Aging in Place Solutions

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April 2021 - ILTCIconf.org

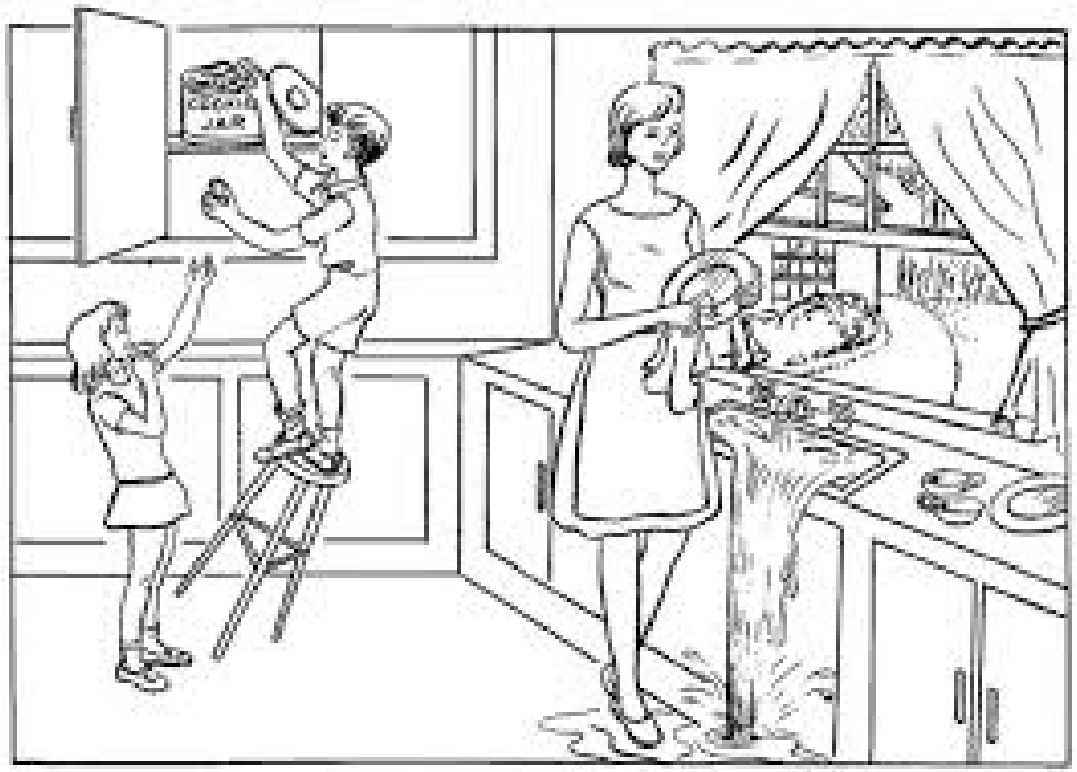
Linguistic markers predict onset of Alzheimer's Disease

Motivation

- Cognitive decline manifests itself in almost all aspects of language comprehension and production.
- Research question: To what extent linguistic performance at a single time point can be utilized as a prognostic marker for future diagnosis of Alzheimer's Disease in cognitively normal subjects?
- Classification Task: Whether participant will develop Alzheimer's Disease on or before 85 years old.

