Voice Assistant for Quality of Life and Healthcare Improvement in Aging Populations

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Motivations

- Population is a global issue [UN Report ’19];
- Toward an Inclusive Design of Voice Assistants:
  - Information technology is promising for helping with health management and daily routine, yet accessing them could be challenging, esp. for older adults;
  - Voice is a promising modality for enabling natural hands-free and eye-free interactions, yet has not been incorporated and well-designed for older adults, and is usually considered as “toy” by aging individuals;

Key Questions and Aims

- Technical: How digital assistants, NLP and ML could produce meaningful health-related conversations by leveraging population- and patient-level data from EHR (e.g., MyChart)?
- Social, Behavior and Cognitive:
  - How to design features and services for older adults based on their needs to support independence?
  - What’s the acceptability of digital assistants among older adults and their providers?
- Clinical: How voice assistants could be used to detect new symptoms and correlate them with medication side effects, medication interactions, worsening of existing conditions, or onset of a new illness and allergy?

Needs-Findings

- Significance: A first work to understand the barrier that older adults might encounter during health management and daily routine, as well as design space of conversational voice assistant from both patients and providers;
- 21 Participants from UC San Diego Health:
  - 16 older adults with or without past voice assistant user experience;
  - 2 geriatricians and 3 nurses specialized in senior care;
- Remote Semi-Structured Interview, with Key Guiding Questions:

Older Adults:

- A Day in the Life;
- Prescription Management and Health Information;
- Voice based Technologies;

Results:

<table>
<thead>
<tr>
<th>Category</th>
<th>Barriers</th>
<th>Providers</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medication Management</td>
<td>Lack of efficient ways to manage prescribed medications and track medication adherence;</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Lack of efficient ways to support the selection of OTC medications;</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Daily Life and Routines</td>
<td>Lack of advising on healthy and unhealthy lifestyles;</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Lack of efficient ways for providers and caregivers to monitor patient’s life;</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Patient-Doctor Communication</td>
<td>Lack of efficient ways for health data reporting and check-ins;</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Memorizing appointments with providers could be challenging;</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

- Use of Voice Based Technologies:
  - Frustations related to technology complexity and technical glitches;
  - Setbacks caused by hearing impairment and incorrect speech recognition;
  - The gap between features experienced and features expected;
  - Concerns related to security of data privacy, leading to failures of trust;

- Functions and features that older adults have experience
- Functions and features that older adults expect to use

Methods and Systems

- System:
  - Third-party Information Providers
  - Health Knowledge Environmental Curated Repositories
  - Voice Interface
  - Olders UI Clinicians UI

- Methods:
  - STAKEHOLDERS ENGAGED
    - Older Adults
    - Formal Caregiver
    - Informal Caregivers
  - DESIGN OUTCOMES
    - Understanding
    - Define
    - Ideate
    - Prototype
    - Design
  - Data
    - UCSD Medical System
    - EHR
    - Smart Speaker
    - Web UI, Email/SMS
    - UCSD Provider
    - Participant
    - Clinician, Researcher, Family member, Caregiver

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