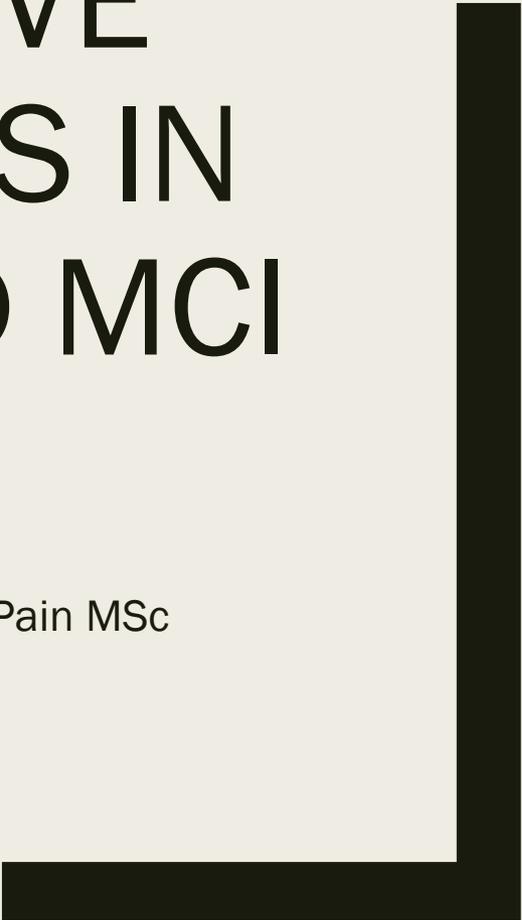




# NEW ASSISTIVE TECHNOLOGIES IN DEMENTIA AND MCI CARE

Dr. Stephen Lee-Cheong MB BCh BAO PgCPain MSc  
PGY-2 Psychiatry Resident  
University of Saskatchewan



# Conflicts of Interest

- Employee of University of Saskatchewan
- No relationship with any technology companies or ATs

# Table of Contents

- The Burden of Care
- New Assistive Technologies (ATs)
  - *Types and Benefits of ATs*
- Barriers to AT implementation
- Areas of future research

# Dementia

- Global cognitive dysfunction manifesting in difficulties with ADLs
- Results in a vulnerable population that often don't have proper support
- Global incidence in 2015 was 47 million
- Global incidence predicted to be
  - *75 million in 2030*
  - *132 million in 2050*
- Dementia is a key social and health emergency

# Dementia Care

- Slow progression of disease
  - *Socialization*
  - *Mentally stimulating activity*
  - *Physical exercise*
  - *Balanced diet*
- Ultimate goal is to attain high QOL

# Social Isolation

- High risk of discontinuing ADLs being socially isolative
- Contributing factors to social isolation
  - *Stigma*
  - *Loss of independence*
  - *Difficulty accessing public spaces*
- Believed that 70% is due to lack of confidence rather than functional limitations
- Empower and motivate patients to maintain independence and ability to function

# MCQ

■ Around how many PwD are institutionalized?

A. 20%

B. 40%

C. 60%

D. 80%

# The Burden of Care

- ~40% of PwD are institutionalized
  - *Costs \$315 Billion worldwide/year*
  - *Ontario long-term care homes cost \$1900 - \$2700/month*
  - *2022 Ontario average salary \$4700 - \$5300/month before tax*

# The Burden of Care

- ~60% of PwD live at home
- Family caregivers spend 20-40h/week caring for PwD
- Lay-caregivers found to have poorer biopsychosocial health
- Stress comes from
  - *Medication management*
  - *Patient memory loss*
  - *Hygiene care*
  - *BPSD*
- Demand for novel methods to improve care and decrease current gaps in care

