Improving outcomes of hospitalized older persons

Luci K. Leykum, MD, MBA, MSc
Center Lead, Elizabeth Dole HSR&D Center of Excellence

Rocky Mountain Geriatrics Conference
Sept 26, 2023
Objectives:

• Identify patient and family priorities for improving hospital care

• Identify best practices in care transitions

• Identify strategies to improve hospital care team effectiveness
3 topics:

• What are people’s priorities for improving hospital care?
  • Data from 2 research agenda projects

• What are best practices for care transitions?
  • Program components
  • Implementation realities

• System level interventions
  • RESET
  • Collaborative care

• Implications for practice
3 topics:

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  • RESET
  • Collaborative care

• Implications for practice
Acute Care of Older Persons
Priority Setting Partnership

&

Improving Hospital Outcomes through Patient Engagement
Challenges in the Acute Care of Older Patients

- Disproportionately suffer from “hazards of hospitalization”
- Often excluded from trials
- Atypical disease presentations
- Outcomes of interest unstudied
- Functional and cognitive impairments complicate decision-making and transitions
- Limited life expectancy alters risk-benefit analysis
Methodology for both projects

Convene
Consult
Collate
Prioritize
Disseminate

http://www.lindalliance.org/JLA_Method.asp
Stakeholders

- Alzheimer’s Association
- American Academy of Neurology
- American Association of Retired Persons
- American College of Cardiology
- American College of Emergency Physicians
- American College of Surgeons
- American Geriatrics Society
- American Hospital Association
- Centers for Medicare and Medicaid Services
- Gerontological Society of America
- John A Hartford Foundation
- National Alliance for Caregiving
- National Association of Social Workers
- National Coalition on Healthcare
- National Institutes on Aging, NIH
- National Partnership for Women and Families
- Nurses Improving the Care of Healthsystem Elders
- Society of Critical Care Medicine
- Society of Hospital Medicine
Respondents (n=580)

- 77% female
- 85% white
- 65% 45-65 years old
- 26% patient / caregiver / advocate
- Represent 17 stakeholder organizations
<table>
<thead>
<tr>
<th>Topic</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced care planning</td>
<td>What approaches for <strong>determining and communicating goals of care</strong> across and within healthcare settings are most effective in promoting goal-concordant care?</td>
</tr>
<tr>
<td>Delirium</td>
<td>What practices are most effective for consistent <strong>recognition, prevention, and treatment of delirium</strong> subtypes?</td>
</tr>
<tr>
<td>Dementia</td>
<td>Does <strong>universal assessment of hospitalized older adults for cognitive impairment</strong> lead to more appropriate application of geriatric care principles and improve patient centered outcomes?</td>
</tr>
<tr>
<td>Depression</td>
<td>Does <strong>identifying depressive symptoms and initiating a therapeutic plan</strong> prior to discharge improve patient-centered and/or disease specific outcomes?</td>
</tr>
<tr>
<td>Medication</td>
<td>What systems interventions improve <strong>medication management</strong> for older adults in hospital and post-acute care?</td>
</tr>
<tr>
<td>Models of care</td>
<td>For which populations of hospitalized older adults does <strong>systematic implementation of geriatric care principles/processes</strong> improve patient-centered outcomes?</td>
</tr>
<tr>
<td>Care Transitions</td>
<td>What is the comparative effectiveness of <strong>transitional care models</strong> on patient-centered outcomes?</td>
</tr>
<tr>
<td>Surgery</td>
<td>What <strong>perioperative strategies</strong> can be used to optimize care processes and improve outcomes?</td>
</tr>
<tr>
<td>Physical Function</td>
<td>What is the comparative effectiveness of interventions that <strong>promote mobility, improve and preserve physical function</strong>, and reduce falls?</td>
</tr>
<tr>
<td>Training</td>
<td>What is the most effective approach to <strong>training hospital-based providers</strong> in geriatric and palliative care competencies?</td>
</tr>
</tbody>
</table>
Improving Hospital Outcomes through Patient Engagement: The i-HOPE Study

8 Research Committee Members & 7 PFAC Partners
<table>
<thead>
<tr>
<th>Stakeholder Partner Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agency for Health Research and Quality Evidence Based Practice Centers Scientific Resource Center</td>
</tr>
<tr>
<td>Alzheimer's Association</td>
</tr>
<tr>
<td>American Academy of Hospice &amp; Palliative Medicine</td>
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<tr>
<td>American Academy of Neurology</td>
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<tr>
<td>American Academy of Physical Medicine &amp; Rehabilitation</td>
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<tr>
<td>American Association of Neurological Surgeons</td>
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<tr>
<td>American Association of Nurse Practitioners</td>
</tr>
<tr>
<td>American College of Clinical Pharmacy</td>
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<td>American Geriatrics Society</td>
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<tr>
<td>American Nurses Credentialing Center</td>
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<tr>
<td>American Society of Plastic Surgeons</td>
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<tr>
<td>Community First Health Plans</td>
</tr>
<tr>
<td>Congress of Neurological Surgeons</td>
</tr>
<tr>
<td>Health Hats</td>
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<tr>
<td>Health Research &amp; Educational Trust - American Hospital Association</td>
</tr>
<tr>
<td>Institute for Healthcare Communication</td>
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<tr>
<td>Institute for Healthcare Excellence</td>
</tr>
<tr>
<td>Institute for Patient and Family Centered Care</td>
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<tr>
<td>Living Beyond Breast Cancer</td>
</tr>
<tr>
<td>Louise H. Batz Patient Safety Foundation</td>
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<tr>
<td>Minnesota Hospital Association</td>
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<tr>
<td>National Alliance for Caregiving</td>
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<tr>
<td>Partnership to Improve Patient Care</td>
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<tr>
<td>Patient Centered Outcomes Research Institute Ambassador Program</td>
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<tr>
<td>Planetree International</td>
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<tr>
<td>Society for Post-Acute and Long-Term Care Medicine</td>
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<tr>
<td>Society of General Internal Medicine</td>
</tr>
<tr>
<td>Society of Medical Decision Making</td>
</tr>
<tr>
<td>US Department of Veterans Affairs, Hospitalist Field Advisory Committee</td>
</tr>
<tr>
<td>US Department of Veterans Affairs, Health Services Research &amp; Development</td>
</tr>
</tbody>
</table>
Who Submitted Questions?

499 respondents submitted 789 questions
<table>
<thead>
<tr>
<th></th>
<th>Prioritized Research Questions In original wording</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>How can we ensure shared decision-making and that patients and families are included in treatment decision-making and goals of care discussion?</td>
</tr>
<tr>
<td>2</td>
<td>How can the hospital discharge hand off to other care facilities, primary care providers and specialists be made smoother?</td>
</tr>
<tr>
<td>3</td>
<td>How can education on medications, medical conditions, hospital care and discharge be better coordinated by the care team, and not so confusing and overwhelming to patients?</td>
</tr>
<tr>
<td>4</td>
<td>How can patients, family members, other caregivers and health care teams work together to create effective discharge experiences that allow patients to feel empowered to manage their health once they get home?</td>
</tr>
<tr>
<td>5</td>
<td>How do we ensure that information provided by the care team during hospitalization and at discharge was clearly understood and clearly communicated by patients and caregivers?</td>
</tr>
<tr>
<td>6</td>
<td>How can we use telemedicine technology to improve transitions of care and reduce re-hospitalization?</td>
</tr>
<tr>
<td>7</td>
<td>Who do I call if I have any questions after I have been discharged?</td>
</tr>
<tr>
<td>8</td>
<td>Did your health-care providers explain to you what your problem or diagnosis is, what steps were done to further explore that condition, what treatment was undertaken, and what will still need to be done after discharge?</td>
</tr>
<tr>
<td>9</td>
<td>What are patient expectations related to the treatment of pain/chronic pain?</td>
</tr>
<tr>
<td>10</td>
<td>Which interventions improve medication reconciliation at key time points of the care trajectory (hospital/home, admission/discharge) and what are each intervention’s outcomes?</td>
</tr>
<tr>
<td>11</td>
<td>Can hospital staff be more transparent about hospital practices (e.g. parking, cafeteria, entering patient rooms, rounds, sleep)?</td>
</tr>
</tbody>
</table>
Common Themes

• Care Transitions
• Assessing people’s goals of care
• Communication across sites
• Medications – often functionally subsumed in the above topics

• Dementia was the most frequently mentioned chronic condition
3 topics:

- What are people’s priorities for improving hospital care?
  - Data from 2 research agenda projects

- **What are best practices for care transitions?**
  - Program components
  - Implementation realities

- System level interventions
  - RESET
  - Collaborative care

- Implications for practice
What does a *successful* care transition look like?

- Post-hospital plan clear & understood
- Medications updated
- Follow-up appointments made
- Points of contact identified

From a person / caregiver perspective:
- I know what to do
- I know who to call
- I don’t need to go back!

*Everyone is on the same page about what is going on*
How can this be achieved?
Project BOOST

<table>
<thead>
<tr>
<th>Assessing the 8 Ps</th>
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<tbody>
<tr>
<td>Problems with medications</td>
</tr>
<tr>
<td>Psychological</td>
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<td>Principal diagnosis</td>
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<tr>
<td>Physical limitations</td>
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<td>Poor health literacy</td>
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<td>Poor social support</td>
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<tr>
<td>Prior hospitalization</td>
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<tr>
<td>Palliative care</td>
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## Project BOOST

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<th>Potential Interventions</th>
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<td>Problems with medications</td>
<td>Medication reconciliation</td>
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<tr>
<td>Psychological</td>
<td>Address behavioral health issues</td>
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<tr>
<td>Principal diagnosis</td>
<td>Assess guidelines / education</td>
</tr>
<tr>
<td>Physical limitations</td>
<td>DME, home supports</td>
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<tr>
<td>Poor health literacy</td>
<td>Education, tools for adherence</td>
</tr>
<tr>
<td>Poor social support</td>
<td>Home &amp; community-based supports</td>
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<td>Prior hospitalization</td>
<td>Care plan, appointments</td>
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<td>Palliative care</td>
<td>Consultation</td>
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<td>Re-Engineered Discharge</td>
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<td>Reconcile discharge plans with guidelines</td>
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<td>Teach written discharge plan</td>
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<tr>
<td>Educate patient about diagnosis</td>
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<td>Assess understanding of discharge plan</td>
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<td>Review what to do if a problem arises</td>
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<td>Send discharge summary</td>
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# Re-Engineered Discharge

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What is the Evidence?

