


Aspects of cognition that impact aging-in-place and long-term care planning

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Abstract

Background: Older adults frequently defer decisions about their aging-in-place/long-term care (AIP-LTC) needs. As a result, when older adults experience worsening Alzheimer's disease, family members/friends become surrogate decision makers. We sought to understand what aspects of cognition impact older adult AIP-LTC planning.

Methods: As part of the PlanYourLifespan (PYL)-LitCog study, we longitudinally examined AIP-LTC decision-making among a cohort (LitCog) of community-based older adults (65 years and older) recruited from hospital-associated primary care clinics in Chicago, Illinois, with extensive cognitive testing. PlanYourLifespan.org (PYL) is an evidence-based online intervention that facilitates AIP-LTC planning. Subjects underwent baseline testing, received the PYL online intervention, and then were surveyed at 1, 6, and 12 months about AIP-LTC decision-making. Cross-sectional logistic regression analysis was conducted examining cognitive variables that impacted AIP-LTC decision-making.

Results: Of the 293 older adults interviewed (mean age 73.0 years, 40.4% non-White), subjects were more likely to have made AIP-LTC decisions if they had adequate inductive reasoning (ETS letter sets total—OR = 1.14 (95% CI = 1.03–1.27; $p < 0.05$)) and adequate working memory (size judgment span total—OR = 1.76 (95% CI = 1.13–2.73; $p < 0.05$)). There were no differences in decision-making observed in verbal abilities, long-term memory, or processing speed. All analyses were adjusted for participant gender, race, age, and decision-making response at baseline.

Conclusion: Inductive reasoning and working memory are critical to AIP-LTC decision-making. Screening routinely for these specific cognitive domains is important in targeting and helping older adults prepare in time for their future AIP-LTC needs.

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KEYWORDS

Alzheimer's disease, cognition, long-term care planning

INTRODUCTION

Older adults frequently defer decisions about their aging-in-place/long-term care (AIP-LTC) needs.¹⁻³ As a result, when older adults experience worsening Alzheimer's disease and are unable to provide their AIP-LTC preferences, loved ones become surrogate decision makers.^{4,5} If the older adult has not communicated their AIP-LTC preferences, surrogate decision makers attempt to make best guesses about their older adult loved one's goals.^{6,7}

Aging-in-place is defined as the ability to live in one's own home and community safely, independently, and comfortably, regardless of age, income, or ability level.⁸ Long-term care involves services designed to meet a person's health or personal care needs, and is provided in different places (e.g., home, assisted living, skilled nursing facility) with varying caregiving (e.g., family members, paid caregivers).^{9,10} Over time older adults face increasing frailty and disability, requiring additional support.¹¹ The lifetime probability of becoming disabled in at least two activities of daily living or being cognitively impaired is 68% for people aged 65 and older yet individuals underestimate the likelihood that they will need assistance in the future with only 40% believing that they will ever require LTC services.^{12,13}

Multiple factors, such as cognition, health literacy, and multiple chronic conditions, impact older adult institutionalization.¹⁴ Research has shown that subtle age-related changes in cognition can detrimentally affect decisions that are critical for maintaining health and well-being. This inability to make informed AIP-LTC decisions can result in critical errors and the loss of the older adult's voice in the process.¹⁶ Nakagawa et al. found ample discrepancies existed between the actual and desired places of receiving LTC care, as some older adults preferred to remain in their home but were instead institutionalized.

To effectively make informed decisions, older adults must rely upon a range of cognitive skills to access, use, apply and remember health information and instructions.¹⁵⁻¹⁷ Components of cognition that are involved in decision-making include attention (e.g., concentration on the issues for the decision), remote and recent recall (e.g., remembering the historical influences and current events that would impact a decision), working memory (e.g., processing the information), inductive reasoning (e.g., making the decision on best guesses for the future), language (e.g., conveying the decision), and abstraction (e.g., connections between decisions and future effects).

