

# **Documentation Report**

Documentation of the

Summary Cognitive Performance and Functional Performance Measures Data File

in the Health and Retirement Study / Harmonized Cognitive Assessment Protocol Study

Product of the HRS/HCAP Working Group:

Richard N. Jones  
Kenneth M. Langa  
Deborah A. Levine  
Jennifer J. Manly  
Ryan J. McCammon  
Lindsay H. Ryan  
David R. Weir

Survey Research Center  
University of Michigan  
Ann Arbor, MI

22 July 2024

## Contents

|                                                                                                                 |    |
|-----------------------------------------------------------------------------------------------------------------|----|
| I. HRS/HCAP: Overview and previous publications and documentation reports .....                                 | 3  |
| A. Background and relevant resources .....                                                                      | 3  |
| B. Other relevant data .....                                                                                    | 4  |
| C. Workflow and variable sets.....                                                                              | 6  |
| II. Technical details.....                                                                                      | 8  |
| A. Imputations.....                                                                                             | 8  |
| B. Note about expected a posteriori (EAP) and Bayesian plausible value (PV) estimates of<br>factor scores ..... | 8  |
| III. Data Files .....                                                                                           | 9  |
| IV. Codebook.....                                                                                               | 11 |

## **I. HRS/HCAP: Overview and previous publications and documentation reports**

The HRS/HCAP summary cognitive and functional measures data file contains processed HRS/HCAP data described in two manuscripts, one describing a factor analysis of HRS/HCAP cognitive performance items (Jones et al., 2023) and a second a dementia algorithm using HRS/HCAP and other data collected in HRS (Manly et al, 2022). The purpose of this document is to describe the context of the generation, and technical details regarding the contents, of the HRS/HCAP summary cognitive and functional measures data file.

Correction note: In our paper titled “Estimating the Prevalence of Dementia and Mild Cognitive Impairment in the US: The 2016 Health and Retirement Study Harmonized Cognitive Assessment Protocol Project”, published on December 1, 2022, the analysis made use of an early version of the data collected for the 2016 wave of the Harmonized Cognitive Assessment Protocol. The current (2024) public release of the HCAP data contains some differences relative to the analytic data files used in the manuscript. The current public release data file clarifies the coding of non-response and coding of errors on some cognitive items, corrects a small number of errors in sociodemographic variables, updates imputations for informant data, and incorporates updates in computation of the sampling weights. During the process of assisting other HCAP studies with replication of our methods, we discovered that once the analytic data file was updated, there were some changes in classification of individuals across diagnostic groups. This happens primarily because we use Bayesian plausible values for cognitive performance estimates and imputation models for missing data (see [section II.B in this document](#)). This step, advantageous for estimation of prevalence of Dementia and Mild Cognitive Impairment, involves a probabilistic process, so small changes in the data changed individual classifications, particularly when cognitive performance estimates were on the margins between diagnostic groups. Despite changes in individual classification, the key findings of the manuscript are unchanged, such as the weighted national prevalence of Mild Cognitive Impairment and Dementia.

### A. Background and relevant resources

The aim of the Health and Retirement Study (HRS) Harmonized Cognitive Assessment (HCAP) project is to create a new HRS data resource to better assess the current and future trends in mild cognitive impairment (MCI) and dementia in the United States. The first HRS sub study on dementia, the Aging, Demographics, and Memory Study (ADAMS) provided the first estimates of dementia incidence and prevalence in the United States using a nationally representative sample. The new Harmonized Cognitive Assessment Protocol (HCAP) project builds on the experience and methods of the HRS and ADAMS for studying cognition, cognitive decline, and dementia. The main strategy is to administer an expanded battery of cognitive tests and informant interviews to a random subsample of HRS respondents aged 65 and older. The first wave of HRS/HCAP participants was fielded in 2016.

The following are key reports and publications that describe the US Health and Retirement Study Harmonized Cognitive Assessment Protocol (HRS/HCAP).

### **1. HRS/HCAP technical documentation**

- Weir, D., McCammon, R., Ryan, L., & Langa, K. (2014). Cognitive test selection for the harmonized cognitive assessment protocol (Health and Retirement Study Users Guides to Study Content. [http://hrsonline.isr.umich.edu/sitedocs/userg/HCAP\\_testselection.pdf](http://hrsonline.isr.umich.edu/sitedocs/userg/HCAP_testselection.pdf)

### **2. Design paper (Langa et al 2020)**

Langa, K. M., Ryan, L. H., McCammon, R. J., Jones, R. N., Manly, J. J., Levine, D. A., Sonnega, A., Farron, M., & Weir, D. R. (2020). The Health and Retirement Study Harmonized Cognitive Assessment Protocol Project: Study Design and Methods. *Neuroepidemiology*, 54(1), 64-74. <https://doi.org/10.1159/000503004>

### **3. Factor analysis of HCAP (Jones et al 2023)**

Jones, R. N., Manly, J. J., Langa, K. M., Ryan, L. H., Levine, D. A., McCammon, R., & Weir, D. (2023). Factor structure of the harmonized cognitive assessment protocol neuropsychological battery in the Health and Retirement Study. *Journal of the International Neuropsychological Society*, in press. Preprint available at <https://doi.org/10.31234/osf.io/rvmhj>

### **4. Dementia classification in HRS/HCAP (Manly et al 2022)**

Manly, J. J., Jones, R. N., Langa, K. M., Ryan, L. H., Levine, D. A., McCammon, R., Heeringa, S., & Weir, D. (2022). The prevalence of dementia and mild cognitive impairment (MCI) in the United States. *JAMA neurology*, 79(12), 1242-1249. <https://doi.org/doi:10.1001/jamaneurol.2022.3543>

### **5. Code repository for Manly et al (2022) and Jones et al (2023) manuscripts**

<https://github.com/rnj0nes/HCAP22>

A repository of computer code used in the Manly et al (2022) and Jones et al (2023) manuscripts is publicly available on GitHub.

<https://github.com/rnj0nes/HCAP23>

Repository using corrected HCAP data. This repository is notable for having exclusively Stata code, where the HCAP22 code is a blending of Stata and LaTeX code for report generation. The procedures in the HCAP22 and HCAP23 code are identical, but the code is perhaps easier to decipher in the HCAP23 repository, and the README is more informative in this repository.