Project BOOST Increases Patient Understanding of Treatment and Follow-up Care
May 26, 2021

Project BOOST: effectiveness of a multihospital effort to reduce rehospitalization


Affiliations + expand
PMID: 23873709 DOI: 10.1002/jhm.2054

Magnitude of benefit:
2% reduction in readmission rates

How Hospitals Reengineer Their Discharge Processes to Reduce Readmissions
Suzanne E. Mitchell, Jessica Martin, Sally Holmes, Carol van Deusen Lukas, Ramon Cancino, Michael Paasche-Orlow, Cindy Brach, and Brian Jack

Project RED Impacts Patient Experience
Ramon S Cancino, MD, MSc,1 Chris Manasseh, MD,2 Lana Kwong, MPH, CPH,3 Suzanne E Mitchell, MD, MSc,2 Jessica Martin, MPH,2 and Brian W Jack, MD2

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PMC Disclaimer
What does this look like in practice?

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<td>Direct communication with PCP</td>
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<td>Assessment of need for rehab</td>
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Association with readmissions

• Number / consistency of care transitions practices associated with readmission rates (p<0.015)

• Four specific practices associated with readmission rates:
  • Communication of plans in front of patients
  • Pharmacist involvement in med rec
  • Enlisting home / community-based supports
  • Post-discharge hotline
What about Interprofessional Teams / Rounds?
Interprofessional Rounds

• Pannick
  • Some evidence to support improved patient safety, but no difference in LOS

• Bhamidipati
  • Some evidence to support improved LOS and staff satisfaction but little data on patient safety or satisfaction

• Ratelle – Bedside Interprofessional Rounds
  • Small improvement in patient experience, no improvement in patient knowledge

Limitations to Prior Efforts to Improve Teamwork

• Interventions implemented in isolation
• Don’t address all contributing factors
• Interventions that are complementary and mutually reinforcing may be more effective
Where do we go from here?

System-level interventions to improve hospital care
3 topics:

• What are people’s priorities for improving hospital care?
  • Data from 2 research agenda projects

• What are best practices for care transitions?
  • Program components
  • Implementation realities

• System level interventions
  • RESET
  • Collaborative care

• Implications for practice
What happens on effective teams?

“Failure to rescue”

- Operation
- “Seminal” complication
- “Domino” complication
- Patient outcome

We want people to have a low threshold for raising concerns

Shared knowledge & understanding
Care Transitions
REdesigning SystEms to Improve Teamwork and Quality for Hospitalized Patients
Advanced and Integrated Microsystems (AIMS) Interventions

• Unit-based Physician Teams
• Unit Nurse-Physician Co-leadership
• Enhanced Interprofessional Rounds
• Unit-level Performance Reports
• Patient Engagement Activities
Ratings of Quality of Collaboration

Nurse and Hospitalist Collaboration

Graphs show % rating quality of collaboration with other as high or very high.

Change in ratings of nurses by hospitalists not significant.
Change in ratings of hospitalists by nurses significant (p<0.01).
<table>
<thead>
<tr>
<th>Outcome</th>
<th>Control unit</th>
<th>Intervention unit</th>
<th>Adjusted DiD p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-intervention (n=1097)</td>
<td>Post-intervention (n=789)</td>
<td>Unadjusted pre-post effect (IRR or OR)</td>
</tr>
<tr>
<td>Adverse Events (AE), No. (AEs per 100 days)</td>
<td>24 (0.52)</td>
<td>33 (0.98)</td>
<td>1.87 (1.10-3.17) (^a)</td>
</tr>
<tr>
<td>Presence of one or more AE, No. (%)</td>
<td>24 (2.2%)</td>
<td>30 (3.8%)</td>
<td>1.77 (1.03-3.06) (^b)</td>
</tr>
</tbody>
</table>
Collaborative Care
How are people currently organized?
System Interdependencies

Infrastructure

Processes

CHECKLIST

✓
✓
✓
✓
?

Relationships

Self-organization
Self-Organization

Infrastructure
- Unit size
- Common areas
- EHR

Processes
- IPRs
- Discharge checklists

Relationships
- Trust
- Respect
- Communication

Shared Mental Models & Effective Sensemaking

Patient Outcomes
- LOS
- Pt Experience
- Readmissions

Clinician Outcomes
- Satisfaction
- Turnover
- Quality
Infrastructure

• Geography

• Team member stability

• White Boards -> Post its
# Processes - Workflow

<table>
<thead>
<tr>
<th>Time</th>
<th>Students / Interns*</th>
<th>Resident*</th>
<th>Attending*</th>
<th>Nurse</th>
<th>Care coordination</th>
<th>Physical therapy</th>
<th>Pharmacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00-7:00</td>
<td>Data gathering. Determine sick patients</td>
<td>See intern’s patients if intern off</td>
<td>Not present</td>
<td>Completing overnight work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7:00-7:30</td>
<td>Bedside signout with nursing</td>
<td>See overnight admissions</td>
<td>Reviewing charts, seeing sick patients</td>
<td>Bedside signout with students / interns</td>
<td></td>
<td>Not present</td>
<td></td>
</tr>
<tr>
<td>7:30-8:00</td>
<td>Review patients and plans</td>
<td>Begin daily work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:00-8:30</td>
<td>Complete data gathering</td>
<td>Speak re: sick patients, discharges, confirm with nursing</td>
<td></td>
<td>Begin daily work, take care of discharge needs</td>
<td>Begin new patient and follow-up assessments</td>
<td>Begin patient assessments</td>
<td></td>
</tr>
<tr>
<td>8:30-9:15</td>
<td>Morning report</td>
<td>See sick patients / discharges</td>
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<tr>
<td>9:15-11:30</td>
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<td></td>
<td>Collaborative bedside rounds</td>
<td></td>
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<tr>
<td>11:30-1:30</td>
<td>Learner conferences/ Continue work</td>
<td>Seeing patients, notes</td>
<td>Daily work lunch</td>
<td>Daily work</td>
<td>Daily work</td>
<td>Daily work</td>
<td></td>
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<tr>
<td>1:30 - 2:00</td>
<td></td>
<td></td>
<td>Collaborative team meeting</td>
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<tr>
<td>2:00-5:00</td>
<td>Additional collaborative care rounds / family meetings as needed</td>
<td>Wrap up work</td>
<td>Anticipate discharges</td>
<td>Additional rounds, complete work</td>
<td>Additional rounds, complete work</td>
<td>Additional rounds, complete work</td>
<td></td>
</tr>
</tbody>
</table>
Relationships:
Conversation & Reflection

• Interprofessional rounds
• Daily reflection sessions
• Weekly steering committee meetings
• Monthly PFAC meetings
Length of Stay

Mean LOS by CC and Month

January 2015 to August 2015

- CC
- Non-CC
What started happening in June & July?

• Repeat attendings!

• More consistency among the rest of the team.
Length of Stay / Unnecessary LOS

With faculty experience, LOS ↓ 0.75 days
ULOS decreased by 0.66 days

• > 5,000 bed days of care
• ~ 950 more patients
• $2.5 million cost avoidance
• $5.9 million potential revenue
<table>
<thead>
<tr>
<th>HCAHPS item</th>
<th>CC Mean (%)</th>
<th>Usual Care Mean (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Your care from doctors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctors listened carefully to you</td>
<td>83.2</td>
<td>81.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Treated w/courtesy and respect by Doctors</td>
<td>91.7</td>
<td>86.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Doctors explained things understandably</td>
<td>80.4</td>
<td>77.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Your care from nurses</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurses listened carefully to you</td>
<td>83.7</td>
<td>82.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Treated w/courtesy and respect by Nurses</td>
<td>89.0</td>
<td>86.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Nurses explained things understandably</td>
<td>84.2</td>
<td>76.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rating of hospital</td>
<td>83.3%</td>
<td>78.2%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Putting this all together...

• Hospitalization is challenging for older persons and their families

• People often don’t understand what to do

• Efforts to improve care transitions have mixed outcomes

• Attempts to improve team-based care also have mixed outcomes
A systems approach

- We are trying to promote shared understandings
- We should pay attention to how people are organized
  - Relationships
  - Processes of care
  - Infrastructure
- Complimentary approaches that bring people together
Care Transitions

- Technical Processes
- Relating / Sensemaking
- System Resources
- Successful Care Transition
- Readmission

Care Transition Staff
- Inpatient Providers
- Outpatient Providers
- Home-Based Providers
- Patient

Flow direction: Technical Processes → Care Transition Staff → Inpatient Providers → Patient → Outpatient Providers → Home-Based Providers → Relating / Sensemaking → System Resources
DISCLOSURES

• Dr. Stephens is supported by the Substance Abuse & Mental Health Services Administration
• Dr. Farrell is supported by the Health Resources and Services Administration.
• Dr. Farrell and Dr. Sanders are supported by the John A. Hartford Foundation to disseminate Patient Priorities Care.
GOALS FOR THIS MORNING...

• Challenge and expand your thinking about resilience (& resistance) in aging – theoretically and practically
• Demonstrate the alignment of resilience with Age-Friendly Health Systems
• Identify ageism as a threat to resilience
• Discuss Patient Priorities Care as a strengths-based approach to elicit what matters and to better understand resilience
PART 1: RESILIENCE

WHAT DOES RESILIENCE MEAN TO YOU?

WHAT ABOUT HOW IT RELATES TO AGING?
Resilience: The Courage to Come Back

Resilient/Adjective
1. (of a substance or object) Able to recoil or spring back into shape after bending, stretching, or being compressed.
2. (of a person or animal) Able to withstand or recover quickly from difficult conditions.

Resilience: Bouncing back

Resilience: Fall down seven times, get up eight
~ Japanese Proverb
OLDER ADULTS & RESILIENCE: EVOLVING CONCEPTUALIZATIONS

• Resilience, which relates to one's ability to respond to stressors, typically declines with age and the development of comorbid conditions in older organisms.

