Project Title

New Model of Care – Virtual Ward for Continuity and Remote Patient Care

Project Lead and Members

Project Lead: Assoc Prof Low Lian Leng

Project Members: Juweita Binte Arba'In, Rachel Marie Towle, Tang Woon Hoe, Hazel Lim Jia Hui, Joanne Lee Goh Sai Luan, Jerry Wong, Liu Yong, Lei Xiaofeng, Wang Long, Yang Yechao, Lu Sifei, Rick Goh, Susan Lee, Michelle Tan, Ang Kwok Ann, Chua Kim Chuan, Lee Chen Ee, Franklin Tan, Tan Teck Choon, Joleen Chean

Organisation(s) Involved

Singapore Health Services, Singapore General Hospital, Agency for Science, Technology and Research

Healthcare Family Group(s) Involved in this Project

Ancillary Care, Medical

Applicable Specialty or Discipline

Infectious Diseases

Project Period

Start date: Oct 2021

Completed date: May 2022

Aims

To develop an effective and accessible home-based recovery programme designed to serve medically complex COVID-19 patients

Background

See poster appended/ below

Methods

See poster appended/ below

Results

See poster appended/ below

Lessons Learnt

Realistic requirements

To facilitate early deployment of SGH@Home COVID Virtual Ward to cope with the expected increase in patient admission, decision was made to leverage on existing tools to shorten the prototyping process – Doctor COVID, FORMSG and Telegram. While readily available for use, these tools came with limitations which the team had to be mindful of during requirements gathering to minimise rework or wasted efforts which could delay the development timeline. These include ensuring that:

- The integrated solution supported the streamlined workflow processes
- Data transmitted were in line with data and cybersecurity guidelines
- Patients would be able to cope with the self-reporting of vital sign requirements and understand the auto-generated reminders/messages sent to them without information overload

Importance of collaboration

SGH and SingHealth collaborated with A*STAR/IHPC to develop SGH@Home COVID Virtual Ward. A*STAR/IHPC was pivotal in conceptualising the solution's software architecture, which detailed information on data flow and storage, and developed functionalities of the Bot. On top of developing a patient-centric Bot, A*STAR/IHPC was also key in the creation of a staff-centric dashboard which enables medical team, including our external partner, to grasp colour-coded information and render care/intervention to patients promptly.

The multi-disciplinary team conducted SPRINT sessions, user acceptance tests, identify areas for improvement, iterate and refine the workflow processes. The team

has also put together a user guide that could be used to train extended team members as more patients satisfy the eligibility criteria of SGH@Home COVID Virtual Ward.

The open communication has allowed the multidisciplinary team to overcome the tight timeline, and work cohesively toward the common goal of serving the public better. The shared goal and common vision of having a user-friendly and highly customized system was the driving force, keeping the team in focus throughout the development. Mutual understanding, trust, dedication and patience was evidently demonstrated as the team overcome challenges and difficulties developing and implementing a new system in torrential times

To do differently

Pre-emptively enhance accessibility to the Dashboard by putting in whitelist request for SGH@Home COVID Virtual Ward domain in advance, such that the care team would be able to access it via their corporate laptops. Designed the software architecture differently such that it facilitates scaling of the solution to other institutions. In view of the deployment timeline, the team had opted to tap onto an existing Amazon Web Services setup for another project. However, this posed some challenges down the road as more institutions came onboard and the architecture framework and costing structure grew increasingly complex.

Conclusion

See poster appended/ below

Additional Information

SGH@Home COVID Virtual Ward was adopted by Changi General Hospital for a similar home recovery programme for C+ patients and work is in progress to adapt this model of care for other use cases, ensuring that the redesigned workflow process remains sustainable in the long run.

