The Future of Aging In Place—Quality of Life and Enhanced Care with Sensor Technology and APRNs

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TigerPlace and MU Sinclair School of Nursing

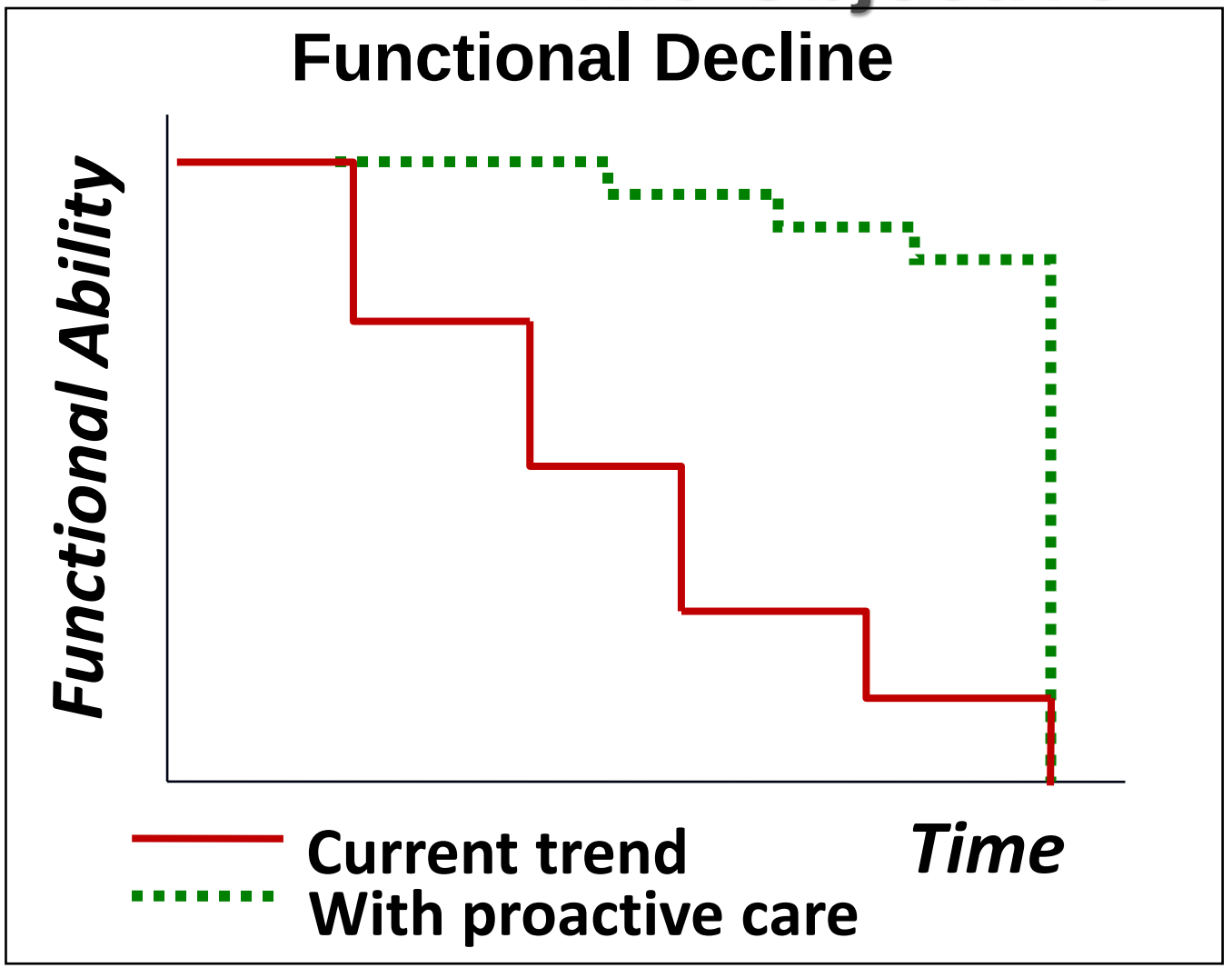
- Aging in Place (AIP) legislation passed in 1999 and 2001 to enable construction
- Built to nursing home standards and opened in 2004
- Licensed as an Intermediate Care Facility (ICF) with some regulatory exceptions
- Operates as independent housing with services available
- Allows residents to AIP through end of life in their own apartment with pets supported, too

TigerPlace

54 apartments, designed for Aging in Place
Built & operated by Americare
Clinical care model by MU Nursing School
Functions as a living lab for longitudinal studies
All residents consent to research with their Electronic Health Record data—this is key to the clinical care and sensor research

Introduce Eric Minturn, Executive Director TigerPlace

Squaring the Life Curve-
The Objective

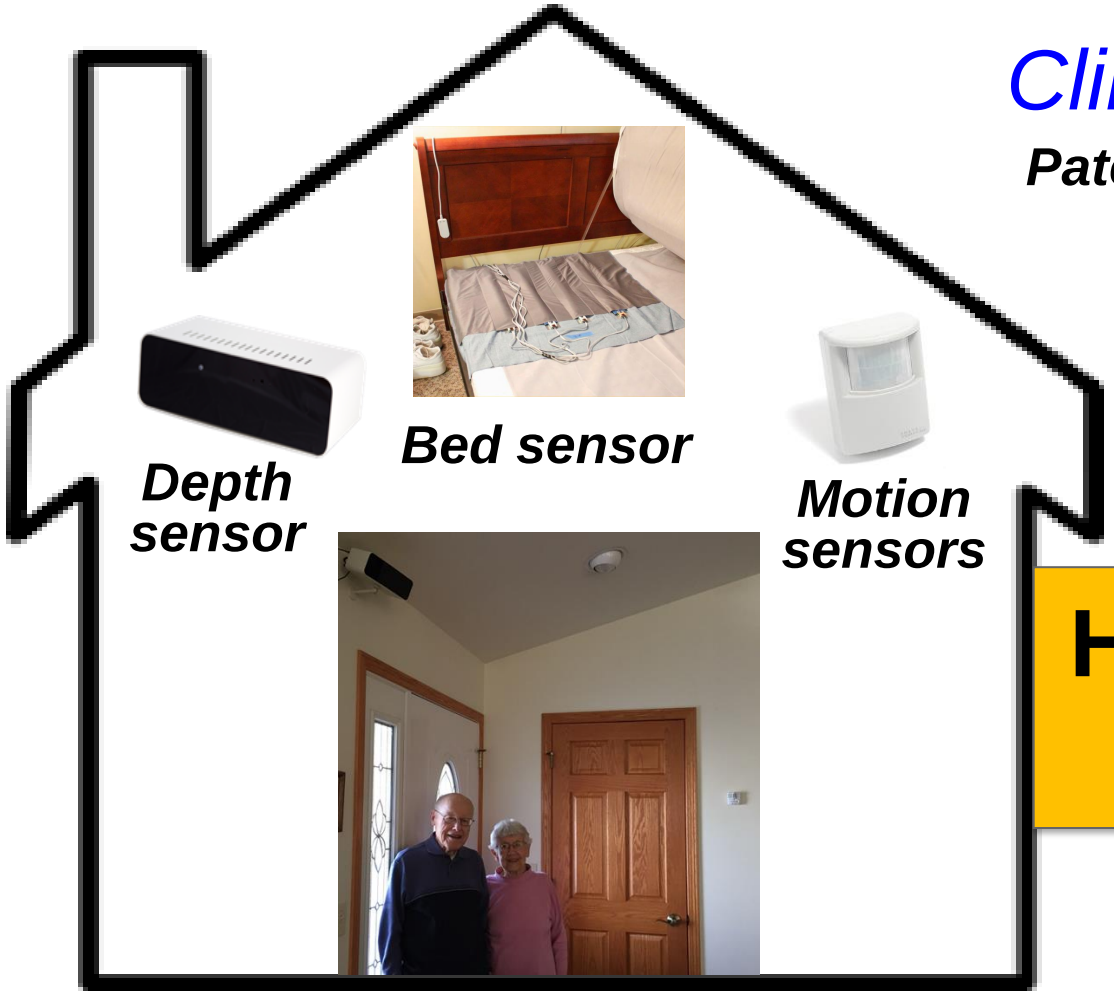


Clinical Collaborators from:

Nursing
Medicine
Social Work
Physical Therapy
Occupational Therapy

Rantz et al., Nursing Outlook, 2005

Detecting Health Changes with In-Home Sensors



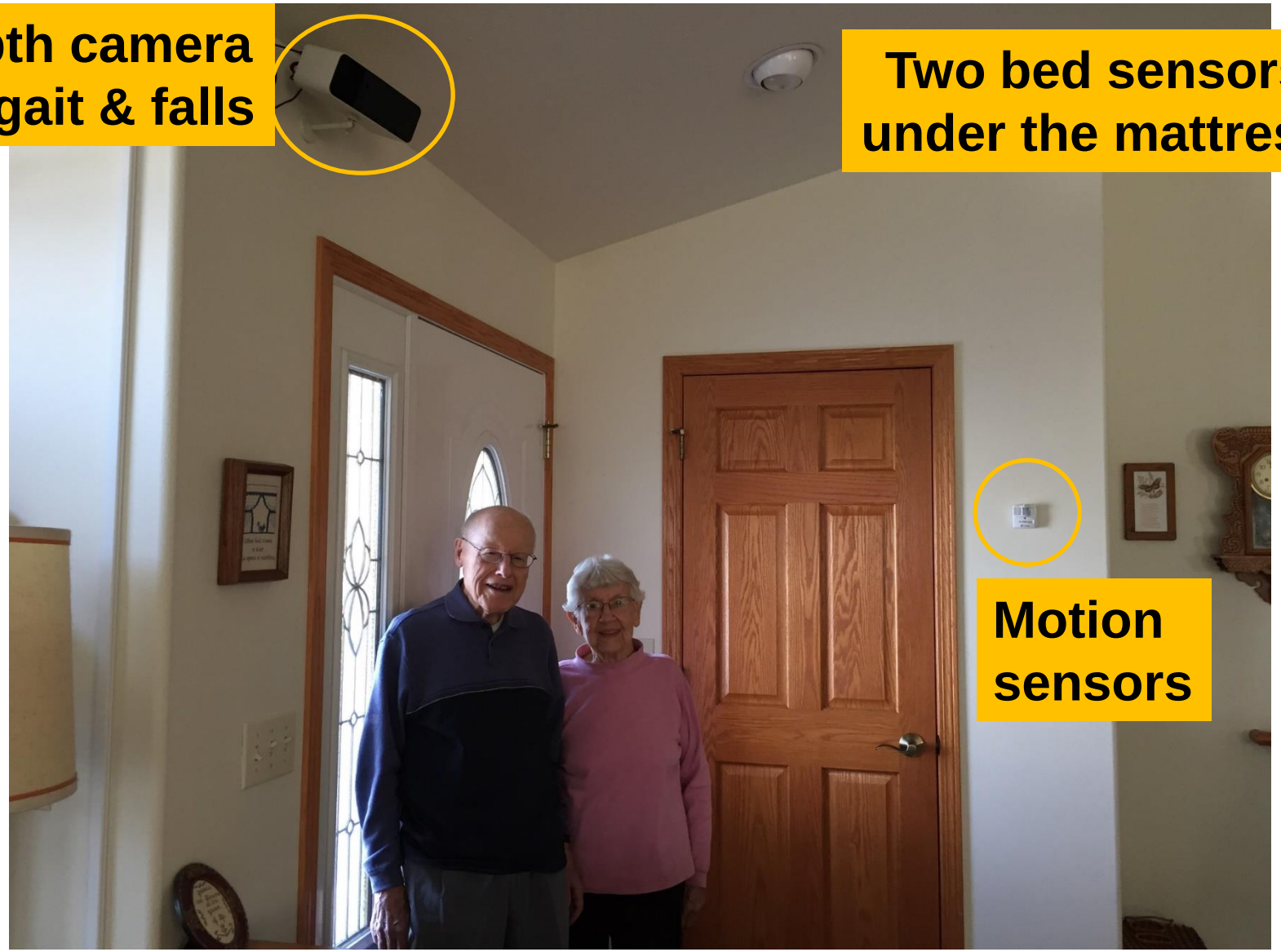
Clinical decision support system

Patented and licensed to Foresite Healthcare

Health alerts
Fall alerts

Nurses
Social Workers

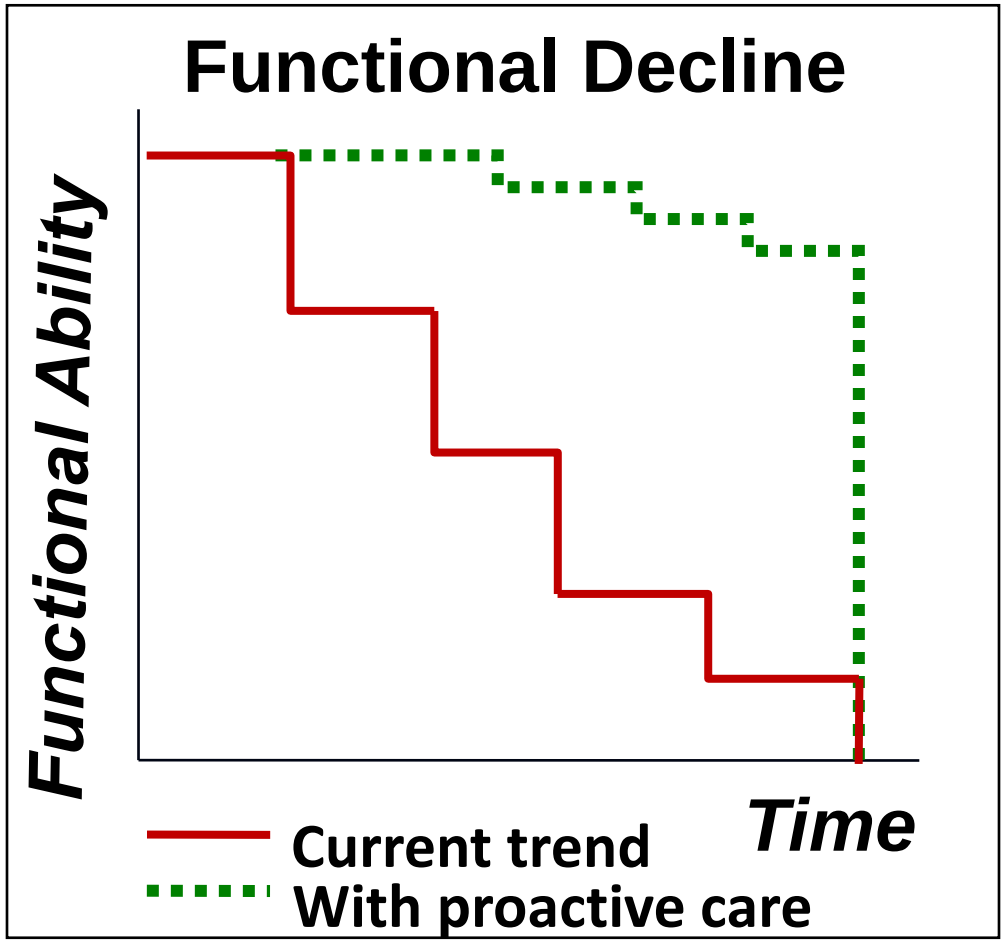
Skubic et al., *THC,* 2009; Rantz et al., *JGN*, 2010



www.eldertech.missouri.edu

Email: SkubicM@missouri.edu

What we have learned about Squaring the Life Curve with Sensor Technology



TigerPlace residents with in-home sensors stay 1.7 years longer than those without sensors at TigerPlace