### **B. Other relevant data**

The HRS/HCAP summary cognitive and functional measures data file contains data generated in the process of completing the Manly et al (2022) and Jones et al (2023) manuscripts (described above). Additionally, investigators may find HRS/HCAP relevant data in the following HRS data files:

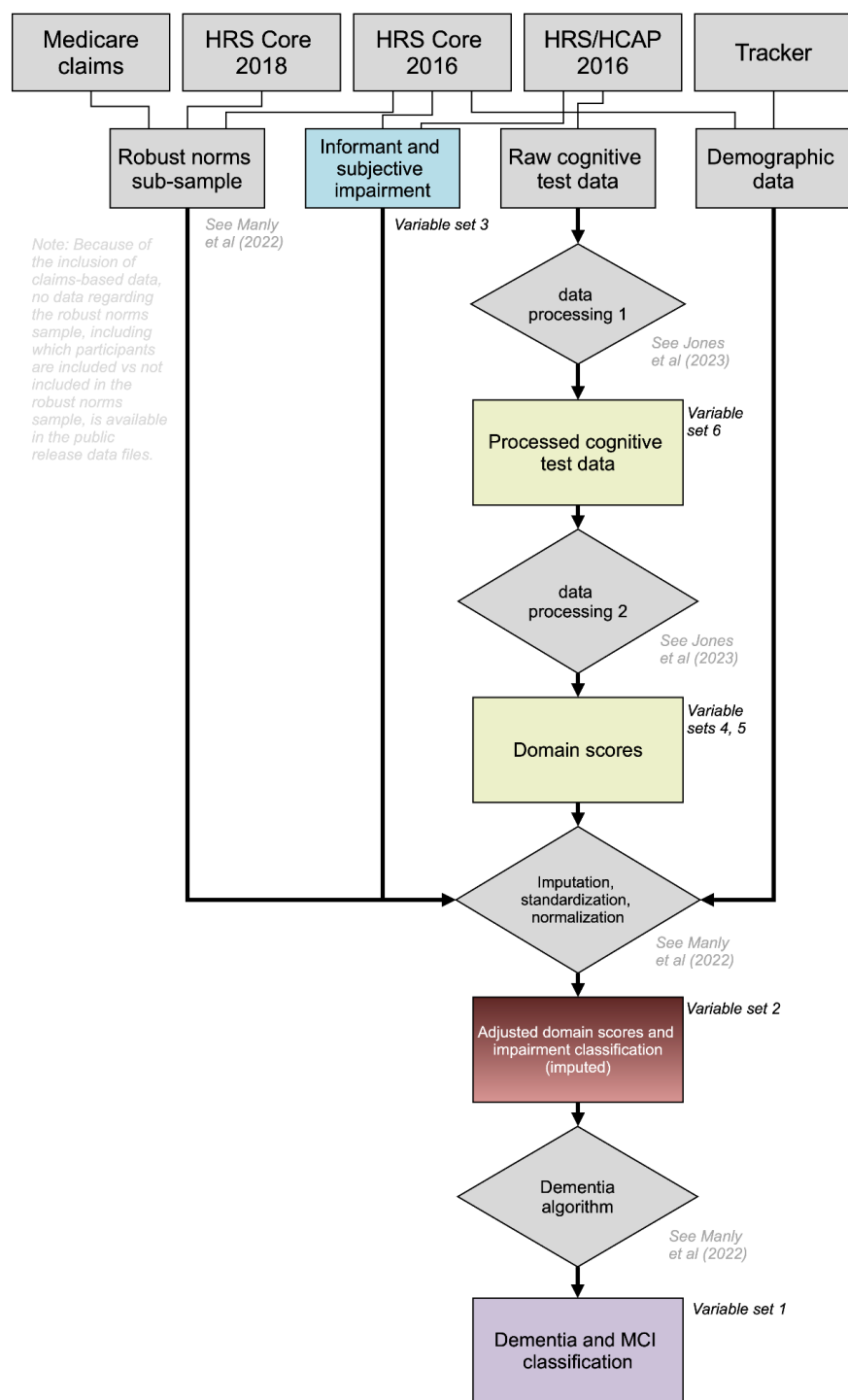
| <b>HRS Data file</b>    | <b>Relevance to HRS/HCAP and URL</b>                                                                                                                                                                                                            |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cross-Wave Tracker file | Eligibility, sociodemographics, weights<br><a href="https://hrsdata.isr.umich.edu/data-products/cross-wave-tracker-file">https://hrsdata.isr.umich.edu/data-products/cross-wave-tracker-file</a>                                                |
| Core (2016)             | Self-reported cognitive impairment, informant-rated cognitive impairment, medical and residential history.<br><a href="https://hrsdata.isr.umich.edu/data-products/2016-hrs-core">https://hrsdata.isr.umich.edu/data-products/2016-hrs-core</a> |

|                    |                                                                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HRS/HCAP Data file | Raw neuropsychological and cognitive testing performance data<br><a href="https://hrs.isr.umich.edu/data-products/hcap">https://hrs.isr.umich.edu/data-products/hcap</a> |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

*Table 1. Other HRS/HCAP relevant data available at [hrsdata.isr.umich.edu/data-products](https://hrsdata.isr.umich.edu/data-products)*

### C. Workflow and variable sets

The workflow for the factor analysis (Jones et al, 2023) and dementia classification (Manly et al, 2022) products using HRS/HCAP data is illustrated in **Figure 1**. The HRS/HCAP projects involved data from different sources (claims, HRS Core, HRS/HCAP, etc.) and generated distinct sets of variables (colored boxes in Figure 1) throughout the factor analysis and dementia classification steps. These distinct generated variable sets are separately identified in the HRS/HCAP summary cognitive and functional measures data file.



**Figure 1. Workflow for the HRS/HCAP summary cognitive and functional measures data file.** The source data for the HRS/HCAP summary cognitive and functional measures data file and the Jones et al (2023) and Manly et al (2022) manuscripts include Medicare Claims, HRS Core data files from 2016 and 2018, the HRS/HCAP data file (2016), and the HRS Tracker file. We made seven key sets of variables, and users can access six of them in a single HRS/HCAP summary cognitive and functional measures data file (Figure 1, colored boxes). These six variable sets can be easily identified by their variable name. One of the generated variable sets -- the identification of a robust norms sample -- is not distributed in the HRS/HCAP summary cognitive and functional measures data file. The distributed data variable sets include informant and subjective cognitive impairment ratings, processed HRS/HCAP cognitive test performance data, domain scores for individual and global domains of function, adjusted domain scores, and dementia classification.

As described in Jones et al (2023) and associated technical documentation, raw HRS/HCAP cognitive test performance data were recoded for factor analysis. We share these processed cognitive performance data as **variable set 6** (and variable prefix “vd” in the HRS/HCAP summary cognitive and functional measures data file). These processed cognitive performance data were analyzed with factor analysis methods as described in Jones et al (2023) and resulting from this are a set of factor or domain score estimates. These domain score estimates are distributed as **variable sets 4** (domain specific) **and 5** (global cognitive performance) and identified in the HRS/HCAP summary cognitive and functional measures data file with variable prefixes vs4 and vs5, respectively. Selected of these domain scores were used in the dementia classification algorithm, and those that were subjected to standardization, adjustment, and imputation procedures as described in Manly et al (2022). These adjusted, standardized, and imputed variables are distributed in **variable set 2** and identified in the HRS/HCAP summary cognitive and functional measures data file with variable prefix vs2. The algorithm also makes use of self and informant rated cognitive impairment (also subjected to imputation) and these variables are distributed and described as **variable set 3** and identified with variable prefix vs3 in the HRS/HCAP summary cognitive and functional measures data file. Finally, we describe the single three-level variable (normal, MCI, dementia) in **variable set 1**.

It is important to note that the algorithm makes use of a robust norms sample in the adjustment and standardization step (Manly et al, 2022). Our definition of the robust norms sample includes information derived from the Medicare claims data linked to HRS. These data are not available in the public use data files. Therefore, information on which of the HRS/HCAP participants were included in the HRS/HCAP dementia classification algorithm is only available through restricted access.