Project Category

Care & Process Redesign, Value Based Care, Patient Satisfaction, Productivity, Cost Saving, Manpower Saving, Access to Care, Bed Occupancy Rate, Quality Improvement, Workflow Redesign

Care Continuum, Intermediate & Long Term Care & Community Care, Home Care

Technology, Digital Health, Telehealth, Tele-Monitoring, Tele-Collaboration

Keywords

Virtual Ward, Home-based Recovery

Name and Email of Project Contact Person(s)

Name: A/Prof Low Lian Leng

Email: low.lian.leng@singhealth.com.sg

New Model of Care – Virtual Ward for Continuity and Remote Patient Care

Juweita Binte Arba'In[1], Rachel Marie Towle[1], Tang Woon Hoe[1], Joanne Lee[1], Goh Sai Luan[1], Jerry Wong[1], Liu Yong[2], Lei Xiaofeng[2], Wang Long[2], Yang Yechao[2], Rick Goh[2], Susan Lee[1], Ang Kwok Ann[1], Chua Kim Chuan[3], Lee Chen Ee[3], Franklin Tan[3], Tan Teck Choon[3], Joleen Chean[3], Michelle Tan[1], Low Lian Leng[1]

[1] Singapore General Hospital; [2] Agency for Science, Technology and Research; [3] Singapore Health Services

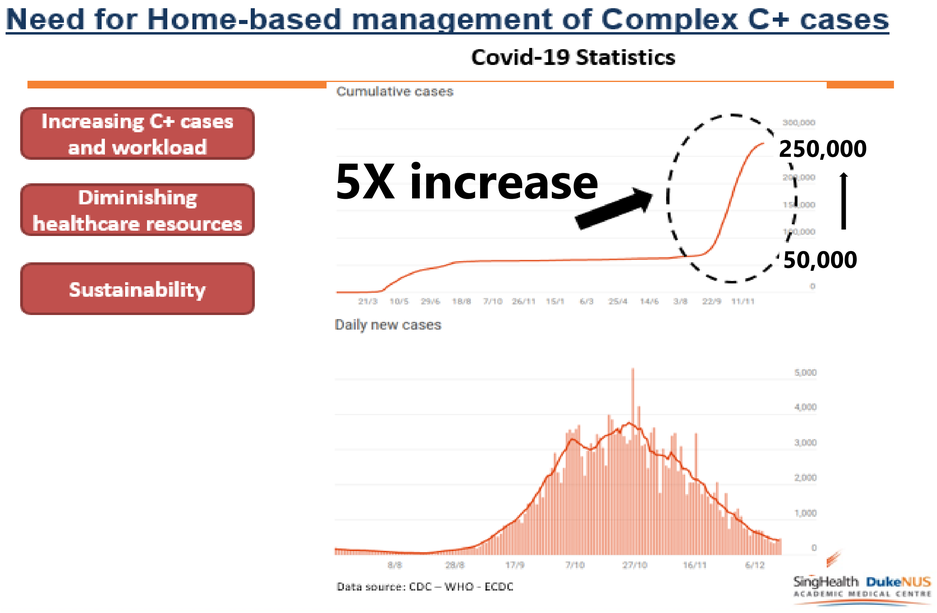
BACKGROUND

At the peak of the ongoing COVID-19 pandemic, the exponential demand for diminishing healthcare resources have catalysed the SGH@Home COVID **Virtual Ward, an effective and accessible home-based recovery programme** that enables COVID-positive (C+) patients who do not meet the eligibility criteria for standard home recovery programmes to recuperate in the comfort of their homes.

The enhanced Doctor COVID solution comprising **(a)** FormSG for onboarding, symptoms and vital signs gathering, **(b)** Dashboard for patient monitoring, and **(c)** Telegram bot for communication, engagement and education of enrolled patients.

This was agilely developed by the multidisciplinary team comprising personnel from Singapore General Hospital (SGH), Singapore Health Services (SingHealth), and the Agency for Science, Technology and Research's Institute of High Performance Computing (A*STAR/IHPC) **to serve medically complex C+ patients in just 3 weeks from the formation of team**, while **ensuring the solution is interweaved with the streamlined operational workflow processes and making it sustainable**.

