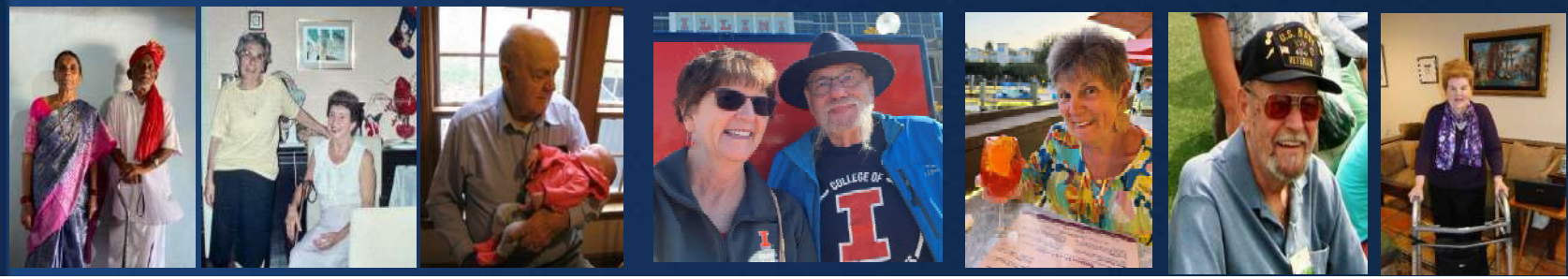
Federal University of Santa Catarina
November 2023
Florianópolis, Santa Catarina, Brazil

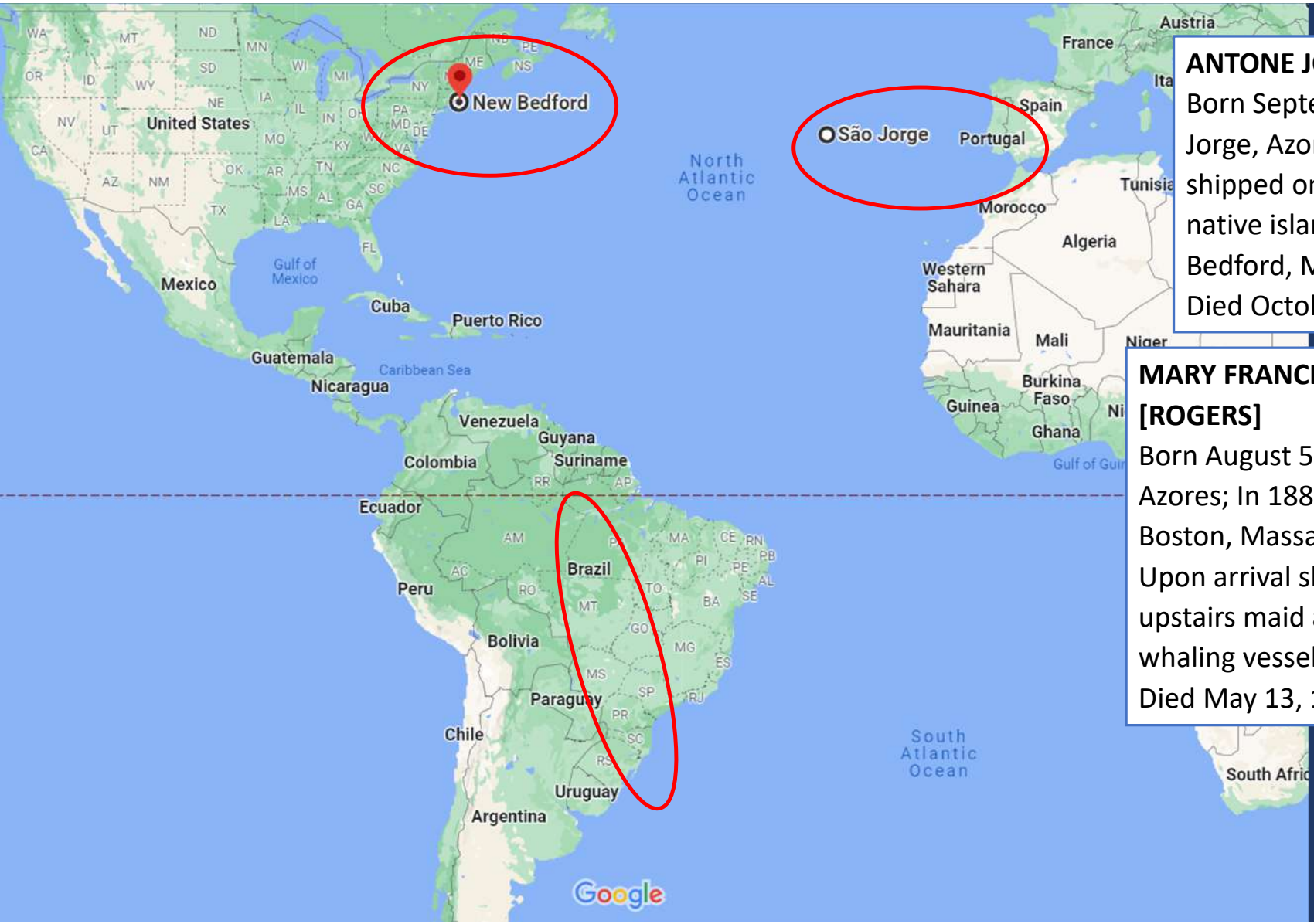
Living in Interactive Future Environments: Supporting Successful Aging through Technology Innovation

Wendy A. Rogers, Ph.D.
Khan Professor of Applied Health Sciences
University of Illinois Urbana-Champaign

Human Factors & Aging
LABORATORY

hfaging.org





ANTONE JOSEPH ROGERS

Born September 4, 1848 in Sao Jorge, Azores; As a boy he shipped on a whaler from his native island and arrived at New Bedford, Massachusetts at age 17.

Died October 16, 1913 **at age 65**

MARY FRANCIS DIAS SOARES [ROGERS]

Born August 5, 1861 in Sao Jorge, Azores; In 1882 she arrived in Boston, Massachusetts at age 21. Upon arrival she was employed as an upstairs maid at the home of a whaling vessel owner.

Died May 13, 1954 **at age 93**

CHART

Collaborations in Health, Aging, Research, and Technology

chart.ahs.illinois.edu

ILLINOIS
McKechnie Family LIFE Home
COLLEGE OF APPLIED HEALTH SCIENCES

LIFEhome.ahs.Illinois.edu

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HEALTH TECH
HEALTH TECHNOLOGY EDUCATION PROGRAM

healthtech.ahs.illinois.edu

Health Technology Education Program

Designing for Health

Health Technology Professional Education Program (HT-PEP)

General Education Course in Health Technology

Undergraduate Certificate in Health Technology (with Engineering)

Health Technology Interdisciplinary Minor (with Engineering)

Master of Science in Health Technology (MS-HT) (with Engineering)

HEALTH TECH

MS in Health Technology

healthtech.ahs.Illinois.edu
healthtech@illinois.edu

Designing for Health

Training the next generation of applied health technology professionals to improve the design of technology that supports the health and well-being of individuals.

- 1-year intensive MS program
- Capstone project experience
- STEM-designated program
- Small cohorts
- **100%** of students receive scholarships/fellowship

Learn More
Info Sessions
Application Workshops

Applications Open October 1–March 1

Early Deadline: December 1

Health Technology
University of Illinois Urbana-Champaign

College of Applied Health Sciences + The Grainger College of Engineering

MS-HT Alumni Placements

The National Academies of SCIENCES ENGINEERING MEDICINE

innovation hub
BRIGHAM HEALTH
BRIGHAM AND WOMEN'S HOSPITAL

OSF HEALTHCARE

DESIGN SCIENCE
Usability starts here.

