Predictors of Cognitive Intra-individual Variability in Women with and without HIV in the MWCCS

445

David E. Vance[1], Wei Jin[2], Yanxun Xu[3,4], Lang Lang[3], Raha Dastgheyb[5], Pauline M. Maki[6], Andrea Norcini Pala[7], Roger C. McIntosh[8], Pariya L. Fazeli[1], Mirjam-Colette Kempf[1], James B. Brock[9], Karl Goodkin[10], Matthew Wright[11,12], Matthew Miamiga[13], Leah. H. Rubin[5,14,15]

[1.] School of Nursing, University of Alabama at Birmingham, Birmingham, AL; [2.] Department of Biostatistics, Boston University, Boston, MA; [3.] Department of Applied Mathematics and Statistics, Johns Hopkins University, Baltimore, MD; [4.] Division of Biostatistics and Bioinformatics at The Sidney Kimmel Comprehensive Cancer Center, Johns Hopkins University School of Medicine, Baltimore, MD; [5.] Department of Neurology, Johns Hopkins University School of Medicine, Baltimore, MD; [6.] Department of Psychiatry and Psychology, University of Illinois at Chicago, Chicago, IL; [7.] School of Public Health, State University of New York Downstate Health Sciences University, Brooklyn, NY; [8.] College of Arts and Sciences, University of Miami, Miami, FL; [9.] Department of Medicine, University of Mississippi Medical Center, Jackson, MS; [10.] Consultant, Advancing Clinical Trials Globally for HIV/AIDS and Other Infections, Los Angeles, CA; [11.] Department of Psychology, California State University, Fresno, CA; [12.] Department of Psychiatry, University of San Francisco, CA; [13.] Department of Epidemiology, Fielding School of Public Health, University of California, Irvine, CA; [14.] Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD; [15.] Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, Baltimore, MD

BACKGROUND

- Cognitive intra-individual variability (IIV) refers to the variation observed in cognitive performance when various cognitive tests are administered within the same person (i.e., dispersion).
- For example, someone who cannot solve problems well but has good memory is an example of cognitive IIV.
- In people with HIV, greater cognitive IIV has been associated with poorer cognitive performance and decline over time, cortical brain atrophy, and increased mortality risk.
- If we know what predicts (and perhaps causes) cognitive IIV, they may serve as targets for intervention.
- In this study, we calculated cognitive IIV from cognitive test performance in women with HIV (WWH) and without HIV (WWoH) and examined what predicts greater cognitive IIV.

METHODS

- This study examined the association between cognitive IIV and a set of possible predictors among 1,686 (WWH) and 448 socio-demographically similar WWoH. Objective cognitive performance across 7 domains was assessed among participants of the Women's Interagency HIV Study (WIHS).
- Several predictors were examined including age, body mass index (BMI), CD4 nadir, HIV viral plasma load, hypertension, diabetes, current smoking, Centers for Epidemiological Studies – Depression scale, and drinking (alcohol).
- Cognitive IIV was calculated from the standard deviation across these cognitive domains to calculate dispersion (i.e., *sd*IIV).
  - 1) **intra-individual standard deviation** (*sd*; the *sd* of *Z*-scores for the 7 cognitive domains; denoted as *sd*IIV)
- Using all available data across all the waves (up to visit 49), linear mixed effects models were conducted in the overall sample (WWH + WWoH), WWH only, and WWoH.

Women with HIV (WWH) had higher levels of cognitive intra-individual variability (IIV).

Aging, depressive symptomatology, and diabetes predicted cognitive IIV in WWH.

Table. Predictive Values of Cognitive IIV Between Women with HIV (WWH) and Women without HIV (WWoH)

Predictors	WWoH		WWH	
	t-value	*p*-value	*t-value*	*p*-value
Age	2.575	0.010	3.889	0.0001
Body Mass Index	-1.306	0.192	-0.741	0.459
CD4 Nadir	na	na	-0.350	0.726
Viral Load	na	Na	-1.223	0.221
Hypertension	-0.513	0.608	0.633	0.527
Diabetes	1.703	0.089	2.131	0.033
Current Smoking	0.059	0.953	-1.361	0.174
CES – Depression	0.646	0.518	2.131	0.005
Drinking (alcohol)	0.157	0.875	1.05	0.292

Notes: CES-D = Centers for Epidemiological Studies – Depression scale; IIV = intra-individual variability; na = not applicable.