## II. Technical details

### A. Imputations

As is described in **Figure 1** and in **Table 2**, missing data were imputed for the purposes of estimating dementia prevalence as described in Manly et al (2022). Note: These imputations are distinct from the imputations done for the 2016 HCAP final release dataset. Missing values for cognitive performance data or informant data were singly imputed as Bayesian plausible values using Mplus software. The procedure now imputes missing cognitive performance scores and missing self- and informant ratings of impairment given observed cognitive performance scores and self- and informant ratings of impairment.

### B. Note about expected a posteriori (EAP) and Bayesian plausible value (PV) estimates of factor scores

We have generated factor score estimates as expected a posteriori (EAP) estimates and single draws from a Bayesian posterior distribution (Bayesian plausible values, PV). Both of these estimates were derived using Mplus software (version 8.8, Muthén & Muthén, Los Angeles CA)(Asparouhov, 2010; <https://www.statmodel.com/download/Plausible.pdf>). Factor scores are estimates of a latent variable. And latent variables are, by definition, not directly observable. Therefore, any estimate of that latent variable has some level of imprecision. In the context of categorical data item factor analysis (or item response theory), the imprecision is determined by the number of items used in the factor model, the strength of the correlation between the items

and the underlying factor, and the distribution of difficulty levels of the items. Factors with more items, items with strong relationships with the underlying factor, and many widely dispersed difficulty levels will have less imprecision than factors with only a few items with weak relationships with the underlying factor and coarse and skewed responses. If a factor is measured by all continuous indicators, imprecision is constant across the level of the latent trait. But if a factor is measured with at least one categorical indicator, imprecision will vary across the level of the latent trait, generally being higher at the extremes.

When we generate factor score estimates as plausible values, each person's score is a draw from the posterior distribution of their factor score estimate, which is determined by the level of imprecision of the factor score. These are analogous to imputations in multiple imputation. In fact, it might be desirable to use multiple plausible values generated for each participant as if they were multiply imputed values in a data analysis. If we were to take many draws from the posterior for each participant, and then compute the mean of each persons' plausible values - that mean would approach the EAP estimate we obtain for each person.

In addition to factor scores, we produce results of the classification algorithm using single draws from the Bayesian posterior distribution of factor scores (vs1hcapdx) and expected a posteriori (EAP) factor scores (vs1hcapdxeap) for data users to include in their analysis as they determine is appropriate. We recommend using plausible values (or multiple plausible values) in any circumstance where population-level parameter estimation and inference is desired. Use of EAP estimates in such circumstances is anti-conservative and may result in biased low standard errors in inflated type-I error levels. In some situations, such as descriptive analysis, or in a high-stakes decision making procedure (e.g., selecting participants for a module or sub-study) the EAP estimates would be preferable. For example, when we are interested in generating a prevalence estimate for older adults living in the US, we prefer the classification algorithm that uses the single draws from the plausible values, because that version incorporates uncertainty in the estimation of cognitive ability. On the other hand, when we are interested in comparing how the HCAP algorithm compares to a reference standard classification, we make use of the EAP factor score derived algorithmic results. The latter example involves a "high stakes" decision about agreement at the individual participant level, and we would not like that decision to be clouded by random fluctuations in assignment due to measurement imprecision in the cognitive assessment.

### **III. Data Files**

The HRS/HCAP summary cognitive and functional measures data are provided in ASCII format, with fixed-length records, and "ready-to-use" files. Use the associated SAS, SPSS or Stata program statements to read the data into the analysis package of your choice.

The following extensions are used for the 2016 HCAP Final release files:

- HC16HP\_F.da for the ASCII data file
- HC16HP\_F.sas for the SAS program statements
- HC16HP\_F.sas7bdat for "ready-to-use" SAS file
- HC16HP\_F.sps for the SPSS program statements
- HC16HP\_F.sav for "ready-to-use" SPSS file

HC16HP\_F.do for the STATA do statements  
HC16HP\_F.dct for the STATA dictionary statements  
HC16HP\_F.dta for “ready-to-use” Stata file HC16HP\_F.txt for the codebook file

#### IV. Codebook

| Variable             | Description                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>hhid</b>          | <b>HRS 2016 HHID</b><br>Missing values: 0/3496<br>Distinct values: 3465                                                                                                                                                                                                                                                                                                                                                |
| <b>pn</b>            | <b>HRS PERSON NUMBER</b><br>Missing values: 0/3496<br>Distinct values: 10                                                                                                                                                                                                                                                                                                                                              |
| <b>vs1hcapdx_bpv</b> | <b>HRS HCAP Dementia and MCI Classification (BPV version, HRS HCAP variable set 1)</b><br>Missing values: 0/3496<br>Distinct values: 3<br>1: 2276 [Normal (1)]<br>2: 832 [MCI (2)]<br>3: 388 [Dementia (3)]                                                                                                                                                                                                            |
| <b>vs1hcapdx_eap</b> | <b>HRS HCAP Dementia and MCI Classification (EAP version, HRS HCAP variable set 1)</b><br>Missing values: 0/3496<br>Distinct values: 3<br>1: 2313 [Normal (1)]<br>2: 808 [MCI (2)]<br>3: 375 [Dementia (3)]                                                                                                                                                                                                            |
| <b>vs2memsc</b>      | <b>Memory score (HRS HCAP variable set 2)</b><br>Missing values: 0/3496<br>Distinct values: 3324<br>Mean (SD): 46.768 (11.784)<br>NOTE: This is a singly imputed, standardized and adjusted (for age, sex, race, ethnicity, and educational attainment), plausible value factor score estimate for the memory domain and used indirectly in the HRS/HCAP dementia algorithm by defining cognitive impairment criteria. |
| <b>vs2exfsc</b>      | <b>Executive function score (HRS HCAP variable set 2)</b><br>Missing values: 0/3496<br>Distinct values: 3296<br>Mean (SD): 46.015 (11.771)                                                                                                                                                                                                                                                                             |

| Variable  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| vs2lflsc  | <p>NOTE: This is a singly imputed, standardized and adjusted (for age, sex, race, ethnicity, and educational attainment), plausible value factor score estimate for the executive functioning domain and used indirectly in the HRS/HCAP dementia algorithm by defining cognitive impairment criteria.</p> <p><b>Language and fluency score (HRS HCAP variable set 2)</b><br/> Missing values: 0/3496<br/> Distinct values: 3308<br/> Mean (SD): 47.688 (11.035)<br/> NOTE: This is a singly imputed, standardized and adjusted (for age, sex, race, ethnicity, and educational attainment), plausible value factor score estimate for the language and fluency domain and used indirectly in the HRS/HCAP dementia algorithm by defining cognitive impairment criteria.</p> |
| vs2visc   | <p><b>Visuospatial score (HRS HCAP variable set 2)</b><br/> Missing values: 0/3496<br/> Distinct values: 2324<br/> Mean (SD): 47.579 (11.391)<br/> NOTE: This is a singly imputed, standardized and adjusted (for age, sex, race, ethnicity, and educational attainment), performance score on CERAD constructional praxis, and used indirectly in the HRS/HCAP dementia algorithm by defining cognitive impairment criteria.</p>                                                                                                                                                                                                                                                                                                                                            |
| vs2vdori1 | <p><b>Orientation score (vdori1, HRS HCAP variable set 2)</b><br/> Missing values: 0/3496<br/> Distinct values: 141<br/> Mean (SD): 9.254 (1.406)<br/> NOTE: This is the singly imputed sum score on the MMSE orientation questions (scored 0-10). Equivalent to vdori1 other than for the imputation of missing values. This variable was indirectly used in the dementia algorithm by informing the missing data imputation</p>                                                                                                                                                                                                                                                                                                                                            |

