy makers in advancing the following objectives:

- 1. Understanding of the need for an alternative mode of care delivery** such as virtual care
- 2. Attitudes towards the viability of virtual hospitals** or beds care model to augment acute beds' supply or demand in future pandemics
- 3. Gaps and opportunities for interventions and innovations** to the existing virtual ward programmes implemented for COVID-19

In turn, the study findings can help **inform steps in co-creating and improving interventions** – e.g. healthcare delivery to home and scalable technology-enabled platforms for teleconsultations and monitoring – to reduce reliance on limited hospital resources, more effectively respond to pandemics in the future and ensure sustainability in our healthcare system.

Method

Semi-structured interviews were conducted by the investigators between August 2022 and December 2022 among healthcare professionals from four public hospitals in Singapore and government officials from the Ministry of Health. Study participants were approached by the investigators for written informed consent before data collection commenced.

For the development of the interview topic guide, three domains of interests were focused on: **(1) Understanding of the need for an alternative for inpatient hospitalisation, (2) perception on the safety and effectiveness of this care model and viability of upscaling virtual hospitals to be part of the standard practice of care, (3) implementation-related gaps and opportunities for interventions and innovations to this existing unsubsidized homecare programmes.** Specifically for focus area 3, the study team referenced key constructs from the **Consolidated Framework for Implementation Research (CFIR)** (Figure 1). Before commencement of the interviews, pretesting and cognitive debriefing were done internally within the study team.

Audio recordings of the interviews were transcribed verbatim, coded, and analyzed by thematic analysis (Clarke, 2016) using a six-step approach: (1) data familiarization, (2) creating initial code, (3) exploring potential themes, (4) reviewing themes, (5) defining and naming of themes, (6) producing the findings. The researcher will independently analyze the data and emerging themes and subthemes. Findings will be reported in accordance to the **Consolidated Criteria for Reporting Qualitative Studies (COREQ)** (Tong, 2007).

Conclusion

There is a need for an **alternative to brick-and-mortar hospitalization**. Many believe in the viability of upscaling virtual hospitals to be part of the standard practice of care while ensuring the safety and effectiveness of this care model. The hospitals' leadership and decision makers were also very supportive of the initiative alongside many of the participants who were very passionate and enthusiastic about being part of this model of care despite having little to no pre-established frameworks and being the trailblazers. While there is much room for improvement on the implementation-related gaps and opportunities for interventions and innovations to these existing unsubsidized homecare programmes, the majority of the participants believe that Singapore is ready for such a care plan. Given the possibility of future pandemics, Singapore's aging population, and increasingly limited hospital resource capacity in Singapore, it is crucial for virtual wards to be **considered part of the standard of care in our healthcare system and extended to a wider range of diseases.**

Declarations and Acknowledgements

The investigators and authors of this study declare no conflict of interest. The study was approved by the Pharmacy Department Ethics Review Committee (DERC), National University of Singapore. The study was conducted with limited funding support from the Department of Pharmacy, Faculty of Science, National University of Singapore to pay for Quirkos subscription (a qualitative data management software). We would also like to thank clinicians and administrators from the National University Health System, Singapore General Hospital, Changi General Hospital, Khoo Teck Puat Hospital and the Ministry of Health Singapore for their support and guidance towards the planning and execution of this study.

Photo credits: NUHS@Home, SGH@Home, YH Medical Home, Hospital Management Asia.

References

- Sitammagari K, Murphy S, Kowalkowski M, Chou SH, Sullivan M, Taylor S, Kearns J, Batchelor T, Rivet C, Hole C, Hinson T, McCreary P, Brown R, Dunn T, Neuwirth Z, McWilliams A. Insights From Rapid Deployment of a "Virtual Hospital" as Standard Care During the COVID-19 Pandemic. *Ann Intern Med.* 2021 Feb;174(2):192-199. doi: 10.7326/M20-4076. Epub 2020 Nov 11. PMID: 33175567; PMCID: PMC7711652.
- Clarke V, Braun V (2016). Thematic analysis. *The journal of positive psychology.* 2016;12(3):297-298. doi: 10.1080/17439760.2016.1262613.
- Tong A, Sainsbury P, Craig J (2007). Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International journal for quality in health care.* 2007;19(6):349-357. doi: 10.1093/intqhc/mzm042.