• Across disciplines, there are differing conceptualizations of resilience and its multicomponent dimensions in response to physical, cognitive, and social stressors.
A TALE OF TWO LADIES

Mrs. A

- 65 y/o female
- Hx HTN, DM, afib, hyperlipidemia
- Day 3 s/p left-sided CVA w/right-sided HP, mild dysarthria & unsteady gait

Mrs. C

- 92 y/o female
- Hx HTN, DM, afib, hyperlipidemia
- Day 3 s/p left-sided CVA w/right-sided HP, mild dysarthria & unsteady gait
A TALE OF TWO LADIES...SAME CLINICAL PROFILE, SAME DEFICITS...BUT 3 DAYS S/P CVA...

Mrs. A (65)       Mrs. C (92)
The more things that are wrong with them, the more likely they are to be frail.

BUT... need to also consider the abilities & resources of older adults.

SO…IS PHYSICAL RESILIENCE SIMPLY THE OPPOSITE OF FRAILTY?

• Short answer – no. (Dr. Whitson will elaborate!)
• Clearly there are points of conceptual overlap.
• Frailty is influenced by the resources available to a system, whereas resilience is the extent to which this complex system can recruit those resources when challenged by a stressor.

EVOLVING MODELS WITHIN THE CONTEXT OF MULTIMORBIDITY

“Successful aging” (Rowe & Kahn, 1997)

“Resilient to various challenges”
...even in the face of advanced age, chronic illness, and reduced function (DiPietro et al, 2012)

Older adults have differing abilities to maintain (resist) or regain function after encountering a health stressor
“The Castle Under Siege”
FRAILTY VS RESILIENCE

<table>
<thead>
<tr>
<th>Spectrum</th>
<th>Resilience</th>
<th>Frailty</th>
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<td>Observation</td>
<td>Multiple Points in Time</td>
<td>Snapshot</td>
</tr>
<tr>
<td>Viewpoint</td>
<td>Strengths Approach</td>
<td>Deficit Approach</td>
</tr>
</tbody>
</table>

“If the spectrum from robustness to frailty reflects the amount of physiological potential one has to react to stressors, physical resilience refers to the actualization of that potential.”

LIFECOURSE MODEL OF MULTIMORBIDITY RESILIENCE (WISTER ET AL, 2016)

Identifies 3 valuable consequences of resilience

Interventions need to focus on the most mutable points in the illness resilience cycles to maximize management of competing conditions within the context of multimorbidity.
RESILIENCY DEBATE CONTINUES…

• A unifying definition of resilience that incorporates its physiological, cognitive, psychosocial and other domains has not been established.

• AGS/ NIA R13 Bench-to-Bedside Conference Series, “Overview of the Resilience World – State of Science” held October 2022
  – discussed working definitions of resilience across the 3 domains
  – compared and contrasted resilience, resistance, reserve, and compensation.
Trans-NIH Resilience working group definition: “Resilience can be defined as a system’s capacity to resist, recover, recover better (grow), or adapt in response to a challenge or stressor”
The ability to identify frailty AND the multicomponent aspects of resilience can provide clues about how to optimize health for both of these ladies.
TAKE HOME POINTS

• Frailty is influenced by the resources available to a system, whereas resilience is the extent to which this complex system can recruit those resources when challenged by a stressor.

• Clinical interventions, health systems and health policies need to be (re)designed to help older adults resist, recover, recover better (grow), or adapt in response to a challenge or stressor.
  – Adopting a strengths-based approach to care can promote resilience

• Recognize that there may be differences between what the care team, care partner and/or patient deem as a “good outcome” – need to determine what matters most to the patient.
Wrinkles should merely indicate where smiles have been.
PART 2: AGE-FRIENDLY HEALTH SYSTEMS, AGEISM, AND RESILIENCE
The Age-Friendly Health System Imperative

Terry Fulmer, PhD, RN,* Kedar S. Mate, MD,†‡ and Amy Berman, BSN*
Distilled to 4 elements or “4Ms” that should be reliably provided to all older adults, regardless of the care setting or specialty.
THE 4MS OF AGE FRIENDLY HEALTH SYSTEMS

What Matters
Know and align care with each older adult’s specific health outcome goals and care preferences including, but not limited to, end-of-life care, and across settings of care.

Medication
If medication is necessary, use Age-Friendly medication that does not interfere with What Matters to the older adult, Mobility, or Mentation across settings of care.

Mentation
Prevent, identify, treat, and manage dementia, depression, and delirium across settings of care.

Mobility
Ensure that older adults move safely every day in order to maintain function and do What Matters.
As of July 2023:

~3000 participating hospitals and practices

1,939 achieved “Committed to Care Excellence” designation
DEVELOPING AGE-FRIENDLY ECOSYSTEMS

CHARACTERISTICS OF AGE-FRIENDLY ECOSYSTEMS

• Requires recognition of the heterogeneity of older people

• What works to address older adults’ functional needs likely works for younger adults as well
THE 4MS OF AGE-FRIENDLY CARE: FINDING THE SWEET SPOT

What Matters

Clinical Guidelines

Medications, Mobility, Mentation
AGEISM

(from Amazon.com: NobleWorks - 1 Funny Greeting Card for Birthdays - Funny Cartoons and Comics, Bday Celebration Notecard - Senior Bumper Stickers C2649BDG: Office Products)
AGEISM

“Ageism is the only “-ism” in which we act against our future selves”

– Laura Mosqueda, MD
DEFINITION OF AGEISM

• Discriminating against a person solely based on age
AGEISM: THE INVISIBLE “-ISM”

• 93.5% of US adults age 50-80 experience microaggressions about age

• Yet, ironically, ageism is often overlooked in diversity, equity, and inclusion efforts
ADVERSE EFFECTS OF AGEISM

• Reduced life expectancy by 7.5 years*

• In the US, 1 of 7 dollars spent on health care every year for the eight most expensive illnesses was due to ageism†


†Levy BR et al. Gerontologist 2018.
ADDITIONAL MANIFESTATIONS OF AGEISM IN HEALTH CARE

• Exclusion of older people from clinical trials
• Unjust resource allocation strategies during COVID (e.g. age-based cutoffs)
• Lack of residency training in geriatrics
  – Only required in FM, IM, IM/pediatrics, neurology, and psychiatry

AGEISM AS A BARRIER TO ELICITING WHAT MATTERS MOST

• Act of commission
  – E.g. using patronizing terminology (“sweetie, honey”)
• Act of omission
  – E.g. addressing all questions to a younger care partner instead of the older adult
• When an older adult’s values, goals, and preferences are minimized or ignored, what matters most to them is not elicited
# PRACTICAL STRATEGIES TO ADDRESS AGEISM: REFRAMING AGING

<table>
<thead>
<tr>
<th>Instead of:</th>
<th>Say this instead:</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Elderly” or “senior citizen”</td>
<td>“Older person” or “older adult”</td>
</tr>
<tr>
<td>“Silver tsunami” or “graying of the population”</td>
<td>“The increasing number of older people presents opportunities to do X”</td>
</tr>
<tr>
<td>“Struggle,” “battle” or “fight” ageing</td>
<td>“As we age, we accumulate wisdom, insight, and rich experiences”</td>
</tr>
<tr>
<td>“Conflict between older and younger generations”</td>
<td>“In a just society, all people are treated equally”</td>
</tr>
</tbody>
</table>
PRACTICAL STRATEGIES TO ADDRESS AGEISM: INCLUSIVITY

• Include anti-ageist efforts in DEI efforts
• Include geriatrics training in all health professions programs
• Include geriatrics health care professionals and older adults when formulating policies that affect older adults
INTERSECTION OF AGEISM AND RACISM

FIGURE 1  Intersection of ageism and racism in healthcare: a double disadvantage
INTERSECTION OF AGEISM AND RACISM: NEGATIVE IMPACT ON RESILIENCE

• “Double jeopardy” hypothesis
• Cumulative inequality theory
• “Weathering” hypothesis
PART 3: PATIENT PRIORITIES CARE

- What is Patient Priorities Care?
- Why talk about this at a Resilience Conference?
- Take Home Points PPC and Current Projects
WHAT IS PATIENT PRIORITIES CARE?

• https://patientprioritiescare.org/patient-facing-materials/
• https://patientprioritiescare.org/
• https://geripal.org/mary-tinetti-patient-priorities-care/
Complexity Typically Increases with Aging
THE END RESULT

• Uncertain benefit
• Unintentional harm
• Burdensome to the patient
• Frustrating for clinicians → Burnout
• Not aligned with What Matters Most
IDENTIFY HEALTH PRIORITIES

- Values (What Matters most to the patient)
- Actionable, specific, realistic health outcome goals
- Health care preferences (which care the patient finds helpful and which burdensome) and any tradeoffs
- “One Thing” – the health problem (burdensome symptom, health care task, or medication) the patient most wants to address to help them achieve their health goal.

ALIGN CARE WITH HEALTH PRIORITIES

Consider if current and potential care is:

- Consistent with health outcome goals including patient’s “One Thing”?
- Consistent with care preferences?

