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

[1, 3]Chen Chen, [1]Khalil Mrini, [6]Kemeberly Charles, [1, 3]Janet G. Johnson, [5]Alice Lee, [4]Ella T. Lifset, [6]Michael Hogarth, [6]Alison Moore, [1]Ndapa Nakashole, [1, 3]Nadir Weibel, [2]Emilia Farcas

[1]Computer Science and Engineering, [2]Qualcomm Institute, [3]The Design Lab, [4]Biological Sciences, [5]Cognitive Science, [6]School of Medicine, University of California San Diego, Email: voli@ucsd.edu Website: voli.ucsd.edu
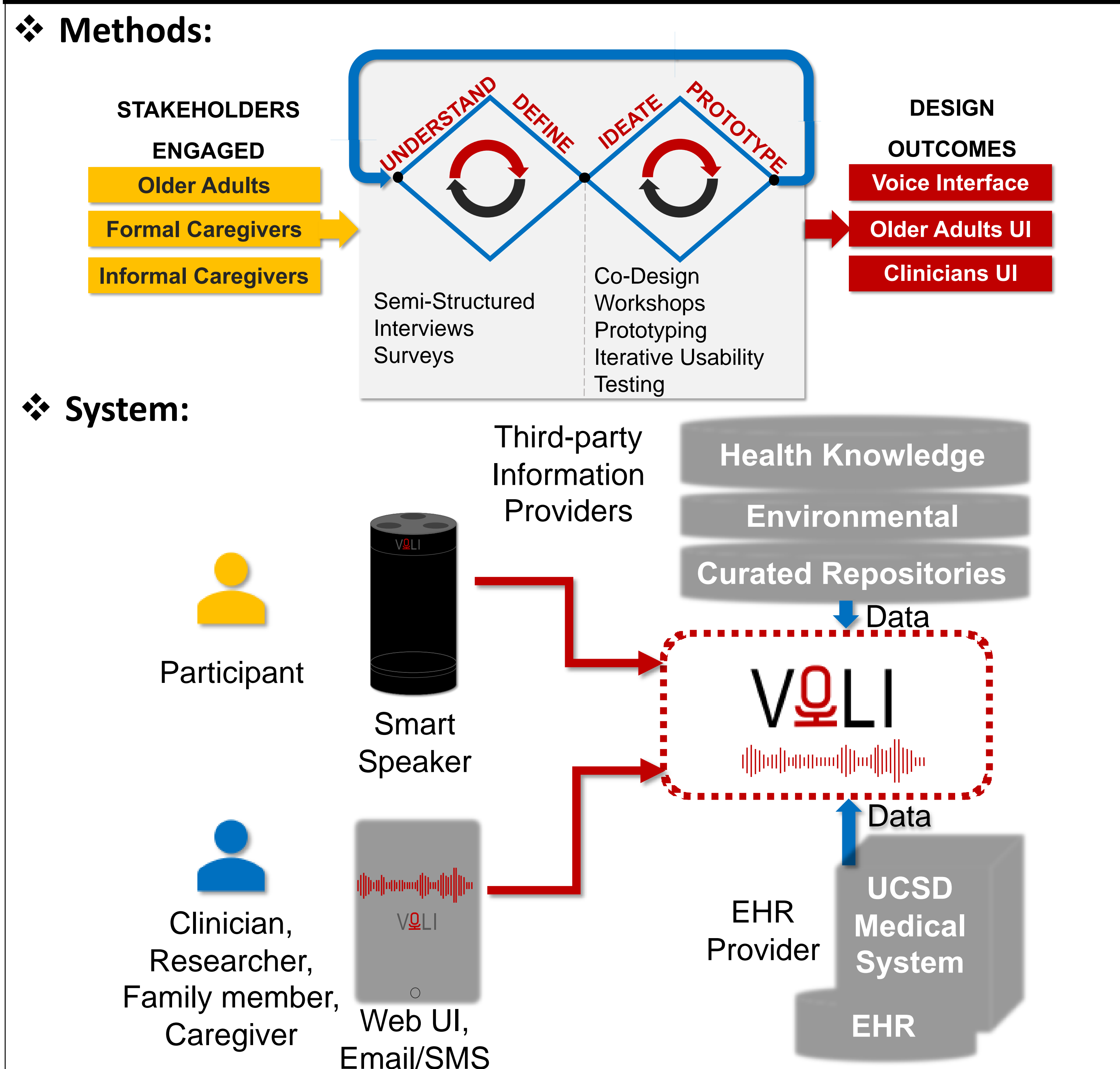
Motivations

❖ **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, <u>yet</u> 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?

