Langa-Weir Classification of Cognitive Function (1995-2020)

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This document describes a researcher contributed dataset that provides a total summary score for cognition using measures[1] from the core HRS interview as well as three derived categories: Normal, Cognitively Impaired but not Demented (CIND), and demented. We refer to these as the Langa-Weir Classifications (Crimmins et al., 2011).[2] HRS also makes use of proxy respondents to reduce sample attrition.[3] Therefore, this dataset also includes scoring of cognition based on data from proxy respondent interviews.

Self-Respondents

Face-to-face / TEL Interview

HRS employs a range of measures to assess cognitive status that can be used to create a summary score. Depending on the study sample, researchers can use either a 35-point (range 0-35) or 27-point (range 0-27) scale to determine total cognitive functioning. The 35-point scale[4] includes a subset of questions that **were only asked of respondents age 65 and older** whereas the 27-point scale includes question that were asked of all HRS respondents.

The 27-point scale includes: 1) immediate and delayed 10-noun free recall test to measure memory (0 to 20 points); 2) a serial sevens subtraction test to measure working memory (0 to 5 points); and 3) a counting backwards test to measure speed of mental processing (0 to 2 points). The additional questions included in the 35-point scale are the three mental status questions that include: 1) date naming (0 to 4 points); 2) object naming (0 to 2 points); and 3) naming the president and the vice president of the United States (0 to 2 points).

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[1] Much more detail on all of these measures is available in the user guide, *Documentation of Cognitive FunctioningMeasures in the Health and Retirement Study,* also available on the HRS website: https://hrs.isr.umich.edu/sites/default/files/biblio/dr-006.pdf

[2] Crimmins, E.M., Kim, J.K., Langa, K.M., & Weir, D.R. (2011). Assessment of cognition using surveys and neuropsychological assessment: the health and retirement study and the aging, demographics, and memory study. The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences, 66B(S1), i162–i171, doi:10.1093/geronb/gbr048

[3] Weir DR, Faul JD, Langa KM. Proxy interviews and bias in cognition measures due to non-response in longitudinal studies: a comparison of HRS and ELSA. Longitudinal and Life Course Studies. 2011;2(2):170-184. doi:10.14301/llcs.v2i2.116.

[4] The 35-point scale is available in the RAND HRS dataset as RwCOGTOT.

Web Self-Administered

Beginning the 2018 interview, HRS included Web based self-administered interview for some participants. The variable "cogivemodeX" indicates mode of interview (1=Self-respondent Interviewer administer FTF/TEL, 2=self-respondent, self-administer WEB, 3= Proxy-respondent Interviewer administer FTF/TEL). User should use this variable to identify web participants. Immediate and delayed word recall and serial subtraction were administered to web respondents. The 27-point scale for the web participants was created by summing the immediate word recall score, delayed word recall score, serial subtraction score, and a wholly imputed backward count score was based on analysis of the 2018 web data[5], and this score was then adjusted by subtracting one from the total, and the Langa-Weir Classifications were done using this adjusted score.

Self-respondent cognition classification

The Langa-Weir Classifications map onto the 27-point scale (variable name *cogtot27_imp*) thus: Normal (12 – 27); Cognitively Impaired but not Demented (CIND) (7 – 11); and Demented (0 – 6) (variable name *cogfunction*). Crimmins et al. (2011) documents the methods used to make these classifications based on diagnostic information from the ADAMS. Another important feature of the present contributed dataset is that it makes use of imputed information for the HRS cognitive measures. Procedures for the imputation methodology are available on the HRS website.[6] It is important to note that if you choose to use raw (not imputed) data, you will be missing a large fraction of respondents with dementia.

Proxy Respondents

If you wish to include proxy respondents in your study sample, it is important to understand that there is no direct assessment of cognition. Rather, we suggest the use of a combination of instrumental activities of daily living (IADLs), proxy assessment of respondent's memory, and interviewer's assessment of respondent's cognition to create a total cognition score based on proxy information. Note that in this contributed dataset, we also imputed missing values on these three variables.