# Assistive Technologies (ATs)

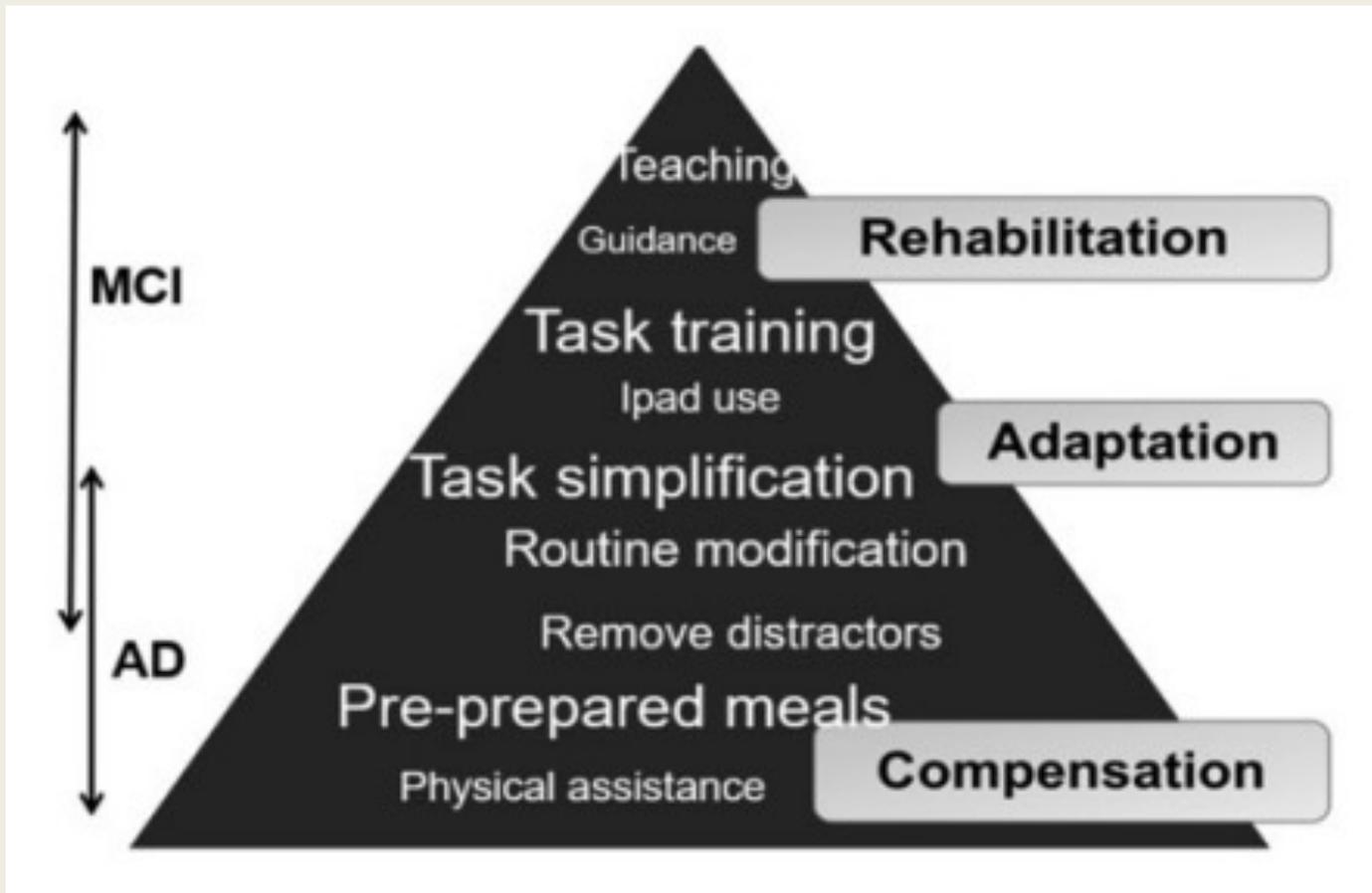
- Technological advancement
  - *GPS*
  - *Smart phones*
  - *Smart homes*
  - *Artificial Intelligence*

# MCQ

- What are some potential benefits of using ATs
  - A. Increase access to care
  - B. Improve patient independence
  - C. Reduce health care costs
  - D. Reduce caregiver burnout
  - E. All of the above

# Goals of Assistive Technologies (ATs)

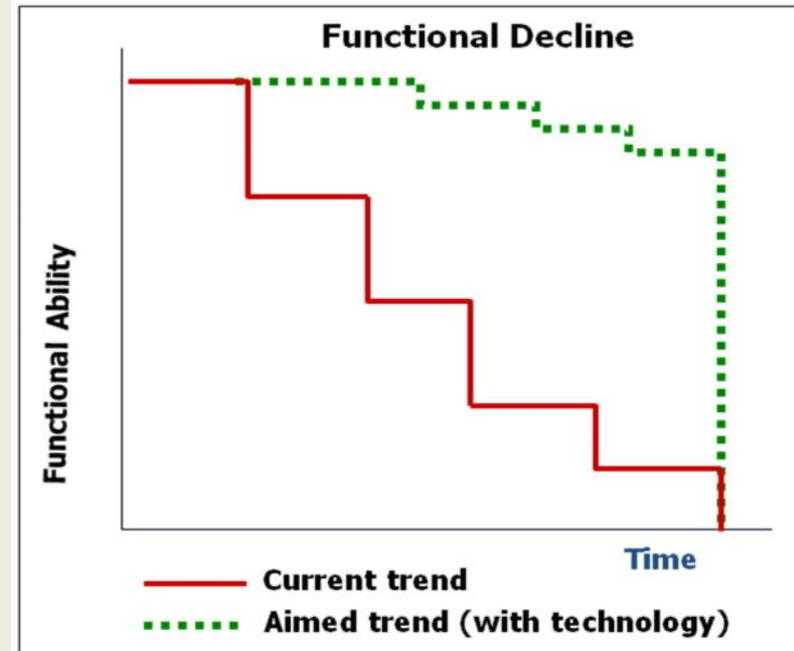
- Achieve greater health equity
  - *Increasing access to care for rural and remote areas*
  - *Available 24/7*
  - *Reduction in costs*
- Reduce burnout and improve QOL for patients and caregivers
  - *Facilitate aging-in-place*



Yaddaden et al., 2020

# QOL Improvement

- Perform & maintain ADL and IADLs
  - *Cognitive functioning*
  - *Nutrition*
  - *Exercise*
  - *Self-esteem*
- Patient and caregiver safety
  - *Real-time monitoring*
  - *Manage BPSD*
  - *Reduce prescribing rates (polypharmacy)*
- Improve caregiver to patient relationship and management
  - *Stress Process Model of family relationships*

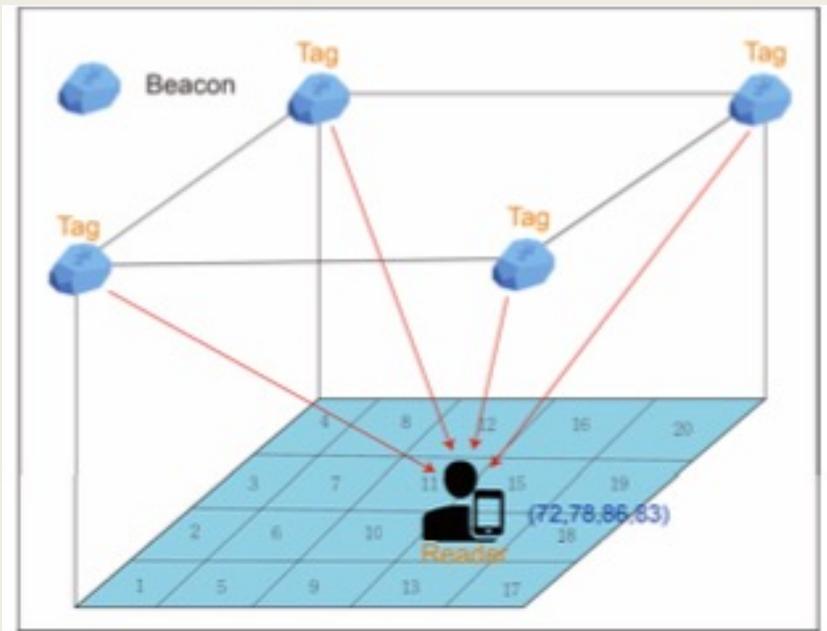


Trajectory of Functional Decline (Galambos et al., 2013)