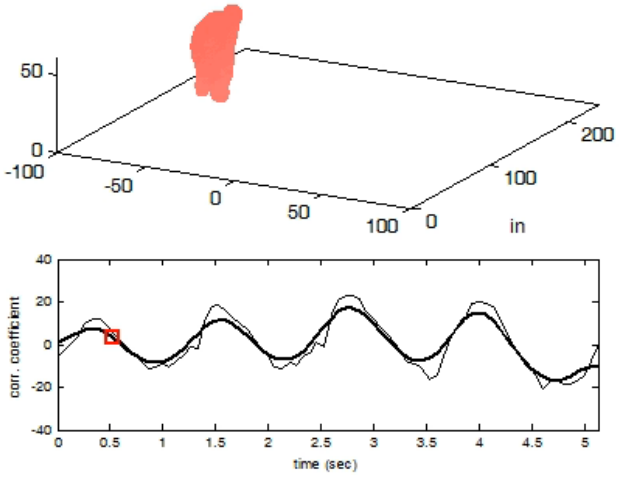
Rantz et al., Nursing Outlook, 2015

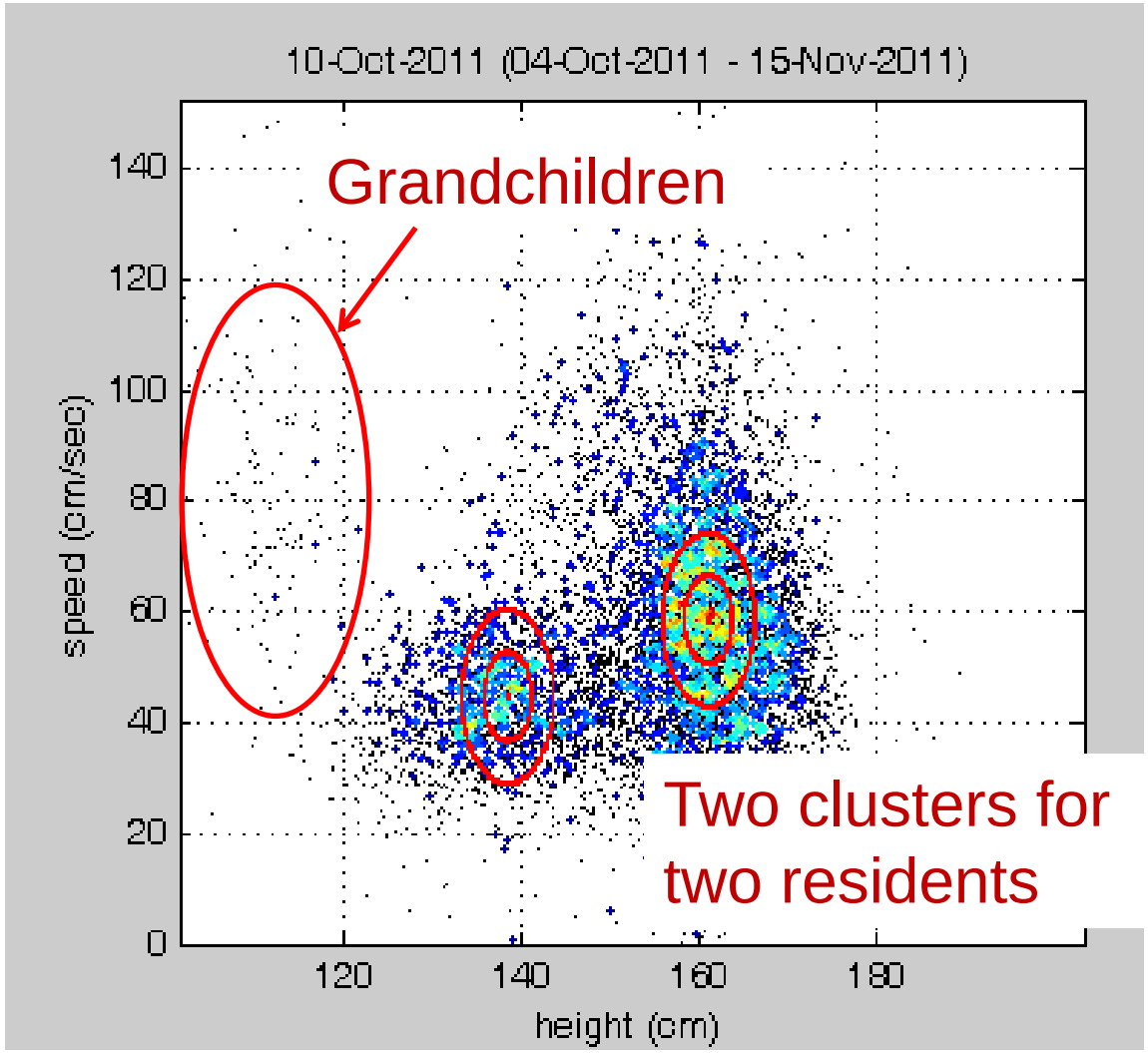
In-Home Gait Changes Monitored by the Sensors Predict Falls

- Decrease in walking speed of 5.1 cm/sec over 7 days
  → 86% probability of falling within the next 3 weeks
- Decrease in stride length of 7.6 cm over 7 days
  → 51% probability of falling within the next 3 weeks

