Assistive technology for unmet needs in Persons with Dementia and Caregivers

Orapitchaya Krairit, MD
Chief of Geriatric Medicine Division, Department of Internal Medicine
Faculty of Medicine, Ramathibodi Hospital
MAHIDOL UNIVERSITY
Assistive technology for persons with dementia: Definition

• Any item, piece of equipment, product or system driven by electronics, whether acquired commercially, off-the-shelf, modified or customized, that is used to help persons with dementia in dealing with the consequences of dementia

Benefits of Assistive Technology in Dementia Care

• Persons with dementia:
  • Positive attitude about using electronic devices to facilitate their independence and reduce family stress \(^1,2\)
  • Small-scale studies have found that assistive technologies improve independence, behavioral symptoms in persons with dementia \(^3\)

• Caregivers:
  • ↑ quality of life \(^3\) and ↓ stress in caregivers \(^4\)

Current Issues in Using of Assistive Technology in Dementia Care

- Current technology solution is not appropriate with general lifestyle of people with dementia
  - Predominant use of current technological solutions are for safety and security and caregiver reassurance\(^1\)
- Slow uptake and implementation of assistive technologies\(^2,3\)
- Lack of high-quality scientific research into the effectiveness and cost-effectiveness of assistive technologies in dementia care\(^2,3\)
- Lack of successful commercialization of prototype technologies\(^4\)
- Limited attention to aesthetics → stigmatizing for people with dementia\(^4\)
- Assistive technology in dementia is not being integrated into mainstream dementia care practice\(^4,5\)

The 3 areas of global need in Dementia Care

1. Devices intended to help in managing everyday life of people with dementia
   • Electronic calendars and reminders for activities, medication reminders, aids to perform activities of daily life, robots, and navigation systems

2. Technologies to help people with dementia engage in meaningful and pleasurable activities
   • Cognitive stimulation and physical activities, as well as technologies to improve social participation, contact, and support

3. Health care technologies to support professional organizations and systems within dementia health and social care
   • Behavior monitoring, shared decision making, and global positioning system (GPS) tracking systems

Challenges in The Development of Technological Devices

1. How can technologies address the heterogeneous needs of persons with dementia?
2. Should technologies be designed specifically for dementia or adapted from mainstream technology?
3. What methods are more efficacious when developing technologies for persons living with dementia?

*JMIR Rehabil Assist Technol.* 2017 Jan-Jun; 4(1): e1. Published online 2017 Jan 16. doi: [10.2196/rehab.6376](https://doi.org/10.2196/rehab.6376)
Things to consider when making a selection of available technology

1. Staging of dementia: How advanced is the person’s dementia?
2. User friendly: Is the user comfortable with technology?
3. Easy to use: How will the technology be set up?
4. Safety and availability: Who will make sure it’s charged and used?
5. Reaction of PWD to technology: Could it cause agitation or concern in the person with dementia?
6. Connection: Is a Wi-Fi connection necessary?
7. Advantages: Does it solve an important need or bring joy?
### Guidelines for the development of technologies for dementia care

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Technologies must be <strong>based on a theoretical framework</strong> that shapes the technological innovation</td>
</tr>
<tr>
<td>2.</td>
<td>The development team must <strong>include experts in dementia</strong> as well as end users such as carers, patients, developers and health-care professionals</td>
</tr>
<tr>
<td>3.</td>
<td>Products must be <strong>conceptualized and developed</strong> with <strong>input from end users at all stages</strong></td>
</tr>
<tr>
<td>4.</td>
<td>Devices must be <strong>trialed and tested by end users</strong> and adapted to their needs</td>
</tr>
<tr>
<td>5.</td>
<td>Technology must be <strong>capable of multiple tasks to enable sustainability across the stages of dementia</strong></td>
</tr>
<tr>
<td>6.</td>
<td>Technology must be well tested and beyond the early prototype stage for <strong>commercialization</strong> to be considered</td>
</tr>
<tr>
<td>7.</td>
<td>Technology must adhere to <strong>privacy standards</strong> for the collection, use, storage and transmission of patient data</td>
</tr>
<tr>
<td>8.</td>
<td>Pricing of the technology must consider not only research, development and production costs but also a <strong>viable purchase cost</strong> for the intended market</td>
</tr>
<tr>
<td>9.</td>
<td>Robots must be developed that react appropriately to human emotions</td>
</tr>
<tr>
<td>10.</td>
<td>Technologies must be <strong>easily incorporated into the Internet of Things</strong></td>
</tr>
<tr>
<td>11.</td>
<td>Technological support must be developed and delivered using <strong>multiple platforms</strong> (such as telephone helplines, online videos and printed problem-solving information)</td>
</tr>
<tr>
<td>12.</td>
<td>Research exploring the effectiveness of the technology must move from small descriptive studies to incorporate larger randomized controlled trials</td>
</tr>
<tr>
<td>13.</td>
<td>Research must include the <strong>cost-effectiveness</strong> of technology</td>
</tr>
</tbody>
</table>
Current Available Technology

Current Available Technology

• Current technologies have focused on helping people who are in the early stages of their syndrome to remain independent, improving social participation, security and monitoring of physical and behavioral status.