# Types of ATs

- Positioning systems
- Caregiver coaching systems
- Patient coaching systems
  - *Cognitive training*
- Facial recognition
- Reminder devices
- Multi Sensory Environments / Ambient Assisted Living
- Health monitoring systems

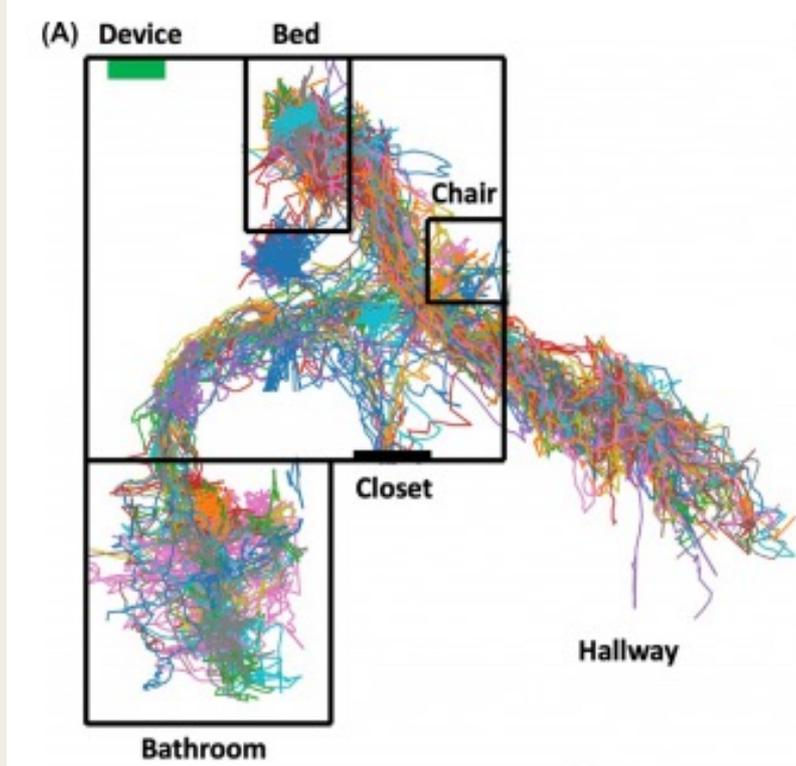
# Positioning Systems



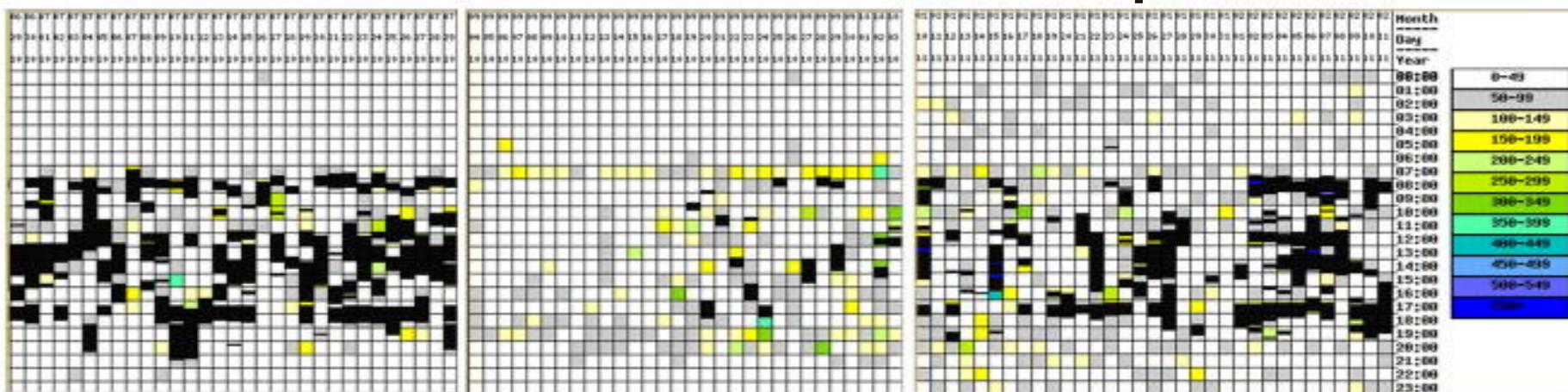
Beacon tags and reader  
(Hung et al., 2021)



Bluetooth low energy beacons (red) and sensor bracelet (Kernebeck et al., 2019)