Phillips et al., *Western Journal of Nursing Research*, 2016

Capturing Gait in the Home



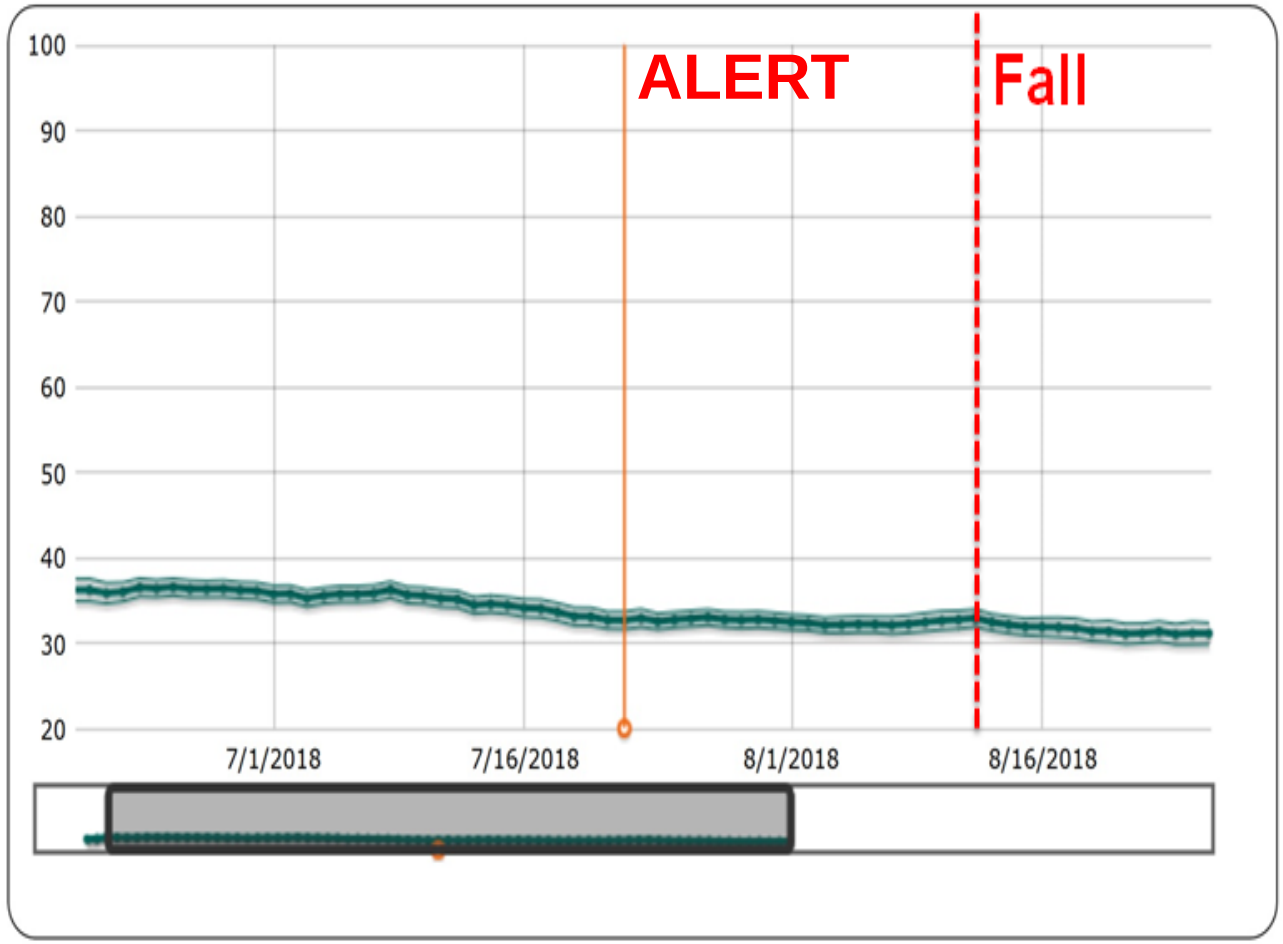


Examples of In-Home Walks

https://www.youtube.com/watch?v=MF6yZyLuuII

Stone & Skubic, EMBC 2012; *TBE* 2013; EMBC 2014.