Use the patient’s priorities:

- As the focus for communication with the patient
- As the goal for serial trials to start, stop or continue interventions
- To prioritize care decisions, especially where differing perspectives exist

Update components as needed
INTRODUCING MR. C

- 86 y/o male, retired lawyer
- Heart Failure, reduced ejection fraction
- Atrial fibrillation on chronic anti-coagulation
- Recurrent VT s/p CRT-D
- Lumbar spondylosis
- Bladder paralysis – requiring intermittent self catheterization
- Hearing Loss
- Bilateral Inguinal Hernias
- Mild cognitive impairment MoCA 2018 26/30
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 2021</td>
<td>Largely Independent; <strong>Weight loss</strong>, stopped amiodarone → Increased Atrial fibrillation and atrial flutter</td>
</tr>
<tr>
<td>Jan 2022</td>
<td><strong>Worsening HF</strong> → empagliflozin added</td>
</tr>
<tr>
<td>Feb through Aug 2022</td>
<td>Monthly follow up with cardiology; <strong>mobility worsening</strong>; various complaints – fatigue, neuropathy in hands, home health off and on</td>
</tr>
<tr>
<td>Aug 2022</td>
<td>ER visit abdominal pain; CT <strong>bilateral inguinal hernias with possible low grade obstruction</strong>; able to be reduced; New finding: nodular <strong>liver cirrhosis</strong>; surgery consult – high risk candidate</td>
</tr>
<tr>
<td>Sept 2022 RPV w/ me</td>
<td><strong>Goals:</strong> <strong>Values mental acuity</strong>; if unable to engage thoughtfully in conversations or decision, this would be considered a poor quality of life for him; Recognizes he has been “living on borrowed time;” willing to adjust to physical limitations that may present themselves as long as he is still able to&quot; have his mental acuity&quot;.</td>
</tr>
<tr>
<td>Date</td>
<td>Event Description</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>January 2023</td>
<td>Admission for Heart Failure, NSTEMI; declines SNF admission; inguinal hernias so large → foley catheter placement</td>
</tr>
<tr>
<td>RPV w/ me later January</td>
<td>Decreased mobility, weight loss, foley catheter removed mid February</td>
</tr>
<tr>
<td>2/24 -3/9/23</td>
<td>Admission Heart Failure → milrinone for palliation</td>
</tr>
<tr>
<td>March 2023</td>
<td>Goals: Primary goal is extending life as long as he maintains mental capacity. Secondary goals are to be alive for another 5 years to see grandkids graduate high school, watch football and basketball seasons, and play golf at a tournament in April. Also wants to go home as much as he can to be with his family and dog and tie up loose ends at his law practice/finance managing practice. Discussed code status repeatedly; patient would like to be full code but he would appreciate further palliative care discussions.</td>
</tr>
<tr>
<td>May 2023</td>
<td>Another HF Admission, EF 19%</td>
</tr>
<tr>
<td>June 20, 2023</td>
<td>ER for strangulated right inguinal hernia</td>
</tr>
</tbody>
</table>
DOES THIS PATIENT GET SURGERY?

- Decline over 18 months (21# weight loss)
- Worsening mobility
- Fatigue
- 4 hospitalizations
- Multiple office visits
FRAILTY VS RESILIENCE

<table>
<thead>
<tr>
<th></th>
<th>Resilience</th>
<th>Frailty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectrum</td>
<td>Lifespan</td>
<td>Compressed/Towards End of Life</td>
</tr>
<tr>
<td>Observation</td>
<td>Multiple Points in Time</td>
<td>Snapshot</td>
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<td>Deficit Approach</td>
</tr>
</tbody>
</table>

“If the spectrum from robustness to frailty reflects the amount of physiological potential one has to react to stressors, physical resilience refers to the actualization of that potential.”
• Outcome of Case
• Had we not identified what matters to this patient, we might have dismissed him as
  • “too old”
  • “too frail”
PPC PROJECTS AND NEXT STEPS

- Utilize PPC as the framework to addressing the What Matters M in Age Friendly Care
- Integrate PPC training into the required geriatrics rotation for University of Utah internal medicine interns
- Collaborating with Yale to align the University of Utah PPC training with the Yale PPC training as a roadmap for national dissemination of this curriculum
- [https://patientprioritiescare.org/](https://patientprioritiescare.org/)
CONCLUSIONS

• Frailty and Resilience are not the same concept
• All health care professionals should be familiar with the age-friendly 4Ms
• Ageism is insidious, often invisible, and associated with harms including reduced life expectancy
• Age Friendly Care is patient centered and focuses on reducing frailty and increasing resilience
• Patient Priorities Care is a framework that can be used to address the What Matters “M” of Age Friendly Care
Q&A
When One Needs Care, Two Need Help: How Providers Manage Caregiver Needs

Kate Nederostek, MGS, CDP
Kristy Russell, MHL, CHES
Objectives

● Recognize the challenges and needs of the family caregiver/care partner
● View care partners/caregivers as a valuable resource and seek to incorporate them into the care team
● Understand the role you play in setting patients/caregivers up for success
● Overview of supportive resources
Caregivers are the Backbone of our Healthcare System

- By 2040, there will be over 80 million Americans 65+
- More than 1 in 5 are providing unpaid caregiving services to their family and friends
  - Over 41 million (79% of all caregivers) are supporting someone 50+
Caregivers are the Backbone of our Healthcare System

- Caregivers/care part of older adults
  - 61% help with at least 1 ADL
  - 43% help with 2 or more ADLs
  - On average help with 4.4 IADLs
  - 59% assist with medical/nursing tasks
  - 72% monitor severity of the care receivers condition
  - 66% communicate with health care professionals
  - 56% advocate with providers, services, agencies
Caregivers are the Backbone of our Healthcare System

• As the need for family caregivers is increasing, so too is an awareness that they will need both support and training
The Caregiving Continuum

- Requirements on the caregiver
- Caregiver ability / sustainability
- Functionality / ability of care receiver
Impact of Caregiving

- 6 in 10 consider their caregiving situation stressful
- 1 in 5 report high physical strain due to caregiving duties
- Caregivers spend on average 26% of their income on caregiving activities
- 18% cut back on their own healthcare spending
- 1 in 4 say it is difficult to get affordable services for their care recipient
- 61% of caregivers employment situations have been negatively effected
Effects on the Care Receiver

When family caregivers are in distress/crisis the care receiver is affected as well

- Increased institutionalization rates
- Exacerbated behavioral and psychological challenges
- Increased risk of abuse
Caregivers and Healthcare Professionals

- 6 in 10 could use more information and support
- 55% of caregivers rely on healthcare professionals for information about providing care
  - 29% of caregivers have conversations with providers about what they need to care for care receiver
  - 13% have conversations about what they need to care for themselves
Caregivers are Vital to Better Care

- Partner with family caregivers/care partners because they:
  - Often know their loved one better than anyone else
  - Know their own capacity and limitations in providing care safely in the home
- Utilizing family caregivers results in:
  - Better care, better health, and quality of life for patient
  - Lower costs
  - Easier and more meaningful work
Community Supports and Resources
Support Throughout the Caregiving Journey

• Training on medical tasks
• Develop caregiving skills (assisting someone with ADLs)
• Medical equipment/supplies that could be helpful
• Education on condition
  o Dementia, MS, Diabetes, mental health, etc.
• Referrals to community resources
  o Transportation, food banks, legal, financial, chore services
• Points of contact for crisis
Support Throughout the Caregiving Journey

- Keeping care receiver safe at home
  - Driving, falls
- How to choose/arrange/solve problems with LTC/service providers
  - In-home, residential communities
- Advocating for care receiver
- Help navigating forms, paperwork, and eligibility for services
  - Power of attorney, advanced directives, guardianship, etc.
  - County financial programs, VA services
- Preparing for and managing end of life
  - Grief/loss
Support Throughout the Caregiving Journey

• Managing new relationship with care receiver
  o Keeping personal relationships while caregiving
• Discussion of caregiver needs and capability to provide care
  o Managing caregiver stress, self care, setting boundaries
• How to build informal networks of support
  o Coordinating services, communication
• Connection with peers
  o Support groups, engaging in activities/social events
• Respite services/options
Area Agencies on Aging (AAA)

To promote positive aging and assist seniors in maintaining health, independence, and quality of life

- Information and resources
- Advocacy
- Plan, coordinate, and provide services

Find your local AAA:
https://eldercare.acl.gov/ or UtahAging.Org

Utah Department of Health & Human Services
AAA Services

- Information & Resources
- Nutrition; Meals on Wheels
- Medicare Insurance Counseling
- Caregiver Support Program
- In-Home Services Programs
- Evidence-Based Health Programs
- Long-term Care Ombudsman
- Transportation
- Senior Centers
- And so much more ...

To find your local AAA: [https://eldercare.acl.gov/](https://eldercare.acl.gov/) or UtahAging.Org
Caregiver Support Program

- Information about available community resources
- Assistance in gaining access to supportive services
- Care consultation & case management
- Support groups
- Caregiver education/training
- Respite care (relief for caregivers)
- Supplemental services (Emergency Response System, grab bars, incontinence supplies, etc.)
As a result of receiving caregiver services:

- 85% able to provide care for a longer period of time than would have been possible without these services
- 76% have delayed placement in an assisted living or nursing home
- 88% able to be more self-reliant
VA Caregiver Support Program

VA Caregiver Support Line: 855-260-3274
www.caregiver.va.gov

- Resource and Referral: assistance navigating VA services
- Counseling
- Education, Training, and Support
- May also qualify for:
  - In-Home Care
  - Respite Care
  - Equipment & Supplies
National Dementia Organizations

- Alzheimer’s Association
  www.alz.org
  Helpline: 800-272-3900

- Association for Frontotemporal Degeneration
  www.theaftd.org
  Helpline: 866-507-7222

- Creutzfeldt-Jakob Disease Foundation
  www.cjdfoundation.org
  Helpline: 800-659-1991

- Huntington’s Disease Society of America
  www.hdsa.org
  Helpline: 800-345-4372

- Lewy Body Dementia Association
  www.lbda.org
  Lewy Line: 800-539-9767

- Parkinson’s Foundation
  www.parkinson.org
  Helpline: 800-473-4636
National Dementia Organizations

- Information about and referral to community resources
- Support groups
  - Individuals in the early stages of dementia
  - Family caregivers
- Caregiver education programs (in-person or online)
- Educational material
National Resources

- AARP Caregiver Resource Center
  www.aarp.org/caregiving
  1-877-333-5885
- American Cancer Society
  www.cancer.org
  800-227-2345
- American Diabetes Association
  www.diabetes.org
  800-342-2383
- American Heart Association
  www.heart.org
  800-242-8721
- ElderCare Locator
  www.elder.gov
  800-677-1116
- National Indian Council on Aging
  www.nicoa.org
- National Resource Center on LGBT Aging
  www.lgbtagingcenter.org
- National Multiple Sclerosis Society
  www.nationalmssociety.org
- National Respite Network
  www.archrespite.org
- And many more...
Welcome to UtahAging.org

The Utah Commission on Aging (UCOA) sponsors and manages UtahAging.org as Utah’s official statewide virtual resource center for older adults. UCOA convenes expert stakeholders to share resources and best practices from our communities, public policy, education, and research to help Utahns navigate the opportunities and challenges of the aging experience.
What Providers/Health Systems Can Do

• Bring care partners/caregivers into the conversation as early as possible

• Not everyone identifies as a “caregiver”
  o Ask “who else needs to be involved in these meetings/discussions?”