| Variable             | Description                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>vs2memimp_bpv</b> | <p>model for the orientation impairment indicator.</p> <p><b>Memory impairment (PV, HRS HCAP variable set 2)</b><br/> Missing values: 0/3496<br/> Distinct values: 2<br/> 0: 2979 [Not impaired (0)]<br/> 1: 517 [Impaired (1)]<br/> NOTE: This is the impairment flag for v2memsc, on which scores of less than 35 are considered impaired. The impairment indicators were directly used in the dementia algorithm.</p> |
| <b>vs2exfimp_bpv</b> | <p><b>Executive function impairment (PV, HRS HCAP variable set 2)</b><br/> Missing values: 0/3496<br/> Distinct values: 2<br/> 0: 2962 [Not impaired (0)]<br/> 1: 534 [Impaired (1)]<br/> NOTE: This is the impairment flag for v2exfsc, on which scores of less than 35 are considered impaired. The impairment indicators were directly used in the dementia algorithm.</p>                                            |
| <b>vs2lflimp_bpv</b> | <p><b>Language and fluency impairment (PV, HRS HCAP variable set 2)</b><br/> Missing values: 0/3496<br/> Distinct values: 2<br/> 0: 3069 [Not impaired (0)]<br/> 1: 427 [Impaired (1)]<br/> NOTE: This is the impairment flag for v2lflsc, on which scores of less than 35 are considered impaired. The impairment indicators were directly used in the dementia algorithm.</p>                                          |
| <b>vs2visimp</b>     | <p><b>Visuospatial impairment (HRS HCAP variable set 2)</b><br/> Missing values: 0/3496<br/> Distinct values: 2<br/> 0: 3061 [Not impaired (0)]<br/> 1: 435 [Impaired (1)]</p>                                                                                                                                                                                                                                           |

| Variable             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>vs2orimp</b>      | <p>NOTE: This is the impairment flag for v2vissc, on which scores of less than 35 are considered impaired. The impairment indicators were directly used in the dementia algorithm (both EAP and PBV).</p> <p><b>Orientation impairment (HRS HCAP variable set 2)</b><br/> Missing values: 0/3496<br/> Distinct values: 2<br/> 0: 2966 [Not impaired (0)]<br/> 1: 530 [Impaired (1)]</p> <p>NOTE: This is the impairment flag for orientation, and is based on a singly imputed impairment indicator for the orientation score, where a score of 8 or less is considered impaired. This variable is not directly coded from vs2vdori1, and due to the imputation procedure for vs2vdori1 some apparent discrepancies are present. This variable was directly used in the dementia algorithm (both EAP and BPV).</p> |
| <b>vs2memimp_eap</b> | <p><b>Memory impairment (EAP, HRS HCAP variable set 2)</b><br/> Missing values: 0/3496<br/> Distinct values: 2<br/> 0: 2993<br/> 1: 503</p> <p>NOTE: Impairment flag for memory (EAP estimates)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>vs2exfimp_eap</b> | <p><b>Executive function impairment (EAP, HRS HCAP variable set 2)</b><br/> Missing values: 0/3496<br/> Distinct values: 2<br/> 0: 3016<br/> 1: 480</p> <p>NOTE: Impairment flag for executive functioning (EAP estimates)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>vs2lflimp_eap</b> | <p><b>Language and fluency impairment (EAP, HRS HCAP variable set 2)</b><br/> Missing values: 0/3496<br/> Distinct values: 2</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

| Variable                   | Description                                                                                                                                                              |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            | 0: 3065<br>1: 431<br>NOTE: Impairment flag for language (EAP estimates)                                                                                                  |
| <b>vs2memsc_iflag</b>      | <b>Memory score (HRS HCAP variable set 2) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3345 [Not imputed]<br>1: 151 [Imputed]               |
| <b>vs2exfsc_iflag</b>      | <b>Executive function score (HRS HCAP variable set 2) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3343 [Not imputed]<br>1: 153 [Imputed]   |
| <b>vs2lflsc_iflag</b>      | <b>Language and fluency score (HRS HCAP variable set 2) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3347 [Not imputed]<br>1: 149 [Imputed] |
| <b>vs2vissc_iflag</b>      | <b>Visuospatial score (HRS HCAP variable set 2) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3308 [Not imputed]<br>1: 188 [Imputed]         |
| <b>vs2vdori1_iflag</b>     | <b>Orientation score (vdori1, HRS HCAP variable set 2) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3340 [Not imputed]<br>1: 156 [Imputed]  |
| <b>vs2memimp_bpv_iflag</b> | <b>Memory impairment (HRS HCAP variable set 2) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3345 [Not imputed]                              |

| Variable                    | Description                                                                                                                                                                                                                   |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                             | 1: 151 [Imputed]                                                                                                                                                                                                              |
| <b>vs2exfimp_bp_v_iflag</b> | <b>Executive function impairment (HRS HCAP variable set 2) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3343 [Not imputed]<br>1: 153 [Imputed]                                                   |
| <b>vs2lflimp_bp_v_iflag</b> | <b>Language and fluency impairment (HRS HCAP variable set 2) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3347 [Not imputed]<br>1: 149 [Imputed]                                                 |
| <b>vs2memimp_eap_iflag</b>  | <b>Memory impairment (EAP, HRS HCAP variable set 2) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3345 [Not imputed]<br>1: 151 [Imputed]<br>NOTE: Imputation flag for vs2memimp_eap               |
| <b>vs2exfimp_eap_iflag</b>  | <b>Executive function impairment (EAP, HRS HCAP variable set 2) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3343 [Not imputed]<br>1: 153 [Imputed]<br>NOTE: Impairment flag for vs2exfimp_eap   |
| <b>vs2lflimp_eap_iflag</b>  | <b>Language and fluency impairment (EAP, HRS HCAP variable set 2) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3347 [Not imputed]<br>1: 149 [Imputed]<br>NOTE: Impairment flag for vs2lflimp_eap |
| <b>vs2visimp_iflag</b>      | <b>Visuospatial impairment (HRS HCAP variable set 2) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3308 [Not imputed]                                                                             |