The total cognition score based on proxy information is an 11-point scale using proxy assessment of memory (excellent, very good, good, fair, poor), IADL limitations (ranging from no

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[5] Domingue, B. W., McCammon, R., West, B. T., Langa, K. M., Weir, D., & Faul, J. (2023). The mode effect of web-based surveying on the 2018 HRS measure of cognitive functioning. *The journals of gerontology. Series B, Psychological sciences and social sciences*, gbad068. Advance online publication. https://doi.org/10.1093/geronb/gbad068

[6] Health and Retirement Study Imputation of Cognitive Functioning Measures: 1992-2018, available on the HRS website: https://hrs.isr.umich.edu/sites/default/files/biblio/COGIMP9218_dd.pdf

limitations to 5 limitations), and the interviewer assessment of cognitive impairment (CI: no CI, may have CI, has CI). For proxy assessment of memory, "excellent" was assigned a value of 0, "very good" a value of 1, "good" a value of 2, "fair" a value of 3, and "poor" a value of 4. For the interviewer assessment of CI, "no CI" was assigned a value of 0, "may have CI" a value of 1, and "has CI" a value of 2. In the 2000 interview, there is a fourth classification of interviewer assessment (please refer to variable G517), and it is classified as "has CI." Combining these three variables results in a scale ranging from 0 to 11, with higher scores indicating worse cognitive function.

The interviewer assessment of cognitive impairment question was not asked for any wave prior to 2000; therefore, for waves 1995-1998, we created a 9-point scale by adding the proxy assessment of memory and IADL limitations. The 11-point scale and the 9-point scale were combined into a single variable that range from 0-11 or 0-9 depending on the year cognition was assessed (variable name *prxyscore_imp*). Therefore, beginning in the 2000 HRS interview, we used the 11-point scale and 9-point scale prior the 2000 HRS interview to classify proxy-respondents into Normal, CIND or Demented. This categorization is combined with the non-proxy categorization so that both proxy and non-proxy interview information is used to create the summary categorization (variable name: *cogfunction*).

Lastly, note that the dataset also contains all the variables used to create the summary scores with imputed values. For web cases, the mode adjustment results in a value for *cogtot27_imp* that is one less than sum of the constituent measures.

The classifications and their relevant cut points are summarized in Table 1. The variable names and labels included in this dataset are in Table 2. The data are released in wide format, but the code to reshape to long format is included at the end of this document.

Papers that use the Langa-Weir Classifications

Davydow D, Levine D, Zivin K, Katon W, Langa KM. The association of depression, cognitive impairment without dementia, and dementia with risk of ischemic stroke: A cohort study. Psychosomatic Medicine. 2015; 77(2): 200-208.

Langa KM, Larson E, Crimmins E, Faul J, Levine D, Kabeto M, Weir D. A comparison of the prevalence of dementia in the United States in 2000 and 2012. JAMA Internal Medicine. 2017; 177(1): 51-58.

Wei M, Kabeto M, Langa KM, Mukamal K. Multimorbidity and physical and cognitive function: performance of a new multimorbidity-weighted index. J Gerontol A Biol Sci Med Sci. 2018; 73(2): 225-232.