Need for Home-based management of Complex C+ cases



AGILE METHODOLOGY

- **REQUIREMENTS GATHERING** – Identify project goals and deliverables.
- **EXPLORE & DESIGN -** Review current workflow processes, developed a set of criteria to identify eligible patients who would benefit from the new model of care – Virtual Ward.
- **DEVELOP & ITERATE** – Continuous improvement to refine and close gaps in order to satisfy evolving needs.
- **DEPLOY & REFINE** – Identified gaps that need to be addressed.

REULT & BENEFIT$

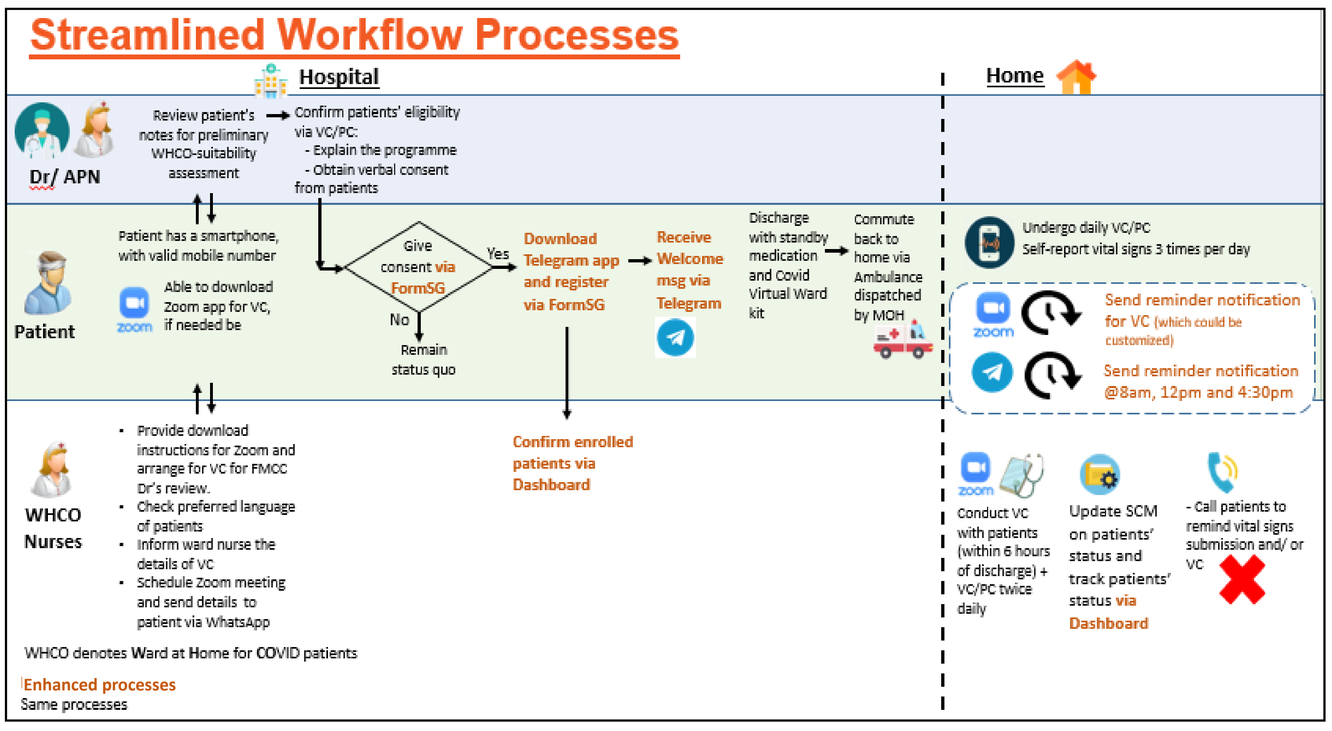
Improved productivity, with

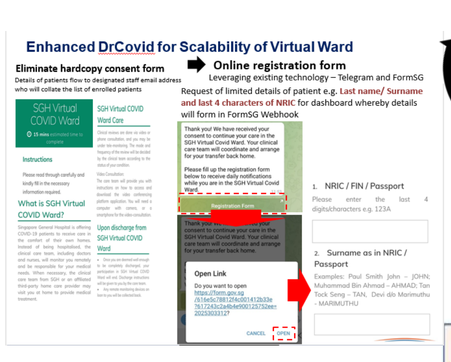
- ✓ **Patient Consent is digitised and easily retrievable**
- ✓ **Eliminates need to manage patient enrolment manually via Paper / Excel spreadsheet**
- ✓ **Eliminates need to remind patients via text messages and call thus allow healthcare workers to focus on more urgent and higher value added activities**

Within 7 months of project deployment (as of 31 May 2022), and despite of limited healthcare resources, the SGH@Home has:

- ✓ **Benefitted 635 patients (as well as their caregivers)**
- ✓ **Gained manpower productivity of 102 man days**
- ✓ **Saved of over $4.1M from 4,151 bed days**
- ✓ **Conducted over 1,000 video-consult sessions**
- ✓ **Enabled upscale of Virtual Ward capacity**
- ✓ **Facilitated early inpatient discharge**
- ✓ **Improved satisfaction**
- ✓ **Streamlined workflow processes**

as well as deepen collaboration spirit with partner

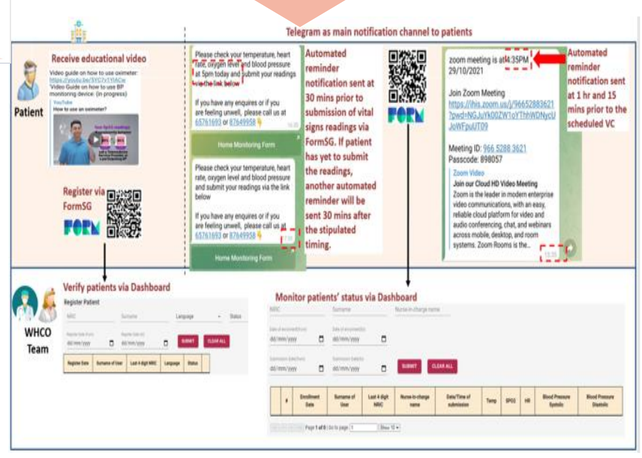




