The Association Between Digital Technology Activities and Cognitive Domains of Community-Dwelling Older Adults

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Intro:

- While prior research has established a relationship between digital technology use and improved cognitive function among older adults, the impacts of different technology activities on specific cognitive domains remain underexplored.
- This study examines associations between transition in/out of various technology activities and cognitive domains among community-dwelling older adults without dementia.

Method:

- Sample included 5,596 community dwelling older adults without dementia from the **National Health and Aging Trends Study (NHATS)** (2015-2022).
- Technology activities included online shopping, banking, medication refills, social network site visits, and checking health conditions online.
- Cognitive domains assessed were episodic memory (0-20), executive function (0-5), and orientation (0-8).
- Covariates included sex, age, race, education, living arrangement, income, daily and instrumental activity difficulties, self-rated health, rurality, and device ownership.
- Asymmetric within/between random effects models were used.
- We created variables to explore the transition of technology use due to the time varying nature of technology use.

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Results:

Online shopping was associated with improved episodic memory (β = 0.195**) and orientation (β = 0.097**) (Model A). Adding an interaction term (Model B) showed that the onset of online shopping mitigated the rate of cognitive decline in orientation (β = 0.056**).

Online banking was associated with improved episodic memory (β = 0.273**) and executive function (β = 0.105**), while stopping online banking was related to to declines in both episodic memory (β = -0.376***) and executive function (β = -0.121***) (Model A). The onset of online banking mitigated the rate of episodic memory decline (β = 0.082*, Model B).

Starting to **refill medication online** was associated with improved episodic memory (β = 0.330***) and orientation (β = 0.098**), while stoping this activity was associated with decreased episodic memory (β = -0.267***) (Model A). The start of of online medication refill mitigated the rate of orientation decline (β = 0.070***, Model B).

Social media use was associated with increased episodic memory (β = 0.230**), executive function (β = 0.068**) and orientation (β = 0.102***), while stopping use was associated with declines in episodic memory (β = -0.300***) and executive function (β = -0.072**) (Model A). Beginning to use social media mitigated the rate of orientation decline (β = 0.063***, Model B).

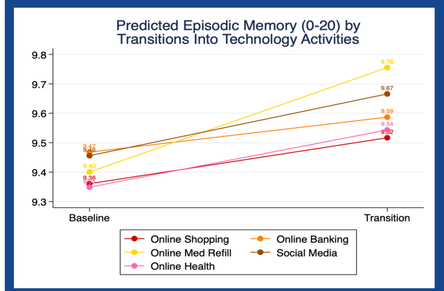
Checking health information online was associated with improved orientation at a given wave (β = 0.135***, Model A), and associated with the mitigation on the rate of orientation decline (β = 0.051***, Model B).

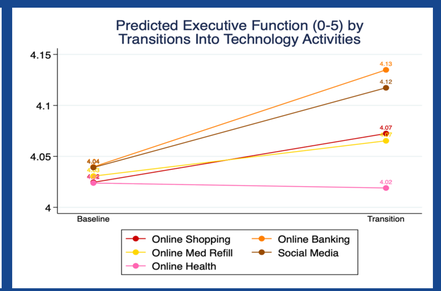
Example of Model A Main Effect

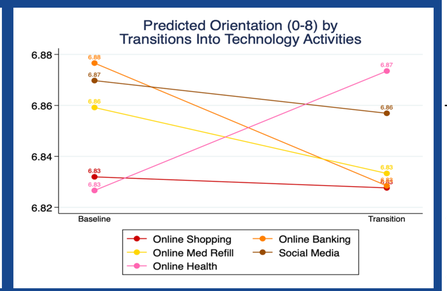
$$Episodic\ Memory_{ij} = \beta_0 + \beta_1 Transition\ In\ Online\ Shopping_{ij} + \beta_2 Tansition\ Out\ Online\ Shopping_{ij} + \beta_3 Round_{ij} + \beta_4 Sex_i + \beta_5 DeviceOwnership_{ij} + \beta_6 CenteredAge_{ij} + \beta_7 Race_i + \beta_8 Education_i + \beta_9 LivingArrangement_i + \beta_{10} Income_i + \beta_{11} ADL_{ij} + \beta_{12} IADL_{ij} + \beta_{13} SelfRatedHealth_{ij} + \beta_{14} Rurality_i + u_{0i} + \varepsilon_{ij}$$