CURO

MEDLINE

SOMATUS
REVOLUTIONIZING KIDNEY CARE

EMERGO by UL

VIRTUSENSE™

Bold Insight

motorola

ILLINOIS

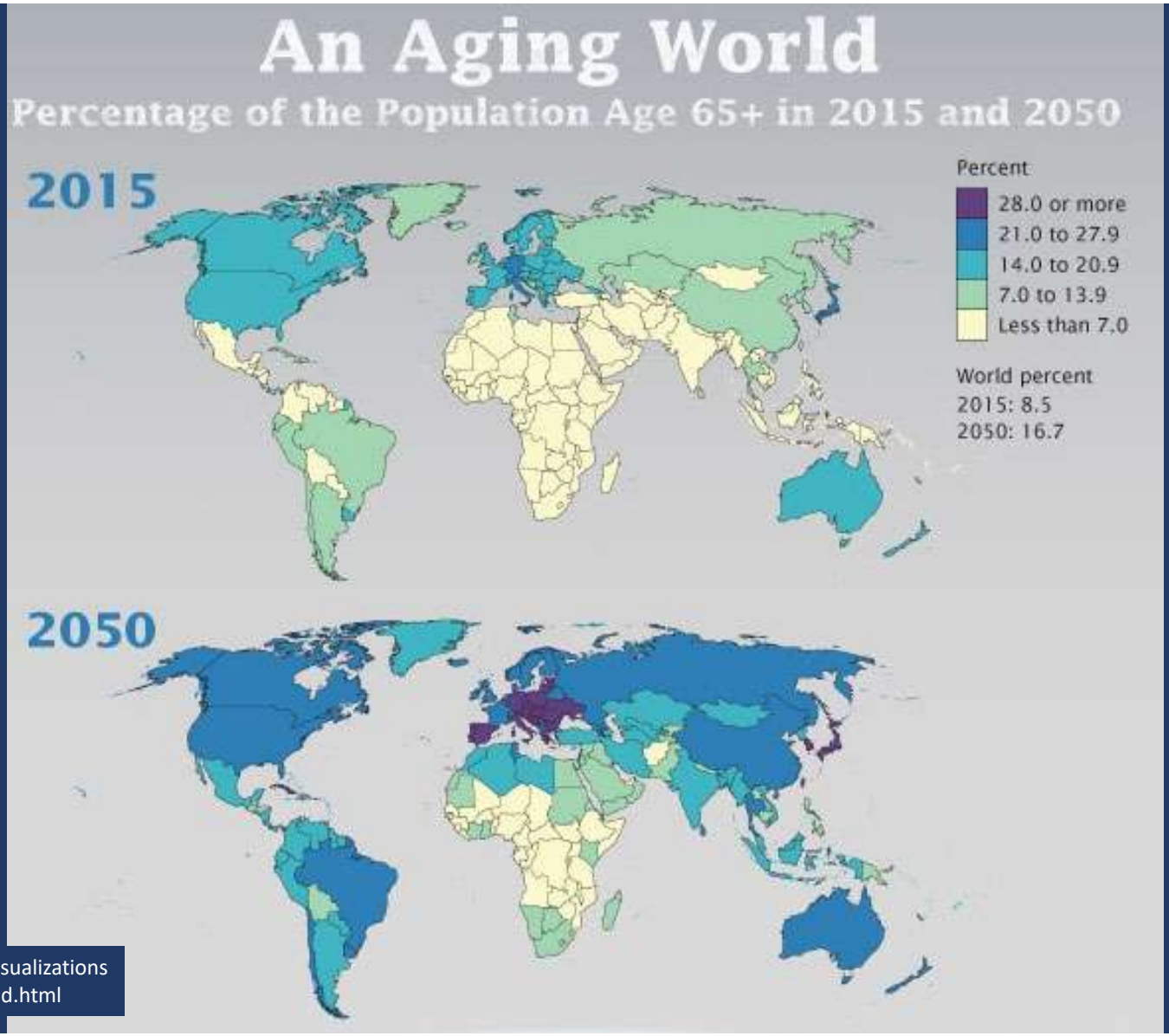
Job Titles

- Research Associate
- Data Engineer
- Innovation and Operations Analyst
- Human Factors Associate
- Associate Human Factors Engineers
- Design Fellow
- UX Researcher
- Associate Product Manager
- Product Coordinator
- UI/UX Designer

CHART (Collaborations in Health, Aging, Research, & Technology) is a research theme in the College of Applied Health Sciences at the University of Illinois Urbana-Champaign (established January 2017)

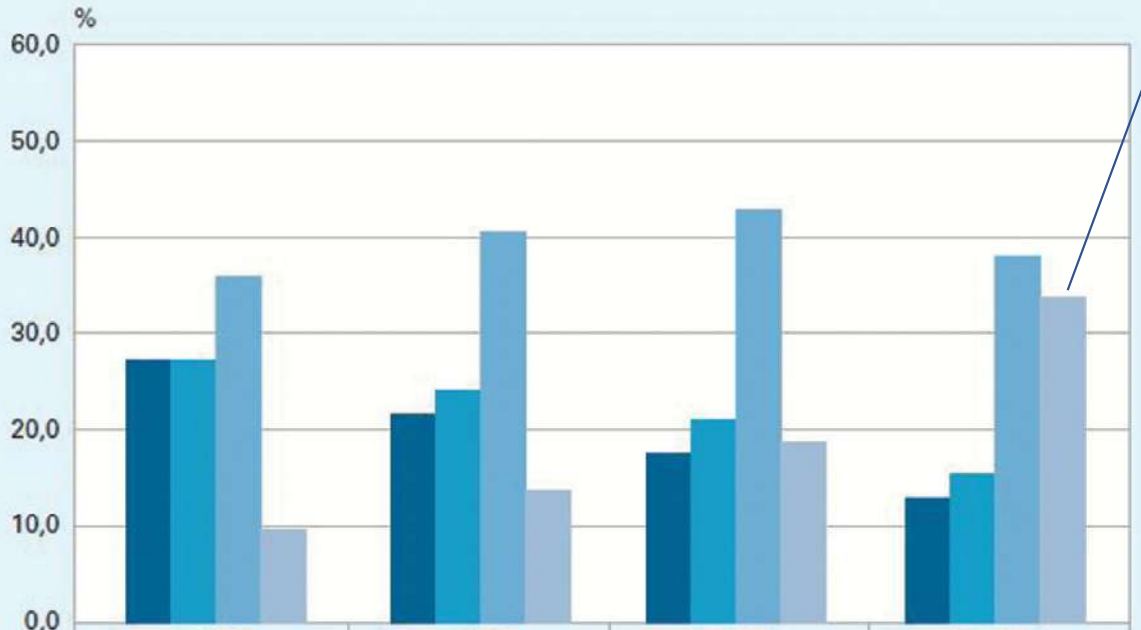
To **enable successful aging** through:

- Fundamental **research**
- Advanced technology **development**
- **Education** of researchers, developers, healthcare professionals, older adults
- Guidance for **policy** decision-making
- **Translation** of these efforts to positively affect the lives of older adults.



https://www.census.gov/library/visualizations/2016/comm/cb16-54_aging_world.html

Gráfico 1.3 - Distribuição percentual da população residente, por grupos de idade
Brasil - 2004/2060



	2004	2014	2030 (1)	2060 (1)
0 a 14 anos	27,1	21,6	17,6	13,0
15 a 29 anos	27,3	24,1	21,0	15,3
30 a 59 anos	35,9	40,6	42,7	38,0
60 anos ou mais	9,7	13,7	18,6	33,7

Fonte: IBGE, Pesquisa Nacional por Amostra de Domicílios 2004/2014 e Projeção da População do Brasil por Sexo e Idade para o Período 2000-2060 - Revisão 2013.