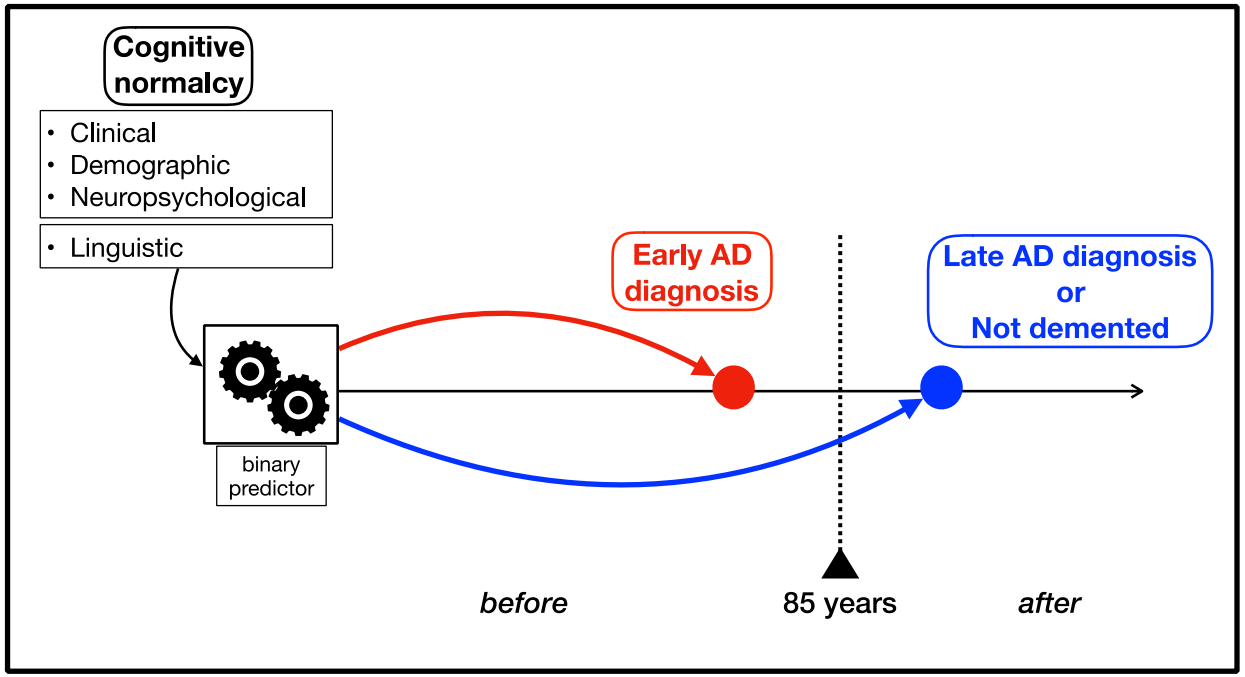
Outline

- Data: Framingham Heart Study, 1948
- Neuropsychological test battery included a picture description task.
- Natural Language Processing (NLP) to extract linguistic variables from responses to the picture description task.



Classification Task

- Alzheimer's Disease patients who developed Mild Cognitive Impairment on or before age 85 were defined as **Cases**.
- **Controls**:
  - Normal-aging group: participants who were recorded to be dementia free on or after age 85
  - Very late onset Alzheimer's Disease: AD patients whose onset of cognitive impairment was after 85



Method and Results

- **Non-linguistic variables**

  Demographics, Genetics , Medical history (diabetes, hypertension), 32 neuro-psychiatric scores from 13 neuro-psychiatric tests

- **Psycho-linguistic variables**

  Misspellings, Punctuation, Repetitiveness, Syntactic, Semantic, Language modeling,

- **Machine Learning**
  - Semi-supervised learning
  - 703 samples from 270 participants.
  - 80 subjects/samples for testing
    - Time to mild-AD: 7.59 years std 4.91
    - Time to cognitive impairment onset: 3.93, std 3.69.

