Singapore's Telerehabilitation Experience: Preliminary Results & Steps Forward

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Research

Clinical Care

MINISTRY OF HEALTH SINGAPORE

MOH HOLDINGS

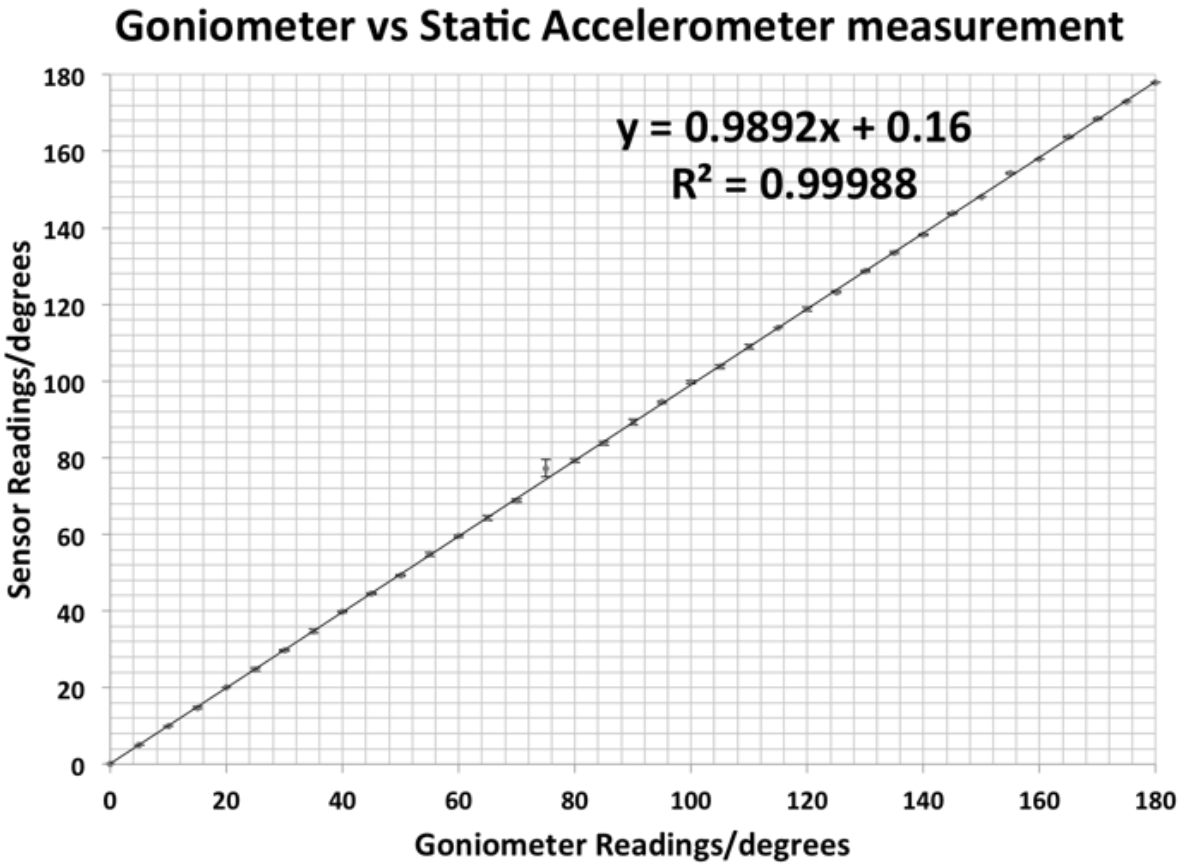