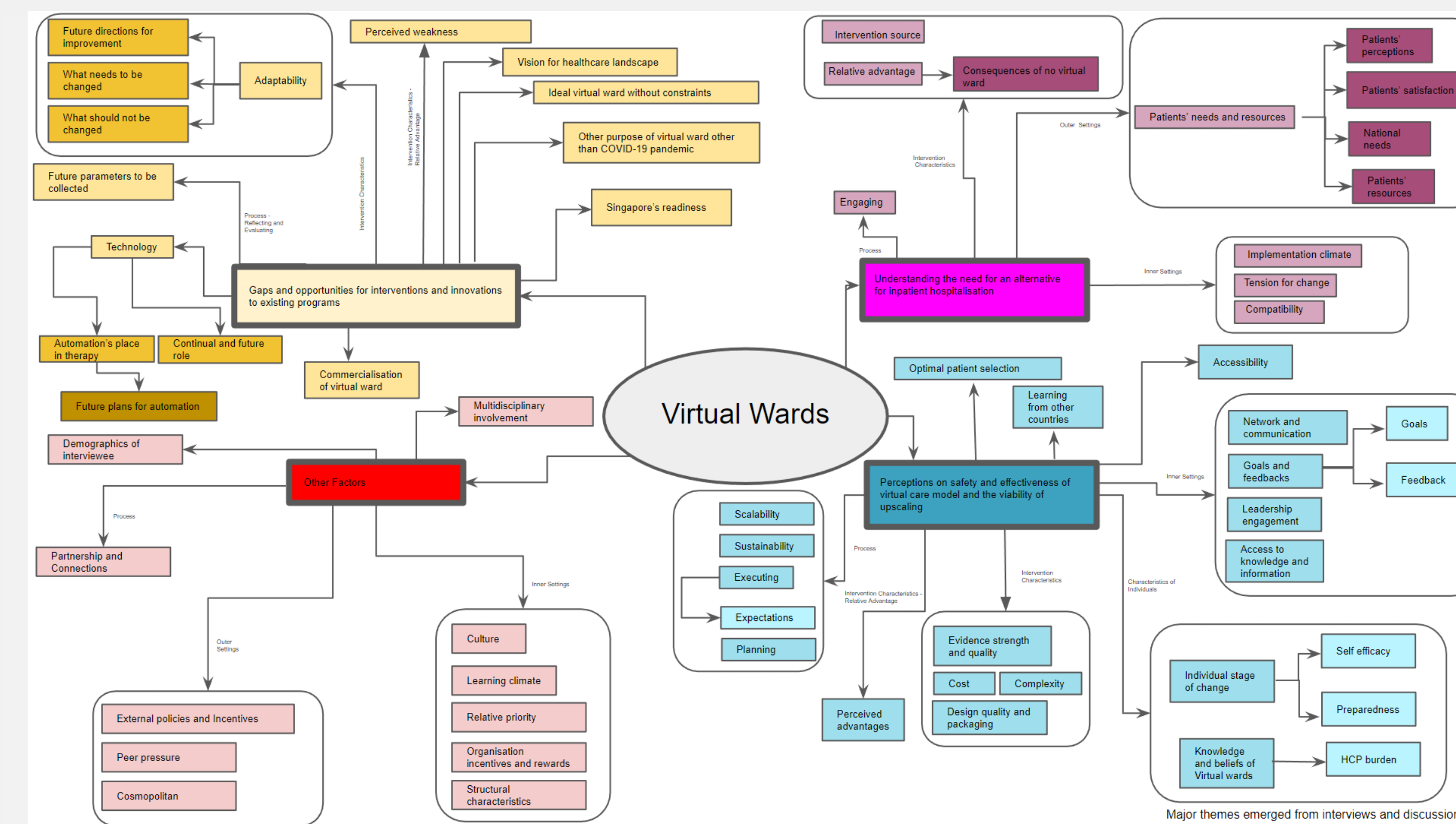


Figure 1: Overview of codes generated in the study, guided by CFIR Framework

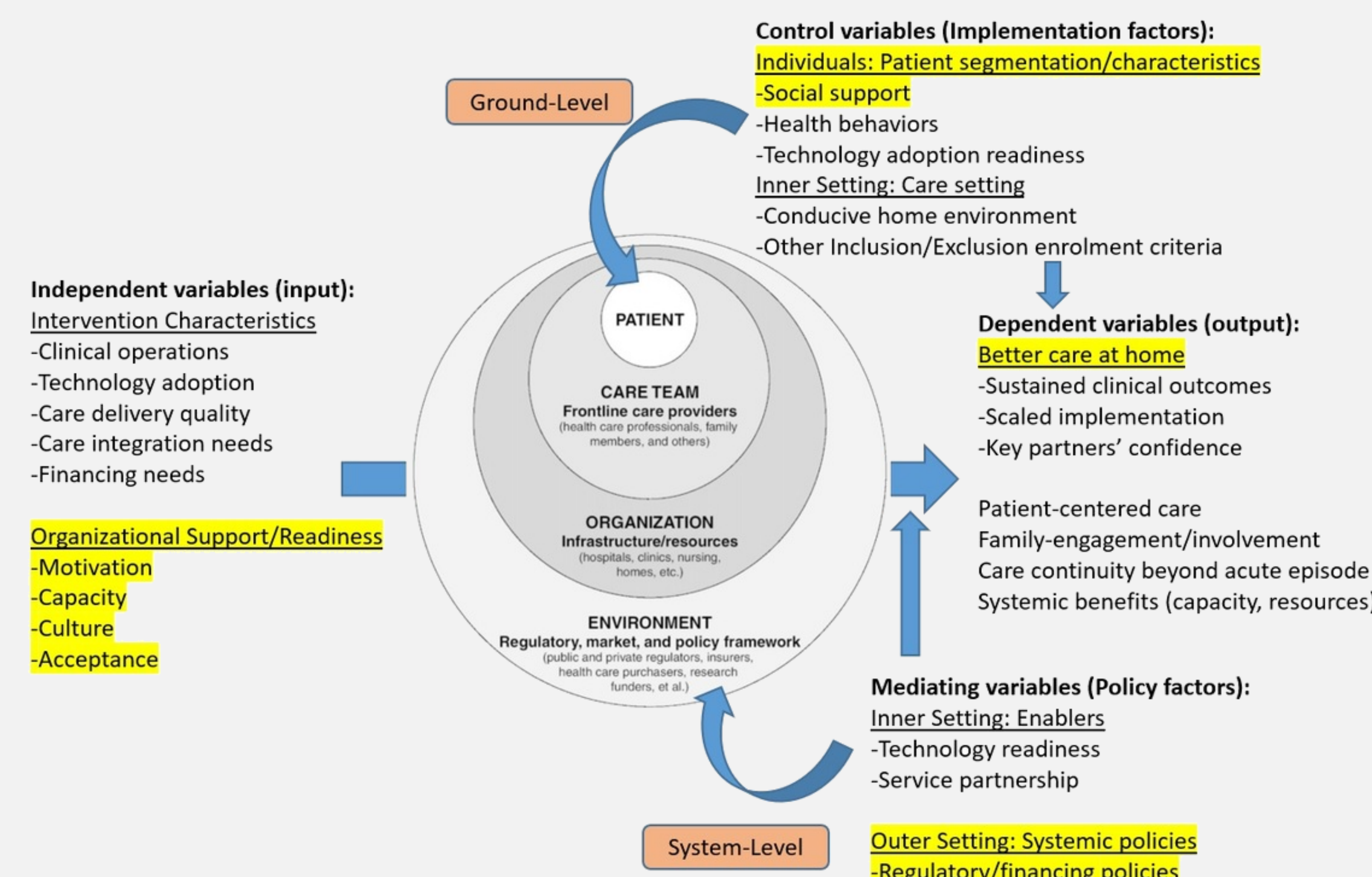


Figure 2: Conceptual model and significant themes

Results

24 participants (6 physicians, 3 nurses, 2 admin personnel, 1 pharmacist, 5 government officials, 6 healthcare professionals from the private sector, and 1 researcher) agreed to be interviewed. All of them agreed that the virtual ward implementation was a good idea, but many implementation-related challenges were surfaced, such as low provider and patient awareness, skepticism, insufficient resources, logistical & operational issues, difficulty in accessing clinical information, and concerns over data security. 7 (29%) participants believe that the virtual ward's sustainability and scalability potential depends on availability, planning, and allocation of resources such as manpower and funds, while 5 (20.8%) participants believed that it would depend on optimal patient selection. 18 (75%) participants believe that Singapore is ready for such a care model.

Following synthesis of the study data and codes (Fig 1), 4 significant themes emerged (Fig 2):

- 1. Perceived better care at home:** Participants shared positive virtual ward experiences and care outcomes, which included comfort, convenience, increased involvement in patient care, engagement with the care team, and perceived improved patient outcomes.
- 2. Importance of social support for successful implementation:** The availability of caregiver support was important for virtual wards. Furthermore, it was common for participants to employ live-in domestic helpers that provided additional support for virtual ward patients. Nonetheless, some family members did express caregiver stress and disruption of daily routine during the virtual hospitalisation period.
- 3. Organizational structures required to support virtual ward care:** This theme summarized the various organizational structures which can support virtual ward processes. This included remote monitoring of vital signs and teleconsultations, the trustworthiness of the care team, the importance of care continuity with private providers, and the affordability of virtual ward care.