Tracking Walking Speed and Fall Risk

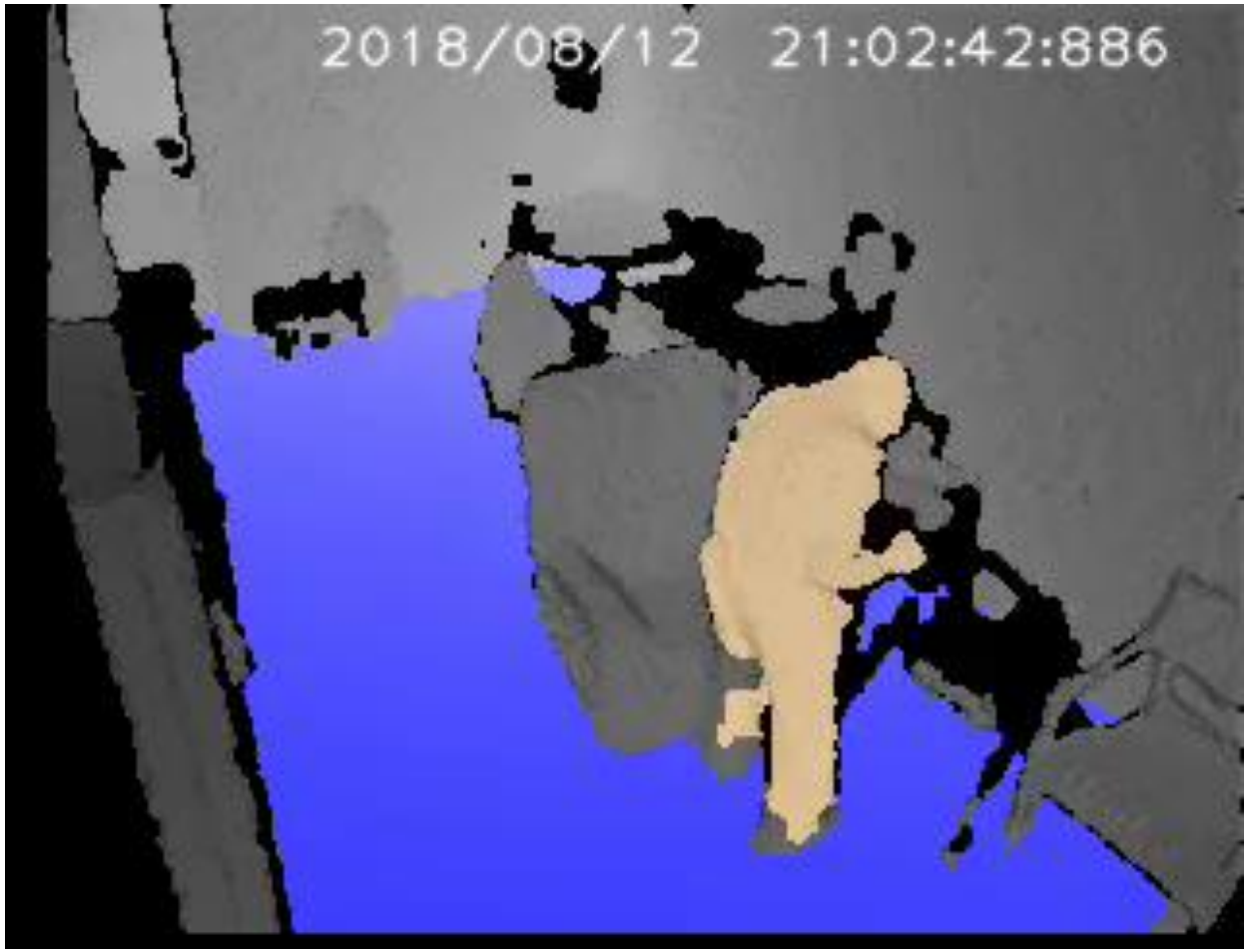


Decrease in walking speed of 5 cm/sec over 7 days

→ 86% probability of falling within the next 3 weeks

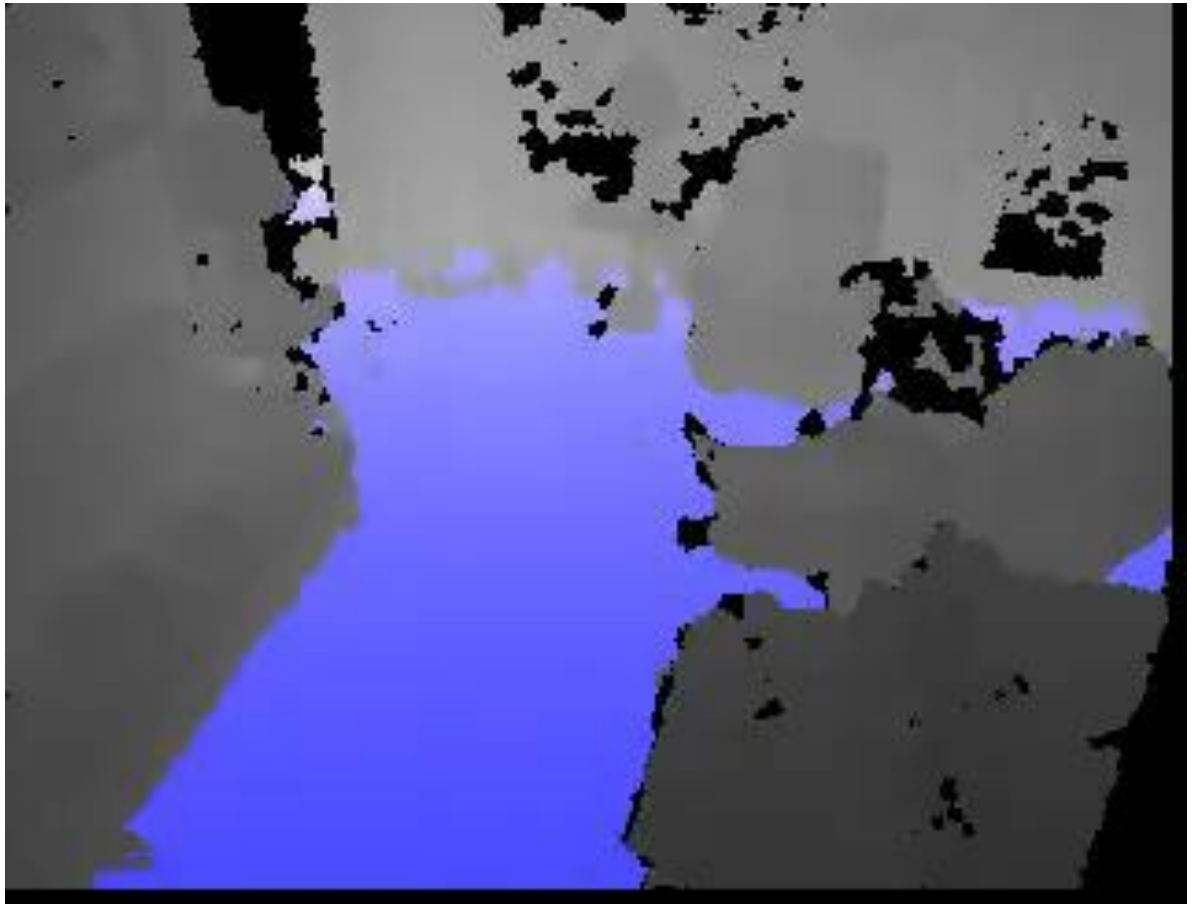
Phillips et al., WJNR, 2016

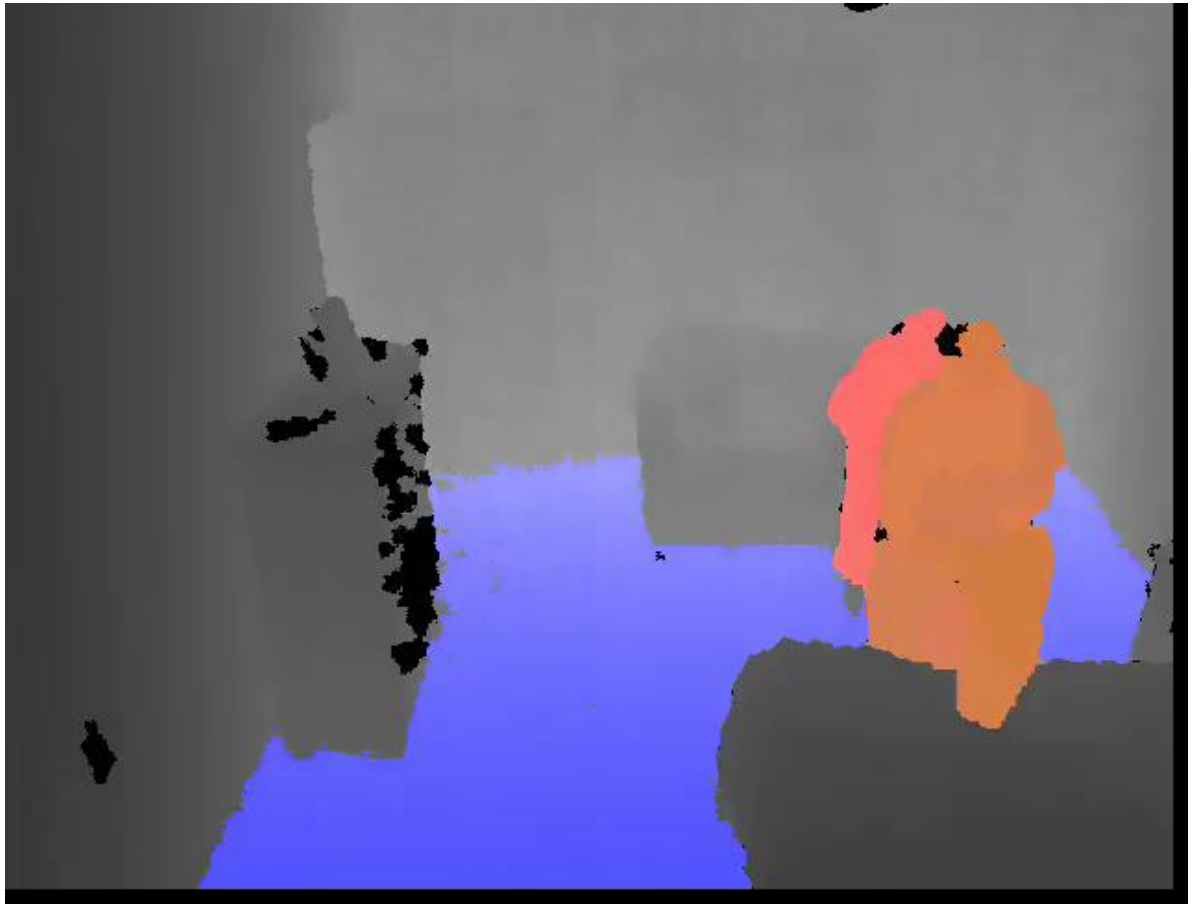
Capturing Falls in the Home with Depth Sensors