• Ensure your intake process has the option to list a family caregiver or someone who supports their care

• Ensure your entire team recognizes the important role caregivers play so they don’t get lost along the way
What Providers/Health Systems Can Do

• Speak with the caregiver to understand their challenges
• Ask questions such as:
  o What can I help you with at home that you are not able to accomplish?
  o What else do you have on your plate?
  o What stresses do you have at home that you are struggling with?
What Providers/Health Systems Can Do

- Connect caregivers to resources in their local area
- Have information packets/one-pagers ready to go to hand to family caregivers
- Follow up that those resources are helpful
Takeaways

- Care partners/caregivers are a valuable resource
- You and your team play a vital role in connecting patients/caregivers to resources and encouraging their self-advocacy
- Without being directed to community resources/supports, caregivers will struggle/fail
- Eldercare.acl.gov will get you to an Area Agency on Aging near you, which will open the door to all other resources
Kate Nederostek, MGS, CDP
Program Manager
Caregiver Support & ADRD Programs

Email: knederostek@utah.gov
Office: 801-538-3926
Cell: 385-239-0596

Kristy Russell, MHL, CHES
ADRD State Plan Specialist
Alzheimer’s Disease and Related Dementias Program

Email: krussell@utah.gov
Cell: 385-266-1733
I don’t bounce back like I used to: The Science of Resilience to Health Stressors

HEATHER E. WHITSON, MD, MHS
PROFESSOR OF MEDICINE (GERIATRICS), OPHTHALMOLOGY, NEUROLOGY, HEAD & NECK SURGERY AND COMMUNICATION SCIENCES
DIRECTOR, DUKE AGING CENTER
CO-DIRECTOR, DUKE/UNC ALZHEIMER’S DISEASE RESEARCH CENTER
DUKE SCHOOL OF MEDICINE/DURHAM VA GRECC
Disclosures

National Institute on Aging: P30AG028716-11, UH3AG056925, P30-AG064201-02, R01-AG062623-01A1, U13 AG054139, R33-AG057806, P30AG072958-01

Veterans Administration – Durham VA GRECC

AGS Board of Directors
1) The importance of **resilience to stressors** in overall human health

2) The role of aging in health-related resilience

3) Duke Pepper Center Framework for Physical Resilience

4) Examples of resilience research in the Duke Pepper Center
“I don’t bounce back like I used to”
A Brief (and surely incomplete) History of Resilience in Aging Research

- Wagnild & Young 25-item Resilience Scale (1993)
- Barbara Resnick’s Physical Resilience Measure
- Many tools in psychosocial literature

- Cognitive reserve elaborated by Yaakov Stern (2012)
- NIA Workshop on Measuring Resilience in Laboratory Animals (2014)
- 1st Workshop on Research Definitions for Reserve and Resilience in Cognitive Aging & Dementia (2016)
- NIA Workshop on Measures of Physiologic Resiliencies in Human Aging (2022)

- AGS/NIA Workshop on Overview of the Resilience World (2022)
Overview of the Resilience World: State of the Science

Abadir et al. J Am Geriatr Soc. 2023
PMID: 37079440

NIA/AGS Conference
October 12-13, 2022  Washington, DC
A cosmopolitan appreciation of “resilience” in health research

• Many fields have developed their own theoretical models and definitions for resilience

• Generally, resilience entails a positive or adaptive response to a stressor

• It is important to specify how you define resilience and to recognize that others may be familiar with a different framework
Consider two patients being evaluated as candidates for total knee replacement.

76 year old woman who is a caregiver for her husband. She has obesity, depression, sedentary lifestyle, and history of coronary artery disease treated with a stent in 2015. She had gall bladder surgery and a hysterectomy, each more than 10 years ago.

75 year old man with well-controlled hypertension and glaucoma who plays golf and tennis weekly and has a supportive wife and two daughters nearby. He has never had a surgery.
Much of Successful Aging Depends on “Bouncing Back” After Health Stressors
Every person is a complex dynamic system

**Interconnected Systems and Sub-systems** constantly moving, transitioning, and adapting to changing environments and new stressors

Image by: Institute for Systems Biology, Seattle, WA
With age, our ability to respond briskly and adaptively to perturbation declines.
Diseases can diminish biologic resilience… and lower resilience makes us vulnerable to the next disease…
Geroscience: Biological resilience has a molecular basis

…and all of these molecular pathways exhibit decline with age (over time), even in the absence of serious disease.

Adapted from Kennedy et al. Cell 159; 2014
But the rate of decline is not the same for everyone. Why?

And sometimes our patients really surprise us...
Can we get better at predicting and promoting physical resilience to health stressors?

Step 1: We have to decide what to measure
Duke Pepper Center Conceptual Model of Physical Resilience

- Stressors:
  - Acute Illness
  - Injury
  - Surgery
  - Psychosocial

- Pre-Stress Reserve:
  - Cognitive
  - Psychological
  - Physical

- Resilience (Dynamic Response)

- Range of Response

- Outcomes:
  - Survival
  - Independence
  - Quality of Life
  - Morbidity

*Opportunities to intervene
Duke Pepper Center Resilience Leadership Team

Leadership and Administration Core
- Claude D. Pepper OAIC
- Kenneth Schmader, Director

External Advisory Board

Independent Review Panel

Internal Operating Committee

Data Integration Working Group
- William Kraus

Research Education Core
- Cathleen Colon-Emeric (CL)
- Kim Johnson (CL)

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  - Elaine Guavara
  - Gentzon Hall
  - Adam Devore
How might we quantify “resilience” after a stressor?

Two Key Clinical Questions

1. What is the pattern of recovery my patient will experience across health measures that matter?

2. How much better/worse will my patient do than expected, given their age and pre-stressor status?
Recovery Phenotype Approach

- Descriptive
- Can quantify multiple parameters (slope, % recovery, etc)
- Can summarize multiple outcomes simultaneously
  - Latent Class Trajectory Analysis
  - Factor Analysis
  - Principle Components Analysis
- Driven by age, comorbidities, pre-stressor function

What are Appropriate Health Measures to Capture Resilience?

Duke Pepper Center Health and Mobility Measures Core

• Provides consultation and training, develops standard protocols, and creates or adapts innovative new measurement approaches across the adult lifespan

They maintain websites with curated lists of measures:
https://agingcenter.duke.edu/functional-assessment
https://agingcenter.duke.edu/psychosocial-resilience

Katherine Hall & Amy Pastva
Example: Recovery phenotype approach after hip fracture

Latent Profile Analysis trajectory group

- Lowest resilience
- Medium resilience
- Highest resilience

J Am Geriatr Soc. 2019 Dec;67(12):2519-2527
What Factors Were Associated with the Phenotype of High Resilience after Hip Fracture?

Model Predicting High vs. Low/Medium Resilience

<table>
<thead>
<tr>
<th>AUC FOR VARIABLE CHUNK</th>
<th>Stressor Factors</th>
<th>Environment</th>
<th>Psychosocial</th>
<th>Comorbidities</th>
<th>Demographics</th>
<th>Pre-stressor function</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6</td>
<td>0.6</td>
<td>0.61</td>
<td>0.67</td>
<td>0.67</td>
<td>0.67</td>
<td>0.84</td>
</tr>
</tbody>
</table>
Expected Recovery Differential (ERD) Approach

- Quantifies how observed outcomes differed from expected
- Requires predictive model from large cohort
- Accounts for baseline status, stressor factors, environment etc.

Proof of Concept: Are key resilience biomarkers linked to Recovery Differentials after Hip Fracture?

Gene Expression: miRNA panel

Response to Damage & Toxins

Genetics & DNA Repair

Mobilizing Energy Stores

Regulating Inflammation & Immune Response

Stem Cells & Regeneration

Protein Folding & Recycling

Cellular Damage Control

Metabolism: Acylcarnitine, branched chain amino acids, IGF-1

Immune Response: IL6, IL10, V-CAM, TNF R1&2, SASP Panel
This panel of biomarkers explained 38% of the observed variability in recovery differential after hip fracture.

Daniel Parker, MD

Example #1: PRIME-KNEE Study

Predicting resilience to a planned stressor
200 Duke patients scheduled for elective knee replacement surgery

**Baseline Visit**
- Consent
- Covariates (Demographics, education, social support, environment)
- Cognitive Reserve Tests
- Physical Reserve Tests
- Provocative Tests (dual task gait/cognition, fNIRS reactivity tests, PBMC reactivity tests)
- Blood for biomarkers
- 7 day Step Counts

**Surgery Week**
- Provocative test (ECG variability)
- Covariates (surgery characteristics, complications, length of stay)
- Pain intensity and interference (daily)
- 3D-CAM Attention items
- Blood for biomarkers
- 7 day Step Counts

**1, 2, 4 Month Phone Calls**
- Pain intensity and interference
- LE PADs
- Cognitive Change Index (subject, informant)
- 7 day Step Counts
- Intercurrent events, Rehabilitation received

**6-Month Visit**
- Cognitive Reserve Tests
- Physical Reserve Tests
- Provocative Tests (dual task gait/cognition, fNIRS reactivity tests, PBMC reactivity tests)
- 7 day Step Counts

Are there feasible, safe tests that can predict physical recovery after big health stressors?
Provocative Tests: Baseline and 6 months

- **Gait Speed Dual Task Test** walking while performing a speech generation task
- **Near-Infrared Spectroscopy** (NIRS) cerebrovascular reactivity before and after cognitive task, orthostatic challenge
- **In vitro PBMC response** influenza vaccine/virus and LPS stimulation
Measures of Reserve at Baseline

Physical/Biological Reserve
- Grip strength, 3-min walk test, and usual gait speed
- Biomarkers: TNFR1, sVCAM, miR-376a-3p, miR-16-5p, miR-26b-5p, miR-499a-3p, IL6, Aspartate, Arginine, C22, C5:1, Lactate, Glutamate/Glutamine, Myostatin

Cognitive Reserve
- 3MS, trails A/B, 15 item word list, digit symbol substitution

Psychosocial Reserve
- 25-item psychosocial Resilience Scale, Patient Health Questionnaire-9, and (PROMIS) Emotional Support Instruments
A sneak peek at PRIME-KNEE data

Do self-reported psychosocial measures collected before elective total knee arthroplasty predict pain trajectories in older adults?