| Variable                  | Description                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                           | 1: 188 [Imputed]                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>vs2orimp_iflag</b>     | <b>Orientation impairment (HRS HCAP variable set 2) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3340 [Not imputed]<br>1: 156 [Imputed]                                                                                                                                                                                                                                 |
| <b>vs3jormsc</b>          | <b>Jorm score (HRS HCAP variable set 3)</b><br>Missing values: 0/3496<br>Distinct values: 339<br>Mean (SD): 3.180 (0.551)<br>Source variable(s): inf1jorm_score<br>NOTE: This is a singly imputed version of a core HCAP variable inf1jorm_score (Jorm IQCODE score), and used in the dementia algorithm indirectly in coding the informant-rated concern and informant-rated impairment indicators. |
| <b>vs3jormsc_iflag</b>    | <b>Jorm score (HRS HCAP variable set 3) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3183 [Not imputed]<br>1: 313 [Imputed]                                                                                                                                                                                                                                             |
| <b>vs3blessedsc</b>       | <b>Blessed score (HRS HCAP variable set 3)</b><br>Missing values: 0/3496<br>Distinct values: 238<br>Mean (SD): 1.189 (1.621)<br>Source variable(s): inf1bl1_score<br>NOTE: This is a singly imputed version of a core HCAP variable inf1bl1_score (Blessed score), and used in the dementia algorithm indirectly in coding the informant-rated concern and informant-rated impairment indicators     |
| <b>vs3blessedsc_iflag</b> | <b>Blessed score (HRS HCAP variable set 3) imputation flag</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 3183 [Not imputed]                                                                                                                                                                                                                                                              |

| Variable                       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                | 1: 313 [Imputed]                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>vs3informant_concerns</b>   | <b>Informant-rated concerns (HRS HCAP variable set 3)</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 1052 [No (0)]<br>1: 2444 [Yes (1)]<br>NOTE: This informant-rated concern indicator variable based on the Jorm and Blessed was used in the dementia algorithm (both EAP and BPV).                                                                                                                                                |
| <b>vs3informant_impairment</b> | <b>Informant-rated impairment (HRS HCAP variable set 3)</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 2507 [No (0)]<br>1: 989 [Yes (1)]<br>NOTE: This is an informant-rated impairment indicator variable based on the Jorm and Blessed, and used in the dementia algorithm (both EAP and BPV).                                                                                                                                     |
| <b>vs3self_concerns</b>        | <b>Self-rated concerns (HRS HCAP variable set 3)</b><br>Missing values: 0/3496<br>Distinct values: 2<br>0: 2391 [No (0)]<br>1: 1105 [Yes (1)]<br>NOTE: This is an indicator variable coded directly from pd102, and is 1 if pd102 is 1 or 2, otherwise it is 0 (including missing on pd102). It is used directly in the dementia algorithm to identify participants with positive evidence of self-rated cognitive concerns (both EAP and BPV). |
| <b>vs4mem_pv</b>               | <b>Memory estimate, PV (HRS HCAP variable set 4)</b><br>Missing values: 151/3496<br>Distinct values: 894<br>Mean (SD): 50.000 (10.000)<br>NOTE: This is the factor score estimate for the mem domain. It has been standardized to a                                                                                                                                                                                                             |

| Variable             | Description                                                                                                                                                                                                                                                                                                      |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | mean of 50 and standard deviation of 10 in the HRS/HCAP sample.                                                                                                                                                                                                                                                  |
| <b>vs4mem_eap</b>    | <b>Memory estimate, EAP (HRS HCAP variable set 4)</b><br>Missing values: 151/3496<br>Distinct values: 824<br>Mean (SD): 50.000 (10.000)<br>NOTE: This is the factor score estimate for the mem domain. It has been standardized to a mean of 50 and standard deviation of 10 in the HRS/HCAP sample.             |
| <b>vs4mem_se_eap</b> | <b>Memory standard error, EAP (HRS HCAP variable set 4)</b><br>Missing values: 151/3496<br>Distinct values: 51<br>Mean (SD): 3.221 (0.295)<br>NOTE: This is the estimated standard error for the factor score estimate for the mem domain.                                                                       |
| <b>vs4exf_pv</b>     | <b>Executive function estimate, PV (HRS HCAP variable set 4)</b><br>Missing values: 153/3496<br>Distinct values: 702<br>Mean (SD): 50.000 (10.000)<br>NOTE: This is the factor score estimate for the exf domain. It has been standardized to a mean of 50 and standard deviation of 10 in the HRS/HCAP sample.  |
| <b>vs4exf_eap</b>    | <b>Executive function estimate, EAP (HRS HCAP variable set 4)</b><br>Missing values: 153/3496<br>Distinct values: 673<br>Mean (SD): 50.000 (10.000)<br>NOTE: This is the factor score estimate for the exf domain. It has been standardized to a mean of 50 and standard deviation of 10 in the HRS/HCAP sample. |
| <b>vs4exf_se_eap</b> | <b>Executive function standard error, EAP (HRS HCAP variable set 4)</b><br>Missing values: 153/3496                                                                                                                                                                                                              |

| Variable      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| vs4lfl_pv     | <p>Distinct values: 54<br/> Mean (SD): 2.902 (0.632)<br/> NOTE: This is the estimated standard error for the factor score estimate for the exf domain.</p> <p><b>Language and fluency estimate, PV (HRS HCAP variable set 4)</b><br/> Missing values: 149/3496<br/> Distinct values: 523<br/> Mean (SD): 50.000 (10.000)<br/> NOTE: This is the factor score estimate for the lfl domain. It has been standardized to a mean of 50 and standard deviation of 10 in the HRS/HCAP sample.</p> |
| vs4lfl_eap    | <p><b>Language and fluency estimate, EAP (HRS HCAP variable set 4)</b><br/> Missing values: 149/3496<br/> Distinct values: 267<br/> Mean (SD): 50.000 (10.000)<br/> NOTE: This is the factor score estimate for the lfl domain. It has been standardized to a mean of 50 and standard deviation of 10 in the HRS/HCAP sample.</p>                                                                                                                                                           |
| vs4lfl_se_eap | <p><b>Language and fluency standard error, EAP (HRS HCAP variable set 4)</b><br/> Missing values: 149/3496<br/> Distinct values: 28<br/> Mean (SD): 8.003 (0.626)<br/> NOTE: This is the estimated standard error for the factor score estimate for the lfl domain.</p>                                                                                                                                                                                                                     |
| vs5gcp_pv     | <p><b>Global cognitive performance, PV (HRS HCAP variable set 5)</b><br/> Missing values: 149/3496<br/> Distinct values: 797<br/> Mean (SD): 50.000 (10.000)<br/> NOTE: There is no variable v5gcp_se_pv. This is because the general factor is modeled as a second-order factor, and Mplus software does not produce a standard error estimate for second order factors.</p>                                                                                                               |

| Variable          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>vs5gcp_eap</b> | <p><b>Global cognitive performance, EAP (HRS HCAP variable set 5)</b><br/> Missing values: 149/3496<br/> Distinct values: 754<br/> Mean (SD): 50.000 (10.000)<br/> NOTE: There is no variable vs5gcp_se_eap. This is because the general factor is modeled as a second-order factor, and Mplus software does not produce a standard error estimate for second order factors.</p>                                                                                                                                                                                                                                                                                                                   |
| <b>vdasp1</b>     | <p><b>Symbol Digit Modalities Test score (HRS HCAP variable set 6)</b><br/> Missing values: 328/3496<br/> Distinct values: 68<br/> Mean (SD): 32.493 (12.523)<br/> Source variable(s): r1dig_score<br/> NOTE: The variable vdasp1 is simply a renaming of r1dig_score. No accommodation for missing or other non-response codes has been used. Note that according to the 2016 Harmonized Cognitive Assessment Protocol (HCAP) Study Protocol Summary}, the SDMT score is the number of correct pairings minus any mistakes or skips. Special handling: if the variable r1fdig_score has a value of 1, this implies that r1dig_score is imputed the created variable vdasp1 is set to missing.</p> |
| <b>vdasp1z</b>    | <p><b><math>vdasp1z = (vdasp1 - .007827027941) / 71.01565406</math> (HRS HCAP variable set 6)</b><br/> Missing values: 328/3496<br/> Distinct values: 68<br/> Mean (SD): 0.458 (0.176)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>vdasp2</b>     | <p><b>Trails A (HRS HCAP variable set 6)</b><br/> Missing values: 286/3496<br/> Distinct values: 190<br/> Mean (SD): 0.320 (0.085)<br/> Source variable(s): r1tma_score<br/> NOTE: vdasp2 is calculated as <math>1 - \{\log(T\_A) / \log(300)\}</math> where T_A is the number of seconds needed to complete the</p>                                                                                                                                                                                                                                                                                                                                                                               |