(1) Dados projetados.

By 2060, ~35% of population of Brazil will be over age 60

CHART Activities Include:

- Faculty affiliates
- Event support
- Community engagement
- Age-Friendly University
- Participant recruitment
- Visiting scholars

CHART Steering Committee

Illinois Department on Aging

CHART faculty part of three federally-funded centers

Center for Research and Education on Aging and Technology Enhancement
www.create-center.org

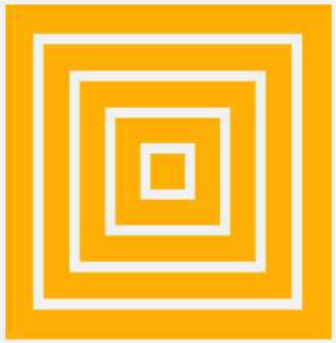
National Institute on Aging (National Institutes of Health) PO1 AG017211

1999

Technologies to Support Aging Among People with Long-Term Disabilities
www.techsagererc.org

National Institute on Disability, Independent Living, and Rehabilitation Research (Department of Health & Human Services) Grant 90REGE0006

2013



Center for Enhancing Neurocognitive Health, Abilities, Networks, & Community Engagement
www.enhance-rerc.org

National Institute on Disability, Independent Living, and Rehabilitation Research (Department of Health & Human Services) Grant 90REGE0012

2019

McKechnie Family LIFE Home

University of Illinois Urbana-Champaign

Living in Interactive Future Environments
Simulated home environment

Research Examples:
Support for Successful Aging

Human Factors & Aging
LABORATORY

PARTICIPATORY RESEARCH APPROACH FOR EVALUATING HOME ENVIRONMENT FOR OLDER ADULTS WITH DISABILITIES

- Juliana T. Tissot (julianatissot@gmail.com)
- Widya A. Ramadhani (wramadh2@Illinois.edu)
- Lizandra G. Vergara
- Wendy A. Rogers

Gerontological Society of America 2022

Tissot, J., Ramadhani, W., Vergara, L., & Rogers, W. A. (in press). Design guidelines for a safe environment to improve aging in place. In M. Kolak and I. Mois (Eds.), *Place & the social-spatial determinants of health*. Springer Nature.

How do architecture and human factors contribute to creating a safer environment for aging in place?

Kitchen:

- Appliances at waist level
- Layout it "C" or "U" shape
- Lights under cabinets
- Translucent cabinet doors in the foot space

Personal care:

- High friction flooring
- Grab bars on both sides of toilet sides
- Adequate wheelchair maneuvering space
- Color contrast

Overall floor plan should be **designed** with considerations of **users' everyday activities** and the **relationship between these activities,** such as having the personal care nearby bedroom, laundry nearby the kitchen to improve users' mobility.

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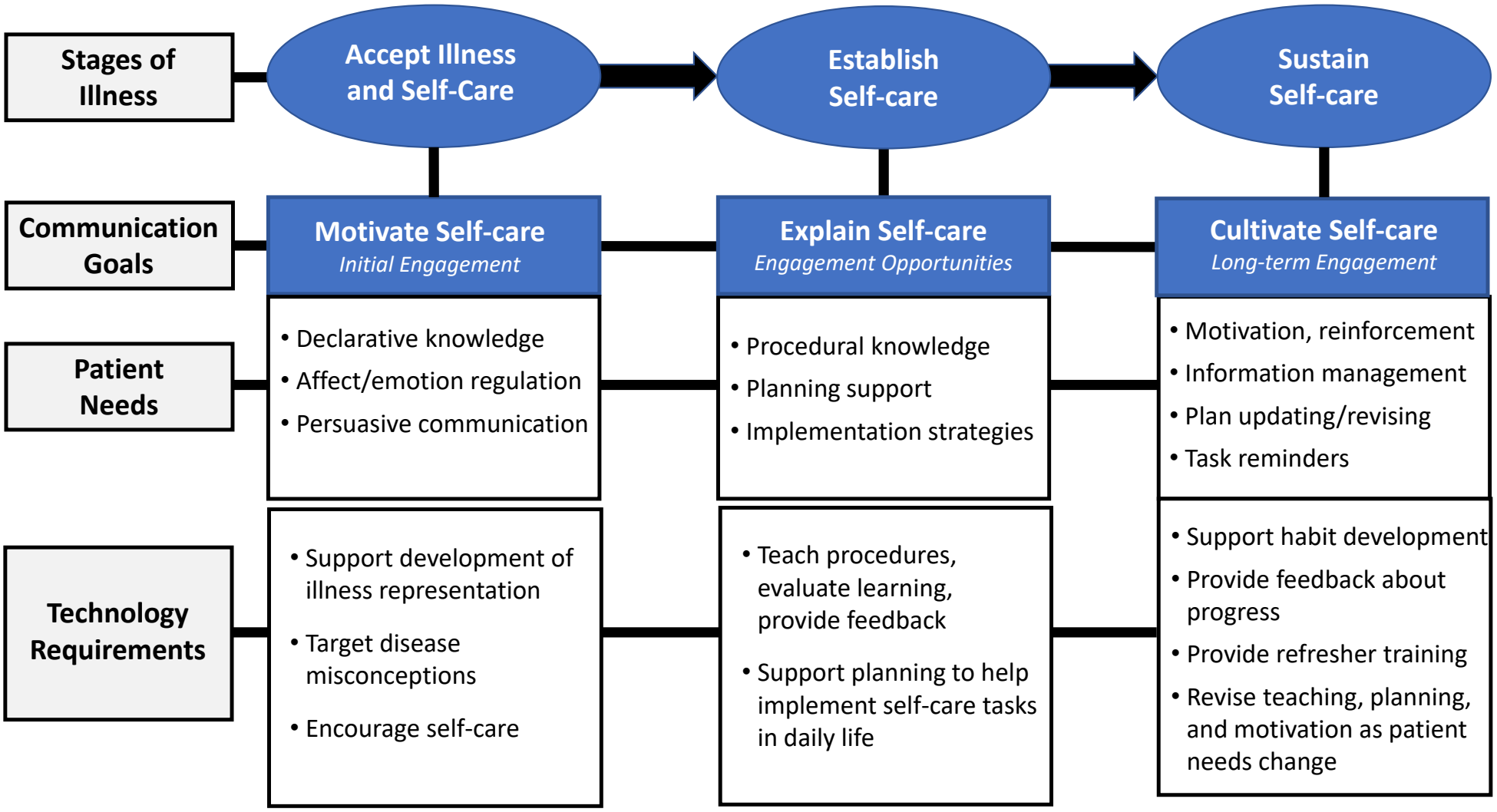
Health Self-Management

Framework for Designing Technology to Support Health Self-Care (Morrow, Lane, & Rogers, 2021)



Apps for Health Self-management

Mobile Health Apps: Improving Usability for Older Adult Users

With smartphone use among older populations on the rise, older adults have increased access to health-focused mobile apps. Despite their potential benefits for managing health, currently no guidelines exist for designing these apps specifically for older adult users.