• Current technologies help to fill a gap in care support if they can help to maintain a person comfortably in their community and promote independence, positive mood and quality of life for the person living with dementia, and supporting the family caregivers.

• No current technologies have been developed that achieve to reduce stigmatization and discrimination towards people with dementia.

## Current Monitoring Technology – 1

<table>
<thead>
<tr>
<th>Device name (manufacturer)</th>
<th>Functions</th>
<th>Developed for</th>
<th>Level of evidencea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Google Home (Google)</td>
<td>• Calendar reminders, weather and controls lighting and heating through smart phone</td>
<td>General use</td>
<td>Level VII</td>
</tr>
<tr>
<td>Find Me Tunstall Watch (Tunstall)</td>
<td>• GPS monitoring</td>
<td>Cognitively impaired</td>
<td>Level V</td>
</tr>
<tr>
<td></td>
<td>• Can aid orientation, location tracking and fall detection; offers 24/7 support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wireless movement sensors (Just Checking)</td>
<td>• Text and e-mail messages to alert carer</td>
<td>Cognitively impaired</td>
<td>Level II</td>
</tr>
<tr>
<td></td>
<td>• Information on activity and when different rooms are used</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Current Monitoring Technology – 2

Google Home App
Current Monitoring Technology – 3

Find Me Tunstall Watch®
Current Monitoring Technology

Discreet wireless motion sensors and a plug-in controller

Bedroom: went to bed, got up and whether they had a disturbed night.

Kitchen: visited the kitchen to prepare meals.

Hallway: received expected visitors or care calls.

Front Door: left the house and for how long.
## Current Available Assistive robotics – 1

<table>
<thead>
<tr>
<th>Device name (manufacturer)</th>
<th>Functions</th>
<th>Developed for</th>
<th>Level of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assistive robotics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Care-O-Bot (Fraunhofer Institute for Manufacturing Engineering and Automation)</td>
<td>• A range of applications, including fetch and carry, monitoring, reminders and communication</td>
<td>Older people and cognitively impaired</td>
<td>Level V</td>
</tr>
<tr>
<td>RAMCIP (EU Horizon 2020 project)</td>
<td>• Reminds individuals about daily tasks such as taking medications, brings fluid and food, can detect falls and offers communication via video conference</td>
<td>MCI</td>
<td>Level VI</td>
</tr>
<tr>
<td>Riken and Robear (RIKEN-SRK)</td>
<td>• Can transfer frail people from floor to chair or bed</td>
<td>Older people and disabled</td>
<td>Level VII</td>
</tr>
</tbody>
</table>

Current Available Assistive robotics - 2

Care-O-bot®

= A mobile robot assistant to actively support humans in domestic environments
Current Available Assistive robotics – 3

RAMCIP - Robotic Assistant for MCI Patients at home
= A real robotic solutions for assistive robotics for the elderly and those suffering from Mild Cognitive Impairments and dementia
Current Available Assistive robotics-4

Riken and Robear®
= The strong robot with the gentle touch
= Capable of performing tasks such as lifting a patient from a bed into a wheelchair or providing assistance to stand up a patient
<table>
<thead>
<tr>
<th>Device name (manufacturer)</th>
<th>Functions</th>
<th>Developed for</th>
<th>Level of evidence&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assistive innovations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obi</td>
<td>• Robotic spoon that allows automatic or semi-automatic feeding</td>
<td>Disabled</td>
<td>Level VII</td>
</tr>
<tr>
<td><strong>MARIO</strong> (National University of Ireland)</td>
<td>• Entertainment and reminders</td>
<td>Older people and cognitively impaired</td>
<td>Level VI</td>
</tr>
<tr>
<td><strong>MiRo</strong> (Consequential Robotics)</td>
<td>• Autonomous robotic dog that reminds user about medications, hydration and temperature, and can contact emergency services</td>
<td>Cognitively impaired</td>
<td>Level VII</td>
</tr>
</tbody>
</table>

Current Assistive Innovations- 2

Obi® = the first *robotic* feeding device of its kind
Current Assistive Innovations – 3

3D-platform games can boost cognition and memory by serving as a mental workout

Current Assistive Innovations - 4

MiRo® Dog

- A companion robot with a familiar form of a non-threatening, small friendly hybrid mammal, rather than a mechanical-looking device
Current Assistive Innovations-5:

Others such as safety aids etc.