https://www.youtube.com/watch?v=TFB7YOUmHho Stone & Skubic, 2014, 2015

False Alarms in the Home

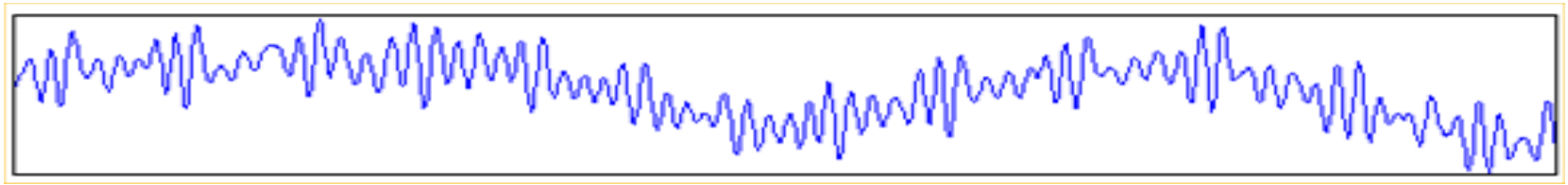


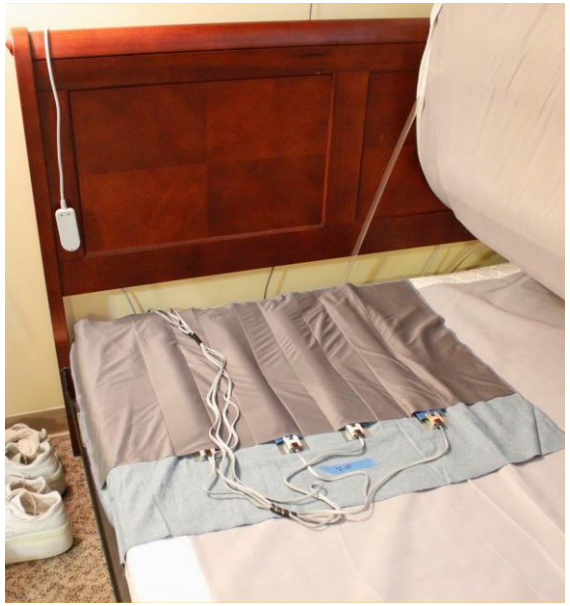


MU Hydraulic Bed Sensor

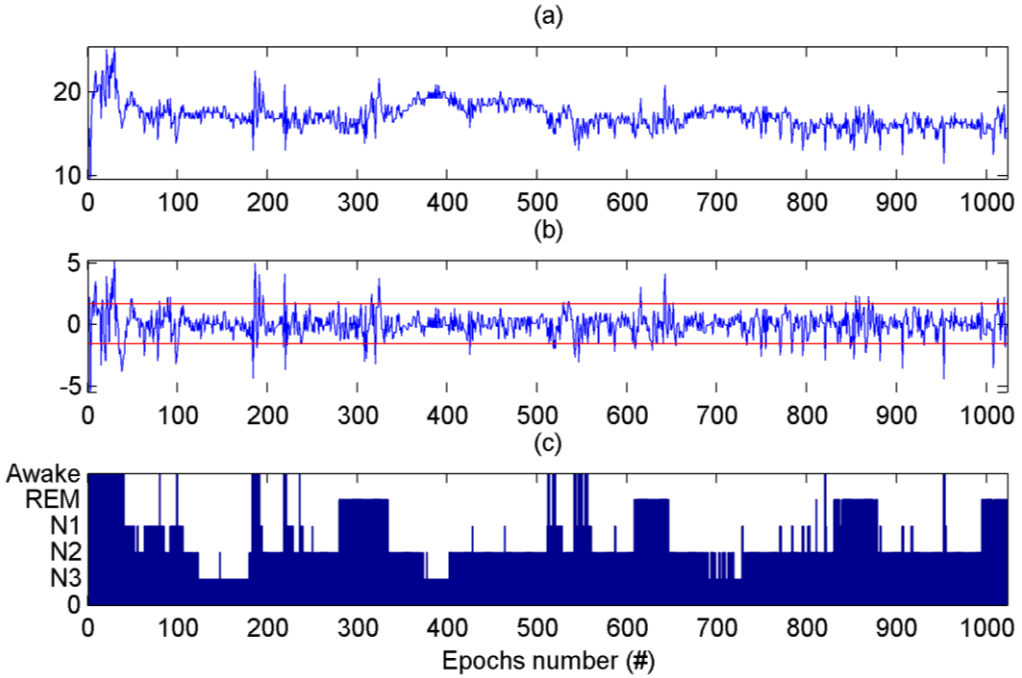
Captures the ballistocardiogram & respiration

10 seconds



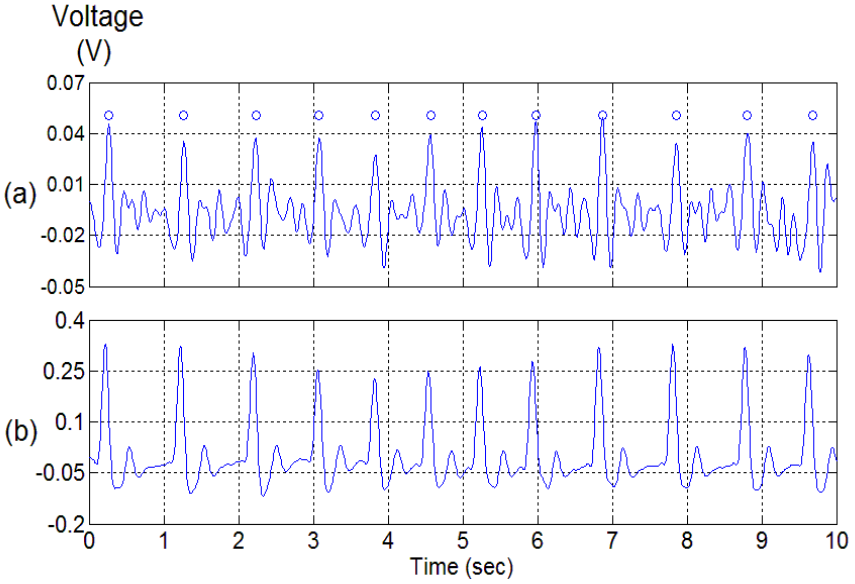


Sleep stage detection



Jang et al., EMBC 2016

Heartbeat detection



Heise et al., 2011, 2013;
Rosales et al., 2017

Keeping Eva out of the hospital

Recognizing early heart failure problems with a bed sensor

Health Changes Detected Early

- urinary tract infections
- pneumonia & other upper respiratory infections
- increasing congestive heart failure
- pain post hospitalization
- delirium
- low blood sugar

Uses a model of early illness recognition
to generalize across different health problems and
automatically sends health alert message

Rantz et al., *J of Gerontological Nursing*, 2012; *Gerontology*, 2015.

Health Alerts Evolution

Simple alert

Alert Summary

Resident id 3076 has had 6 health alerts since Saturday, September 23, 2017. Please visit the visualization interface via the link below to view the details of the alerts.

View Data on Interface

New linguistic style

Alert Summary

Day & Night Time in Bed have been increasing for the past 5 days.
Many instances yesterday had low pulse rate.
Many instances yesterday had low respiration rate.

View Data on Interface

Jain et al., JBI, 2019

Enhancing APRN and RN Care Coordination with Sensor Technology

Combines all the benefits of the positive care outcomes of access to APRN care with sensor technology for the best possible early illness recognition and early treatment plans

APRN Role in Eldercare—Aging in Place Project

- Aging in Place Project (CMS grant, 1999-2003) tested RN Care Coordination with the support of an APRN for home and community based services
- RN care coordination reduces adverse health events, improves care outcomes, nursing home utilization, and costs less
- Clinical outcomes are better
  - ADL performance, better cognition, less depression, continence, pain, shortness of breath

  Cost savings $1591 per month (vs. nursing homes); $483 per month (vs. community comparison)

APRN Role in Nursing Homes—MOQI Results (Slide 1 of 2)

- Full time Advanced Practice Registered Nurses (APRNs) in sixteen (16) NHs to promote early interventions for residents with declining health conditions
- Major focus is not primary care, but improving illness recognition of all staff and improving care delivery systems to prevent dehydration, promote activity, nutrition, communication, agree on goals of care
- Role model evidence-based care to facility nursing staff for effective recognition, assessment, and communication about residents' change in condition to primary care providers

CMS funded grants, 2012-2020, Reducing Avoidable Hospitalizations of Nursing Home Residents, Rantz, PI, $35 million

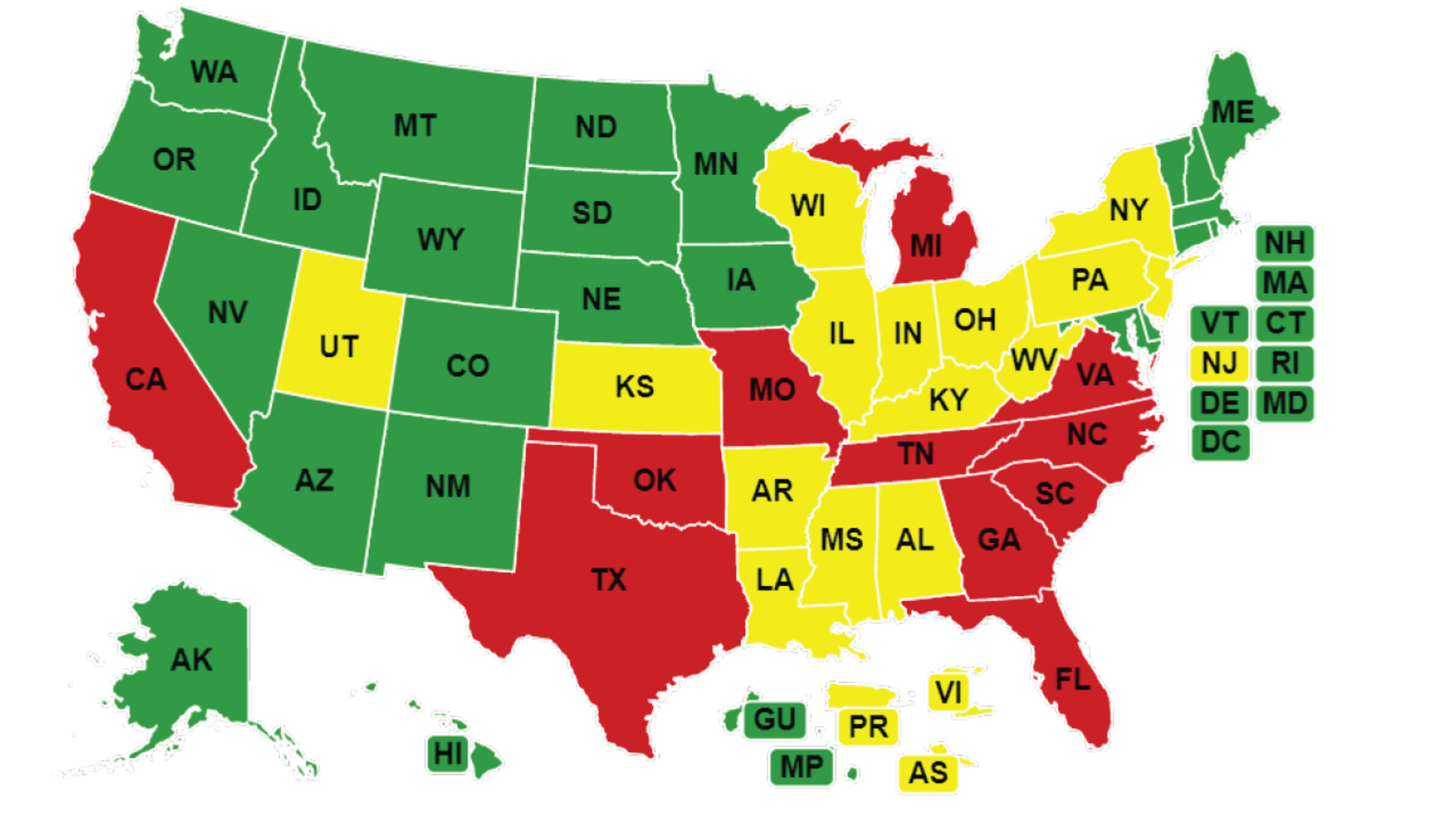
APRN Role in Nursing Homes—MOQI Results (Slide 2 of 2)