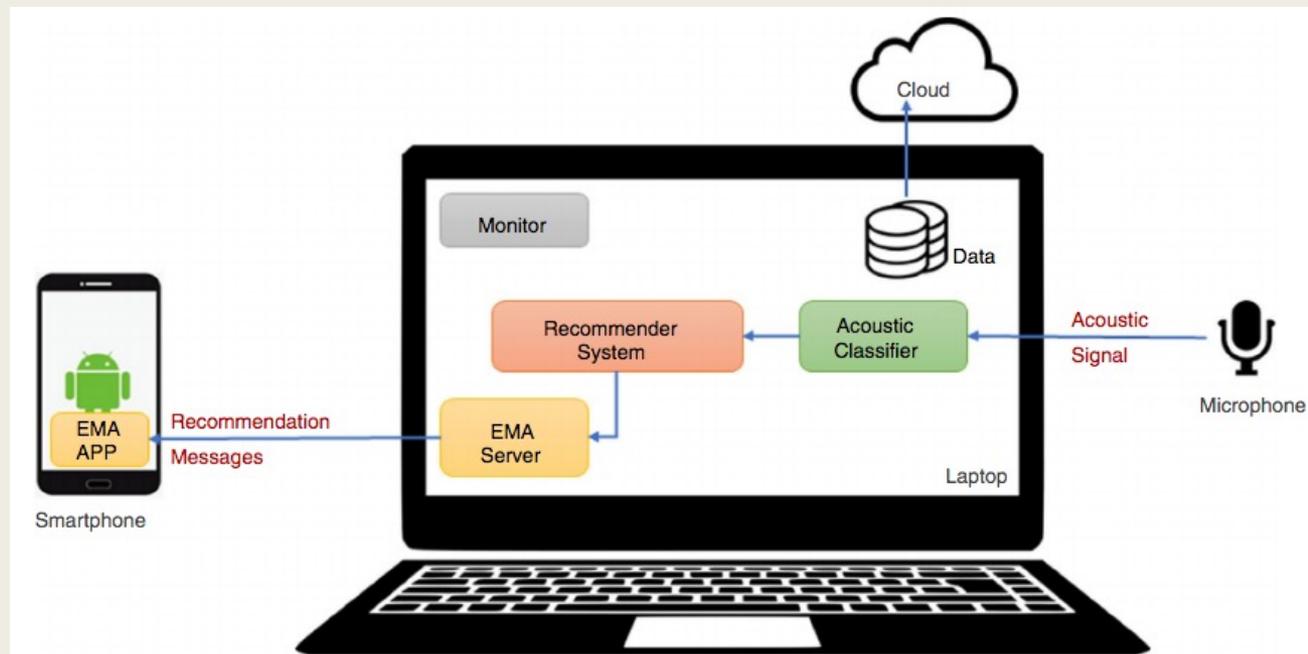
# Baseline Decline Improve



Density map showing three points in time (baseline, decline, and improvement) of a resident with dementia and depression (Galambos et al., 2013)

# Caregiver Coaching System

- Audio/video recording systems +/- AI = Recommendations
- Listen in on conversations in the home
- Detect stressful situations using AI
- Provide recommendations to improve the situation
- Maintain good patient-caregiver relationships



Acoustic monitoring and intelligent recommendation system (Rose et al., 2021)

# Patient Coaching Systems

- Help patients complete ADLs and IADLs
- AI, environmental sensors, cameras, videos, apps, video game systems



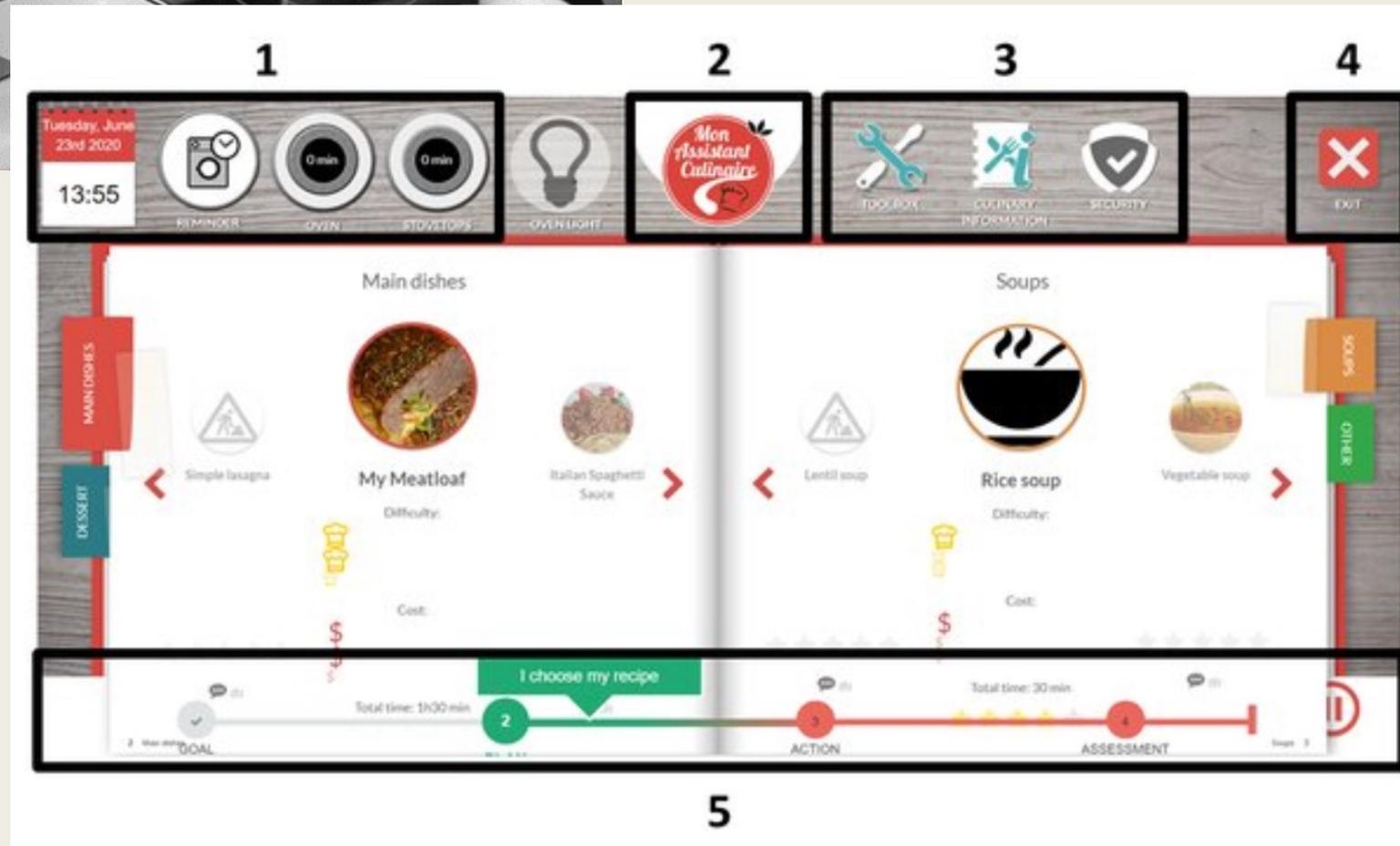
Determining the hand's location given two vertically stacked blobs.