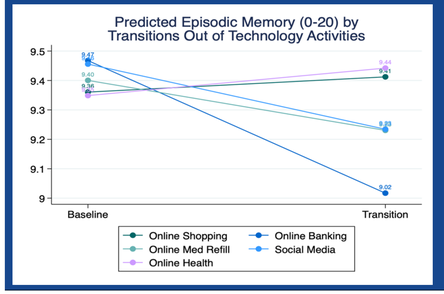
Example of Model B Moderation Effect

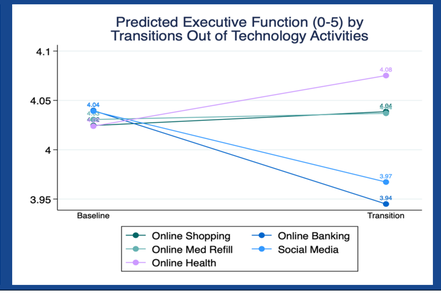
$$Episodic\ Memory_{ij} = \beta_0 + \beta_1 Transition\ In\ Online\ Shopping_{ij} + \beta_2 Round_{ij} + \beta_3 (Transition\ In\ Online\ Shopping_{ij} \times Round_{ij}) + \beta_4 TransitionOut\ Online\ Shopping_{ij} + \beta_5 (Transition\ Out\ Online\ Shopping_{ij} \times Round_{ij}) + \beta_6 Sex_i + \beta_7 DevicOwnership_{ij} + \beta_8 Age_i + \beta_9 Race_i + \beta_{10} Education_i + \beta_{11} LivingArrangement_i + \beta_{12} Income_{ij} + \beta_{13} ADL_{ij} + \beta_{14} IADL_{ij} + \beta_{15} SelfRatedHealth_{ij} + \beta_{16} Rurality_i + u_{0i} + \varepsilon_{ij}$$











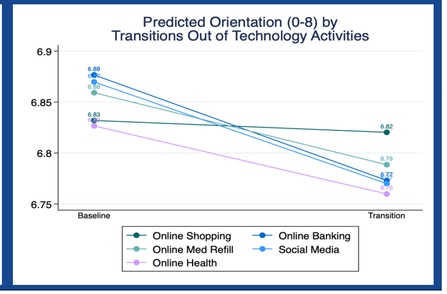
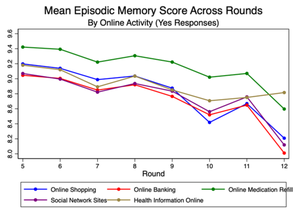
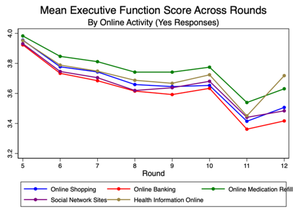
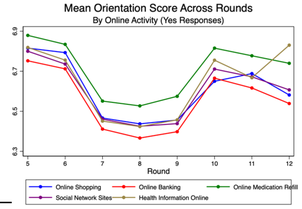


Table 1. Digital Technology Ownership, Use, and Characteristics of Community-Dwelling Older Adults, without Dementia, by Sex in 2015

Characteristic	Overall, N = 5,596
Age	76.51 (7.07)
Race	
NH-White	4,017 (73%)
NH-Black	1,027 (19%)
NH-AAPI	150 (2.7%)
Hispanic	277 (5.1%)
Number of Device Ownership (Cellphone, Computer, and Tablet)	
0	387 (6.9%)
1	1,427 (26%)
2	1,956 (35%)
3	1,826 (33%)
Online Shopping	1,130 (20%)
Online Banking	1,553 (28%)
Online Medication Refill	666 (12%)
Visit Social Network Sites	1,417 (25%)
Check Health Condition Online	1,199 (21%)
Education	
No College Degree	3,762 (67%)
College Degree or Beyond	1,834 (33%)
Living arrangement	
Alone	1,767 (32%)
Living with someone	3,829 (68%)
Income	69,450.98 (477,266.68)
Number of difficulties in ADL	0.63 (1.27)
Number of difficulties in IADL	0.42 (0.86)
Self-rated health	
Excellent	726 (13%)
Very good	1,723 (31%)
Good	1,925 (34%)
Fair	985 (18%)
Poor	235 (4.2%)
Rurality	
Metropolitan	4,508 (81%)
Non-metropolitan	1,088 (19%)
Episodic Memory (0-20)	9.13 (2.93)
Executive Function (0-5)	3.91 (0.93)
Orientation (0-8)	6.88 (1.24)







Discussion:

- Social media use covers the widest range of effects on cognitive domains compared to other activities.
- Online shopping and online medication refills were primarily associated with improvements in episodic memory and orientation, while online banking was associated with improvements in episodic memory and executive function.
- Future interventions should prioritize encouraging the initiation and sustainment of technology activities among older adults.

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