| Variable      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>vdas2z</b> | <p>Trails A task, and 300 is the ceiling on the number of seconds allowed to complete the task. The resulting score is 0 when the participant took 300 seconds to complete the task (or did not complete the task in 300 seconds and was assigned a score of 300), and 1 when the task was completed in 0 seconds (unsurprisingly, we do not observe scores of 1). The direction of this log transformed score is such that higher scores (approaching 1) are better and indicate faster performance. Missing codes (i.e., not between 0 and 300 on the source variables) are treated as missing. Special handling: if the variable <code>r1ftma_score</code> has a value of 1, this implies that <code>r1tma_score</code> is imputed the created variable <code>vdasp2</code> is set to missing.</p> <p><b>vdasp2z = (vdasp2 - .00005338379933)/.8074956097 (HRS HCAP variable set 6)</b></p> <p>Missing values: 286/3496<br/>Distinct values: 190<br/>Mean (SD): 0.397 (0.106)</p> |
| <b>vdas3</b>  | <p><b>MMSE spell world backwards (HRS HCAP variable set 6)</b></p> <p>Missing values: 320/3496<br/>Distinct values: 6<br/>0: 52<br/>1: 87<br/>2: 159<br/>3: 338<br/>4: 150<br/>5: 2390</p> <p>Source variable(s): <code>r1backwards1</code><br/><code>r1backwards2</code> <code>r1backwards3</code> <code>r1backwards4</code><br/><code>r1backwards5</code></p> <p>NOTE: <code>vdasp3</code> is the sum of 5 recorded responses to the MMSE spell world backwards task, recored with five correct/incorrect indicators. Only correct responses are summed (code 1 on source variables). At least 1 of the five indicators must have a non-missing code (not missing or 96, 97, 98, 99) to get the 0-5 score on <code>vdasp3</code>.</p>                                                                                                                                                                                                                                              |

| Variable       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>vdasp4</b>  | <p><b>Backwards counting (HRS HCAP variable set 6)</b></p> <p>Missing values: 194/3496</p> <p>Distinct values: 72</p> <p>Mean (SD): 29.351 (11.519)</p> <p>Source variable(s): r1bc_score</p> <p>NOTE: This is from the 2016 Harmonized Cognitive Assessment Protocol (HCAP) Study Protocol Summary: This test assesses speed and attention and is derived from the Backward Count measure in the MIDUS Study. Respondents are asked to begin at 100 and to count backwards as fast as possible. They are given 30 seconds and the number they reach and number of errors are recorded. The variable vdasp4 is simply a renaming of the variable r1bc_score. (Note: in analyses prior to 2023-12-06 values greater than or equal to 96 were treated as missing values and that is a mistake, those are valid responses to this item). Special handling: if the variable r1fbc_score has a value of 1, this implies that r1bc_score is imputed the created variable vdasp4 is set to missing.</p> |
| <b>vdasp4z</b> | <p><b><math>vdasp4z = (vdasp4 - .007199349644) / 99.0143987</math> (HRS HCAP variable set 6)</b></p> <p>Missing values: 194/3496</p> <p>Distinct values: 72</p> <p>Mean (SD): 0.297 (0.116)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>vdasp5</b>  | <p><b>Letter cancellation (HRS HCAP variable set 6)</b></p> <p>Missing values: 299/3496</p> <p>Distinct values: 37</p> <p>Mean (SD): 14.775 (5.270)</p> <p>Source variable(s): r1lc_score</p> <p>NOTE: This is from the 2016 Harmonized Cognitive Assessment Protocol (HCAP) Study Protocol Summary}: This test has been included in ELSA and assesses attention and speed. Respondents are given a paper with a large grid of letters and are asked to scan the grid as quickly as possible in a minute and to</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| Variable       | Description                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | cross out as many P and W letters as they can in that time. This variable (vdasp5, renamed and otherwise unchanged version of r1lc_score) is the number of correctly crossed-out letters. Special handling: if the variable r1fbc_score has a value of 1, this implies that r1lc_score is imputed the created variable vdasp5 is set to missing.                                                                                      |
| <b>vdasp5z</b> | <b><math>vdasp5z = (vdasp5 - .003293547937) / 37.0065871</math> (HRS HCAP variable set 6)</b><br>Missing values: 299/3496<br>Distinct values: 37<br>Mean (SD): 0.399 (0.142)                                                                                                                                                                                                                                                          |
| <b>vdexf1</b>  | <b>Raven's progressive matrices (HRS HCAP variable set 6)</b><br>Missing values: 209/3496<br>Distinct values: 18<br>Mean (SD): 12.396 (3.691)<br>Source variable(s): r1rv_score<br>NOTE: vdexf1 is the score from Raven's progressive matrices. It is based only on r1rv_score Special handling: if the variable r1frv_score has a value of 1, this implies that r1rv_score is imputed the created variable vdexf1 is set to missing. |
| <b>vdexf1z</b> | <b><math>vdexf1z = (vdexf1 - .002307011643) / 17.00461402</math> (HRS HCAP variable set 6)</b><br>Missing values: 209/3496<br>Distinct values: 18<br>Mean (SD): 0.729 (0.217)                                                                                                                                                                                                                                                         |
| <b>vdexf2</b>  | <b>Trails B time (HRS HCAP variable set 6)</b><br>Missing values: 670/3496<br>Distinct values: 259<br>Mean (SD): 0.168 (0.079)<br>Source variable(s): r1tmb_score<br>NOTE: vdexf2 is computed as $1 - \{\log(T\_B) / \log(300)\}$ where T_B is the number of seconds needed to complete the Trails B task, and 300 is the ceiling on the number of seconds allowed to complete the task. The resulting score is 0 when the            |