- Reduced potentially avoidable hospitalizations (2014-2016) by 50% and all cause hospitalizations by 32%;1 56.0% reduction in potentially avoidable ED visits; and 41.7% reduction in all-cause ED visits
- Reduced Medicare expenditures (2014-2016) per resident per year $1,241 (6.3%) for all Medicare services;1 $1,153 (28.6%) for all-cause hospitalizations; $514 (40.2%) for potentially avoidable hospitalizations; $62 (36.3%) for all-cause ED visits; $21 (42.8%) for potentially avoidable ED visits

Advanced Practice Nurses (APRN) Increase Access to Care Across the Country

- The following slide is a map of the United States and DC that shows
- Most of the states are full practice states for APRNs (Green)
- Some states are somewhat restrictive practice for APRNs (Yellow)
- The RED states, including Missouri are MOST restrictive of APRN practice
- Research evidence is clear, GREEN states have the best health outcomes for their citizens and RED states have the poorest health outcomes and per capita costs for healthcare

Oliver, G.M., Pennington, L., Revelle, S., & Rantz, M. (2014). Impact of nurse practitioners on health outcomes of Medicare and Medicaid patients. *Nursing Outlook, 62*(6), 440-447.* PMID: 25172368. doi:10.1016/j.outlook.2014.07.004.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Missouri APRN Regulations in Comparison to Surrounding/Nearby States

	Arkansas	Iowa	Illinois	Kansas	Kentucky	Missouri	Nebraska	Oklahoma	Tennessee	South Dakota	Colorado
1) APRN license granted by Board of Nursing	Yes[1]	Yes[2]	Yes[3k]	Yes[4]	Yes[5]	NO[6]	Yes[7]	Yes[8]	Yes[9,13]	Yes[10f]	Yes[11]
2) Board of Nursing has sole authority over APRN scope of practice	Yes[1]	Yes[2]	Yes[3k]	Yes[4]	Yes[5]	NO[6l]	Yes[7]	Yes[8]	Yes[9,13]	Yes[10]	Yes[11]
3) Physicians **can collaborate with an unlimited** number of APRNs	Yes[1]	Yes[2]	Yes[3]	Yes[4]	Yes[5]	NO[6]	Yes[7]	Yes[8]	Yes[9]	Yes[10]	Yes[11]
4) APRNs **practice (physically in person) without a mileage restriction**	Yes[1]	Yes[2]	Yes[3]	Yes[4]	Yes[5,]	NO[6,14h,i]	Yes[7]	Yes[8]	Yes[9g]	Yes[10]	Yes[11]
5) APRNs refer patients to collaborating and other physicians as needed	Yes[1]	Yes[2]	Yes[3]	Yes[4]	Yes[5]	NO[6]	Yes[7]	Yes[8]	Yes[9]	Yes[10]	Yes[11]
6) Physicians review APRN records only when necessary	Yes[1]	Yes[2]	Yes[3]	Yes[4]	Yes[5]	NO[6i]	Yes[7]	Yes[8]	No[12,13,14]	Yes[10]	Yes[11]
7) APRNs **provide care** without a Collaborative Practice Arrangement with a Physician	Yes[1]	Yes[2]	Yes[3a]	Yes[4]	Yes[5]	NO[6l]	Yes[b7]	Yes[8]	NO[9,13,14]	Yes[10]	Yes[11]
8) APRNs prescribe medications **without** a Collaborative Practice Arrangement with a Physician	NO[1c]	Yes[2]	Yes[3a]	No[4]	Yes[5]	NO[6]	Yes[7]	Yes[8]	NO[9]	Yes[10d]	Yes[11e]
9) APRNs order home health services	Yes[m]	Yes[m]	Yes	Yes[m]	Yes[m]	NO	Yes	Yes	Yes	Yes	Yes

Legend:

a. No written collaborative practice agreement required in Illinois after 4000 hours of clinical practice, and at least 250 hours of continuing medical education
b. No written protocols required after APRN has completed 2000-hour post-graduate residency, except certified nurse-midwives and CRNAs.
c. Collaborative practice agreement only required for prescriptive authority.
d. No written agreement needed after passing board exam and 1,040 hours of practice with a physician or another APRN.
e. Must have 1000 hours of documented practice with a physician or another APRN, then full prescriptive authority granted by Board of Nursing.
f. South Dakota Board of Nursing under the umbrella of the South Dakota Department of Health
g. Onsite visit every 30 days
h. If the APRN is providing services pursuant to section 335.175, RSMo, (telehealth for rural areas), no mileage limitation shall apply.
i. Due to the Covid-19 state of emergency, chart review, mandatory physician presence, and geographic limitations of physician collaborators have been temporarily waived under executive order. MO pre-waiver requirement: physician review monthly 10% of charts; 25% if scheduled medication prescribed; APRN practice within 75 miles of physician; physician must see patient/approve plan of care within two weeks for all conditions other than acute self-limited or well-defined problems; APRN must practice with physician one month before seeing patients at another location.