Key points

- Older adults frequently defer decision-making about their aging-in-place and long-term care (AIP-LTC) needs (e.g., home caregivers, retirement communities, home modifications). When cognition worsens, such as in Alzheimer's disease, older adults are not able to make decisions and family members or friends often must step in as surrogates.
- Adequate inductive reasoning and working memory is significantly linked to making AIP-LTC decisions. There were no differences in decision-making observed in verbal abilities, long-term memory, or processing speed.
- AIP-LTC planning should be addressed with older adults prior to changes in inductive reasoning and working memory. Older adults with insufficient skills in these cognitive subsets may not be able to effectively make AIP-LTC plans.

Why does this paper matter?

Recognizing what aspects of cognition are needed to make decisions is imperative to ensuring that older adults have a say in their future AIP-LTC needs.

However, over time each of these skills change.²⁰⁻²² Vocabulary and general knowledge remain relatively stable or increase over a lifespan, while processing speed, working memory, inductive reasoning and remote/recent memory tend to worsen over time.²¹ Cognitive decline can negatively affect the ability to make decision, resulting in life-changing errors.²² We sought to evaluate what discreet components of cognition in older adults impact their AIP-LTC decision-making.

METHODS**Study design, intervention, and population**

We are conducting a longitudinal single-group interventional clinical trial of community-dwelling older adults

TABLE 1 Sociodemographic characteristics (by time point)

Variable	Baseline (n = 293)	1 month (n = 284)	6 months (n = 262)	12 monthss (n = 209)
Age, M (SD)	73.0 (5.0)	73.0 (5.0)	72.9 (5.1)	72.9 (5.1)
Sex, n (%)				
Male	80 (27.3)	78 (27.5)	73 (27.9)	57 (27.3)
Female	213 (22.7)	206 (72.5)	189 (72.1)	152 (72.7)
Race, n (%) ^a				
Black	85 (29.1)	81 (28.6)	74 (28.4)	65 (31.3)
White	174 (59.6)	170 (60.1)	159 (60.9)	119 (57.2)
Other	33 (11.3)	32 (11.3)	28 (10.7)	24 (11.5)
Education, n (%) ^b				
HS or less	43 (14.7)	41 (14.5)	38 (14.6)	32 (15.4)
Some college	54 (18.5)	53 (18.7)	50 (19.2)	43 (20.7)
College graduate	64 (21.9)	62 (21.9)	54 (20.7)	38 (18.3)
Graduate degree	141 (44.9)	127 (44.9)	119 (45.6)	95 (45.7)
Income, n (%) ^c				
<\$10,000	13 (4.6)	13 (4.8)	12 (4.7)	10 (5.0)
\$10,000–\$24,999	39 (13.9)	37 (13.6)	33 (13.0)	32 (15.9)
\$25,000–49,999	70 (24.9)	67 (24.5)	65 (25.7)	53 (26.4)
≥\$50,000	159 (56.6)	156 (57.1)	143 (56.5)	106 (52.7)
Employment status, n (%)				
Working for pay	83 (28.3)	80 (28.2)	76 (29.0)	56 (26.8)
Retired/unemployed	210 (71.7)	204 (71.8)	186 (71.0)	153 (73.2)
Marital status, n (%) ^d				
Married	138 (47.3)	134 (47.4)	121 (46.4)	92 (44.2)
Unmarried/widowed	154 (52.7)	149 (52.7)	140 (53.6)	116 (55.8)
Total # comorbidities, M (SD)	2.3 (1.5)	2.3 (1.5)	2.3 (1.5)	2.3 (1.4)
Health literacy (NVS), n (%) ^e				
Limited	119 (40.6)	116 (40.9)	104 (39.7)	90 (43.1)
Adequate	174 (59.4)	168 (59.1)	158 (60.3)	119 (56.9)

^aRace variable is missing 1 response at all time points.

^bEducation is missing 1 response at all time points.

^cIncome is missing 12 responses at baseline; 11 responses missing at 1 month; 9 responses missing at 6 month; 8 responses missing at 12 month.

^dMarital status is missing 1 response at all time points.

^eNVS, newest vital signs.