The second frame is the binarized image after the NCC model has been applied.

The third frame is a representation of the palm centres after blob analysis has been performed.  
(Mihailidis et al., 2004)



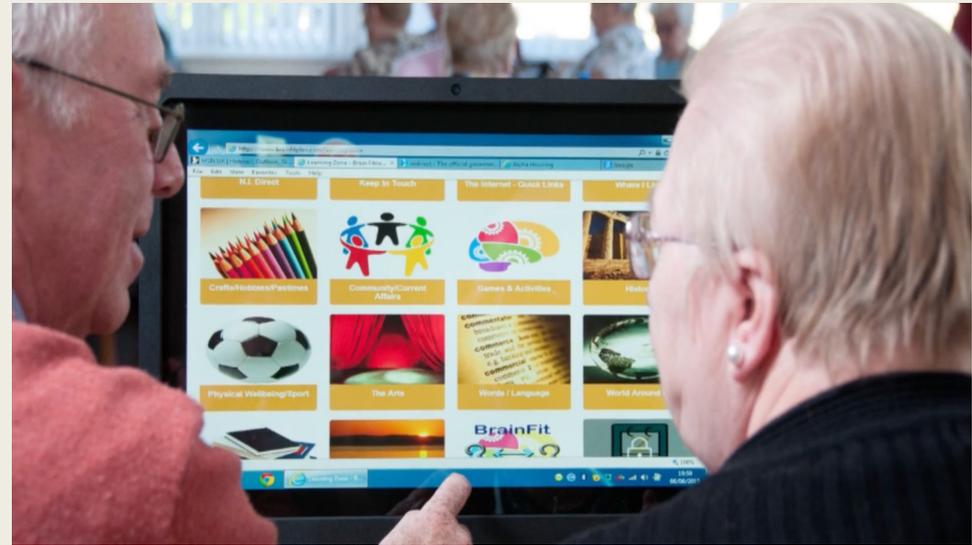
# Cognitive Orthosis for Cooking



# Cognitive Training Programs



Brain Fit Plan (Oksnebjerg et al., 2020)

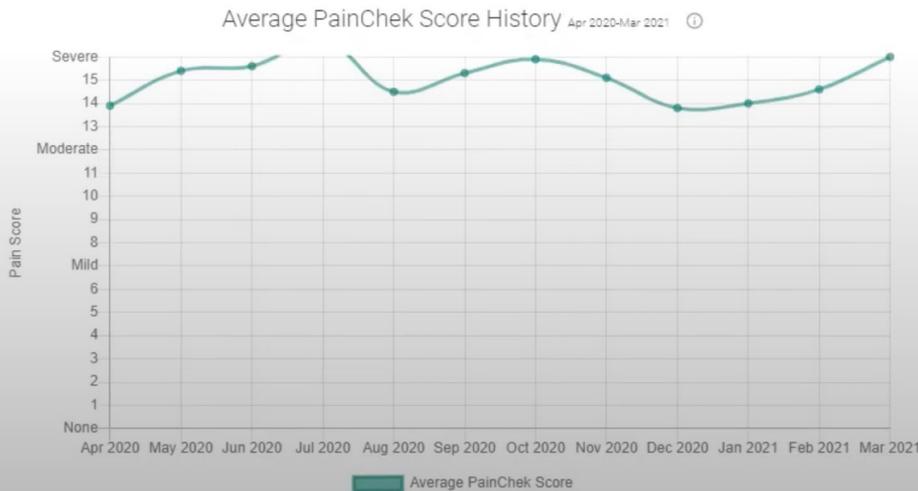
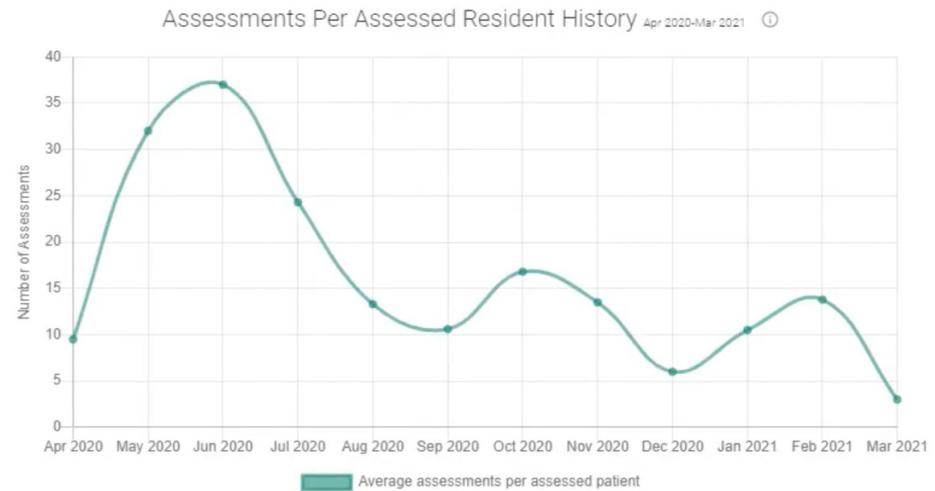
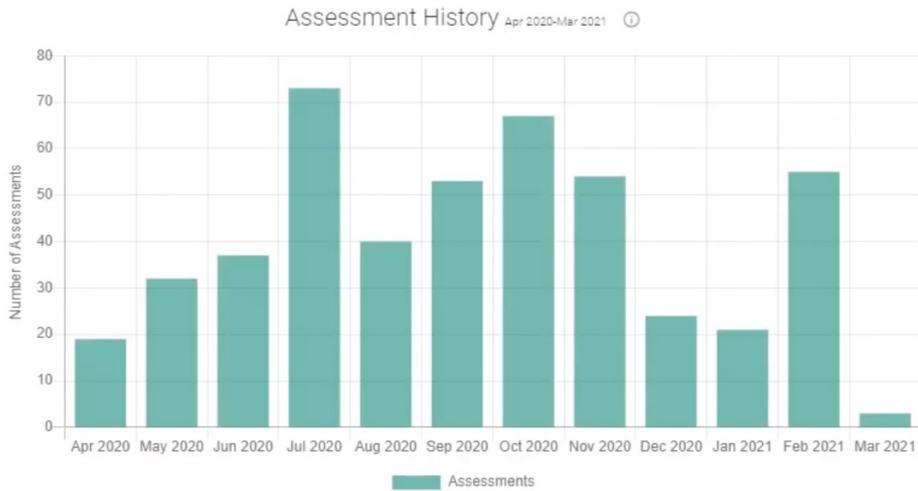