| Variable | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          | <p>participant took 300 seconds to complete the task (or did not complete the task in 300 seconds and was assigned a score of 300), and 1 when the task was completed in 0 seconds (unsurprisingly, we do not observe scores of 1). The direction of this log transformed score is such that higher scores (approaching 1) are better and indicate faster performance. Missing codes (i.e., not between 0 and 300 on the source variable(s)) are treated as missing. NB the reverse transformation is <math>300^{(1-B)}</math> where B is the log transformed, log-normalized complement number of seconds to complete the Trails B task. Special handling: if the variable r1ftmb_score has a value of 1, this implies that r1tmb_score is imputed the created variable vdexf2 is set to missing.</p>                                               |
| vdexf2z  | <p><b>vdexf2z = (vdexf2 - .00004913090975)/.3924776351 (HRS HCAP variable set 6)</b><br/> Missing values: 670/3496<br/> Distinct values: 259<br/> Mean (SD): 0.428 (0.200)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| vdexf7   | <p><b>HRS Number Series (HRS HCAP variable set 6)</b><br/> Missing values: 727/3496<br/> Distinct values: 29<br/> Mean (SD): 522.448 (31.400)<br/> Source variable(s): r1ns_score<br/> NOTE: This is from the 2016 Harmonized Cognitive Assessment Protocol (HCAP) Study Protocol Summary: Developed for the HRS, this section evaluates Respondents ability for numeric reasoning by presenting a series of 6 individual series of numbers, where one or two numbers in the series is missing. The Respondent is asked to take as much time as s/he needs, with the help of scrap paper and a pencil, to identify the missing number/s. This test is a block-adaptive test. Respondents are given a set of three number series questions of varying difficulty to first complete. Based on the number of correct responses in this first set of</p> |

| Variable       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | <p>three (score Range = 0 to 4), Respondents are then assigned to a second set of three questions, for which the difficulty level is based on the number correct on the first set. The HRS uses two versions of the Number Series questions and respondents are assigned to the version that was not done in the previous wave. For HRS-HCAP, Respondents were assigned to the Number Series that was not assigned in the 2016 Core interview. If a Respondent was not able to do the Number Series section in the 2016 Core interview (not able to do practice questions, was too confused), then they were skipped out of this section. In creating vdexf7, missing codes (codes 996 and higher) on the source variable r1ns_score are treated as system missing. Special handling: if the variable r1fns_score has a value of 1, this implies that r1ns_score is imputed the created variable vdexf7 is set to missing.</p> |
| <b>vdexf7z</b> | <p><b>vdexf7z = (vdexf7 - 409.0196249)/175.0392498 (HRS HCAP variable set 6)</b><br/> Missing values: 727/3496<br/> Distinct values: 29<br/> Mean (SD): 0.648 (0.179)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>vdflf1</b>  | <p><b>Category fluency (animals) (HRS HCAP variable set 6)</b><br/> Missing values: 151/3496<br/> Distinct values: 41<br/> Mean (SD): 15.969 (6.570)<br/> Source variable(s): r1verbal_score<br/> NOTE: The created variable vdflf1 is simply a copied or renamed version of r1verbal_score. Special handling: if the variable r1fverbal_score has a value of 1, this implies that r1verbal_score is imputed the created variable vdflf1 is set to missing.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>vdflf1z</b> | <p><b>vdflf1z = (vdflf1 - .004106468202)/43.00821294 (HRS HCAP variable set 6)</b><br/> Missing values: 151/3496<br/> Distinct values: 41</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

| Variable      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>vdlfl2</b> | <p>Mean (SD): 0.371 (0.153)</p> <p><b>Naming 2 items HRS TICS scissors, cactus (HRS HCAP variable set 6)</b></p> <p>Missing values: 162/3496</p> <p>Distinct values: 2</p> <p>0: 287 [0-1]</p> <p>1: 3047 [2]</p> <p>Source variable(s): r1scis r1cactus</p> <p>NOTE: This is the number of correct responses to the HRS TICS items name two objects (scissor, cactus; r1scis r1cactus are the original items). Respondents must have at least 1 non-missing (not system missing, not 7, 8, 9) to get a score. To address maldistribution, observed values of 0 and 1 are scored 0, observed values of 2 are scored 1.</p> |
| <b>vdlfl3</b> | <p><b>Naming 2 items MMSE (HRS HCAP variable set 6)</b></p> <p>Missing values: 158/3496</p> <p>Distinct values: 2</p> <p>0: 40 [0-1]</p> <p>1: 3298 [2]</p> <p>Source variable(s): r1object1 r1object2</p> <p>NOTE: This is the number of correct responses to the two MMSE name objects questions (r1object1 r1object2). Respondents must have at least 1 non-missing (not system missing, not 97, 98, 99) to get a score. To address maldistribution, observed values of 0 and 1 are scored 0, observed values of 2 are scored 1.</p>                                                                                    |
| <b>vdlfl4</b> | <p><b>MMSE write a sentence (HRS HCAP variable set 6)</b></p> <p>Missing values: 260/3496</p> <p>Distinct values: 2</p> <p>0: 188</p> <p>1: 3048</p> <p>Source variable(s): r1senten</p> <p>NOTE: The variable vdlfl4 is an indicator as to whether r1senten is scored as correct (value</p>                                                                                                                                                                                                                                                                                                                               |

| Variable      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>vdflf5</b> | <p>1). Missing codes (any value coded 96 or higher) are treated as missing.</p> <p><b>MMSE read and follow command (HRS HCAP variable set 6)</b><br/> Missing values: 172/3496<br/> Distinct values: 2<br/> 0: 87<br/> 1: 3237<br/> Source variable(s): r1combfol<br/> NOTE: The variable vdflf5 is an indicator as to whether r1combfol is scored as correct (value 1). Missing codes (any value coded 96 or higher) are treated as missing</p>                                                                                                                                                                                                     |
| <b>vdflf6</b> | <p><b>CSID object naming (HRS HCAP variable set 6)</b><br/> Missing values: 155/3496<br/> Distinct values: 3<br/> 0: 121 [0-2]<br/> 1: 698 [3]<br/> 2: 2522 [4]<br/> Source variable(s): r1csid_score<br/> NOTE: The created variable vdflf6 is simply a copied or renamed version of r1csid_score, so long as the variable if r1fcsid_score is not equal to 1, as when it is it implies that ` was imputed. This variable is the number correct for CSID naming items (elbow, hammer, store, point). To address maldistribution, observed values of 0-2 are scored 0, observed values of 2 are scored 1, and observed values of 4 are scored 2.</p> |
| <b>vdmdel</b> | <p><b>CERAD word list delayed (0-10) (HRS HCAP variable set 6)</b><br/> Missing values: 165/3496<br/> Distinct values: 11<br/> Mean (SD): 5.113 (2.653)<br/> Source variable(s): r1word_dscore<br/> NOTE: vdmdel is the number correct on the CERAD delayed 10 word recall task. It is simply a renaming of r1word_dscore. Special handling: if the HRS variable r1fword_dscore has a value of 1, this implies that</p>                                                                                                                                                                                                                              |