- Automatic lights
- Automated shut-off devices
- Water isolation devices
- Special plugs
- Fall sensors
# Therapeutic Robots– 1

<table>
<thead>
<tr>
<th>Device name (manufacturer)</th>
<th>Functions</th>
<th>Developed for</th>
<th>Level of evidence(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Therapeutic robots</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Giraff (Camanio)</td>
<td>• Telepresence robot that enables monitoring via remote connection to anyone worldwide</td>
<td>Older people and cognitively impaired</td>
<td>Level III</td>
</tr>
<tr>
<td>PARO (AIST)</td>
<td>• Therapeutic pet robot that responds to interaction</td>
<td>Cognitively impaired and children with autism</td>
<td>Level I–II</td>
</tr>
</tbody>
</table>

---

Therapeutic Robots-2

**Telepresence Robot**
= A computer, tablet, or smartphone-controlled robot which includes a video-camera, screen, speakers and microphones so that people interacting with the robot can view and hear its operator and the operator can simultaneously view what the robot is “looking” at and "hearing"

**Giraff®**
= An Advanced Telepresence Robot for Hospitals & Home Care
Therapeutic Robots - 3

PARO®

= An advanced interactive robot developed by AIST, a leading Japanese industrial automation pioneer
→ Allows the documented benefits of animal therapy to be administered to patients in environments such as hospitals and extended care facilities where live animals present treatment or logistical difficulties
## Current Therapeutic technology- 1

<table>
<thead>
<tr>
<th>Device name (manufacturer)</th>
<th>Functions</th>
<th>Developed for</th>
<th>Level of evidencea</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Therapeutic technology</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skype, FaceTime and Google Hangouts (various)</td>
<td>Communication apps for mobile devices</td>
<td>General use</td>
<td>Level IV</td>
</tr>
<tr>
<td>The Talking Photo Album (CommunicATe)</td>
<td>Photos linked to individual messages that aid reminiscence</td>
<td>Cognitively impaired</td>
<td>Level VII</td>
</tr>
<tr>
<td>The Dawn Clock (Dawn Clocks)</td>
<td>Five medication and lifestyle alarms</td>
<td>Cognitively impaired</td>
<td>Level VII</td>
</tr>
<tr>
<td>Automated medication-dispensing service (Philips)</td>
<td>Medication-dispensing device</td>
<td>Cognitively impaired</td>
<td>Level VII</td>
</tr>
</tbody>
</table>

Current Therapeutic technology-2

Skype®  FaceTime®  Google Hangouts®
Current Therapeutic technology – 3:

Other Communication Aids

• Adapted landline and mobile phones
  • Pre-programmed with often used numbers e.g., Family, friends, or clinics
  • Call people by pressing a large button or a button with their photo on it
• Other Video chat services: Line®

• Physical communication mats and books
• Talking Mats® app: communicate feelings by selecting pictures and symbols
The Talking Photo Album (CommunicATe)®

= A speech output album that holds standard 5 x 7 inch photos includes a total of 20 pages, each with a individual message capacity of 10 seconds
Current Therapeutic technology- 5

The Dawn Clock (Dawn Clocks)®
Current Therapeutic technology-6: Other Clocks

Day and Night Clock

DayClox®

DayClock®

Alzheimer's Dementia Day Clock® App
Philips Medication Dispensing Service can accommodate complex regimens, dispensing up to 60 cups of medicine, and up to six doses per day.
## Current Available App-1

<table>
<thead>
<tr>
<th>Device name (manufacturer)</th>
<th>Functions</th>
<th>Developed for</th>
<th>Level of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apps</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luminosity</td>
<td>Brain training</td>
<td>MCI</td>
<td>Level VII</td>
</tr>
<tr>
<td>Alzheimer Master</td>
<td>Plays voice recordings to remind individuals to take medication and drink water, etc.</td>
<td>Cognitively impaired</td>
<td>Level VII</td>
</tr>
<tr>
<td>Bettercog, COMCOG</td>
<td>Computerized cognitive training programs</td>
<td>MCI</td>
<td>Level I</td>
</tr>
</tbody>
</table>