- **Results**

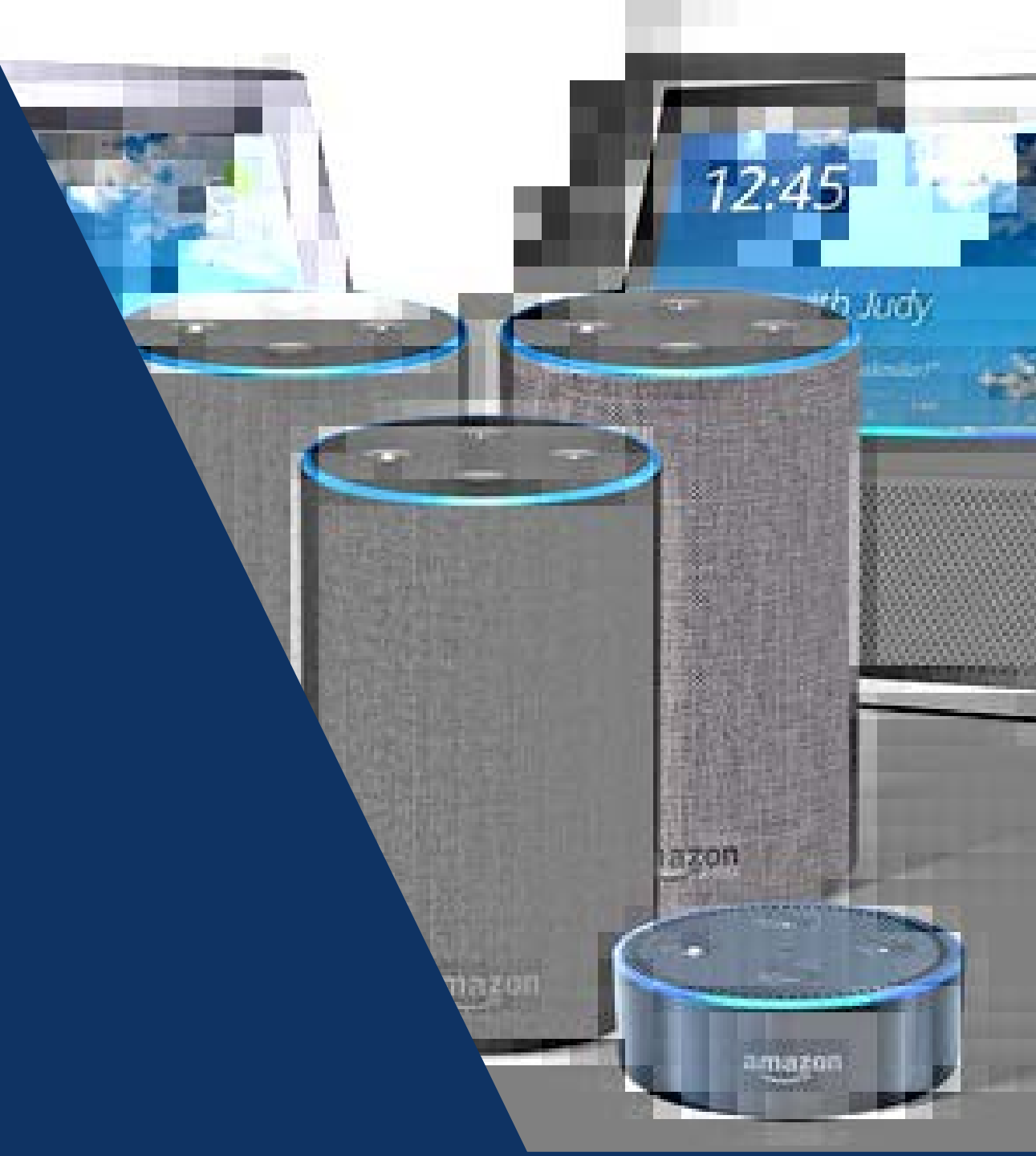
  Classification: AUC of 0.74 and Accuracy of 0.70 when using linguistic variables.

Discussion and Conclusion

- The linguistic variables identified as most relevant for future diagnosis of Alzheimer's Disease:
  - telegraphic speech, repetitiveness and agraphia
- Referential specificity
  - referentially generic terms
    - *boy, girl, woman*
  - instead of the more specific
    - *son, brother, sister, daughter, mother*

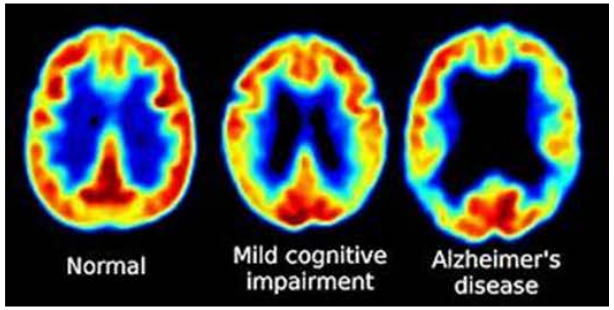
- Differs from other studies on Alzheimer's Disease:
  - While the participants were cognitively healthy – not MCI.
  - Only linguistic metrics derived from a single administration of the Cookie Theft Task
- Conclusion:
  - Simple, naturalistic and inexpensive speech probes can provide an assistive tool for the early detection and progression monitoring of AD
  - Such probes can be easily adapted to remote digital platforms with low patient burden.

Detecting and Tracking Cognitive Decline: Can Alexa Best the Academic Experts?