Table 1. Cut-points on the self-respondent 27-point scale and proxy-respondent cognitive scales

Cognitive Function	Self-Respondent	Proxy Respondent	
	27-point scale (1995 onward)	9-point Scale 1995 – 1998	11-point Scale (2000 onward)
Normal	12 – 27	0 – 2	0 – 2
CIND	7 – 11	3 – 4	3 – 5
Demented	0 – 6	5 – 9	6 – 11

Table 2. Variable names and labels for Langa-Weir classification dataset	
Variable	**Label**
numiadl_impX	NUMIADLs
imparate_impX	Interviewer assessment of proxy
memoryp_impX	Proxy Assessment of Memory
fimrc_impX	IMPFLAG: IMMEDIATE WORD RECALL
fdlrc_impX	IMPFLAG: DELAYED WORD RECALL
fser7_impX	IMPFLAG: SERIAL 7S
fbwc20_impX	IMPFLAG: BACKWARDS COUNT FROM 20
imrc_impX	IMMEDIATE WORD RECALL
dlrc_impX	DELAYED WORD RECALL
ser7_impX	SERIAL 7S
bwc20_impX	BACKWARDS COUNT FROM 20
cogtot27_impX	TICS-m 27-point scale
proxyX	PROXY TYPE STATUS
cogfunctionX	Cognition Category: 1=Normal, 2=CIND, 3=Demented
fnumiadl_impX	IMPFLAG: NUMIADLs
fmemoryp_impX	IMPFLAG: Proxy Assessment of Memory
fimparate_impX	IMPFLAG: Interviewer assessment of proxy
prxyscore_impX	Total: Proxy Score (<2000 0-9; >=2000 0-11)
intrviewX	Interviewed this Wave
cogivewmodeX*	2018- :Cog Interview mode (1=Self-respondent Interviewer administer FTF/TEL, 2=self-respondent, self-administer WEB, 3= Proxy-respondent Interviewer administer FTF/TEL)

X=1995, 1996, 1998, 2000, 2002, 2006, 2008, 2010, 2012, 2014, 2016, 2018 & 2020. For imparate_impX and
fimparate_impX, we have for 2000, 2002, 2006, 2008, 2010, 2012, 2014, 2016, 2018 & 2020
*This variable is available beginning 2018. You may use to identify those completed the web-based interview.

SAS code to reshape data from wide to long format

```sas
/**Macro to reshape data from wide to long format*/
libname cog "...\Cognitive function\data\";

**********************************************************************;
*Note:      1) Interviewer assessment of proxy started in the HRS 2000  *;
*           2) Cognition Interview mode started in 2018                  *;
**********************************************************************;
data work.cognidata;
set cogo.cogfinalimp_9520wide;
run;

%macro cognl(year);
data work.cogd&year (keep= hhid pn studyyr numiadl_imp imparate_imp memoryp_imp fimrc_imp fdlrc_imp fser7_imp
fbwc20_imp imrc_imp dlrc_imp
ser7_imp bwc20_imp cogtot27_imp proxy cogfunction fnumiadl_imp fmemoryp_imp fimparate_imp prxyscore_imp