- PHQ9 Depression Scale
- Brief psychosocial resilience scale
- Emotional support questionnaire

Samantha Karle
Duke SoM MS3
Predicting Pain Trajectories in PRIME-KNEE

How is pain recovery different for people with depressive symptoms?

How is pain recovery different for people with low psychosocial resilience?
Populations with ongoing resilience research at Duke Aging Center

- Sickle cell anemia
- Hemodialysis
- Glomerulosclerosis
- Rheumatoid arthritis
- Bone marrow transplant
- ECMO
- Osteoarthritis
- Fracture
- Alzheimer’s disease/Dementia
- Urinary tract infections
- Vaccination
- Elective abdominal surgery
- Anesthesia/POCD
- Lemurs!
Example #2: Preclinical work to identify mechanisms and druggable targets
Metaphor of the Castle under Siege: Will the Castle Fall?

- Strength of attack (magnitude of stressor)
- Quality of construction and maintenance over time (reserve)
- How quickly it can deploy defenses and repair damage (resilience)

Geroscience Hypothesis: Different cellular and molecular mechanisms may underlie reserve and resilience
Pepper Pilot: Youthful Circulation Rescues Aged Fracture Repair

- Osteoblasts did **NOT** engraft; endogenous aged osteoblasts did the work
- Circulating factor(s) rescue bone repair declines with age
- Apo E is a mediator
- Meteorin-like protein (Metrnl) increases with injury, but was not required for recovery

Baht et. al. (2015). *Nat Comm*
Huang et al (2022) *J Orth Res*
Blood of Young Mice Extends Life in the Old

Infusions of youthful blood led older mice to live 6 to 9 percent longer, a new study found.

3 months of heterochronic parabiosis:
Reduced the epigenetic age of older mouse’s blood and liver
Based on multiple clock models using two independent platforms
Persisted 2 months after detachment
More youthful transcriptome: Gene expression changes opposite to aging but akin to several lifespan-extending interventions
Longer lifespan

Example #3: STRIDE and GeroFit

Interventions to support resilience
A Practical Resilience Intervention: STRIDE

Supervised Walking Program Developed in Hospitalized Veterans

Importance of Mobility
Hospitalized older adults spend only 3-4% of their time standing or walking during their stay.

10 days of bed rest for healthy adults in a hospital can result in up to 1kg (2.2 lbs.) of muscle mass loss.

The STRIDE Program
STRIDE conducts an early assessment of the Veteran within 24 hours of hospital admission so their mobility needs are addressed quickly.

Veterans who are eligible to participate are guided by trained staff to walk up to 20 minutes a day for the duration of their stay.

193
Total number of walks with the STRIDE program at the Michael E DeBakey VAMC.

100% reported feeling better or the same after their walk.

Hastings et al. Geriatrics (Basel) 2018
Ultimate Reserve-Building, Resilience-Promoting Intervention: Physical Activity

Morey MC et al. J Amer Geriatri Soc 2018
Goal: Promoting Resilience Before and During Health Stressors

Predict Recovery Trajectory
- Clinically feasible provocative tests
- Biomarkers

Current Interventions
- “Prehabilitation”/Exercise
- Decision support tools

Future Interventions
- Resilience in a pill?
The Era of Resilience Medicine

Disease Focused Medicine → Preventive Medicine → Resilience Medicine
Motivating Patients toward Resilience: The Platform Metaphor
An Invitation to Get Involved

Conference #2 will focus on mechanisms and predictors of resilience to health stressors.

It will occur in DC area in March 2024

WANT TO BE PART OF IT?
Look for a call late November for applications for Rising Star travel awards to attend!!
Thank you and Questions

Duke Collaborators:
Cathleen Colon-Emeric, Ken Schmader, Kim Huffman, Bill Kraus, Virginia Kraus, James Bain, Micah McClain, Miles Berger, Marty Woldorff, Daniel Parker, Janet Huebner, Harvey Cohen, Miriam Morey, Carl Pieper, Rick Sloane, Mary Cooter, Jody Feld, Patrick Smith, Katherine Hall, Leah Acker

U. Maryland Collaborators:
Jay Magaziner, Denise Orwig, Ann Gruber-Baldini

U. Connecticut Collaborators:
George Kuchel

Harvard Collaborators:
Lew Lipsitz, Junhong Zhou

Johns Hopkins Collaborators:
Peter Abadir, Jeremy Walston, Karen Bandeen-Roche, Ravi Varadhan

NIA Collaborators: Giovanna Zappala, Basil Eldadah, Chhanda Dutta, Laverne Brown
Case-based Studies in Resilience

Rocky Mountain Geriatrics Conference
September 26, 2023
Discussion Lead:
Rand Rupper, MD, MPH
System Failure
Case Study

• You are seeing a 73 year-old Vietnam Veteran in a primary care geriatric clinic. You have known this patient for at least the past five years, when the patient transferred to your clinic because of memory concerns.

• You discovered some short-term memory loss that the patient is able to compensate for in daily function. This has been stable over the time that you have been seeing this patient.
Case Continues

• The patient informs you that life became more challenging when his wife underwent knee surgery 3 months ago. Her recovery is taking longer than they expected. His wife normally accompanies him to clinic but she couldn’t join today.

• His sleep has been more interrupted, and he tells you that for the first time in his life he occasionally has nightmares reflecting his wartime experiences.
Discussion

• What thoughts are you having about this patient’s resilience?

• What about his wife’s resilience?

• What are the stressors that are testing resilience?
Case Continues

• He let’s you know that his wife had an option to go to a skilled facility for rehabilitation, but really just wanted to be at home. She has been getting home physical therapy, and within the last week has been able to manage the stairs to her upstairs bedroom.

• He thinks that his sleep will improve when they are able to sleep together upstairs again.
Case Continues

• You notice that he has lost 6 pounds since his visit 6 months ago.
• When you ask about this, he tells you that his wife had previously been doing all of the cooking, but that he has taken this over after her surgery.
• His daughter lives 30 minutes away and has been visiting weekly to drop off groceries and freezer meals.
• Neighbors have offered to help, but they have declined so far?
Discussion

• What protective factors are you seeing?

• What risk factors are you seeing?

• What else do you really want to know?
Case Continues

• When you examine the patient, you notice that he has some swelling in his ankles that you have not noticed previously.

• What are your thoughts about this finding?

• What tests or interventions might you suggest to address this?
Case Continues

• You encourage the patient to accept more help from neighbors to improve diet/nutrition.
• You proceed with some work-up for heart and kidney failure, but this is unremarkable.
• You encourage the patient to be more physically active.
• You encourage the patient to sleep in bed and not in a reclining chair.
• You ask the patient to follow-up in 3 months and to bring his wife if she is able.
Discussion

• What do you like about these provider suggestions as related to a framework for resilience?

• What else would you like to add?
The Case Continues (3 months later)

• When the patient returns, his wife is with him. She states that she is feeling better, and shares with you that her rationale for rehabbing at home was to not leave the patient alone at home.

• With her knee repaired, she is now able to resume all of her prior function, and is even excited to grow a garden again after three years of not being able to kneel to do gardening.
Case Continues

• Your patient has gained back three pounds and his edema has resolved.

• When you repeat cognitive testing, his scores are between 5 to 10% lower than a year ago.

• Although he feels his sleep has generally improved, he is still having nightmares a few times a month. He is puzzled about why this is happening now, and wants you to know that he is not trying to qualify for new benefits.
Discussion

• What do you think about the patient’s resilience within the following domains?
  – Physical
  – Cognitive
  – Psychosocial

• What do you think about the wife’s resilience within these domains?

• What do you think about their resilience as a dyadic couple?
Looking forward

• Can steps be taken now to improve their resilience as:
  – Patients
  – Caregivers
  – A dyad
TECHNOLOGY-BASED SOLUTIONS FOR PATIENTS AND CARE PARTNERS

Cathy Bodine PhD, CCC-SLP
Professor | Department of Bioengineering/School of Medicine
Coleman-Turner Endowed Chair in Cognitive Disabilities
Executive Director, Coleman Institute for Cognitive Technologies
University of Colorado System
Director | Center for Inclusive Design and Engineering (CIDE)
Director, Innovation Ecosystems, Colorado Clinical Translational Sciences Institute
Over a billion people around the world live with a disability.
That number will double in less than 30 years.
DEMAND FUELS INNOVATION

Cognition, Vision, Hearing, Mobility

1-in-2

Exponential growth

Disability Technology

Sources: WHO world report on disability, BCC research

$158 Billion 2050

$58.5 Billion 2020
Would you like to use this product?
Who are older people anyway?
Who says older adults are afraid of innovation?
Gaps and Opportunities

Key Areas to support older adults:

- Smart City/Smart Home
- Equitable Transportation
- Point-of-Care Technology
- Social Assistive Robotics
- Artificial Intelligence/Machine Learning
CU – a Global Destination for Disability and Aging Innovation

Global Technology Research and Data Science Center
- Innovative
- Partner-driven
- Entrepreneurial
- Human Centered
- Focused on Commercialization

Industry partners
- CIDE
- Coleman Institute
- CU Denver/Anschutz

Innovation District / Living Lab

New industry expertise
Next generation engineers prepared for today’s and tomorrow
Putting it all together

Must haves for successful deployment:

+ Human Centered--User-centered design
+ Clinical expertise
+ Industry partnerships
+ Access to the disability and aging community
+ Industry Testbed
+ Co-Development
Have graduated from an intensive training course focused on supporting research faculty with their projects.
Project: Feasibility trial of Vibrotactile Stimulation to Entrain 40 Hz Gamma Oscillation for Alzheimer’s disease

Team: Mazen Al Borno, PhD (PI) Brice McConnell, MD, PhD Peter Teale Zhengxiong Li

Partner: Coleman Institute for Cognitive Disabilities UNIVERSITY OF COLORADO
Project:
PointItOut: Grocery Shopping Independence for Mild-to-Moderate Disabilities via Augmented Reality-enabled Destination Visualization

Team:
Bing Han, PhD (PI)
Jim Sandstrum, SLP
Kendall Hunter, PhD
Caroline Clevenger, PhD, PE, AIA

Partner:
Project:
Innovative and Stylish Mobility Devices to help in the Prevention of Alzheimer’s Disease

Team:
Petra Conaway, DPT (PI)
Dana Carpenter, PhD
Dan Griner

Partner:
Μ ☝ B E L L A
Thank you!