Current Available App—2

Luminosity®
Speed Games
Memory Games
Attention Games
Flexibility Games
Problem Solving Games
Word Games
Math Games
Current Available App-3

Alzheimer Master®
= A mobile application which helps to coordinate the life of cognitively impaired persons

Notifications
It is an important fact that people diagnosed with Alzheimer disease can recall the voice of their relatives the best. Thus, we designed the application that at time of a notification – instead of a computer-generated sound – the voice of the relatives will be played. The caregiver or the user can set

Memories
The mood of the elderly person may be significantly improved, if we play or show familiar music, pictures or videos, to which he or she can still remember. In this function such contents can be set on a daily/weekly basis.

Recording of reactions
After each notification and memories, the application will automatically record the voice and reaction of the elderly person. Through this function the caregiver can check how the patient reacted to the given notification or memory.

Awakening function
The application senses when the patient awakes. In many cases when the patient wakes up during the night, he or she does not know about his/her whereabouts. The application can illuminate the room and can also play a prerecorded voice message.

Home-leaving notification
This feature is under development! It will be available soon. Once the elderly person opens the entrance door of his or her flat, the application plays a message to remind the patient to take the phone with him- or herself. This way, the caregiver will be
Current Available App-4

Bettercog®
**Current Available App – 5**

Neofect ComCog: An Attention and Memory Training Tool

**Attention training**

The training includes games such as the ‘Finding sounds’ in which patients respond to the sounds of various animals, the ‘Finding different rabbit’ in which patients find something different from others and the ‘Finding expression’ in which patients distinguish pleasant facial expressions.

**Memory training**

The training games include the ‘Link name’ to link a word and image, the ‘Remember number’ to memorize numbers in order, and the ‘Playing keys’ to listen to piano sound and find right notes.

**Single vs 30 min.session training**

It is divided into the ‘single training’ and the ‘session training’. In the single training, a game is selected and played while a number of games are combined and played for about 30 minutes in the session training. In addition, a therapist can create a session.
**EXAMPLE APPLICATION**

A Medium Intensity Patient Monitoring System with Ensuite Ushering

(many more options are available)

- **Infrared Ceiling Receiver**
  - Picks up any help required, emergency or 'staff attack' calls made by a carer's infrared transmitter

- **Superbright LED Light**
  - Switches on, off or dims dependent on the status of the behaviour pattern selected

- **PIR Movement Sensors**
  - Sense patient movement and instruct the controller to switch lights on, off or dim and to raise a call dependent on the status of the behaviour pattern selected

- **Infrared Ceiling Receiver**
  - Picks up any help required, emergency or 'staff attack' calls made by a carer's infrared transmitter

- **Superbright LED Light**
  - Switches on, off or dims dependent on the status of the behaviour pattern selected

- **Corridor Display**
  - Indicates the location and type of all incoming calls (as programmed)

- **Bed Exit Mat**
  - Senses the pressure change when the patient exits and returns to bed

- **Enuresis (bed wet) Sensor**
  - Triggers a call when moisture is detected in the patient's bed

- **Enuresis/Bed Exit Interface Socket**

- **Door Contacts**
  - Can be set up to trigger a call when the bedroom door is opened

- **Room Status Controller**
  - Allows carers to arm/isolate the system and reset any active calls. Optional door bell will trigger a call when pressed by the patient.

- **Dementia Care Controller**
  - Usually mounted in an engineer accessible cupboard inside the bedroom
Cadi SmartSense RTLS Technology for Healthcare Workflow

**Patient Flow and Bed Management**
- Improve efficiency
- Reduce bed wait

**Asset Location Tracking**
- Optimize assets utilization
- Reduce cost

**Infant Matching and Security**
- Protects Infant
- Prevents mismatch

**Staff Contact Tracing**
- Minimize cross infection
- Reduce staff workload
- Improve staff safety

**Wireless Vital Signs Monitoring**
- Better uninterrupted rest
- Enhance patient safety
- Reduce nurses’ workload
- Improve patient care

**Patient Location Tracking and Queue Management**
- Real-time patient search
- Minimize waiting time
Criteria supporting technology development

1. Governments must value innovation and support technology development.
2. Universities and research institutes must promote the commercialization of products they have developed.
3. Medical device regulation bodies must aid developers to gain approval for devices.
4. Potential adverse effects of the technology must be reported.
5. National and international organizations focusing on Alzheimer disease and other causes of dementia should provide detailed information on available technologies.
THANK YOU FOR YOUR ATTENTION