- 4. Implementation and policy strategies needed to sustain virtual ward care model:** Although the virtual ward care model offers evidence-informed responses to demand surges, it was not clear how could we implement the care model at scale to complement usual care. Questions around implementation readiness and policy support need to be investigated so that the appropriate strategies could be put in place to facilitate care model acceptance and downstream scale-up efforts.

Discussions

Our study indicated that the shortage of physical hospital beds and resource crunch, especially during the current pandemic, rapidly accelerated the use of innovative interventions. Many healthcare systems in Singapore had undergone digital transformation and expanded healthcare services beyond the hospital by using virtual hospitals or beds. **Healthcare providers could remotely gather clinical information and treat and monitor patients.** This virtual care model is useful, especially during current and future pandemics where there might be a need for social distancing and minimal physical contact to minimize the spread of the infection. **Teleconsultations made care safer and more convenient, allowing consultations to proceed as usual without having to postpone appointments and delay treatment.** This also allowed patients to reduce their hospital admission and continue to receive high-value care. Lastly, it **frees up space in the hospital for patients requiring critical care.**

Given the possibility of future pandemics, Singapore's aging population, and increasingly limited hospital resource capacity in Singapore, it would be logical to trial and scale-up virtual hospital implementations to prepare for subsequent pandemics and ensure sustainability in our healthcare system. This study also found that implementing hospital-at-home services requires **early development of policies, stakeholder engagement, efficient admission processes, effective communication, and a skilled workforce to safely and effectively implement person-centred hospital-at-home, achieve acceptance by staff** who refer patients to these services, and ensure sustainability.