Real time registration, vital signs submissions and automated reminder notifications, interfaced with user friendly dashboard

"Specially thanks to Doc Grace and Nurse Sharon care during my IO at home. I have been well taken care of... they monitored my condition very closely and provide helps when my condition not in stable condition" (Patient 001, Female)

"SGH provided very good care and service from the time I was hospitalised to the time I was discharged...The team provided efficient care, helped me recover and prevented my condition from deteriorating.... And followed up on me closely during my home recovery period" (Patient 002, Male)



CONCLUSION

SGH@Home COVID Virtual Ward initiative has leveraged the original Doctor COVID[4] to better reach out, engage and care for non-Covid-19 patients. The initiative not only benefitted patients, their caregivers and saved scarce isolation bed days in SGH during the pandemic but reduced burnout experienced by healthcare workers who have been fighting against COVID-19 since 2019. **With the streamlined workflow processes, 635 patients had benefited, 102 man-days saved and 4,151 bed days (~$4.1M) saved within a short span of 7 months**.

The initiative has also '***future-proofed***' **workflow processes even as new COVID-19 variants surface**. Further, it has been scaled to other healthcare institutions and work is in progress to adapt this model of care for other use cases, making the entire workflow processes sustainable.

[4] Doctor COVID is a Telegram bot first developed in 2020 to improve operations and care for multilingual C+ patients admitted to Community Care Facilities.