Education

Mdm Doris Zen’s Story

PMO - Tele-Rehab video - Mdm Doris Zen's Story Cut 4-HD.mp4

How It Works

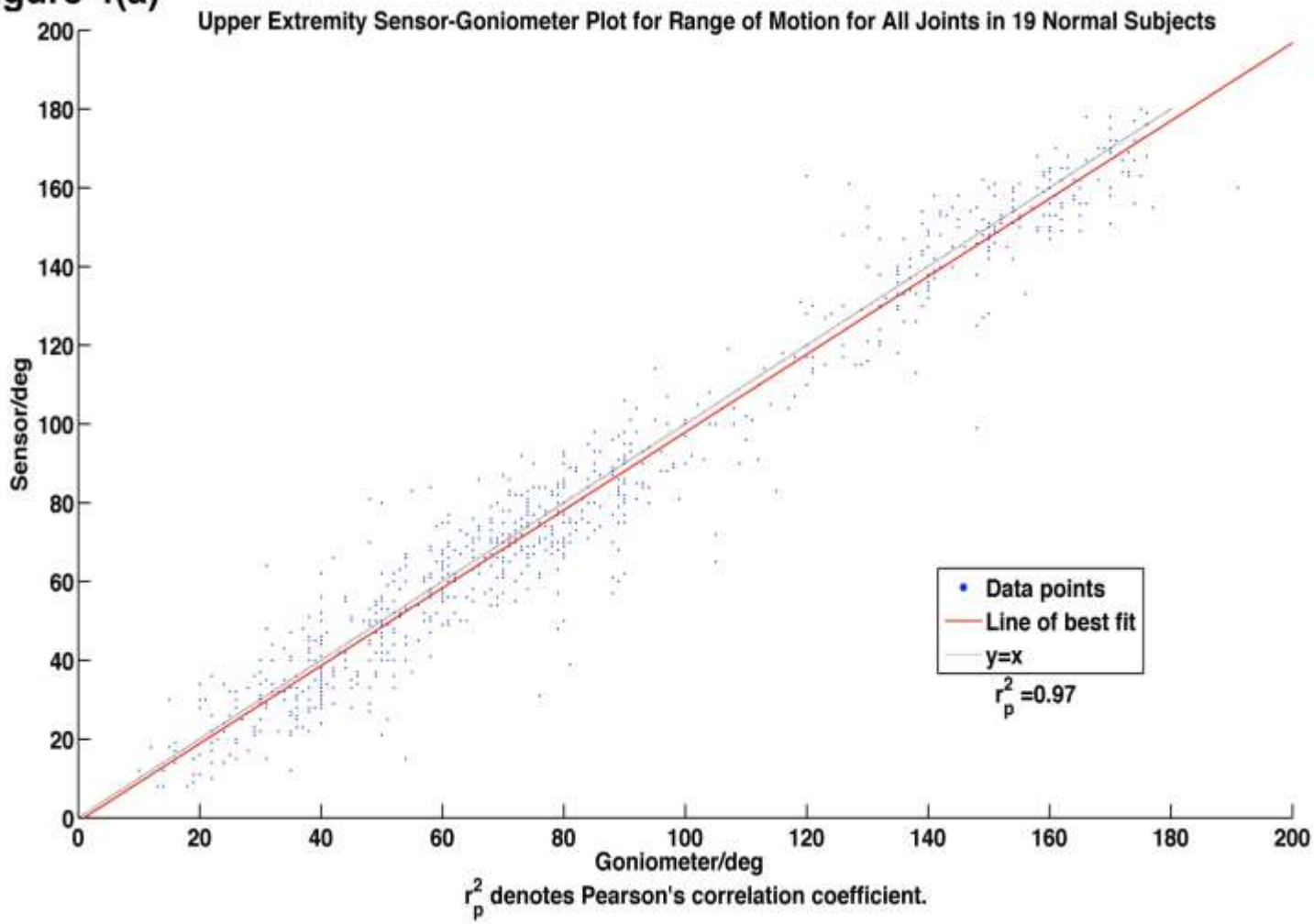
Accuracy of Sensors



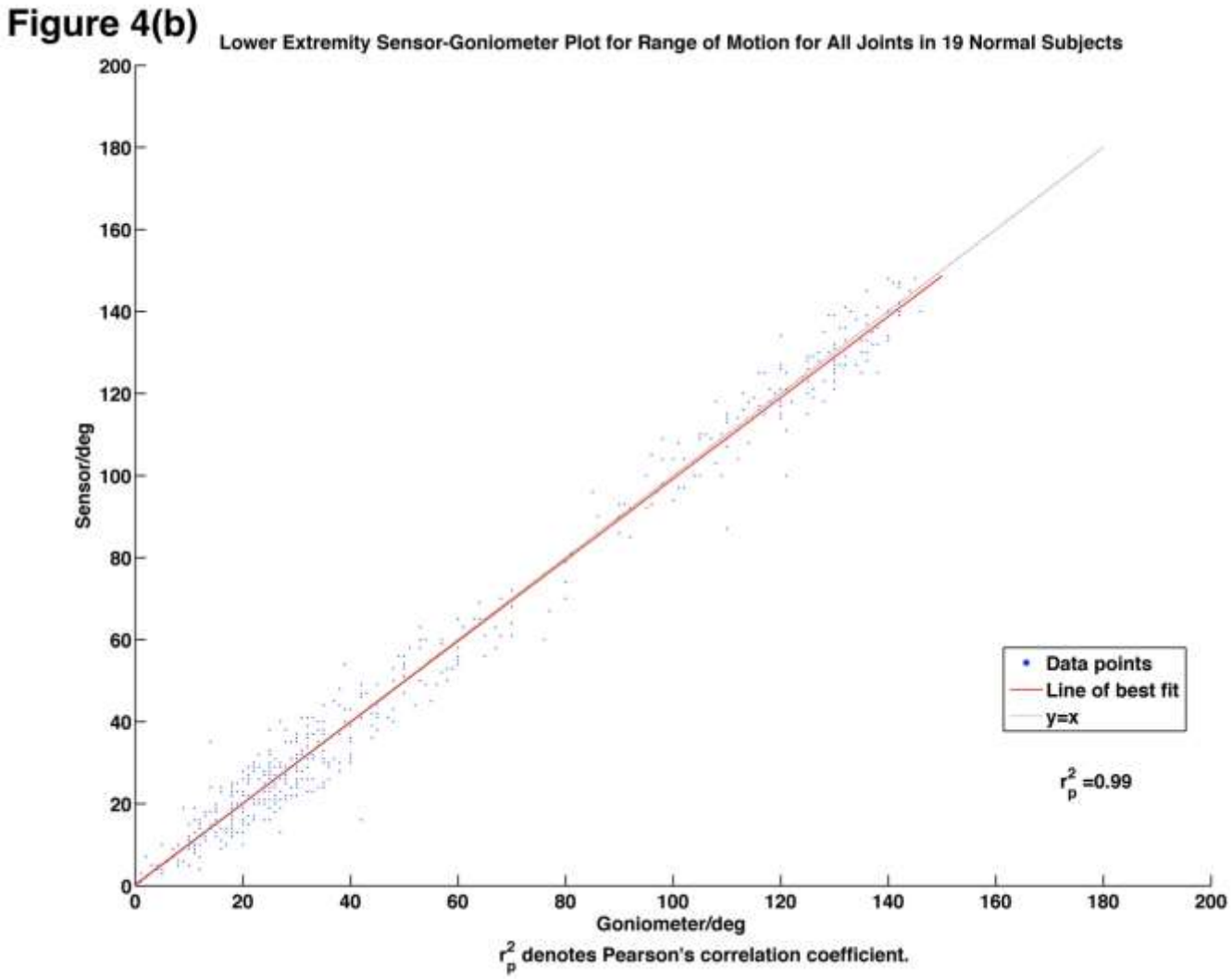
Kumar Y, Yen SC, Tay A, Lee WW, Gao F, Zhao ZY, Li JZ, Hon B, Xu TTM, Cheong A, Koh K, Ng YS, Chew E, **Koh GCH**. A wireless wearable range-of-motion sensor system for upper and lower extremity joints: A validation study. *Health Technology Letters*. 2015.