| Variable       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | r1word_dscore is imputed the created variable vdmde1 is set to missing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>vdmde1z</b> | <b><math display="block">\text{vdmde1z} = (\text{vdmde1} - .001658167546) / 10.00331634</math></b> (HRS HCAP variable set 6)<br>Missing values: 165/3496<br>Distinct values: 11<br>Mean (SD): 0.511 (0.265)                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>vdmde2</b>  | <b>Logical memory delayed (0-25) (HRS HCAP variable set 6)</b><br>Missing values: 180/3496<br>Distinct values: 25<br>Mean (SD): 7.252 (5.436)<br>Source variable(s): r1lmb_delscore<br>NOTE: vdmde2 is the number correct on the WMS-IV Logical Memory I delayed story recall task. There are 25 story points to be recalled, and the source variable is the sum of these that are recalled. vdmde2 is basically a renaming of r1lmb_delscore. Special handling: if the HRS variable r1flmb_delscore has a value of 1, this implies that r1lmb_delscore is imputed the created variable vdmde2 is set to missing. |
| <b>vdmde2z</b> | <b><math display="block">\text{vdmde2z} = (\text{vdmde2} - .003397320931) / 25.00679464</math></b> (HRS HCAP variable set 6)<br>Missing values: 180/3496<br>Distinct values: 25<br>Mean (SD): 0.290 (0.217)                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>vdmde3</b>  | <b>MMSE 3 word delayed recall (0-3) (HRS HCAP variable set 6)</b><br>Missing values: 209/3496<br>Distinct values: 3<br>0: 304 [0-1]<br>1: 765 [2]<br>2: 2218 [3]<br>Source variable(s): r1dlrc3<br>NOTE: vdmde3 represents the number of words recalled after a delay on the MMSE 3 word list. It is simply a recoded version of the original variable r1dlrc3, with responses of 97, 98 , 99 treated as missing. To address                                                                                                                                                                                      |

| Variable       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>vdmde4</b>  | <p>maldistribution, observed values of 0 and 1 are scored 0, observed values of 2 are scored 1, and observed values of 3 are scored 2. Note that in the previous data distribution (and Jones et al 2003, Manly et al 2022) there was a mistake and 3's were recoded to 1.</p> <p><b>CERAD constructional praxis delayed (0-11) (HRS HCAP variable set 6)</b><br/> Missing values: 191/3496<br/> Distinct values: 12<br/> Mean (SD): 5.807 (3.246)<br/> Source variable(s): r1cpdel_score<br/> NOTE: vdmde4 is the number correct shapes drawn from memory after a delay on the CERAD Constructional Praxis task. This is a delayed recall of the geometric shapes drawn in the test of CERAD Constructional Praxis (immediate) task. Respondents are asked to draw the shapes from earlier in the interview to the best of their memory. It is simply a renaming of r1cpdel_score. Special handling: if the HRS variable r1fcpdel_score has a value of 1, this implies that r1cpdel_score is imputed the created variable vdmde4 is set to missing.</p> |
| <b>vdmde4z</b> | <p><b>vdmde4z = (vdmde4 - .002028464166)/11.00405693 (HRS HCAP variable set 6)</b><br/> Missing values: 191/3496<br/> Distinct values: 12<br/> Mean (SD): 0.528 (0.295)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>vdmde5</b>  | <p><b>Brave man delayed score (0-12) (HRS HCAP variable set 6)</b><br/> Missing values: 164/3496<br/> Distinct values: 13<br/> Mean (SD): 4.983 (3.347)<br/> Source variable(s): r1bm_delscore<br/> NOTE: This item vdmde5 is simply a renaming of r1bm_delscore. No accommodation for missing or other non-response codes has been used. Special handling: if the variable r1fbm_delscore has a value of 1, this implies that r1bm_delscore is</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

| Variable       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | imputed the created variable vdmde5 is set to missing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>vdmde5z</b> | <b>vdmde5z = (vdmde5 - .002091814299)/<br/>12.00418363 (HRS HCAP variable set 6)</b><br>Missing values: 164/3496<br>Distinct values: 13<br>Mean (SD): 0.415 (0.279)                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>vdmre1</b>  | <b>CERAD word list recognition task (0-20)<br/>(HRS HCAP variable set 6)</b><br>Missing values: 173/3496<br>Distinct values: 18<br>Mean (SD): 18.527 (2.357)<br>Source variable(s): r1wlrec_totscore<br>NOTE: This item vdmre1 is simply a renaming of r1wlrec_totscore. No accommodation for missing or other non-response codes has been used. Special handling: if the variable r1fwlrec_totscore has a value of 1, this implies that r1wlrec_totscore is imputed the created variable vdmre1 is set to missing.                                       |
| <b>vdmrelz</b> | <b>vdmrelz = (vdmre1 - .001473172551)/<br/>20.00294635 (HRS HCAP variable set 6)</b><br>Missing values: 173/3496<br>Distinct values: 18<br>Mean (SD): 0.926 (0.118)                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>vdmre2</b>  | <b>Logical memory recognition (0-15) (HRS HCAP variable set 6)</b><br>Missing values: 257/3496<br>Distinct values: 16<br>Mean (SD): 10.291 (2.719)<br>Source variable(s): r1lmb_recoscore<br>NOTE: vdmre2 is the number correct on the WMS-IV Logical Memory I story recognition task. It is simply a renaming of r1lmb_recoscore but missing codes (97, 98, 99) are treated as missing. Special handling: if the variable r1flmb_recoscore has a value of 1, this implies that r1lmb_recoscore is imputed the created variable vdmre2 is set to missing. |

| Variable       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>vdmre2z</b> | <b>vdmre2z = (vdmre2 - .001699376703)/<br/>15.00339875 (HRS HCAP variable set 6)</b><br>Missing values: 257/3496<br>Distinct values: 16<br>Mean (SD): 0.686 (0.181)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>vdori1</b>  | <b>MMSE 10 items (number correct, 0-10)<br/>(HRS HCAP variable set 6)</b><br>Missing values: 156/3496<br>Distinct values: 11<br>Mean (SD): 9.322 (1.349)<br>Source variable(s): rlorient_t1 rlorient_t2<br>rlorient_t3 rlorient_t4 rlorient_t5 rlorient_p1<br>riorient_p2 rriorient_p3 rriorient_p4 rriorient_p5<br>NOTE: vdori1 captures orientation to time<br>and place using 10 items from the MMSE. It<br>is coded as the sum of the number of MMSE<br>orientation items (rlorient_t1 rlorient_t2<br>rlorient_t3 rlorient_t4 rlorient_t5 rlorient_p1<br>riorient_p2 rriorient_p3 rriorient_p4<br>riorient_p5') that have a value of 1, with 97,<br>98, and 99 responses treated as missing<br>values. Persons who do not have at least 1<br>item in the list that has a response of 1 or 5<br>are treated as missing. This sum has a<br>Cronbach's alpha of 0.632. |
| <b>vdori1z</b> | <b>vdori1z = (vdori1 - .0008432221464)/<br/>10.00168644 (HRS HCAP variable set 6)</b><br>Missing values: 156/3496<br>Distinct values: 11<br>Mean (SD): 0.932 (0.135)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>vdvis1</b>  | <b>CERAD Constructional praxis (HRS<br/>HCAP variable set 6)</b><br>Missing values: 188/3496<br>Distinct values: 12<br>Mean (SD): 8.179 (2.330)<br>Source variable(s): r1cp_score<br>NOTE: vdvis1 is CERAD constructional<br>praxis immediate. The summary variable is a<br>simple recode (for missing, other non-<br>response codes as system missing) version of<br>r1cp_score. Special handling: if r1fcp_score                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

| Variable | Description                                                                                                                                                                                                                                                                                               |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| vdvis1z  | <p>is equal to 1, this indicates that r1cp_score was imputed and vdvis1 is therefore set to missing.</p> <p><b><math>vdvis1z = (vdvis1 - .001456089426) / 11.00291218</math> (HRS HCAP variable set 6)</b></p> <p>Missing values: 188/3496</p> <p>Distinct values: 12</p> <p>Mean (SD): 0.743 (0.212)</p> |