Sustainable transformation

US National Academy of Medicine
Workshop on Science & Technology for Healthy Longevity

Adj A/Prof Selina Seah
17 Jun 2021
Rapidly changing demographics

Rapidly ageing population in Singapore

Proportion of population 65 and older (projected to 2050)

- Decrease in old age support ratio
  More elderly are living alone, with an increase in demand for chronic disease management

- Shrinking & Ageing Workforce
  Insufficient healthcare professionals to meet growing demand

- Rising Healthcare Costs
  Increasing load on healthcare system and burden on healthcare workers and patients

Sources: UNITED NATIONS POPULATION DIVISION  ST GRAPHICS
Agenda for Healthy Longevity

Transforming healthcare delivery through new care models:
Care pathways from acute to long-term / community care settings to promote age well

Augmenting capabilities and enhancing productive longevity:
Through automation & smart technologies to safe work environment, including for older workers

Enabling clinical innovation & smart healthcare:
Developing the ecosystem to deliver user-centric solutions
• Redesigning infrastructure and enablers, such as smart wards and smart homes
• Motivating right behaviors and assistive technology
Different context, similar technology

From this...
Structured infrastructure, Controlled environment
Technically trained operators

To this...
Diverse infrastructure, Dynamic environment
Long regulatory path and protracted acceptance
How transformation happens… wait a moment!

- Triage
- Diagnosis
- Interventions
- Monitor
- Treatment plans
- Resource constraints
- Communications

... Python, Java, C++, DOF, Ubuntu, CAD, HL7, Ruby, GUI, Machine learning, neural networks, digital twin, AI

Clinicians → Something happens here → Solution developer (industry / academia)

Problems solved
We can use this thing

- Balas and Bohen and Grant, et al both estimate 17 years time lag from discovery to commercialization
Supporting needs-driven transformation

- Identifying user challenges & requirements
- Envisioning healthcare workflows to meet future healthcare demands.

- Steer IHLs/RIs emerging robotic technologies to be applicable for healthcare
- Work with companies to develop solutions that effectively address healthcare needs

Implementation Science
- Facilitate the adoption of evidence-based practices into clinical/routine workflows
- Assess naturalistic variability or measure change in response

Understand our community

- Guided by data
- Understanding the needs of the community
- Population based approach
- Health-social teams
- Customised care delivery for each community

Beyond Sickness to Health
- Screening for Chronic Diseases
- Functional Screening
- Community Mental Health Care

Beyond Hospital to Community
- Neighbours for Active Living
- Community Nursing / Community Nurse Post

Beyond Brick & Mortar to Digital
- CareLine
- Health Management Unit
- Telehealth

- Keep well, get well, age well
- Telehealth & digital care
- Together with the community
Health Management Unit

Telecare for chronic disease management

Telecarers (trained nurses) provide regular phone support to patients with diabetes, COPD, heart failure, hip fracture and acute myocardial infarct.

**Tele-monitoring**
Monitor parameters such as blood glucose, pulse rate, blood pressure and weight.

**Tele-education**
Patients are educated on how to recognise and manage symptoms.

**Care Coordination**
Telecarers coordinate patients' care with partners: polyclinics and GPs, case managers, psychologists, AHPs, ILTC sector.

**Patient Relations Management IT system**
Alerts telecarers when patients visit the A&E, are admitted to the hospital, miss their follow-up appointments, or have any abnormal lab results.

Early intervention and follow-up care

Brick/Mortar to Digital

Sickness to Health

Hospital to Community
Telehealth “Pod”

- Tablet/Desktop
- BP Monitoring Set
- Thermometer
- Glucometer
- Pulse Oximeter
- Weighing Scale

Onboarding of seniors:
- Schedule an appointment
- Telehealth consult

Community Nurse:
- Remind senior about teleconsult
- Assist/guide senior during teleconsult

Partners:
- Schedule an appointment
- Telehealth consult
Understand what technology offers

- **Assistive Technologies** enabling community care
- **Precision Robots** assisting procedures
- **Autonomous Technologies** automating logistics
- **Rehabilitation Technologies** restoring functionality
- **Behavioural Modules / Training Simulation**
Scaling automation with the Robotics Middleware Framework

Developed the world’s first robotics middleware framework in Singapore, with an operational healthcare version RoMi-H

RoMi-H will enable and accelerate large scale deployment of heterogeneous fleets of robotics, leveraging new safety standards and universal charging systems developed in Singapore.
Incorporation of Robotics Requirements in MEP Design Guide

- CHART works with MOHH to update the Healthcare MEP Design Guide to incorporate infrastructure requirements for robotics deployment in new healthcare facilities.
- Safety standards and guidelines on the use of robotics in hospitals and the use of universal charging infrastructure for robotic devices to be incorporated in the MEP Design Guide for new hospitals.
- Updated MEP Design Guide targeted to be published in 2021.
Building libraries on impact of technology to care

• Using social robots to stimulate patients physically and cognitively & for patient education
• Serves as assistant to healthcare staff – latter can focus on patient safety & content development without the “manual” work
• Measure the impact to develop value-driven care
Distance walked during conventional physiotherapy (PT) and robotic therapy

Distance ambulated (meters) during conventional PT and with Andago®

Published in Annals, Academy of Medicine, Singapore
Understanding what our staff needs

Personal Care
- Robots at home / in community

Environment
- In-patient Wards – Patient transfer
- Pharmacy – Medication dispensing

Operation/Contact
- Trained healthcare staff only
- Healthcare staff + Patient/NoK

Enclosed

Rehabilitation
- Service robots

Logistics
- Telepresence robots
- Operating Theatre – Surgical robotics

Disinfection
- Cleaning robots
- In-patient Wards – Last-mile delivery

Rehabilitation
- Walking Aids / Exoskeletons

Personal Care
Robots at home / in community
Simulating with people, context & environment in mind

- Prototyping spaces to simulate care settings
- Observe interactions between human vs machine
Simulating with people, context & environment in mind

AI Sandbox
Pre-processing and model training workstations for data science and AI projects

Virtual Test Farm
Development of full-scale hospital simulation for operational efficiency & planning, validation testing, discrete event simulation, etc.

Prototyping Lab
Rapid prototyping to allow re-finishing of actual solutions developed (soldering, 3D printing, robot arms etc.)
Partnering to Build an Ecosystem of Care

Individual Needs

Community/Population

Social Service Agencies

Community Development Councils & Grassroots

National Agencies

Community Hospitals & Nursing Homes

SingHealth/CGH

Volunteers

GPs

Health

Financial

Social

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Thank You

chart@cgh.com.sg