Cathy Bodine PhD, CCC-SLP (she/her)

303.315-1281 | 303.513.8396
cathy.bodine@cuanschutz.edu

Associate Professor | Department of Bioengineering
CCI Endowed Professorship

University of Colorado Denver | College of Engineering, Design and Computing
Executive Director | Coleman Institute for Cognitive Disabilities
Coleman Turner Endowed Chair in Cognitive Disabilities

Director | Center for Inclusive Design and Engineering (CIDE)

Associate Professor | Departments of Pediatrics, Physical Medicine and Rehabilitation, and Orthopedics

Director, Innovation Ecosystems, Colorado Clinical Translational Sciences Institute

University of Colorado Denver | Anschutz Medical Campus
The Hear and Know: Presbycusis, Cognition, and Cochlear Implants in Older Adults

Thoughts by
Richard K. Gurgel, MD, MSCI
Associate Professor – Otolaryngology
DISCLOSURES

• Research funding:
  • NIH/NIA - 1 R21 AG067403-01A1
  • Center on Aging Pilot Grant

• Surgical Advisory Board: Med-El

• Industry: Institutional Research Funding from Cochlear Corp and Advanced Bionics
INTRODUCTION OF TEAM

- Ankita Date (UPDB), Mike Newman (EDW), Tom Belnap (IHC), Alison Fraser (UPDB)
CASE PRESENTATION

- 84 y/o woman
- Bilateral hearing loss for 20 years
- Can’t communicate with family
- PMHx:
  - Dementia NOS
  - Breast cancer (remission)
  - HTN, Heart failure (mild) with h/o MI
  - OSA
QUESTIONS

• Did her hearing loss cause her dementia (or is her “dementia” just hearing loss)?
• Would you offer a cochlear implant to this patient?
OVERVIEW

• Hearing Loss and Dementia
• Frailty
• Cochlear implants, cognition, and quality of life
CENTRAL PATHWAYS
HEARING LOSS AND DEMENTIA
Central Auditory Dysfunction as a Harbinger of Alzheimer Dementia

George A. Gates, MD, Melissa L. Anderson, MS; Susan M. McCurry, PhD; M. Patrick Feeney, PhD; Eric B. Larson, MD, MPH

Hearing Loss and Cognition in the Baltimore Longitudinal Study of Aging

Frank R. Lin, Hopkins University
Luigi Ferrucci, E. Jeffrey Metter, Yang An, Alan B. Zonderman, and Susan M. Resnick, National Institute on Aging, Baltimore, Maryland

Hearing Loss and Cognitive Decline in Older Adults

Frank R. Lin, MD, PhD; Kristine Yaffe, MD; Jin Xia, MS; Qin Li Xue, PhD; Tamara B. Harris, MD, MS; Elizabeth Parchman-Holper, PhD; Suzanne Satterfield, MD, DrPH; Eliza N. Ayusojan, PhD; Luigi Ferrucci, MD, PhD; Eleanor M. Simonick, PhD, for the Health ABC Study Group

Relationship of Hearing Loss and Dementia: A Prospective, Population-Based Study

*Richard Klaus Gurgel, *Preston Daniel Ward, ‡Sarah Schwartz, ‡†Maria C. Norton, ‡Norman L. Foster, and ‡‡JoAnn T. Tschanz

Hearing Loss as a Risk Factor for Dementia: A Systematic Review

Rhett S. Thomson, BA; Priscilla Auduong, MD; Alexander T. Miller, BS; Richard K. Gurgel, MD
• Cache County Study on Memory, Health, and Aging
• Began in 1995
• ≥ 65 years old
• 90% of residents enrolled
RESULTS

• 4,463 subjects
  – 836 with hearing loss (HL)

• Subjects with HL
  – 16.3% developed dementia vs. 12.1% without HL (p<0.001)

• Mean time to dementia
  – 10.3 years HL vs. 11.9 years without HL (p<0.001)
HL 0.26 points/year worse than without HL

HR = 1.30
p = 0.013
Hearing Loss as a Risk Factor for Dementia: A Systematic Review

Rhett S. Thomson, BA; Priscilla Aduong, MD; Alexander T. Miller, BS; Richard K. Gurgel, MD

- Odds ratio for an older adult with hearing loss developing dementia compared to normal hearing control:
  - 1.24-1.8
  - up to OR 4 for severe-profound SNHL
9% of modifiable risk of Alzheimer’s disease attributed to hearing loss.
CORRELATION OR CAUSATION?

- Neuro-biological
- Cognitive Overload
- Psycho-social
HEARING LOSS WHAT CAN WE DO ABOUT IT?

• Diagnosis: Screening

• Treatment: Cochlear implants and cognition
What level of hearing loss would you treat in a child?
Number of people age 65 and over, by age group, selected years 1900–2006 and projected 2010–2050

Note: Data for 2010–2050 are projections of the population.
Reference population: These data refer to the resident population.
Quality Improvement in Otolaryngology-Head and Neck Surgery: Age-Related Hearing Loss Measures

Richard K. Gurgel, MD, MSCI¹, Selena E. Briggs, MD, PhD, MPhil, Nui Dhepysawan, MEd⁴, and Richard M. Rosenfeld, MD, MP

Screening for Hearing Loss in Older Adults: US Preventive Services Task Force Recommendation Statement

US Preventive Services Task Force


IMPACT: Age-related sensorineural hearing loss is a common health problem among adults. Nearly 16% of US adults 18 years or older report difficulty hearing. The prevalence of perceived hearing loss increases with age. Hearing loss can adversely affect an individual's quality of life and ability to function independently and has been associated with increased risk of falls, hospitalizations, social isolation, and cognitive decline.
QUALITY MEASURE #1

Patients who were screened for hearing loss

All patients age 60 years and older.
SCREENING

• Clinical tests (e.g., detection of a whispered voice, finger rub, or watch tick), a single question (e.g., “Do you have difficulty with your hearing?”)
• questionnaires (e.g., Hearing Handicap Inventory for Elderly-Screening (HHIE-S))
• Online screening
• NHANES survey questions
• Handheld audiometric devices (e.g., the AudioScope)
QUALITY MEASURE #2

Patients who either received, were ordered, or were referred for comprehensive audiometric testing.

All patients who failed screening
QUALITY MEASURE #4

Patients or their caregiver(s) who participated in shared decision making (SDM) regarding treatment options for symmetric sensorineural hearing loss.

All patients age 60 years and older with a diagnosis of symmetric sensorineural hearing loss.
# USPSTF

## Table. Summary of USPSTF Rationale

<table>
<thead>
<tr>
<th>Rationale</th>
<th>Assessment</th>
</tr>
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<tbody>
<tr>
<td>Detection</td>
<td>Adequate evidence that screening instruments can detect hearing loss</td>
</tr>
<tr>
<td>Benefits of screening and intervention and treatment</td>
<td>• Inadequate evidence that screening for hearing loss in asymptomatic patients improves health outcomes</td>
</tr>
<tr>
<td></td>
<td>• Inadequate evidence that interventions to treat hearing loss in screen-detected patients improves health outcomes</td>
</tr>
<tr>
<td>Harms of early detection and intervention and treatment</td>
<td>Inadequate evidence to determine the harms of screening for and treatment of hearing loss</td>
</tr>
<tr>
<td>USPSTF assessment</td>
<td>The evidence on screening for hearing loss is lacking, and the balance of benefits and harms cannot be determined</td>
</tr>
</tbody>
</table>


## Summary of Recommendation

| Asymptomatic adults 50 years or older | The US Preventive Services Task Force (USPSTF) concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for hearing loss in older adults. | I statement |

See the Practice Considerations section for additional information regarding the I statement. USPSTF indicates US Preventive Services Task Force.
SCREENING REQUIREMENTS

• Does screening result in increased detection of disease?
• Does increased detection lead to increased treatment?
• Does increased treatment lead to improved health outcomes?
HEARING AIDS

IIC (invisible-in-the-canal)
CIC (completely-in-the-canal)
ITC (in-the-canal)
ITE (in-the-ear)
RIC (receiver-in-the-canal)
BTE (behind-the-ear)
Super Power
Among presidential advisors, Mr. Reagan’s use of a hearing aid revived speculation on whether his age would be an issue if he seeks re-election next year.
Hearing Loss & Hearing Aid Use Prevalence Among Older Adults in the U.S. 1999-2006

Chien W et al, Arch Int Med, 2012
BARRIERS TO UPTAKE OF HEARING CARE IN ADULTS

Cost/Affordability

Awareness & Understanding

Access to Services & Technology

Technology Design & Utility

Adapted from Frank Lin, 2018 AAO-HNS
Importance of solving health problems with rigorous public health research that can inform public policy

OTC Hearing Aid Bill introduced into U.S. Congress in March 2017 & signed into law in August 2017

This law overturns > 40 years of regulatory precedent in the U.S. & around the world

FDA regulation for OTC hearing aids in the U.S. to go into effect by 2020 (2022)

- Importance of solving health problems with rigorous public health research that can inform public policy

Adapted from Frank Lin, 2018 AAO-HNS
Sony to bring over-the-counter hearing aids to the masses

By Derek Malcolm
September 13, 2022

Sony announced today that it has partnered with Danish hearing device experts WS Audiology to develop consumer-friendly, over-the-counter (OTA) hearing aids that users can “just pick up and use as naturally as contact lenses,” Sony’s Osamu Hajimoto says in a video from Sony Global.
Hearing intervention versus health education control to reduce cognitive decline in older adults with hearing loss in the USA (ACHIEVE): a multicentre, randomised controlled trial