Updated 2/10/2022 M. Butler and M. Rantz
11/1/2019 V. Bader
Adapted from earlier version of comparison of publicly available APRN practice data by P. Sohn, DNP, APRN-BC

Your help is needed for Access to APRNs

- House Bill 2434
- This bill removes the 75 mile restriction that currently limits APRN practice
  - This is very detrimental to rural residents, restricting their access to care, so they must travel much further for primary care and mental health services
  - Many rural counties now do NOT have access to care
- Removes barriers to use of telehealth and home health care that can be authorized by APRNs
- Under the emergency Covid regulation, these barriers were removed and NOW are back in place! Need to remove permanently

The in-home sensors detect your health changes before you do

Testing shows improved health outcomes for seniors with the sensors and health alerts

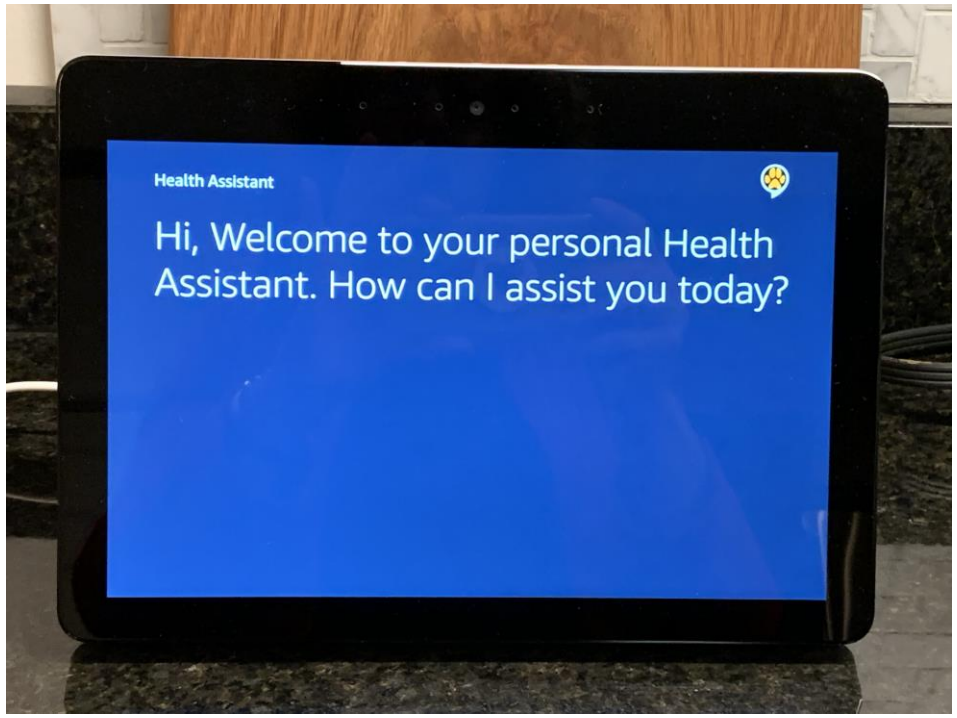
Combining the In-home sensors with ARPN directed care has huge potential

Anticipate the future of AIP will combine these two successful innovations that will improve health outcomes for seniors

Some new work under development

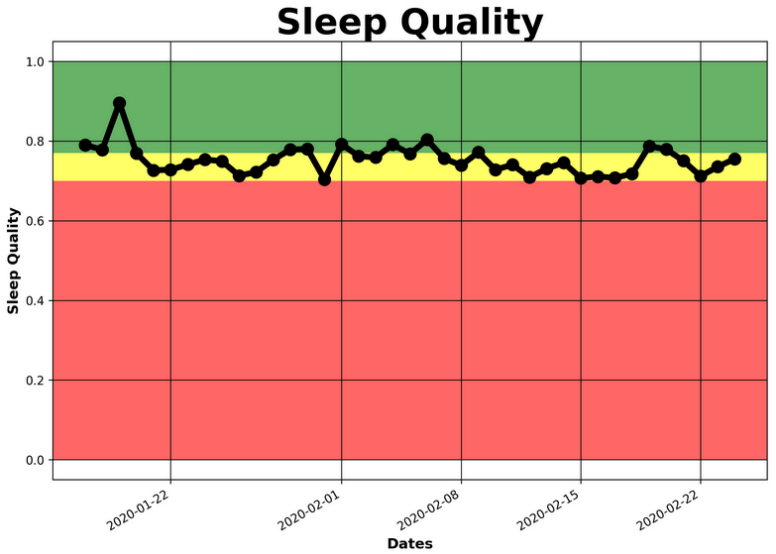
With the sensors and health alerts

New: Consumer Interfaces

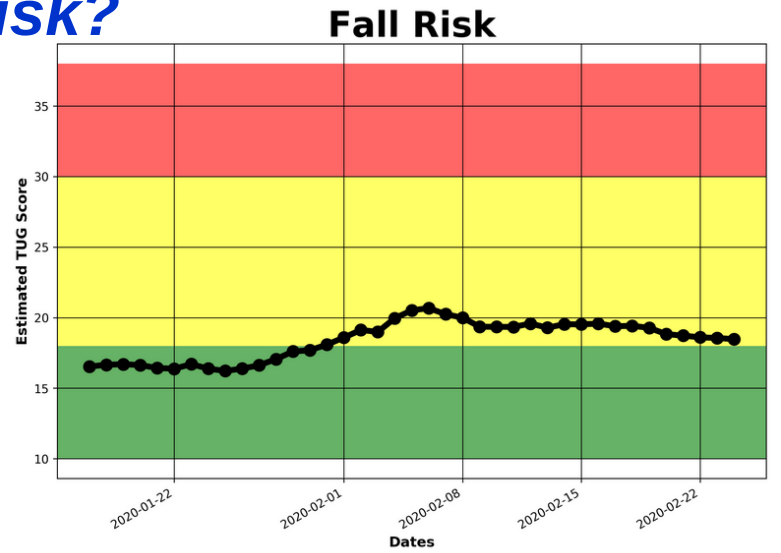


Using voice commands with the Amazon Echo Show

How am I sleeping?



What is my fall risk?

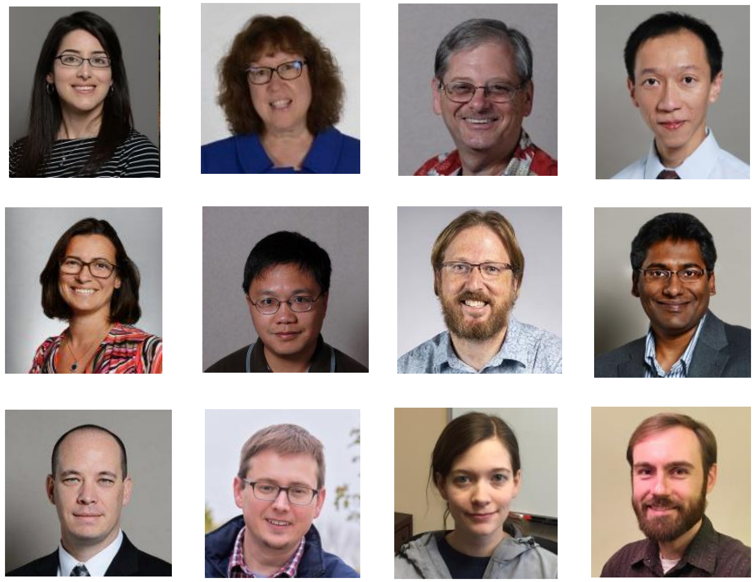


Skubic NIH grant, in progress

Many Collaborators …+ students & seniors

Physical Therapy

Nursing



Engineering & Computer Science

Social Work

Occupational Therapy

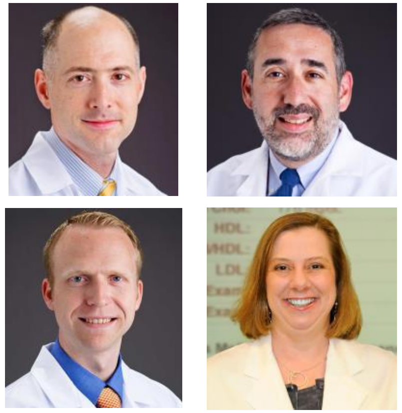
Education

Foresite Healthcare

Architectural Studies

Music

HMI



Medicine

Center for Eldercare and Rehabilitation Technology and Sinclair School of Nursing, Aging in Place at TigerPlace

Many thanks to our faculty and student collaborators, the study participants & the funding agencies.

www.eldertech.missouri.edu

www.agingmo.com

Many Thanks

Many thanks to our faculty and student collaborators,
the older adult study participants & the funding agencies

NSF
NIH National Institutes of Health
NATIONAL LIBRARY OF MEDICINE
AHRQ

Disclaimer

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