Cognitive Decline and Dementia

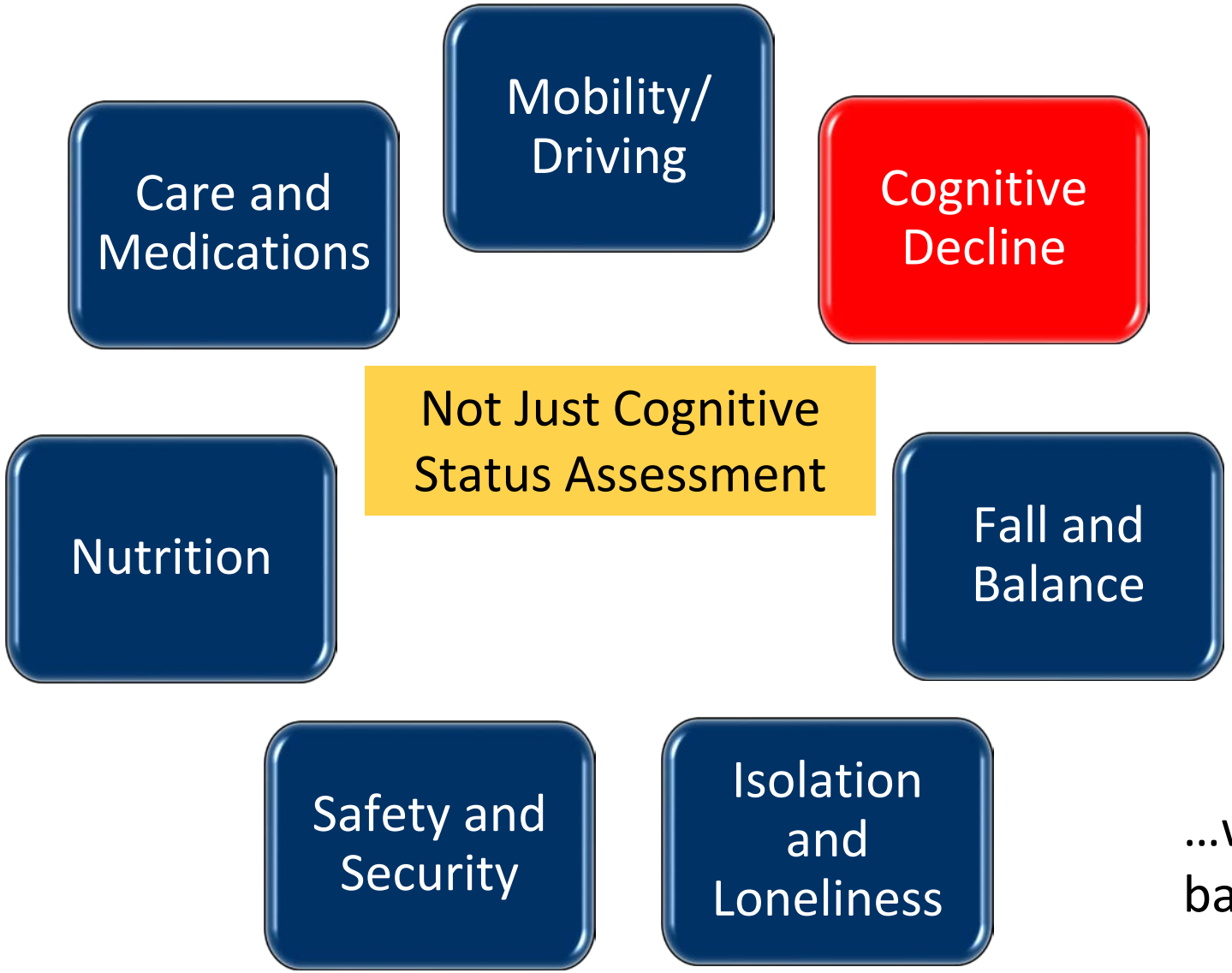
- Defining Dementia: a decline in memory and other cognitive functions leading to disability in daily function
- Components of Dementia:
  - Amnesia – memory loss
  - Agnosia – inability to correctly understand information
  - Apraxia – difficulty consciously directing the body
  - Aphasia – trouble speaking or understanding communication
- Role of functional limitation



Cognitive Decline and Dementia

- How is Dementia discovered?
  - Often suspected by family and denied by individual initially
  - Over 55% of those with significant cognitive decline did not receive screening or diagnosis
- How well is it diagnosed?
  - 85% receive a “presumptive” diagnosis of “unspecified dementia” by PCP without definitive testing/ referral
  - 2 of 3 with dementia NEVER see a dementia specialist
  - Cognitive Decline DOES NOT EQUATE to Dementia
- How is it definitively diagnosed?
  - Most often requires referral to an academic geriatrics or neurology specialist
  - Neuropsychiatric testing
  - Assessment of Praxis – ability to perform daily living tasks
  - MRI, PET Scan and/or CSF for differentiating ALZ from other causes
- Challenges:
  - Screening is not done at scale
  - Definitive diagnosis is logistically difficult, expensive and rarely done
  - ADL’s are rarely directly assessed
  - Care planning is ineffective due to lack of prognosis and tracking of decline

The Power of Voice-Enable AI



- ✓Screen / Detect
- ✓Train / Prevent
- ✓Flag / Alert
- ✓Track / Predict
- ✓Categorize / Define
- ✓Assist / Support