By Stephanie A. Morey, Rachel E. Stuck, Amy W. Chong, Laura H. Barg-Walkow, Tracy L. Mitzner, & Wendy A. Rogers

ergonomics in design | October 2019

Well over 1,000 apps that could be broadly classified as supporting health self-management.

Search Term	App Store Hits (iPhone)
Biking	100+
Blood Pressure Tracking	100+
Diabetes Management	100+
Exercise	100+
Fitness	100+
Mental Health	100+
Nutrition	100+
Running	100+
Sleep Tracking	100+
Hydration Reminder	83
Medication Management	57
Doctor Locator	49
Mental Motivation	29
Health Maintenance	17
Online Therapy	17
Swimming	4

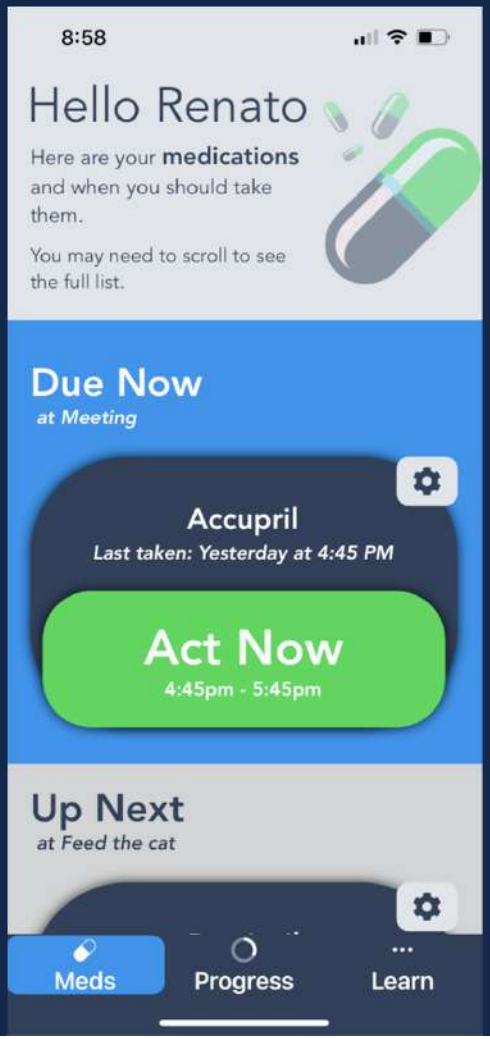
We evaluated commonly downloaded apps: medication reminder and congestive heart failure management:

- heuristic evaluations
- cognitive walkthroughs
- user testing with think-aloud

	Heart Partner		Heart Failure Health Storylines	
	Issues	**User Comments**	**Issues**	**User Comments**
Navigation	Difficulty navigating between screens Scrolling issues Confusion over where to go to enter new data	"Are we missing a bar on the right side of the screen to show more information is below? I'm having to guess and guessing is bad."	Difficulty navigating between screens Difficulty understanding actions to perform a task	"[it is] confusing [working out] where to go to add the different things you need to add" "I would need someone to show me" (when asked to navigate about the app)
Data entry	Issues with entering new data Unclear processes for saving data		Issues with entering new data Unclear processes for saving data Entering data requires many steps	"for me to understand it, it would have to be more simpler" "make [the app processes] easier for a senior citizen to understand" "I guess I'm on the right screen, I just don't know what to do" "cumbersome"
Help information and error recovery	Issues with deleting and editing previously entered data	"At this point, I would pick up the tablet and throw it against the wall"	No directions for how to recover from errors	
Data visualizations	Difficulty understanding graphical information	"it is not clear to me" "I wouldn't know how to do that" (when asked to view weight data graphically)	Difficulty understanding graphical information Graphs contain too many elements (e.g., grid lines, multiple data points, different factors).	"I don't understand [the graph]"

Outcome: Guidelines for designing healthcare apps for older adults

MEDSReM: Medication Education, Decision Support, Reminding, and Monitoring



Currently conducting a randomized controlled trial (RCT) to assess effectiveness for older adults

Funded by National Institute of Nursing Research R01NR020261

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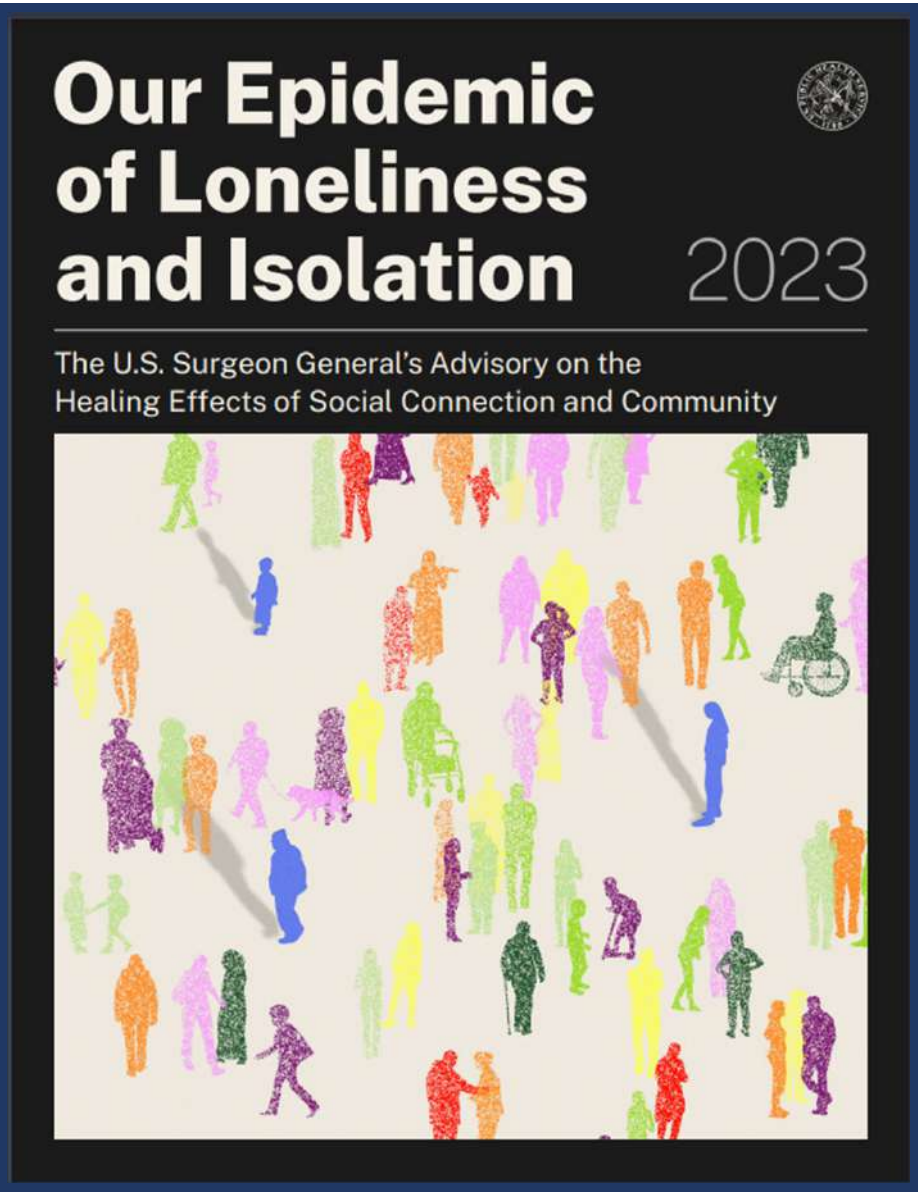
Social Engagement



Bixter, M., Blocker, K.A., & Rogers, W. A. (2018). Enhancing social engagement of older adults through technology. In R. Pak & A. McLaughlin (Eds.), *Aging, Technology, and Health*. Elsevier.