Accuracy of Sensors (Upper Extremities, UE)

Figure 4(a)



Accuracy of Sensors (Lower Extremities, LE)

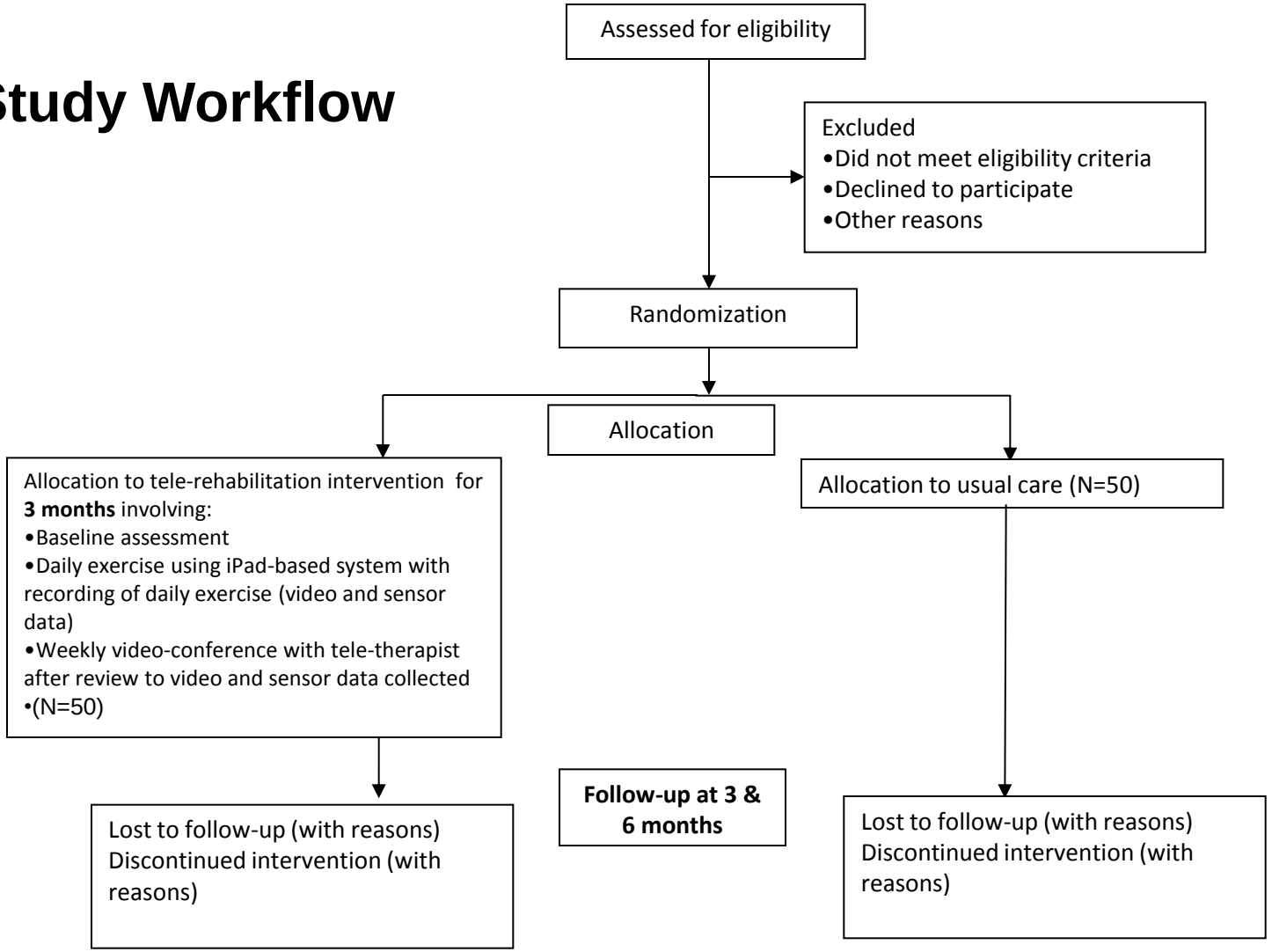


Singapore Tele-technology Aided Rehabilitation in Stroke (STARS) Study: A Randomized Controlled Trial

Primary hypothesis

Among stroke survivors, a tele-rehabilitation intervention involving video-conferencing with a therapist and use of wearable monitoring devices during the first three months after stroke results greater functional recovery at three months, compared to usual care.