Methods and Systems

❖ **Methods:**

❖ **System:**

Please Visit: VOLI.UCSD.EDU

[1] Chen, C., Johnson, J., Charles, K., Lee, A., Lifset, E., Hogarth, M., Moore, A., Farcas, E., Weibel, N., "Understanding Barriers and Design Opportunities to Improve Healthcare and QOL for Older Adults through Voice Assistants", The 23rd International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS'21), October 18–22, 2021, Virtual Event, USA. ACM, New York, NY, USA, 14 Pages.
[2] Charles, K., Chen, C., Johnson, J., Lee, A., Lifset, E., Hogarth, M., Weibel, N., Farcas, E., Moore, A. "How might an intelligent voice assistant address older adults' health–related needs?", In Journal of the American Geriatrics Society, vol. 69, pp. S243–S244. 111 River St, Hoboken 07030–5774, NJ USA: Willey, April 2021. (abstract)
[3] Chen, C., Mrini, K., Charles, K., Lifset, E., Hogarth, M., Moore, A., Weibel N., Farcas, E., "Toward a Unified Metadata Schema for Ecological Momentary Assessment with Voice–First Virtual Assistants", Proceedings of the 2021 ACM Conversational User Interface (CUI) Conference, July 27 – 29, 2021
[4] Mrini, K., Chen, C., Nakashole, N., Weibel, N., Farcas, E. "Medical Question Understanding and Answering for Older Adults", The 3rd Southern California Machine Learning and Natural Language Processing (SoCal ML & NLP) Symposium, March 2021.
[5] Johnson, J., Mrini, K., Hogarth, M., Moore, A., Nakashole, N., Weibel, N, Farcas, E. "Voice–Based Conversational Agents for Older Adults", CHI Conference on Human Factors in Computing Systems, Workshop on Conversational Agents for Health and Wellbeing, ACM, New York, NY, April 25–30, 2020.
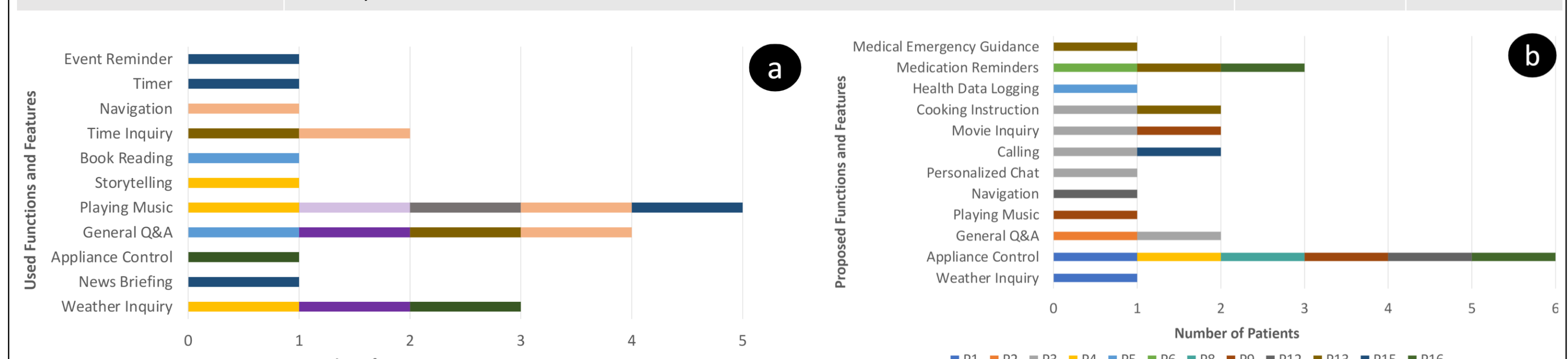
Needs-Findings

❖ **Significance:** A <u>*first*</u> 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 <u>*both*</u> 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;

Providers:
  ➢ Expectations;
  ➢ Technology Benefits & Adoptions;
  ➢ Patients-Provider Communications;

❖ **Results:**

Category	Barriers	Providers	Patients
Medication Management	Lack of efficient ways to manage prescribed medications and track medication adherence;	✓	✓
	Lack of efficient ways to support the selection of OTC medications;	✓	
Daily Life and Routines	Loneliness and lack of companionship;	✓	✓
	Lack of advising on healthy and unhealthy lifestyles;	✓	✓
	Lack of efficient ways for providers and caregivers to monitor patients' life;	✓	✓
Patient-Doctor Communication	Lack of efficient ways for health data reporting and check-ins;	✓	✓
	Memorizing appointments with providers could be challenging!	✓	
	Inefficient GUI-based PPs and telephonic based approaches;	✓	✓
Use of Voice Based Technologies	Frustrations 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

Voice-First Digital Assistants

❖ Voice + Visual v.s. Voice Only?
❖ Will be focusing on Ecological momentarily Assessment (EMA) Applications;