(aged 65 years and older) who are currently enrolled in the Health Literacy and Cognitive Function among Older Adults (LitCog) research study (R01AG03611) that involves extensive multiple-domain cognitive testing.²³

The intervention, PlanYourrLLifespan.org (PYL), is a free, publicly available, RCT-evidence based online tool, which facilitates decision-making and planning for AIP-LTC through education about future health and LTC needs. As inadequate health literacy and cognitive impairment is prevalent among seniors, PYL presents information understandable at all levels of health literacy and sensitive to cognitive load with simplified, large-font, less dense text.²⁴

For this project, rationale and study design protocol has been published previously.²³ In brief, older adult subjects complete baseline testing/surveys, received the PYL online intervention, and then were surveyed at 1, 6, and 12 months. Cognitive tests from five domains (processing speed, working memory, inductive reasoning, long-term memory, verbal abilities) were collected during the subjects' most recent LitCog interview, which occurred prior to baseline. In order to assess AIP-LTC decision-making, our outcome of interest, participants were asked if they had decided on long-term care preferences were they to experience Alzheimer's disease or memory loss and could

no longer live independently. Multivariate logistic regression analysis was conducted cross-sectionally to examine components of cognition that impacted AIP-LTC decision-making.

RESULTS

Demographic characteristics and AIP-LTC decision-making outcomes

The mean age at baseline was 73.0 years, 72.7% of the sample was female, and 40.4% were non-White. Additional demographic characteristics can be found in Table 1. Of the 293 subjects who completed a baseline interview, 284 (96.9%) completed a 1-month interview, 262 (89.4%) completed a 6-month interview, and 209 (71.3%) completed a 12-month interview. Cognitive covariates did not differ significantly between time points (Table 2).

With regard to the outcome, at baseline, 22.4% of participants had made a decision on their long-term care preferences; at 1 month, 19.1% made a decision; at 6 months, 21.5% made a decision; and at 12 months, 25.8% made a decision on long-term care preferences.

Multivariable results

Examining cross-sectional time points of 1, 6, and 12 months revealed significant variables related to AIP-LTC decision-making. When asked if they developed Alzheimer’s disease (AD) and could no longer live independently, subjects were more likely to have made decisions about living preference (e.g., stay in own home, long-term care community, nursing home) if they had adequate inductive reasoning (ETS letter sets total—OR 1.14 ($p < 0.05$ [1.03–1.27]) at 1 month and adequate working memory (size judgment span total—OR 1.76 ($p < 0.05$ [1.13–2.73]) at 12 months. There were no

differences in decision-making observed yet in verbal abilities, long-term memory, or processing speed (Figure 1). All analyses were adjusted for participant gender, race, age, and decision-making response at baseline.

DISCUSSION

In this study of AIP-LTC decision-making, older adults were more likely to have made decisions if they had

Components of Cognition

- Attention
- Concentration
- Inductive Reasoning
- Recall
- Working Memory
- Language
- Executive Function
- Visuospatial
- Abstraction
- Calculation
- Orientation



Involved in Aging-in-Place and Long term Decision Making

- Inductive Reasoning
- Working Memory

FIGURE 1 Components of cognition affecting AIP-LTC decision making

TABLE 2 Cognitive covariates across time points

Variable, mean (SD)	Baseline (n = 293)	1 Month (n = 284)	6 Months (n = 262)	12 Months (n = 209)
Digit comparison (processing speed)	48.3 (12.9)	48.3 (13.0)	48.1 (12.9)	47.4 (13.2)
Size judgment span (working memory)	3.1 (0.8)	3.1 (0.8)	3.1 (0.8)	3.1 (0.8)
ETS letter set (inductive reasoning) ^a	7.1 (3.9)	7.1 (3.9)	7.1 (4.0)	6.9 (4.1)
NY paragraph (long-term memory) ^b	6.9 (2.9)	6.9 (2.9)	6.9 (3.0)	6.6 (3.0)
AM-NART (verbal abilities) ^c	31.9 (10.6)	31.9 (10.6)	32.0 (10.6)	31.6 (11.1)

^aETS, educational testing service.

^bNY, New York.

^cAM-NART, American version of the National Adult Reading Test.

adequate inductive reasoning and working memory. While this may seem to be intuitive, it matters because lapses in these cognitive areas may not be easily recognizable or considered worrisome at first. Working memory is the retention of a small amount of information in a readily accessible form and facilitates planning, comprehension, reasoning, and problem-solving. In order to make AIP-LTC decisions, older adults need to retain information about what their future needs may entail and reason through the options. In a study of older adults living in a continuing care retirement community (CCRC), working memory was found to be intact but lapses in delayed recall and verbal ability were detected.²⁵ These individuals living in a CCRC had already made and implemented AIP-LTC decisions, with their working memory intact. It is imperative that the act of AIP-LTC planning is completed prior to cognitive lapses in working memory.