Study Workflow



Preliminary Results

- The primary time-point for outcomes in the RCT is 3 months and the target size is 50 controls and 50 intervention subjects.
- These are the results of an interim analysis of 30 subjects recruited so far (14 control and 16 intervention subjects) as of end 2014.
  - Of the 14 control subjects, 2 subjects defaulted follow-up, leaving 12 control subjects available for analysis for data at 3 month time-point.
  - Of the 16 intervention subjects, 2 subjects defaulted follow-up, leaving 14 intervention subjects available for analysis for data at 3 month time-point.
- Statistical significance cannot be assessed in this interim analysis because target sample has not been reached and hence current sample size is not powered.
- This interim analysis only reports preliminary primary findings.

Difference in Barthel Index (BI) score between baseline and three months

Group	Mean Change	Interpretation
Usual Care	-0.75	The telerehabilitation group improved in the functional status by 9.07 BI points while the usual care declined by 0.75 BI points.
Telerehabilitation)	+9.07	

(Barthel Index (BI) ranges from 0 to 100. The higher the improvement in Barthel Index score, the greater the functional improvement.)

Difference in Barthel Index (BI) score between baseline and six months

Group	Mean Change	Interpretation
Usual Care	+2.4	The telerehabilitation group continued to improve between 3 and 6 months, even after tele-rehabilitation ended at 3 months.
Telerehabilitation)	+11.50	

(Barthel Index (BI) ranges from 0 to 100. The higher the improvement in Barthel Index score, the greater the functional improvement.)

Attendance at day rehabilitation centre during study

- At recruitment, 41.7% of controls were going for day rehab but only 14.3% of telerehab subjects were going for day rehab which is expected as the telerehab group were already receiving telerehab.
- In contrast, at three months, 33.3% of controls were going for day rehab (a drop from 41.7%) but 64.3% of telerehab subjects (an increase from 14.3%) continued rehabilitation (after telerehab stopped) by going for day rehab.

Attendance at day rehabilitation centre during study

- It seems that without telerehab, patient in usual care remain disabled and possibly become unmotivated/discouraged from not seeing improvement or continue to face physical barriers to getting to day rehab centre from persistent disability, and stop going for rehab.
- In contrast, the tele-rehab group improves in physical function and possibly starts a positive feedback cycle whereby they become more independent and more motivated to do more rehab to the extent that when tele-rehab stops at 3 months, they choose to continue rehab at the day rehab centre thereafter, and continue to improve in functional recovery at 6 months.

Preliminary Trial Results

- It is estimated that the target size of 50 controls and 50 intervention subjects will be reached by June 2016.
- So the preliminary results suggest that telerehabilitation works.
- Logic tells us that it overcomes physical, social and financial barriers.
- However, does it increase efficiency of therapists and save time for caregivers?
- We also conducted a **time motion study** comparing the time spent and tasks executed during telerehabilitation in comparison with centre-based and home rehabilitation.

Time Motion Study

- A time motion study is a work measurement technique consisting of careful time measurement of the task with a watch, adjusted for any observed variance from normal effort or pace and to allow adequate time for such items as foreign elements, unavoidable delays, rest to overcome fatigue, and personal needs. (Industrial Engineering Terminology Standard)

- We quantified the time spent by therapists and their therapy assistants, if applicable) on tasks of a typical rehabilitation session with a stroke patient who may be usually accompanied by a caregiver such as a family member or domestic helper, in the 3 settings:
  1. Home rehabilitation;
  2. Centre-based rehabilitation;
  3. Telerehabilitation