Higher levels of social engagement for older adults:

Reduced hypertension

Yang, Boen, Gerken, Li, Schorpp, & Harris, 2016

Decreased development of dementia

Crooks, Lubben, Petitti, Little, & Chiu, 2008; Fratiglioni, Wang, Ericsson, Maytan, Winblad, 2000; Kotwal, Kim, Waite, & Dale, 2016; Sörman, Sundström, Rönnlund, Adolfsson, & Nilsson, 2014

Increased mental health and psychological well-being

Fiori, Antonucci, & Cortina, 2006; Forsman, Nyqvist, Schierenbeck, Gustafson, & Wahlbeck, 2012; Litwin & Shiovitz-Ezra, 2011

Reduced mortality rates

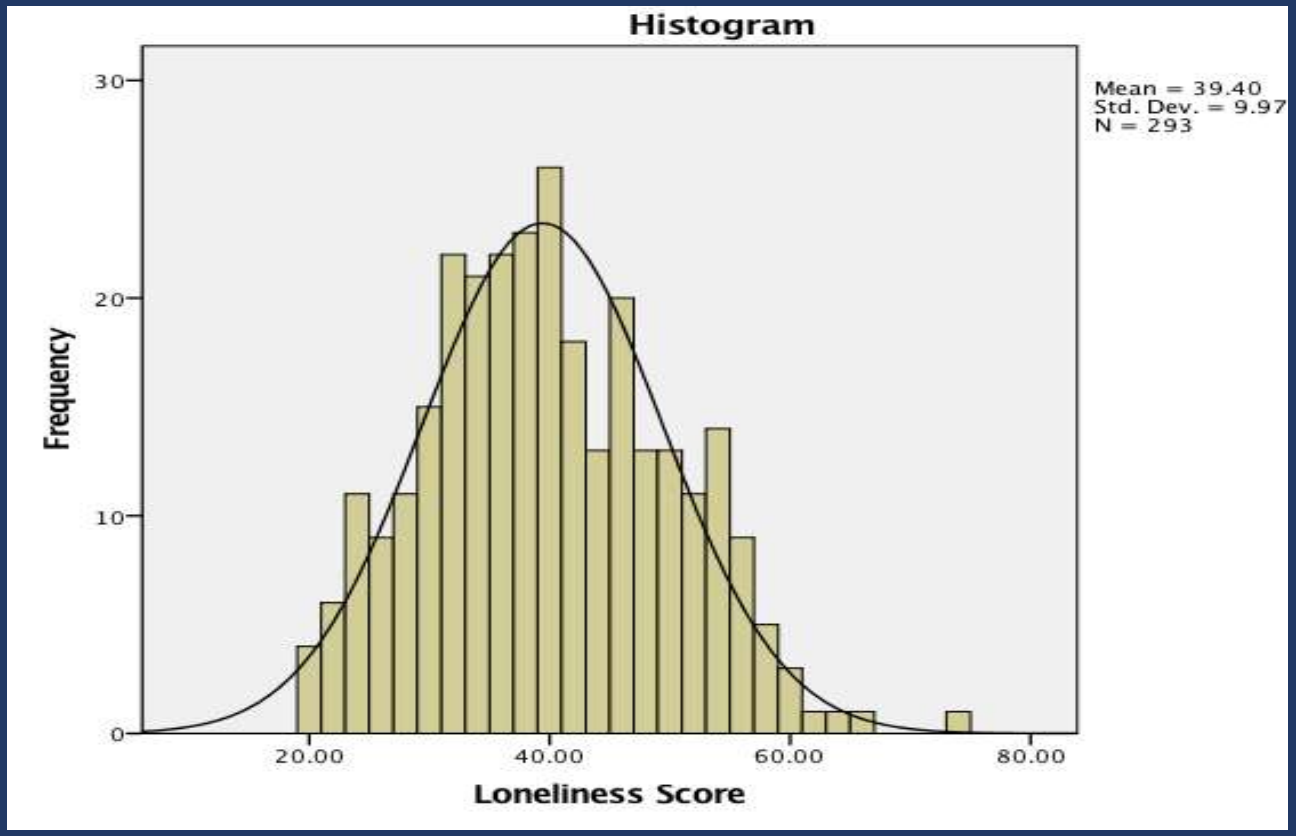
Bennett, 2002; Ceria, Masaki, Rodriguez, Chen, Yano, & Curb, 2001; Dalgard & Håheim, 1998; Eng, Rimm, Fitzmaurice, & Kawachi, 2002; Kiely & Flacker, 2003; Kim, Lee, Kim, Choi, Lee, & Park, 2016; Sampson, Bulpitt, & Fletcher, 2009

Loneliness: PRISM RCT

Czaja, S. J., Boot, W. R., Charness, N., Rogers, W. A., and Sharit, J. (2018). Improving social support for older adults through technology: Findings from the PRISM randomized controlled trial. *The Gerontologist, 58*, 467-477.

At Risk for Social Isolation:

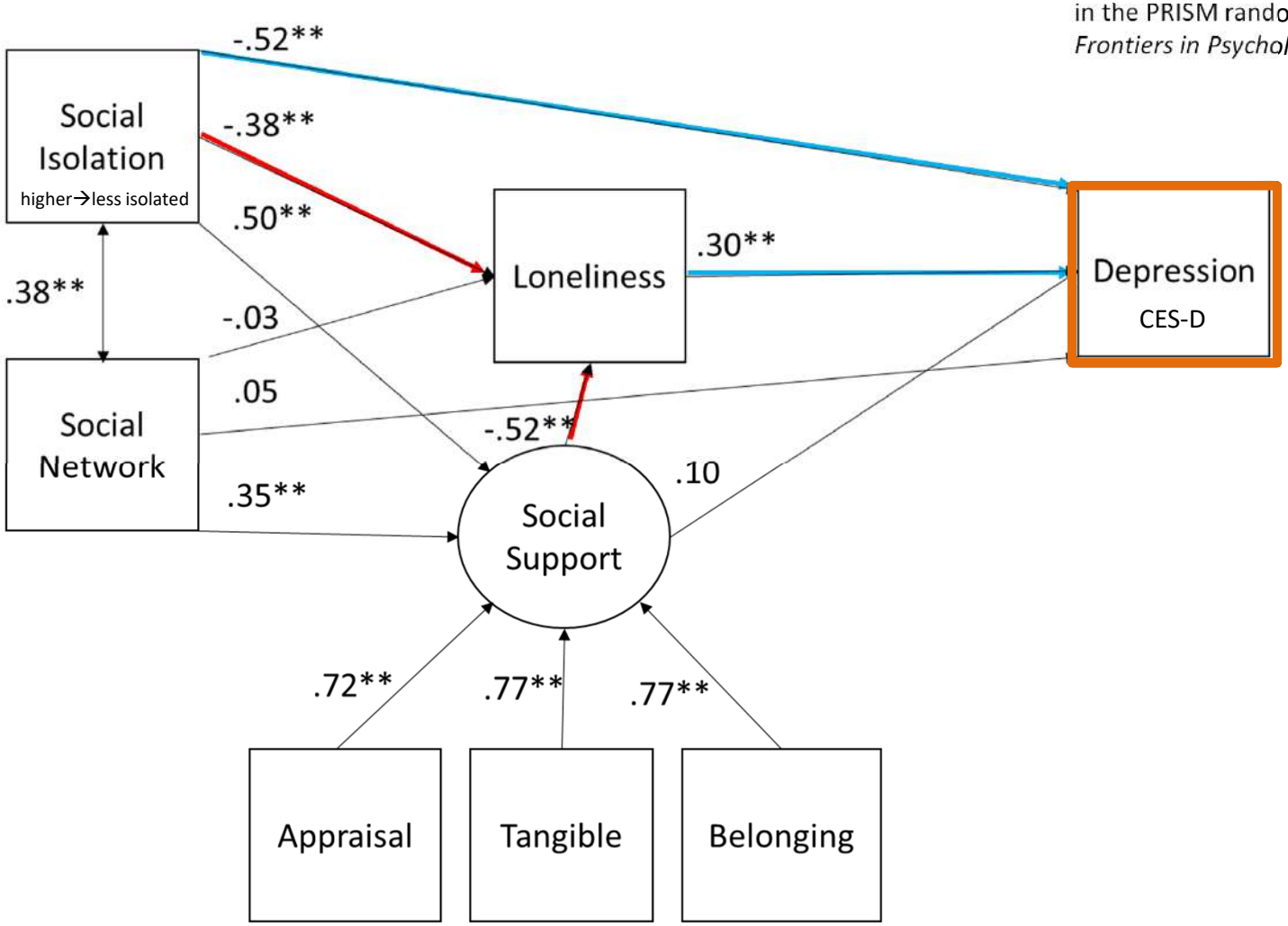
- Recruited 300 people
- 65+ years (64-98 years)
- Live alone in the community
- Minimum computer/Internet use
- Work or volunteer < 5 hrs/wk
- Less than < 10 hrs per/wk Senior Center