cogivewmode intrview);
set work.cognidata;
if intrview&year=1; studyyr=&year;

rename numiadl_imp&year=numiadl_imp imparate_imp&year=imparate_imp memoryp_imp&year=memoryp_imp
fimrc_imp&year=fimrc_imp
fdlrc_imp&year=fdlrc_imp fser7_imp&year=fser7_imp fbwc20_imp&year=fbwc20_imp imrc_imp&year=imrc_imp
dlrc_imp&year=dlrc_imp
ser7_imp&year=ser7_imp bwc20_imp&year=bwc20_imp cogtot27_imp&year=cogtot27_imp proxy&year=proxy
cogfunction&year=cogfunction fnumiadl_imp&year=fnumiadl_imp
fmemoryp_imp&year=fmemoryp_imp fimparate_imp&year=fimparate_imp prxyscore_imp&year=prxyscore_imp
cogivewmode&year=cogivewmode intrview&year=intrview;
run;
proc sort data=work.cogd&year;
 by hhid pn;
%mend;

%cognl(1995); %cognl(1996); %cognl(1998); %cognl(2000); %cognl(2002); %cognl(2004); %cognl(2006);
%cognl(2008); %cognl(2010); %cognl(2012); %cognl(2014); %cognl(2016); %cognl(2018); %cognl(2020);


data work.cognfinalimp_9518long;
set work.cogd1995 work.cogd1996 work.cogd1998 work.cogd2000 work.cogd2002 work.cogd2004 work.cogd2006
work.cogd2008
    work.cogd2010 work.cogd2012 work.cogd2014 work.cogd2016 work.cogd2018 work.cogd2020;

label numiadl_imp        ="`num': NUMIADLs"
          memoryp_imp        ="Proxy Assessment of Memory"
          imparate_imp       ="Interviewer assessment of proxy"
```

```sas
         fimrc_imp         ="IMPFLAG: IMMEDIATE WORD RECALL"
         fdlrc_imp         ="IMPFLAG: DELAYED WORD RECALL"
         fser7_imp         ="IMPFLAG: SERIAL 7S"
         fbwc20_imp        ="IMPFLAG: BACKWARDS COUNT FROM 20"
         imrc_imp          ="IMMEDIATE WORD RECALL"
         dlrc_imp          ="DELAYED WORD RECALL"
         ser7_imp          ="SERIAL 7S"
         bwc20_imp         ="BACKWARDS COUNT FROM 20"
         cogtot27_imp      ="TICS-m 27-point scale"
         proxy             ="PROXY TYPE STATUS"
         cogfunction       ="Cognition Category: 1=Normal, 2=CIND, 3=Demented"
         fnumiadl_imp      ="IMPFLAG: NUMIADLs"
         fmemoryp_imp      ="IMPFLAG: Proxy Assessment of Memory"
         fimparate_imp     ="IMPFLAG: Interviewer assessment of proxy"
         prxyscore_imp     ="Total: Proxy Score (<2000 0-9; >=2000 0-11)"
         cogivewmode       ="2018-: Cognition Interview mode  (1=FTF/TEL, 2=WEB, 3=Porxy R)"
         intrview          ="Interviewed this Wave"
         studyyr           ="Study year";
run;
```