Time Motion Study Results

	Mean Time Spent per Therapist Session (mins)	
	Therapist	**Caregiver**
Day Rehabilitation	70	135
Home Rehabilitation	86	12
Tele Rehabilitation	30	15

Singapore's Telemedicine Climate

- Health IT Master Plan
  - National Electronic Medical Record (EMR) System
  - Infra-structure [e.g. New Generation Broadband Network (NGBN)]
  - Telemedicine
    - National Telemedicine Guidelines
    - Telemedicine Implementation Strategy

Singapore's New Generation Broadband Network (NGBN)

- Singapore's all-fibre ultra-high-speed broadband network, a project under the Infocomm Development Authority of Singapore (IDA), that is capable of delivering speeds of 1Gbps and above, to all homes, offices and schools to offer pervasive connectivity around Singapore.

National Telemedicine Guidelines (NTG)

- The National Telemedicine Guidelines (NTG) was developed over a year with guidance of the National Telemedicine Advisory Committee (NTAC).
- The NTAC comprised of leading Telemedicine practitioners of Singapore spanning almost all health sectors, disciplines and care settings.
- The Committee also had representation from professional bodies like Academy of Medicine, Singapore (AMS), College of Family Physicians, Singapore (CFPS), Pharmaceutical Society of Singapore (PSS), Case Management Society of Singapore (CMSS), and Office of the Chief Nursing Officer (CNO).
- The NTAC met on a regular basis to work on develop the guidelines using literature and lessons from international precedents (Australia, Canada, Japan, and U.S.).

National Telemedicine Guidelines (NTG)

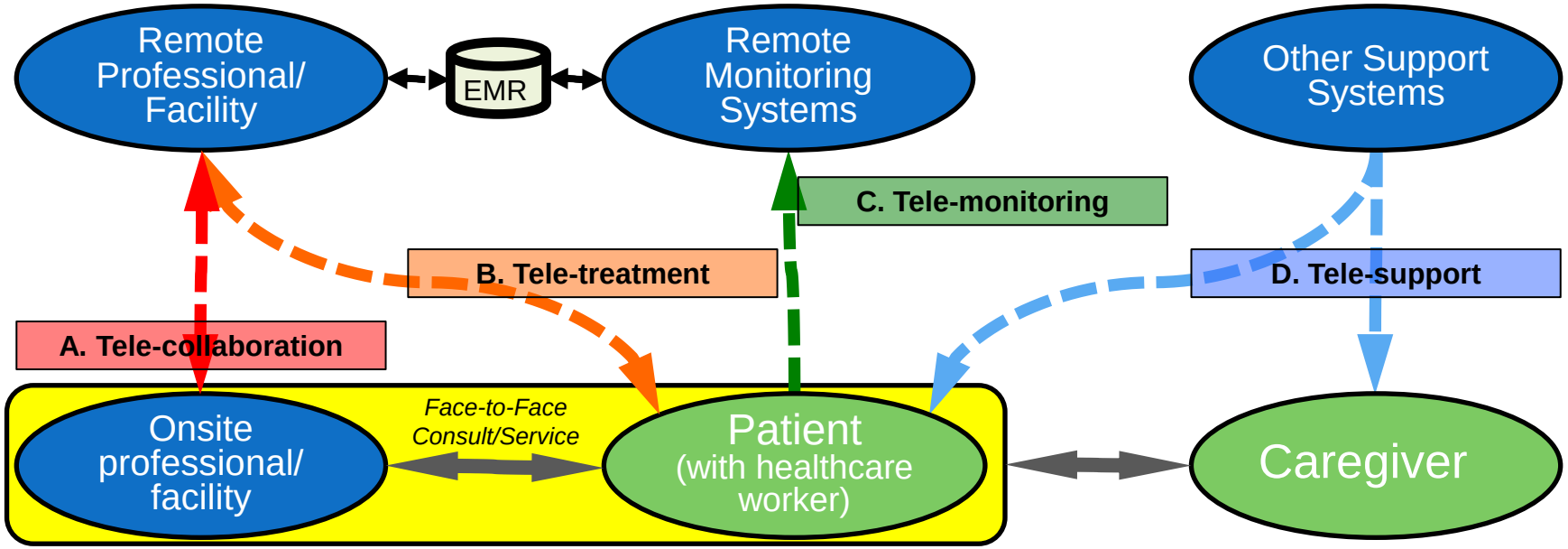
- The NTG and distinguishes between 4 main dimensions/domains of Telemedicine:

    1. Tele-collaboration: The distinguishing feature is that healthcare professionals are involved at both ends of the interaction (e.g. teleradiology and telepathology)
    2. Tele-treatment: The distinguishing feature is that a patient or caregiver is involved directly at one end of the interaction and this creates (or presupposes the existence of) a professional-patient relationship (e.g. telerehabilitation, telegeriatrics, telepsychiatry, teledermatology).

National Telemedicine Guidelines (NTG)

3. Tele-monitoring: The distinguishing feature is that a healthcare professional or organisation is engaged at one end (and excludes self-monitoring where the patient or the caregiver collects health data but does not have a healthcare provider involved at the other end as part of an organized arrangement) [e.g. management of hypertension (blood pressure), diabetes (blood glucose) and heart disease (weight, ECG)].
4. Tele-support: Refers to the use of online services for non-clinical (i.e. educational and administrative) purposes to support the patient, and caregiver. Examples include health education, care administration and the use of treatment prompts in chronic disease management. Tele-support is generally not addressed in the NTG which focuses on the key activities that are regulated for patient safety reasons.

Four telehealth domains as defined by National Telemedicine Guidelines



A. Tele-collaboration

Definition

Collaboration between (facility-based or mobile) onsite and remote healthcare professionals/providers

Processes

Referral, co-diagnosis, supervision, case review

Examples

Radiology, dermatology (imaging)

Any speciality (peer consultation, case reviews, clinical case conferences)

Supervision or consultation for mobile clinical services eg home care, mobile laboratory, etc

B. Tele-treatment

Definition

Direct clinical care processes between remote healthcare professionals/providers and patients/caregivers

Processes

Triage, history, examination, diagnosis, treatment, surgery

Examples

Cardiology, geriatrics, neurology, nursing, psychiatry, rehabilitation, surgery, therapy

Triage, nursing, audiology

Email / messaging correspondence

C. Tele-monitoring

Definition

Biomedical and other data collection by remote systems from patients (or through caregivers)

Processes

Vital signs, investigations, biomedical data

Examples

Hypertension (bp), diabetes (blood glucose), coronary heart disease (weight, ECG), post-stroke (INR), asthma, COPD (oxygenation)

D. Tele-support

Definition

Online services to support patients/caregivers eg education, peer support, other administration, etc

Processes

Health education, care admin, treatment prompts

Examples

Elderly frail

Mental health

Any chronic disease

Source: Dr Jason Yap, AIC (*modified*)