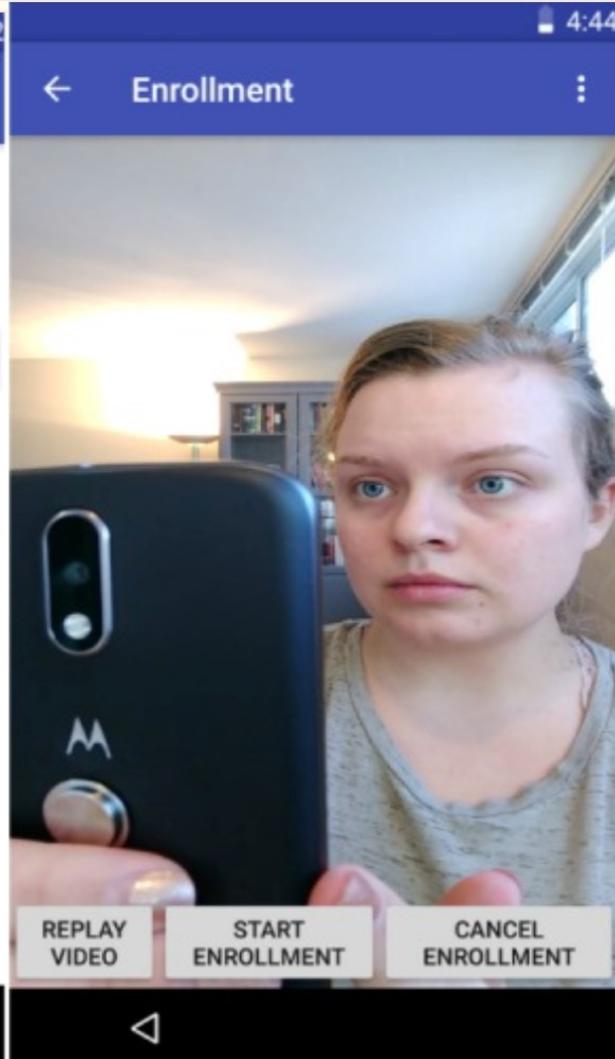
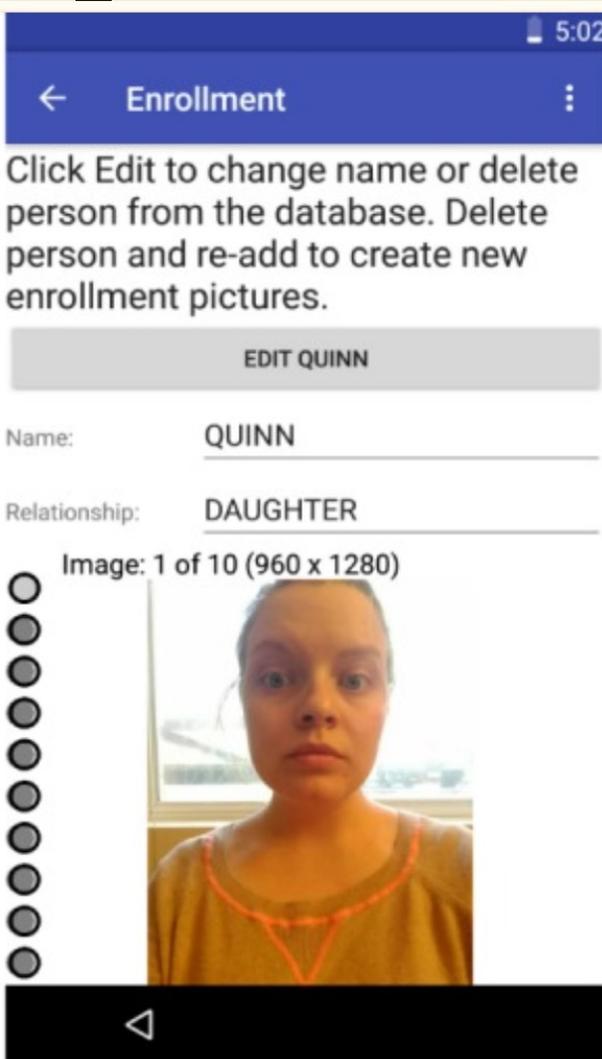
Brain Fit Plan (Boyd et al., 2017)