Stata code to reshape data from wide to long format

```stata
 /**Macro to reshape data from wide to long format*/



#delimit ;

*use "C:\DATA\Ahead_hrs\Cognition92_06 Imputed\LangaWeir\cogfinalimp_9516wide.dta";
use "C:\Users\mkabeto\Dropbox (University of Michigan)\HRS\HRS Cognition data\data\cogfinalimp_9520wide.dta";
tempfile widefile;
save widefile, replace;

/**HRS interview 2018 - 2020*/
 foreach num of numlist 2018 2020 {;
 use widefile.dta;
 tempfile longfile`num';
 keep hhid pn *`num';
 keep if intrview`num'==1;
 foreach x in "bwc20_imp" "cogfunction" "cogtot27_imp" "dlrc_imp" "fbwc20_imp" "fdlrc_imp" "fimparate_imp"
"fimrc_imp" "fmemoryp_imp" "fnumiadl_imp"
           "fser7_imp" "imparate_imp" "imrc_imp" "intrview" "memoryp_imp" "numiadl_imp" "proxy" "prxyscore_imp"
"ser7_imp" "cogivewmode" {;
  rename `x'`num' `x';
  };
 gen studyyr=`num';
 save longfile`num', replace;
 };
```

```
/*Separate for the 1995 and 1998 because interviewer's assessment respondent was not asked**/
foreach num of numlist 1995 1996 1998  {;
 use widefile.dta;
 tempfile longfile`num';
 keep hhid pn *`num';
 keep if intrview`num'==1;
 foreach x in "bwc20_imp" "cogfunction" "cogtot27_imp" "dlrc_imp" "fbwc20_imp" "fdlrc_imp" "fimrc_imp" "fmemoryp_imp"
"fnumiadl_imp"
           "fser7_imp" "imrc_imp" "intrview" "memoryp_imp" "numiadl_imp" "proxy" "prxyscore_imp" "ser7_imp" {;
  rename `x'`num' `x';
  };
 gen studyyr=`num';
 save longfile`num', replace;
 };

 /**HRS interview 2000 - 2018*/
 foreach num of numlist 2000 2002 2004 2006 2008 2010 2012 2014 2016 {;
 use widefile.dta;
 tempfile longfile`num';
 keep hhid pn *`num';
 keep if intrview`num'==1;
 foreach x in "bwc20_imp" "cogfunction" "cogtot27_imp" "dlrc_imp" "fbwc20_imp" "fdlrc_imp" "fimparate_imp"
"fimrc_imp" "fmemoryp_imp" "fnumiadl_imp"
           "fser7_imp" "imparate_imp" "imrc_imp" "intrview" "memoryp_imp" "numiadl_imp" "proxy" "prxyscore_imp"
"ser7_imp" {;
  rename `x'`num' `x';
  };
 gen studyyr=`num';
 save longfile`num', replace;
 };

 /**HRS interview 2018 - 2020*/
 foreach num of numlist 2018 2020 {;
 use widefile.dta;
 tempfile longfile`num';
 keep hhid pn *`num';
 keep if intrview`num'==1;
 foreach x in "bwc20_imp" "cogfunction" "cogtot27_imp" "dlrc_imp" "fbwc20_imp" "fdlrc_imp" "fimparate_imp"
"fimrc_imp" "fmemoryp_imp" "fnumiadl_imp"
           "fser7_imp" "imparate_imp" "imrc_imp" "intrview" "memoryp_imp" "numiadl_imp" "proxy" "prxyscore_imp"
"ser7_imp" "cogivewmode" {;
  rename `x'`num' `x';
  };
 gen studyyr=`num';
 save longfile`num', replace;
 };
```

```stata
  /**Appending all the files: Note the 2020 is already in the memory**/
 foreach file in longfile1995 longfile1996 longfile1998 longfile2000 longfile2002 longfile2004 longfile2006
longfile2008 longfile2010
                longfile2012 longfile2014  longfile2016 longfile2018 {;
                        append using "`file'";
                        };

label var  bwc20_imp        "BACKWARDS COUNT FROM 20";
label var  cogfunction      "Cognition Category: 1=Normal, 2=CIND, 3=Demented";
label var  cogtot27_imp     "TICS-m 27-point scale";
label var  dlrc_imp         "DELAYED WORD RECALL";
label var  fbwc20_imp       "IMPFLAG: BACKWARDS COUNT FROM 20";
label var  fdlrc_imp        "IMPFLAG: DELAYED WORD RECALL";
label var  fimparate_imp    "IMPFLAG: Interviewer assessment of proxy";
label var  fimrc_imp        "IMPFLAG: IMMEDIATE WORD RECALL";
label var  fmemoryp_imp     "IMPFLAG: Proxy Assessment of Memory";
label var  fnumiadl_imp     "IMPFLAG: NUMIADLs";
label var  fser7_imp        "IMPFLAG: SERIAL 7S";
label var  hhid             "HOUSEHOLD IDENTIFICATION NUMBER";
label var  imparate_imp     "Interviewer assessment of proxy";
label var  imrc_imp         "IMMEDIATE WORD RECALL";
label var  intrview         "Interviewed this Wave";
label var  memoryp_imp      "Proxy Assessment of Memory";
label var  numiadl_imp      "NUMIADLs";
label var  pn               "RESPONDENT PERSON IDENTIFICATION NUMBER";
label var  proxy            "PROXY TYPE STATUS";
label var  prxyscore_imp    "Total: Proxy Score (<2000 0-9; >=2000 0-11)";
label var  ser7_imp         "SERIAL 7S";
label var  cogivewmode       "2018-:Cog Interview mode (1=Self-R (FTF/TEL), 2=Self-R WEB, 3=Porxy-R (FTF/TEL)";
label var  studyyr          "Study year";


*save "cognfinalimp_9520long.dta;

 #delimit cr
```