…with the intuitive simplicity of voice-based machine-human interface

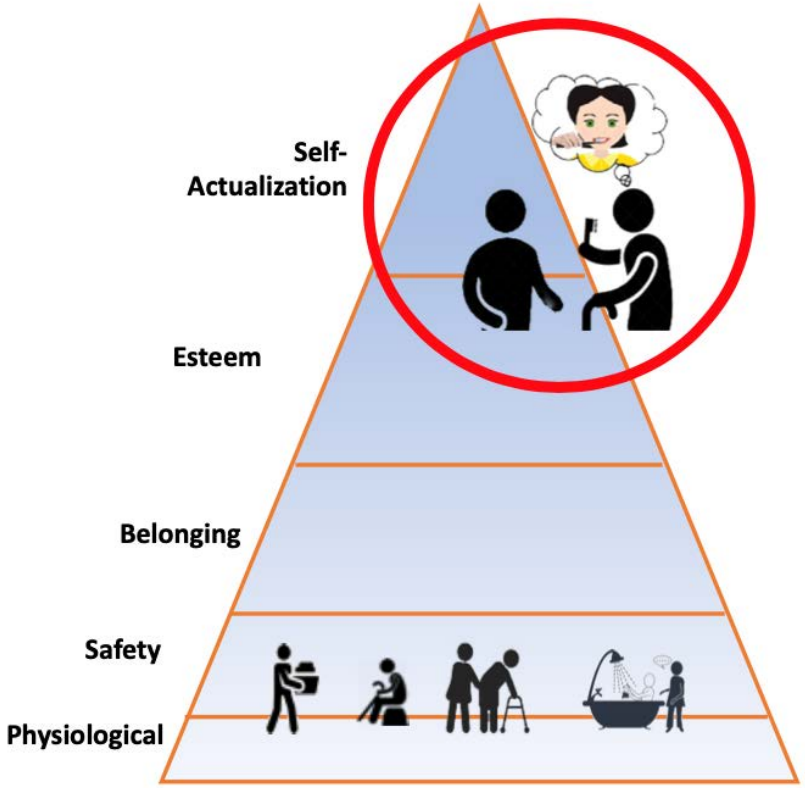
Linguistic markers predict onset of Alzheimer's Disease

We are meeting the growing demand for effective, efficient, non-pharmacological cognitive and behavioral support for the world's older populations

Mentia Inc.
San Francisco

DevaWorld rapidly enhances the care relationship

stronger connections, deeper understanding and
a sense of agency for the dependent person



Maslow's Hierarchy of Needs

Enables self-expression of personhood from informal home care through skilled nursing

Advancements in the Diagnosis and Treatment of Cognitive Conditions

DevaWorld Delays the Move to Higher Level Care

from at home through skilled nursing

Relationship
Agency
Communication
Engagement and Mood

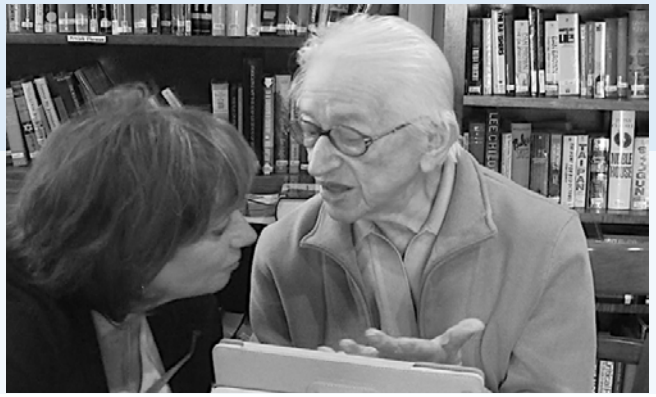
Priming

Encoding

Ease of Completion

More Self Reliance

ADL and IADL



Health/Wellness

Care Plan

Encoding

Acceptance

Self Actualization

Quality of Life
Health Benefits
Fewer Reactive Events
Care Job Satisfaction

personalized engagement is built in care dyad sessions

care and therapies are enabled by the sessions

value for clients, family, care professionals and their businesses

Increasing Healthspan

Technologies

Tech interaction from passive to interactive to responsive
Data collection from active to passive to transparent

Silos

One functional solution fixes one functional problem
Problem are multi-faceted, multiple silo solutions are unaffordable

The Market

Home is first point of inception
Communities and professional care services– low margin, late tech adoption

Investors

Prefer focused silos: one problem, one solution
Prefer scalable tech licenses over custom solutions

What you can do

Build bridges to the startup world
Coordinate within insurance industry
Think about shared savings approaches
Solve the big picture – affordable integrated solutions that keep people at home

Thank You!

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