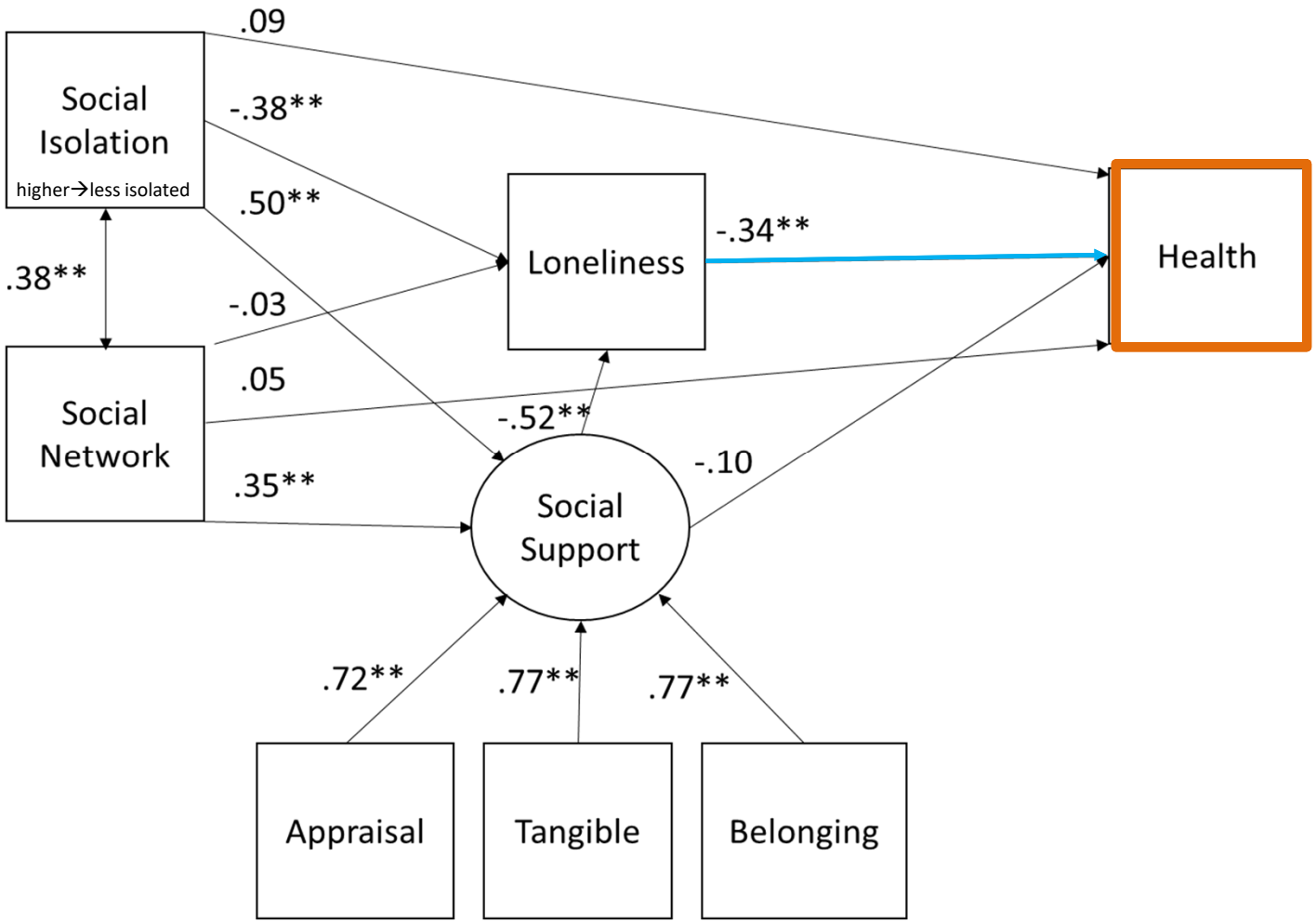
UCLA Loneliness Scale (Version III) – Russell 1996
20-item scale; range = 20 - 80, higher score is greater loneliness

Predicting Depression

Czaja, S. J., Moxley, J. H., & Rogers, W. A. (2021). Social support, isolation, loneliness, and health among older adults in the PRISM randomized controlled trial. *Frontiers in Psychology.*



Predicting Health Self-Rating



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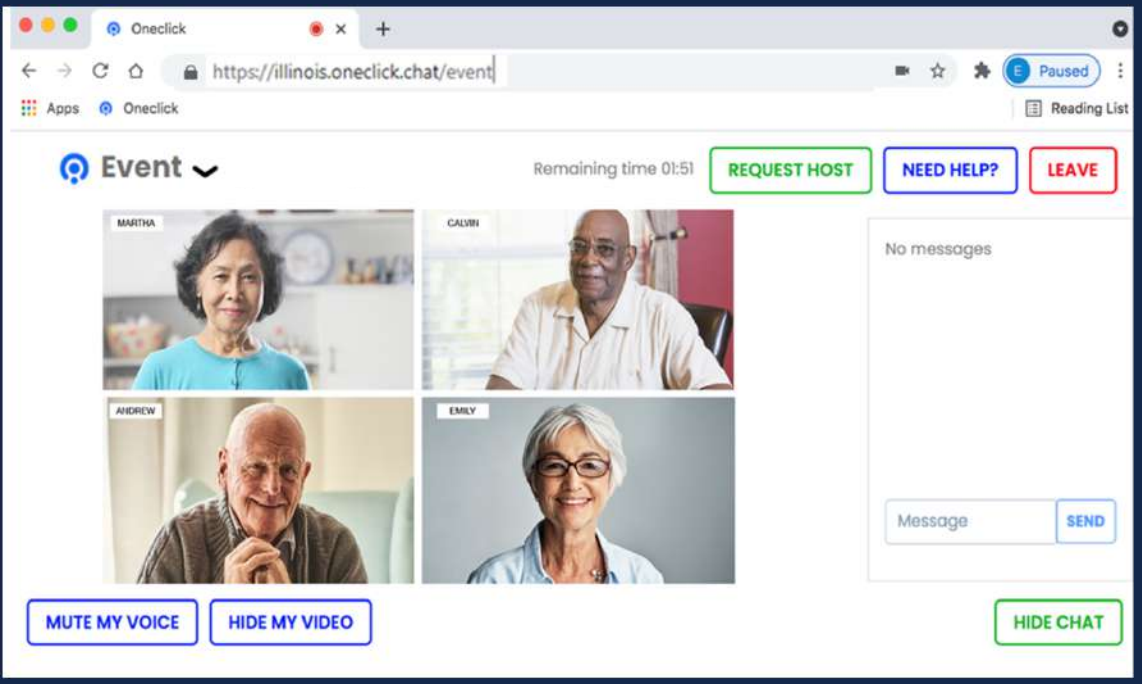
Social Engagement Interventions