# Facial Recognition Devices



Pain Chek (Atee et al., 2017)



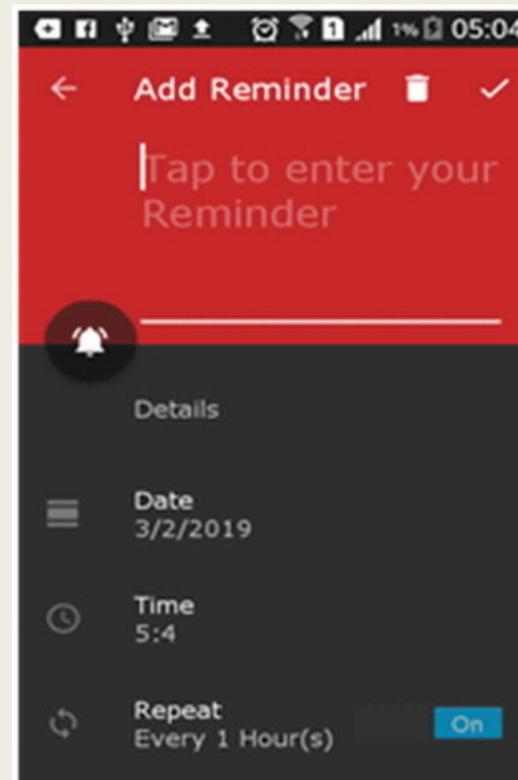


QUINN  
DAUGHTER

Social Support Aid (McCarron et al., 2019)

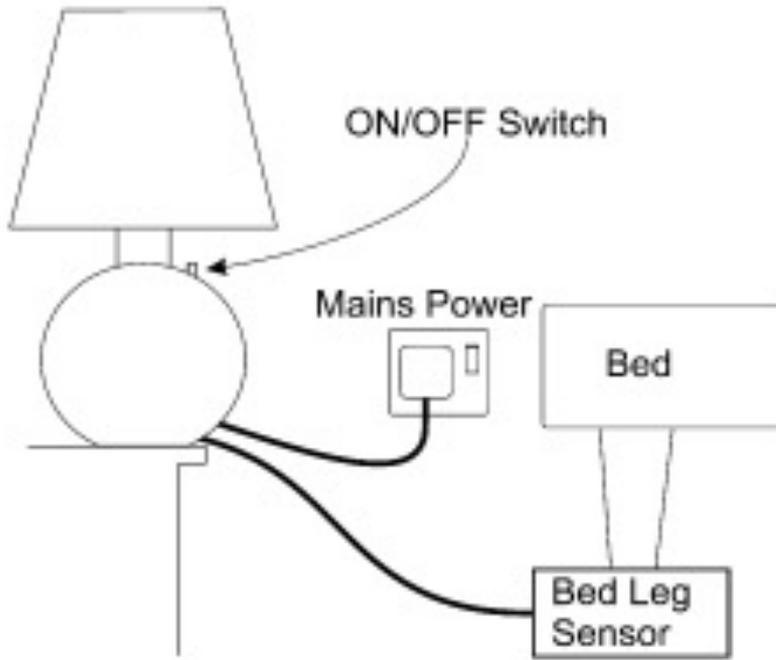
# Reminder Devices

- Smart device
  - *Calendar*
  - *Clock*
  - *Checklists*
  - *Diary notes*
  - *Contacts*
  - *Alarm*



Reminder feature (Rathnayake et al., 2020)

# Multi Sensory Environments/Ambient Assisted Living



# Health Monitoring Systems

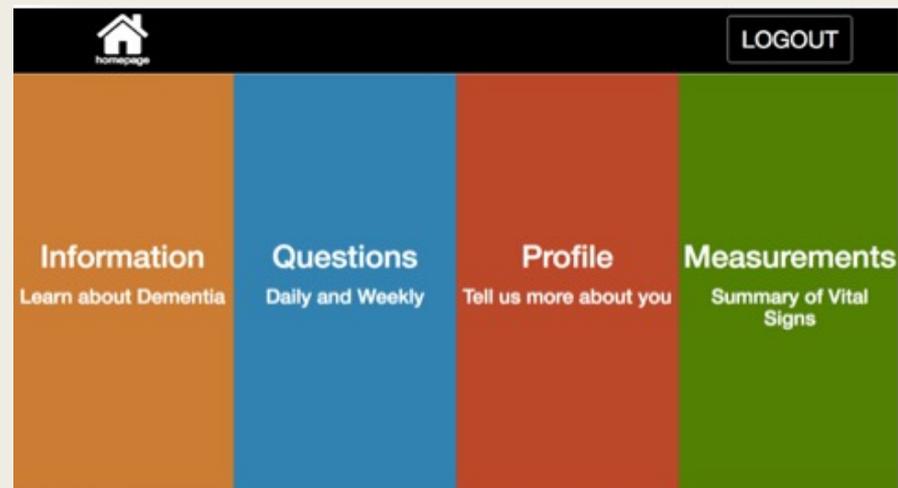
- Focus on physiological health data
- GPS, pedometers, gyroscopes, and barometers
  - *Physical activity*
  - *Sleep duration*
- Data can be monitored by caregivers using a tablet with alerts
  - *Symptom management*
  - *Contacting a physician*