RESULTS

- Although not statistically significant, WWH had higher levels of cognitive IIV across the lifespan than WWoH.
- Few predictors of cognitive IIV emerged.
- For the entire sample, older age (t=4.831, p<0.001), having diabetes (t=2.467, p=0.0137), and having greater depressive symptomatology (t=2.801, p=0.005) were associated with greater cognitive IIV.
- In WWH, older age (t=3.889, p=0.001), having diabetes (t=2.131, p=0.033), and greater depressive symptomatology (t=2.813, p=0.005) were associated with greater cognitive IIV.
- In WWoH, older age (t=2.575, p=0.010) was associated with greater cognitive IIV.

CONCLUSIONS

- WWH experienced higher levels of cognitive IIV than WWoH, and aging contributed to higher levels in both groups.
- Diabetes and depressive symptomatology predicted cognitive IIV in WWH; this suggests addressing diabetes and depression may improve cognitive IIV.
- Future research may consider if different calculations of cognitive IIV (sdIIV vs covIIV) produce the same results.
- These results suggest new questions:
  - Are the predictors of cognitive IIV similar to global cognition and to certain cognitive domains? Is the strength of those associations the same or different?
  - Would treating these predictors (i.e., reducing the impact of diabetes or depressive symptomatology) improve cognitive IIV.

ACKNOWLEDGEMENT/FUNDING

The contents of this work are solely the responsibility of the authors and do not represent the official views of the National Institutes of Health (NIH). MWCCS (Principal Investigators): Atlanta CRS (Ighovwerha Ofotokun, Anandi Sheth, and Gina Wingood), U01-HL146241; Baltimore CRS (Todd Brown and Joseph Margolick), U01-HL146201; Bronx CRS (Kathryn Anastos, David Hanna, and Anjali Sharma), U01-HL146204; Brooklyn CRS (Deborah Gustafson and Tracey Wilson), U01-HL146202; Data Analysis and Coordination Center (Gypsyamber D'Souza, Stephen Gange and Elizabeth Topper), U01-HL146193; Chicago-Cook County CRS (Mardge Cohen, Audrey French, and Ryan Ross), U01-HL146245; Chicago-Northwestern CRS (Steven Wolinsky, Frank Palella, and Valentina Stosor), U01-HL146240; Northern California CRS (Bradley Aouizerat, Jennifer Price, and Phyllis Tien), U01-HL146242; Los Angeles CRS (Roger Detels and Matthew Mimiaga), U01-HL146333; Metropolitan Washington CRS (Seble Kassaye and Daniel Merenstein), U01-HL146205; Miami CRS (Maria Alcaide, Margaret Fischl, and Deborah Jones), U01-HL146203; Pittsburgh CRS (Jeremy Martinson and Charles Rinaldo), U01-HL146208; UAB-MS CRS (Mirjam-Colette Kempf, James B. Brock, Emily Levitan, and Deborah Konkle-Parker), U01-HL146192; UNC CRS (M. Bradley Drummond and Michelle Floris-Moore), U01-HL146194. The MWCCS is funded primarily by the National Heart, Lung, and Blood Institute (NHLBI), with additional co-funding from the *Eunice Kennedy Shriver* National Institute Of Child Health & Human Development (NICHD), National Institute On Aging (NIA), National Institute Of Dental & Craniofacial Research (NIDCR), National Institute Of Allergy And Infectious Diseases (NIAID), National Institute Of Neurological Disorders And Stroke (NINDS), National Institute Of Mental Health (NIMH), National Institute On Drug Abuse (NIDA), National Institute Of Nursing Research (NINR), National Cancer Institute (NCI), National Institute on Alcohol Abuse and Alcoholism (NIAAA), National Institute on Deafness and Other Communication Disorders (NIDCD), National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), National Institute on Minority Health and Health Disparities (NIMHD), and in coordination and alignment with the research priorities of the National Institutes of Health, Office of AIDS Research (OAR). MWCCS data collection is also supported by UL1-TR000004 (UCSF CTSA), UL1-TR003098 (JHU ICTR), UL1-TR001881 (UCLA CTSI), P30-AI-050409 (Atlanta CFAR), P30-AI-073961 (Miami CFAR), P30-AI-050410 (UNC CFAR), P30-AI-027767 (UAB CFAR), P30-MH-116867 (Miami CHARM), UL1-TR001409 (DC CTSA), KL2-TR001432 (DC CTSA), and TL1-TR001431 (DC CTSA). K. Goodkin received funding from ACTG Trial A5402/"COPE" and from MN R01 58532 and MH/AG R01 61629.