Frank L Jin, James R Pike, Marilyn S Albert, Michelle Arnold, Sheila Burgard, Theresa Chisohl, David Couper, Jennifer A Deal, Adele M Gorman, Nancy W Gwyn, Theresa Gmelin, Lisa Gravens-Mueller, Kathleen M Hayden, Alison R Hearing, David Knopman, Christine M Mitchell, Thomas Mosley, James S Pankow, Nicholas S Reed, Victoria Sanchez, Jennifer A Schrack, B Gwen Windham, Josef Coresh, for the ACHIEVE Collaborative Research Group

Interpretation The hearing intervention did not reduce 3-year cognitive decline in the primary analysis of the total cohort. However, a prespecified sensitivity analysis showed that the effect differed between the two study populations that comprised the cohort. These findings suggest that a hearing intervention might reduce cognitive change over 3 years in populations of older adults at increased risk for cognitive decline but not in populations at decreased risk for cognitive decline.
COCHLEAR IMPLANTS
COCHLEAR IMPLANTS IN OLDER ADULTS

• Only 5-10% of adult cochlear implant candidates in the US have received cochlear implants

• Average delay from time of profound ARHL to CI is 10 years

• Fastest growing segment of CI users = older adults
Global Adult Hearing loss (2018)

Total Adult Hearing Loss
432 Million\(^1\)

Potential Implant Candidates
\(~15\) Million could benefit from a cochlear implant\(^2\)

\(~750,000\)
CI Recipients\(^3\)

\(~5\%\) penetration

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1. World Health Organization. Over 5\% of the world’s population – or 466 million people – has disabling hearing loss (432 million adults and 34 million children). It is estimated that by 2050 over 900 million people – or one in every ten people – will have disabling hearing loss. Available from: [http://www.who.int/features/factfiles/health/19/](http://www.who.int/features/factfiles/health/19/)

2. Cochlear internal data.

3. Market penetration estimate based on Cochlear sourced data.
SURGICAL CANDIDACY

• How old is too old?

Mollie Smith, UK, implanted at 99 years old
HIROMU INADA - IRONMAN
FIG. 1. Vulnerabilities of robust and frail older persons to a minor (*solid line*) or major (*dashed line*) change in health status. Based on the work of Calvani et al.\textsuperscript{10} and Clegg et al.\textsuperscript{11}
Association of Baseline Frailty Status and Age With Postoperative Complications After Cochlear Implantation: A National Inpatient Sample Study

*Kyri1 L. Cole, †Eric Babajanian, †Ryan Anderson, †Steve Gordon, †Neil Patel, ‡Alis J. Dicpinigaitis, §Syed Faraz Kazim, §Christian A. Bowers, and †Richard K. Gurgel

*School of Medicine, University of Utah, Salt Lake City, Utah, USA; †Division of Otolaryngology, University of Utah, Salt Lake City, Utah, USA; ‡School of Medicine, New York Medical College, Valhalla, New York, USA; and §Department of Neurosurgery, University of New Mexico, Albuquerque, New Mexico, USA

(6.2%) discharged to a nonhome destination. Multivariate analysis showed no statistically significant correlation between increasing participant age or frailty status and postoperative complications; however, increasing baseline frailty tier showed an independent association with risk of eLOS (severely frail: odds ratio, 4.83; 95% confidence interval, 3.00–7.75; \(p < 0.001\)) and nonhome discharge (severely frail: odds ratio, 6.51; 95% confidence interval, 3.81–11.11; \(p < 0.001\)). The mFI-11 showed very similar trends.
COCHLEAR IMPLANT COGNITION

Evaluating the Impact of Cochlear Implantation on Cognitive Function in Older Adults

Richard K. Gurgel, MD, MSCI; Kevin Duff, PhD; Norman L. Foster, MD; Kaitlynn A. Urano, AuD; Alvin deTorres, MD

- 37 patients, ≥65 yo
- Cognitive testing before and 1 year after cochlear implant

<table>
<thead>
<tr>
<th>Cognitive domain</th>
<th>Verbal stimuli/responses</th>
<th>Visual stimuli/responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple attention</td>
<td>Digit Span</td>
<td>Spatial Span</td>
</tr>
<tr>
<td>Sustained attention</td>
<td>Stroop Color Word Test</td>
<td>d2 Test of Attention</td>
</tr>
<tr>
<td>Learning and memory</td>
<td>HVLT-R</td>
<td>BVMT-R</td>
</tr>
<tr>
<td>Executive functioning</td>
<td>Hayling Sentence Completion Test</td>
<td>Trail Making Test Part B</td>
</tr>
</tbody>
</table>
Table II: Patient characteristics

- Patients initially enrolled: 48
- Patients lost to follow-up prior to 12 months: 9
- Patients who did not undergo surgery or did not have data available to analyze: 2
- Total number of patients: 37

<table>
<thead>
<tr>
<th>Age at implantation, mean (SD)</th>
<th>79.4 (7.4)</th>
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<table>
<thead>
<tr>
<th>Factor, n (%)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>32 (86%)</td>
</tr>
<tr>
<td>Veteran</td>
<td>16 (43%)</td>
</tr>
<tr>
<td>Laterality, right</td>
<td>16 (43%)</td>
</tr>
<tr>
<td>Pre-operative cognitive classification based on MMSE</td>
<td></td>
</tr>
<tr>
<td>Normal (≥25)</td>
<td>24 (65%)</td>
</tr>
<tr>
<td>Impaired cognition (&lt;24)</td>
<td>13 (35%)</td>
</tr>
<tr>
<td>Visual impairment present</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>26 (70%)</td>
</tr>
<tr>
<td>Yes</td>
<td>11 (30%)</td>
</tr>
<tr>
<td>Pre-operative depression classification based on GDS</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>29 (78%)</td>
</tr>
<tr>
<td>Mild</td>
<td>8 (22%)</td>
</tr>
<tr>
<td>Manufacturer</td>
<td></td>
</tr>
<tr>
<td>Advanced Bionics</td>
<td>12 (32%)</td>
</tr>
<tr>
<td>Cochlear</td>
<td>15 (41%)</td>
</tr>
<tr>
<td>Med-El</td>
<td>10 (27%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Non-implanted ear</th>
<th>Pre-operative ear</th>
<th>Bilateral</th>
<th>Post-operative ear</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median (IQR)</td>
<td>Median (IQR)</td>
<td>Median (IQR)</td>
<td>Median (IQR)</td>
</tr>
<tr>
<td>4f-PTA (dB HL)</td>
<td>72.5 (62.8, 80.0)</td>
<td>78.8 (76.6, 90.6)</td>
<td></td>
<td>31.3 (26.9, 45.3)</td>
</tr>
<tr>
<td>CNC (%)</td>
<td></td>
<td></td>
<td>35.2 (23.0, 44.2)</td>
<td>54.4 (46.0, 61.0)</td>
</tr>
<tr>
<td>AzBio in Quiet (%)</td>
<td>41.8 (37.1, 45.7)</td>
<td>22.5 (15.3, 25.5)</td>
<td>37.0 (21.3, 48.0)</td>
<td>51.1 (30.0, 78.5)</td>
</tr>
</tbody>
</table>

p-value
COCHLEAR IMPLANTS COGNITION

• Cochlear implants improve cognition in older adults
• Individuals with cognitive impairment - Even more improvement
• Do cochlear implants protect against dementia?
IMPLANTS IN PATIENT WITH KNOWN DEMENTIA

Similar in principle to children with developmental delay
Eight patients met inclusion criteria
Mean age at time of implantation: 77.8 years (SD 9.6 years)
Average preoperative MoCA cognitive score: 22.1 (SD 4.1, 14-25)
  ≤25 demonstrates cognitive impairment
Average follow up: 26.8 months
RESULTS – CI WITH KNOWN DEMENTIA

• Median pure tone average ($p=0.012$):
  • Pre-op: 88.9 dB HL (IQR 32.2 dB HL)
  • Post-op: 33.8 dB HL (IQR 4.1 dB HL)

• Median preoperative speech testing score (AzBio/HINT) ($p=0.018$):
  • Pre-op: 21% (IQR 24%)
  • Post-op: 44% (IQR 21%)

• No observed surgical complications during the follow up period
  • Two patients passed away at an average 58.0 months (SD 31.1 months) after surgery
For hearing aids for cognitive decline: HR, 0.81; 95%CI, 0.76-0.87; I² = 0%)

For hearing restorative devices, cognitive improvement: ratio of means, 1.03; 95%CI, 1.02-1.04, I² = 0%).
CI – DEMENTIA: TRINETX DATABASE

TriNetX is a cloud supercomputing, HIPPA-compliant, live, multi-HCO international electronic health records (EHR) database representing 78 HCO’s and ~103.5-million patient records from nine countries. Queries on the database were made using medical billing codes (ICD-10, CPT, etc.) via Boolean operators and temporal constraints to define patient cohorts.

Patients with BLSNHL (ICD10: H90.3) with and without CI (CPT: 69930) were queried

Propensity score matching (PSM) was performed to control for covariates. p-values were calculated before and after PSM using chi-squared or unpaired t-tests (QR code).

Multiple comparisons: because outcomes were pre-defined, and the number of comparisons were limited, we decided to not adjust our p-values.

Odds ratios (OR) with 95% confidence intervals were calculated for dementia (ICD10: F01, F03, G30), neuropsychiatric, and ALE outcomes (Fig1 and QR code) 1-4,500 days after index. Patients with outcomes prior to index were excluded from analysis.
COCHLEAR IMPLANTS - RISK OF DEMENTIA
DO COCHLEAR IMPLANTS MITIGATE THE RISK OF AD?
COCHLEAR IMPLANTS IN OLDER ADULTS

• Move past “safe and effective.” No longer research
• How do we improve access?
QUESTIONS

• Did her hearing loss cause her dementia (or is her “dementia” just hearing loss)?
• Would you offer a cochlear implant to this patient?
FUTURE DIRECTIONS

• Screening data

• Observational cohort study: CI-Alzheimer’s
  – UPDB

• Long-term outcomes CI-cognition

• Frailty and CI

• CI and QoL – patients and caregivers
CONCLUSIONS

• There is an association between hearing loss and dementia
• Cochlear implants and hearing aids are safe and effective in older adults, and can improve cognition
• Cochlear implants and hearing aids may reduce risk of cognitive decline and/or dementia
THANK YOU
Questions