Inductive reasoning is, by definition, the activity of using existing knowledge to generate new knowledge that is likely, though not guaranteed, to be true.²⁶ Inductive reasoning is required whenever people need to fill in gaps in their knowledge with “best guesses.” With AIP-LTC decision-making and planning, older adults have to make best guesses on what they will need in the future in the event of increasing needs. Inductive reasoning is fluid and decreases over time among older adults, with discrete worsening seen among people with cognitive impairment.^{27,28} An MRI-based study of inductive reasoning found that neural activity in the frontal and parietal regions (specifically the right dorsal lateral prefrontal cortex [DLPFC] and medial posterior parietal cortex [precuneus]) were activated when more complex rules needed to be followed. Further research is needed to determine if the inductive reasoning needed for AIP-LTC decision-making is linked to specific architectural lapses (e.g., micro-strokes, atrophy) in these cortical areas or early Alzheimer's disease.²⁹

As with all studies, limitations exist. With no differences detected in verbal abilities or long-term memory, these cognitive components may not matter in making the AIP-LTC plans or decisions. However, these factors may be necessary in the future when older adults must communicate their plans and remember them when they need to be implemented. With this longitudinal study, we will rectify this limitation as we plan to continue to follow older adult subjects as they age and implement their plans. This research was also conducted during the COVID-19 pandemic and many older adults experienced worsening subjective cognitive decline, postulated from the lengthy isolation and COVID-19 illnesses. Since we are following this cohort longitudinally, we will be able to detect if changes in cognitive components continue to

persist after the pandemic. Finally, there is the potential for unmeasured confounding in our models. Although we conducted bivariate analyses between several demographic characteristics and our outcomes to assess potential confounding, we may not have had data on all possible confounders.

From a clinical perspective, it is imperative that older adults make AIP-LTC plans and communicate these plans to their future surrogate decision makers prior to experiencing worsening decline in inductive reasoning and working memory. As many providers address advance care planning (ACP) decisions (e.g. powers of attorney, living wills), it may be worthwhile to connect AIP-LTC planning with these decisions so that older adults are prepared for their care in the decades prior to the last 6 months of life. PlanYourLifespan.org is an evidence-based PCORI and NIH funded tool that guides older adults and their loved ones through their AIP-LTC needs and available resources. Besides directly online, it is also available to older adults on the EPIC electronic health record (Verona, WI) through the MyChart Patient facing pages. The earlier that older adults consider AIP-LTC planning, the less likely their decisions will be impacted by cognitive loss.

In conclusion, inductive reasoning and working memory in older adults is significant to making AIP-LTC decisions. This information is important as providers and families need to broach this subject and make future plans with older adults prior to loss in these cognitive areas. Aspects of older adults cognition should be assessed at least annually and incorporated in regular exams (such as the annual medicare wellness visit) so they can be involved in AIP-LTC decision-making as early as beginning of changes in cognitive aspect is detected. Additional cognition testing in decision-making domains may also be warranted, in conjunction with regular screening cognition tests (e.g., clock drawing, recall). Understanding the cognitive factors that impact AIP-LTC decision-making is important in targeting and helping older adults prepare for their future needs before their cognition in these areas worsen.

AUTHOR CONTRIBUTIONS

All authors met criteria for authorship by (1) conception and design of the study: Lindquist, Ramirez-Zohfeld; (2) data acquisition: Miller, Scherier, Murawski, Ramirez-Zohfeld; (3) analysis and interpretation of data: Lindquist, Miller, Scherier, Curtis, Opsasnick, Kim, Ramirez-Zohfeld; (4) manuscript drafting: Lindquist, Miller, Scherier, Opsasnick, Kim, Ramirez-Zohfeld; (5) revising the manuscript critically for important intellectual content: all authors; (6) approval of the version of the manuscript to be published: all authors.

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All authors declare no conflict of interest.

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