Withings Go – activity monitor  
(Guisado-Fernandez et al., 2019)

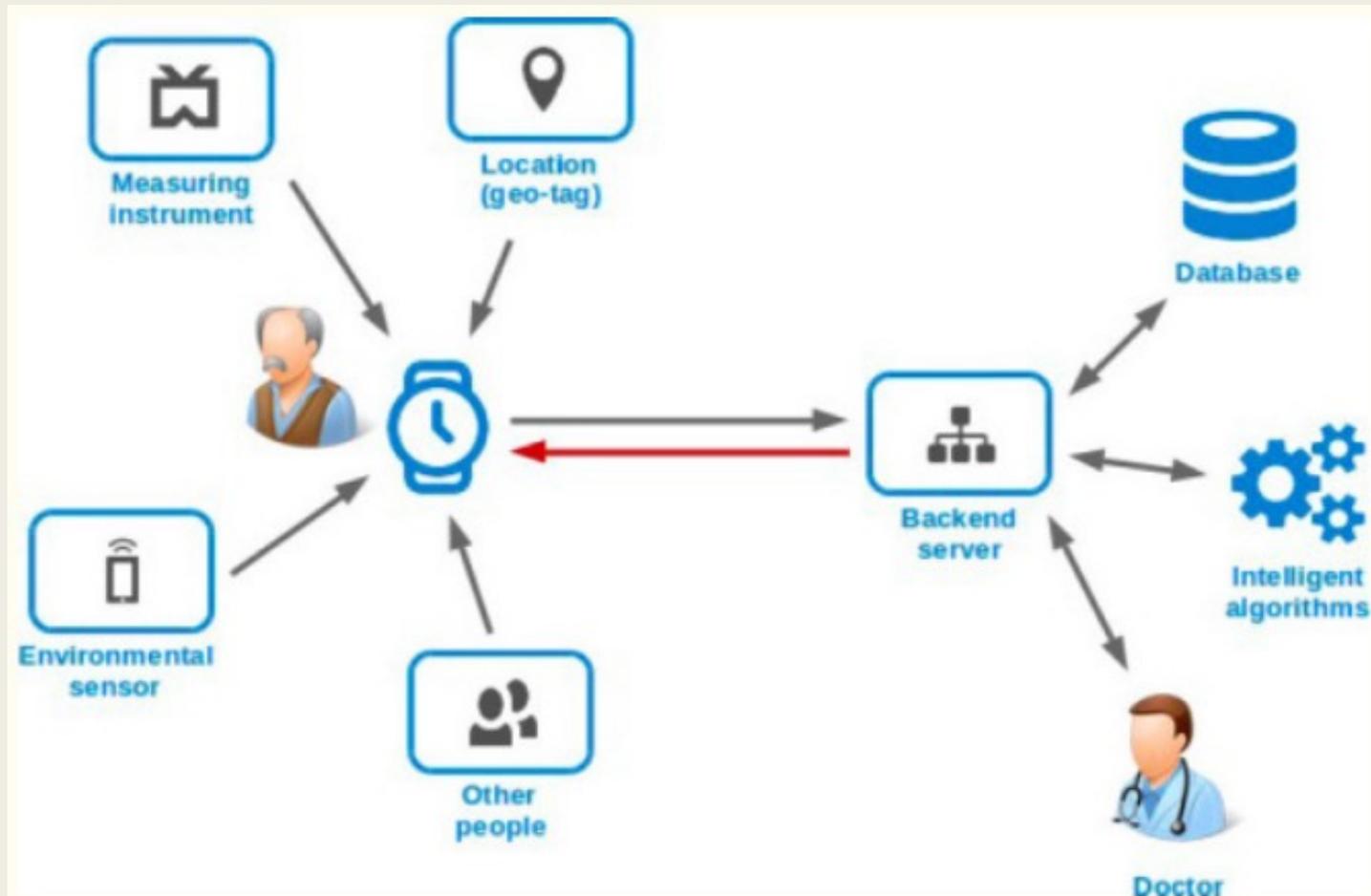


ResMed Sleep Minder  
(Guisado-Fernandez et al., 2019)



Caregivers' platform main screen (Guisado-Fernandez et al., 2019)

# Integrated Systems



# Barriers to Implementation

- Cultural acceptance
  - *Stigma*
  - *Privacy*
- Legal issues on data collection/storage
  - *Health data collection and privacy laws*
- Ethical issues
  - *Obtaining valid informed consent*

# Barriers to Implementation

- Ease of accessibility
  - *Financial barriers*
  - *Internet connection difficulties*
  - *Ease of use*
- Ensuring compliance
  - *Culturally relevant*
  - *Not obstructive for those affected by BPSD and sundowning*

# Future

- Artificial Intelligence
  - *Currently limited, still requiring human monitoring*
- Monitor trajectory of patient's health
  - *Inform management decisions*
  - *Increase understanding of the illness*
  - *Reduced delayed care*
- Virtual Reality
  - *Currently has weak evidence*
  - *May be used as a coaching system or to manage BPSD*

# MCQ

- How often should ATs be recommended for use in dementia care?
  - A. They should be used regularly
  - B. They should be used occasionally
  - C. They should not be used at all
  - D. Unsure

# Limited Amount of Evidence

- No strong recommendations for or against them
- To determine true effects, regular evaluations need to take place



A researcher looking for evidence

# Thank you for listening!

- [stephenleecheong@gmail.com](mailto:stephenleecheong@gmail.com)