

Towards Agentic AI-based Health Coaching for Older Adults Living Alone with Early Cognitive Decline

MOSAIC: Multi-agent Orchestrated System for Adaptive Interactive Coaching

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Aging Alone with Cognitive Decline

~16M

older adults in the U.S.
live alone

U.S. Census Bureau, 2023

50%

higher dementia risk
from social isolation

U.S. Surgeon General, 2023

Social isolation accelerates cognitive deterioration

Yet this population lacks consistent coaching support

Existing digital tools offer generic wellness advice

Disconnected from daily behavioral patterns

Early Warning Signs Go Unnoticed

What the Person Reports

"I'm doing fine, just a bit tired lately"

Self-report unreliable:
anosognosia, memory gaps,
desire not to worry family

What the Sensors Reveal

Phone calls: 5/wk → 1/wk

Sleep: fragmented

Movement: 40% decline

Missed reminders: rising

Behavioral signals surface decline patterns weeks before a clinical visit

MOSAIC: Agentic AI Health Coaching

- **6 specialized AI agents**
 - collaborate through a pipeline
- **Passive behavioral sensing**
 - sleep, social, activity, movement
- **Evidence-based coaching**
 - structured goal-setting with user
- **Data-informed reframing**
 - surfaces concerns proactively



System metaphor

How It Works: A Scenario

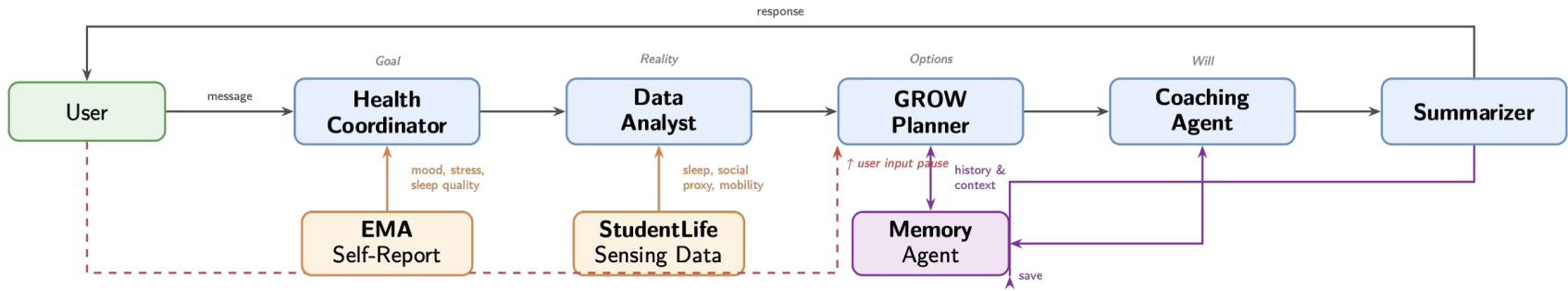
1 **User:** *"I've been doing okay. Just staying home more."*

2 **Data reveals:**
Calls down 80% | Sleep fragmented | No outings in 10 days

3 **MOSAIC:** *"I noticed you haven't called your daughter lately. Would you like to give her a call today?"*

Proactive engagement grounded in real behavioral patterns

System Architecture: 6 AI Agents



Each agent handles a distinct task in the coaching pipeline

Coordinator → **Data Analyst** → **Memory** → **GROW Planner** → **Coach** → **Summarizer**

intent routing | sensing analysis | longitudinal context | options | empathetic response | session close

Preliminary Evaluation

20

**Coaching
Scenarios**

from real sensing data

9

**Quality
Dimensions**

6 positive + 3 negative

5

**Independent
Evaluators**

3 human + 2 AI

900

**Total
Ratings**

comprehensive coverage

Evaluators: Trained researchers in behavioral sciences and human systems engineering

Comparison: Sensor-informed vs. clinical-assessment-informed coaching

Results: Strengths and Challenges

Dimension	Score	Interpretation
Empathetic Tone	4.85 / 5	Near-ceiling; all evaluators agree
Goal Alignment	4.30 / 5	Stays on-topic with user goals
Personalization	3.80 / 5	Uses behavioral data well
Socratic Approach	2.18 / 5	Advises rather than asks

Key Finding: Sensor-informed coaching achieves quality comparable to clinical-assessment-informed coaching

Deployment for Older Adults

Between-Visit Support

Daily check-ins between geriatrician appointments

Caregiver Integration

Behavioral summaries to family (with consent) for early intervention

Privacy Protections

On-device processing; clear consent for data sharing

Escalation Pathways

Automated clinician alerts when patterns indicate decline

Agentic AI Can Help Older Adults Age in Place Safely and with Dignity

- Passive sensing reveals what self-report cannot
- Multi-agent AI enables personalized coaching at scale
- Between-visit support bridges gaps in geriatric care
- Next: pilot deployment with older adults in Arizona