Digital Assistants for Social Engagement and Environmental Control for Older Adults with Mobility Disabilities

All 25 participants successfully learned to use the technology on their own at home [during COVID]…after 5 weeks of use, self-reported loneliness decreased.

Video Chat to Reduce Social Isolation



Connect with others to **Engage** on topics of shared interests

5 content areas (60 unique topics)

- Arts and Culture
- Nature, Health, and Wellness
- Life Experiences
- Science and Technology
- Recreation and Sports

Currently conducting randomized controlled trials (RCTs) to assess effectiveness for older adults with varying levels of cognitive ability as well as for caregivers

Virtual Reality for Cognitive, Activity, and Social Engagement

Supported by Apps

Cognitive Engagement
Learning
Training
Cultural

Activity Engagement
Physical
Games
Hobbies

Social Engagement
Family & Friends
Meeting New People
Community & Social Groups

Technology Skills
Virtual Reality Systems
Game Controllers
Cyber Security
Etiquette

Supported by the Intervention

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Robotics

Gerontological Society of America 2022

Human Factors & Ergonomics Society 2023

Misty

www.mistyrobotics.com

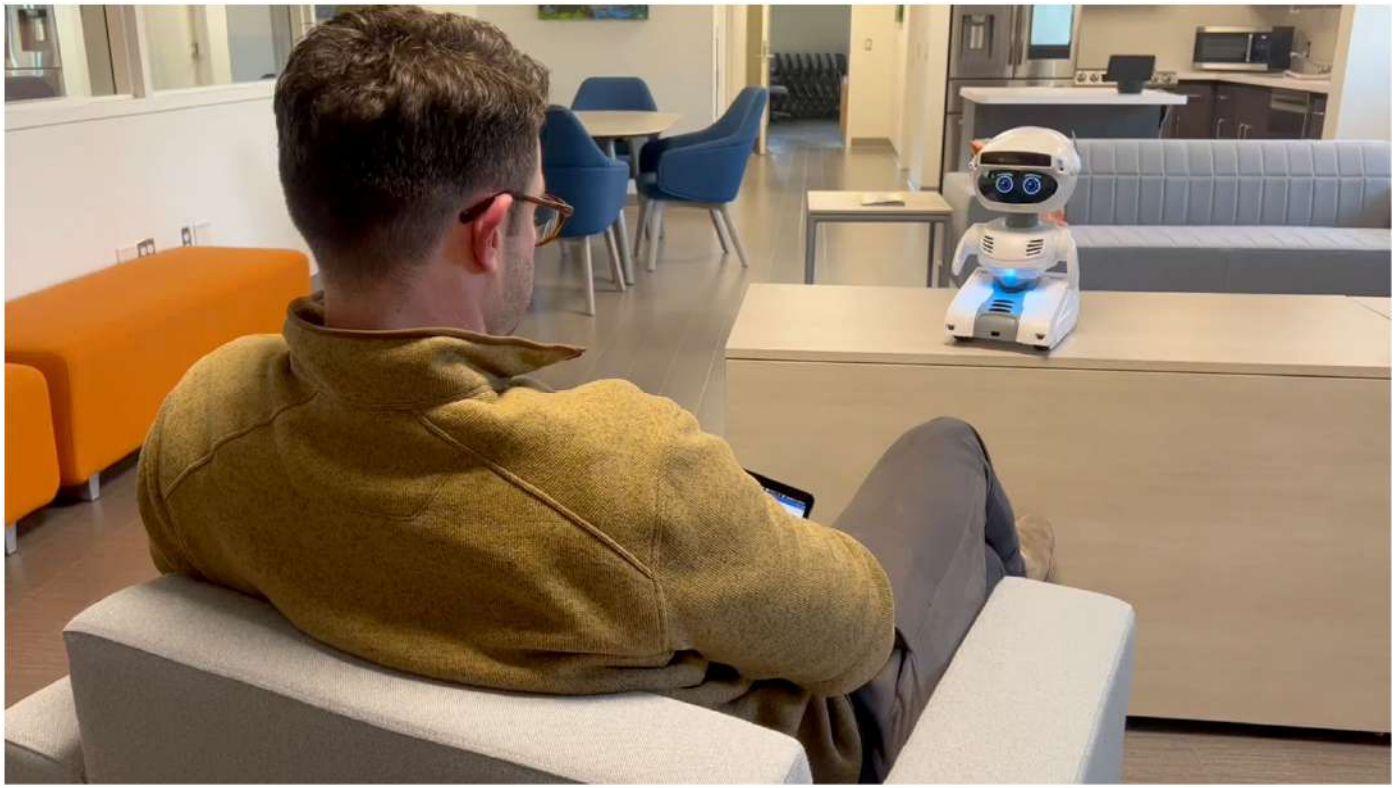
- ❑ Unique market-ready platform; fully programmable; skills built in
- ❑ Customizable to assist with a wide range of activities.

Current Study:
Interviews with older adults

- ❑ Explore potential for Misty as a socially assistive robot to support older adults
- ❑ Understand facilitators and barriers to adoption.
- ❑ Provide guidance for design and implementation of socially assistive robots in home environments.

Social Companion

Health Reminders



Controlling Environment

Preliminary data from older adults:

- Very positive
- Like appearance
- Socially engaging
- Could imagine using for social, health, control of environment

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Assistive Robotics

Stretching their Reach: Robotic Support for Older Individuals with Mild Cognitive Impairment, Early Alzheimer's Dementia, and Mobility Impairments

Funded by National Institute on Aging (National Institutes of Health) Phase II Small Business Innovation Research Grant #2R44AG072982-02

Robot Evolution

PR2: Built in 2010, weighs 500 lbs, cost $400,000

Stretch: Built in 2020, weighs 51 lbs, cost $20,000

Stretch capabilities to provide support for home tasks

Delivery

Turn on light

Reach to back of sink

Open cabinet

Older Adults with Cognitive Impairments: Support Needs and Ideas for Stretch

Stretch Robot Potential:

- Safety monitoring (e.g., turn off range)
- Medication management (reminders, record keeping)
- Social engagement
- Having family members be able to check in on them
- Watching videos on the tablet
- Playing games

Older Adults with Mobility Impairments: Support Needs and Ideas for Stretch

Stretch Robot Potential:

- Delivery of items such as medication, water bottle, towel
- Reaching for items in the kitchen that are high
- Picking up items from the floor that are low
- Scheduling reminders
- Social engagement
- Having family members be able to check in on them
- Dressing (zippers, jewelry)
- Housecleaning, making bed, sweeping

Clark-Lindsey Village: Personal Apartments

Green House Home (memory care)

Stretch Robot Potential:

<u>Resident Benefits</u>

- Increase autonomy
- Enhance connection to remote caregiver
- Maintain privacy
- Assist with everyday activities
- Item retrieval
- Safety support (e.g., access walker)

<u>Staff Benefits</u>

- Remotely connect with residents
- Perform wellness check
- Support multiple residents
- Freeing time to spend with resident for conversation and relationship building
- Reducing physical burden and need for multi-tasking
- Ability to deliver items

Participatory Design Field Trials with Stretch Embedded in a Home

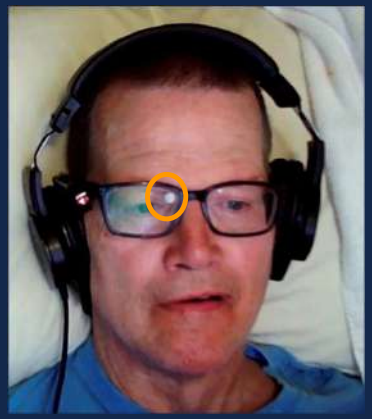
Henry & Jane Evans

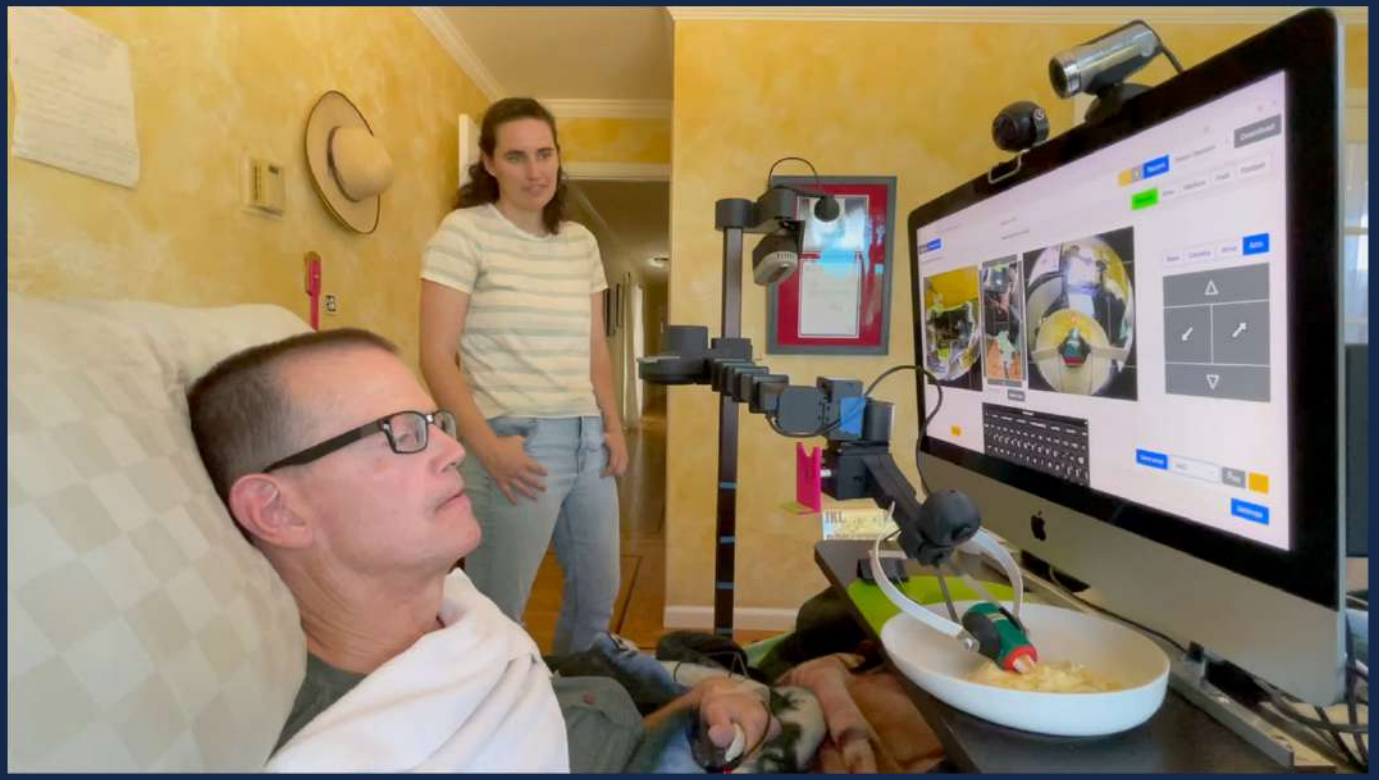
Immersive participatory design approach to improve robot-assisted care.

- Identify tasks to support both the care recipient and care partner in their daily living.
- Develop tools Stretch can use to perform different tasks.
- Improve initial user interface design and assess usability of interface.


hello robot™
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN
NIH National Institute on Aging
UNIVERSITY of WASHINGTON
R4H

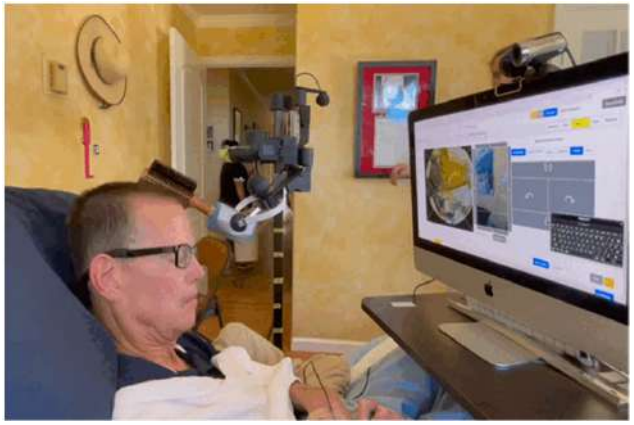
Assistive Robot Support for Older Adults with Mobility Impairments





Scratching Itches

Hair-brush built-up with a pool noodle placed on a ramp for optimal positioning



Henry scratches his head (real-time teleoperation)

Henry relieving an itch

Intergenerational Social Engagement

Jane, Henry, and their granddaughter fishing.

Care Partner Support: Managing Blood Pressure

Team Science:

Interdisciplinary, Multisite, Shared Goals…

…Positive Outcomes

Impact

Henry:

Robotics in general have had a very large impact on my life-and Stretch is an important link in the evolution of those Robotics.

Using Stretch was surprisingly easy, showing how adaptable Stretch is.

Jane:

Robots have influenced Henry's life greatly. They gave him a reason to live…Stretch is the closest to improving Henry's life and therefore mine.

We have to ask ourselves over and over, "Why robots when a caregiver can do it ten times faster"?
I see what it does to my husband mentally when he can do things by himself and not depend on anyone.

How do we designing technology to support successful aging?

- Advance foundational knowledge
- Develop next generation workforce
- Apply behavioral science throughout design cycle
- Practical applications → Quality of life
- Engage users!

Funding Acknowledgments

Obrigada!

College of Applied Health Sciences
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

Postdoctoral Research Associate Positions: Human Factors and Aging
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College of Applied Health Sciences

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