Tele-rehab – Patient journey

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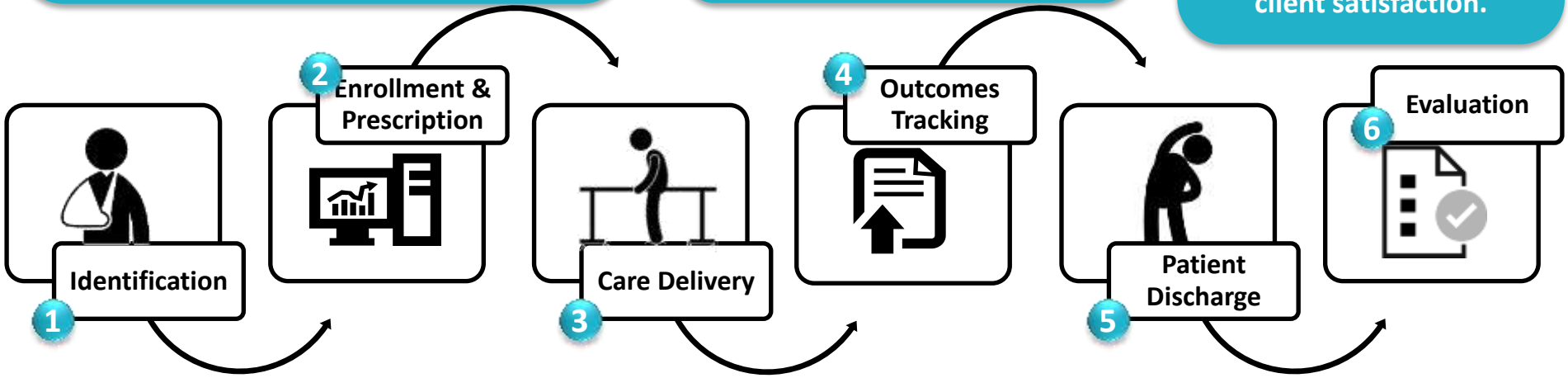
Enrolling patients for tele-rehabilitation through AIC IRMS, taking consent, and making advanced payment. Therapists can prescribe relevant rehabilitation exercises according to patients' conditions. Patients can make and modify appointment.

Tracking of tele-rehabilitation history, enabling therapists to review and generate patients' progress reports.

Evaluating the effectiveness of tele-rehabilitation (e.g. through compliance, clinical indicators or client satisfaction.



Identifying who is referred for tele-rehabilitation, assess patients' conditions, and determine subsidy eligibility.

Involving an initial home visit for set up of equipment at patients' home, and users training; daily recording of patients using tele-rehabilitation system to perform the prescribed exercises; and weekly virtual consults . Therapists n adjust prescribed exercises according to patients' progress.

Returning the equipment to provider, and for therapist to arrange follow up care for patients

Common workflow for Tele-rehab

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Identification

Patient Identification

- Restructured hospitals
- Community hospitals
- Nursing homes
- Day rehab centres
- Polyclinics
- Home care on CHAS
- GPs on CHAS

Stratification

- Disabling conditions, functional status
- Patient profile, caregivers availability

Subsidy Eligibility

- Subsidies (financial info, means-testing)

Enrollment & Prescription

Patient Information

- AIC IRMS (personal particulars, referral source, medical history)
- Patient consent

Care package

- Condition specific rehab prescription
- Service package (with/without iPad)
- Treatment duration

Appointment booking

- Book/modify via phone call to referring agency

Billing & payment

- Treatment costs
- Subsidies
- Medisave, insurance

Care Delivery

Inventory Management

- Inventory mgnt
- Link device to patient
- Device collection

Set up & training

- Installation (onsite)
- User training (onsite/online)
- Technical support (onsite/online)

Therapist Consultation

- Video conferencing
- Recording
- Exercise prescription
- Therapist specific "to-review" list

Reminders & notification

- Appointment reminder
- Event outcome notification

Outcomes Tracking

Data Transmission

- Transmit data via 3G/4G gateway, wifi

Tracking

- Patient treatment compliance status
- Patient progress status
- Capture of exercise video record
- Clinical notes (observations, prescription)
- Therapist time
- Integration to EMR/ NEHR

Alert

- Sub-optimal rehab exercise movement detection (Analytics)

Patient Discharge

Reports

- Discharge summary
- Referral letters
- Integration to EMR/NEHR

Inventory collection

- Delink device(s)
- Return of equipment

Evaluation

Programme Effectiveness

- Tele-rehab sessions actualised
- Interventions actualised
- Tele-rehab indicators
- Patient functional recovery

Patient Satisfaction

- Patient satisfaction survey

Steps Ahead…

- Proof-of-value (POV) project to roll out tele-rehab:
  - To addition sites: acute hospitals, community hospitals, day rehab centres
  - In various care settings: inpatient; outpatient; and patient's home
- Aim to:
  - Increase therapists and patients' exposure to tele-rehab as a new rehab care model
  - Evaluate effectiveness (productivity gain, quality of care)

Thank you

Any questions?

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