

## Health services research / Cost-effectiveness of treatment/prevention and diagnosis

# Differentiating among stages of cognitive impairment: Comparisons of versions two and three of the National Alzheimer's Coordinating Center (NACC) Uniform Data Set (UDS) neuropsychological test battery

Hiroko H Dodge<sup>1</sup> | Felicia C Goldstein<sup>2</sup> | Nicky I Wakim<sup>3</sup> | Tamar Gefen<sup>4</sup> | Merilee Teylan<sup>5</sup> | Walter A Kukull<sup>6</sup> | Lisa L Barnes<sup>7</sup> | Bruno Giordani<sup>3</sup> | Timothy M Hughes<sup>8</sup> | Joel H Kramer<sup>9</sup> | David A Loewenstein<sup>10</sup> | Daniel C Marson<sup>11</sup> | Dan M Mungas<sup>12</sup> | Bonnie Sachs<sup>8</sup> | David P. Salmon<sup>13</sup> | Kyle Steenland<sup>14</sup> | Monica W Parker<sup>14</sup> | Kathleen A Welsh-Bohmer<sup>15</sup> | John C Morris<sup>16,17,18,19</sup> | Sandra Weintraub<sup>4</sup> | National Alzheimer's Coordinating Center

<sup>1</sup> Layton Aging & Alzheimer's Disease Center, Oregon Health & Science University, Portland, OR, USA

<sup>2</sup> Emory University School of Medicine, Atlanta, GA, USA

<sup>3</sup> University of Michigan, Ann Arbor, MI, USA

<sup>4</sup> Northwestern University, Chicago, IL, USA

<sup>5</sup> National Alzheimer's Coordinating Center, University of Washington, Seattle, WA, USA

<sup>6</sup> University of Washington, Seattle, WA, USA

<sup>7</sup> Rush Alzheimer's Disease Center, Rush University Medical Center, Chicago, IL, USA

<sup>8</sup> Wake Forest School of Medicine, Winston-Salem, NC, USA

<sup>9</sup> UMemory and Aging Center, UCSF Weill Institute for Neurosciences, University of California, San Francisco, San Francisco, CA, USA

<sup>10</sup> University of Miami Miller School of Medicine, Miami, FL, USA

<sup>11</sup> University of Alabama at Birmingham, Birmingham, AL, USA

<sup>12</sup> University of California, Davis, Sacramento, CA, USA

<sup>13</sup> University of California, San Diego, La Jolla, CA, USA

<sup>14</sup> Emory University, Atlanta, GA, USA

<sup>15</sup> Duke University, Durham, NC, USA

## Abstract

**Background:** National Institute on Aging (NIA)-funded Alzheimer's Disease Centers in the United States have been using a standardized neuropsychological test battery as part of the National Alzheimer's Coordinating Center (NACC) Uniform Data Set (UDS) since 2005. Version 3 (V3) of the UDS was implemented in 2015 and included several changes to its neuropsychological battery, replacing the previous version [Version 2 (V2)]. The current study compares the V3 and V2 neuropsychological batteries with respect to their ability to distinguish among categories of cognitive impairment captured by the Clinical Dementia Rating (CDR) global scores representing either no cognitive impairment (CDR=0), questionable or mild cognitive impairment (CDR=0.5) or mild stage of dementia (CDR=1.0).

**Method:** Data from the NACC UDS V2 and V3 neuropsychological batteries were examined. There were 16,935 unique subjects from V2 and 5022 unique subjects from V3 aged 60 years and older with CDR global score  $\leq 1$ . To reduce the influence of practice effects, only data from their first assessment was used. To control for inequalities in sample sizes between V2 and V3, we identified an approximately equal number of subjects from V2 within each CDR group. Receiver Operating Characteristics Area under Curve (ROC-AUC) in differentiating stages of cognitive impairment were compared and optimal cut-points based on Youden's J scores were calculated.

**Result:** ROC-AUCs from all of the V3 neuropsychological tests were comparable in their ability to differentiate CDR global scores with the corresponding tests in V2, despite the fact that V3 participants included more subjects at earlier stage of CDR 0.5. UDS V3 composite scores yielded similar ROC-AUCs to the best performing individual

<sup>16</sup> Washington University School of Medicine, St. Louis, MO, USA

<sup>17</sup> Hope Center for Neurological Disorders, St. Louis, MO, USA

<sup>18</sup> Knight Alzheimer Disease Research Center, St. Louis, MO, USA

<sup>19</sup> Washington University in St. Louis School of Medicine, St. Louis, MO, USA

#### Correspondence

Hiroko H Dodge, Layton Aging & Alzheimer's Disease Center, Oregon Health & Science University, Portland, OR, USA.  
Email: [dodgeh@ohsu.edu](mailto:dodgeh@ohsu.edu)

test within each domain, while the Montreal Cognitive Assessment (MoCA) total score yielded higher ROC-AUCs than any individual MoCA index scores. Racial differences in differentiating between CDR=0 and CDR=0.5 were also found.

**Conclusion:** A nonproprietary suite of neuropsychological tests in UDS V3 provided similar discriminative ability to tests in UDS V2 to distinguish categories of cognitive impairment. Optimal cut-points calculated in this study will be useful for clinical diagnosis.