Creating Domain Specific Disability Indicators Using the WG Short Set on Functioning (WG-SS) (SAS)

Introduction

Initial analyses using the Washington Group Short Set on Functioning (WG-SS) were based upon overall disability indicators; that is, measures of disability considering ***all*** six domains of functioning. These overall indicators defined either a dichotomous outcome indicator, identifying those *with* and *without* disability, or more granular measures based on the severity of functional limitations [see: ***Analytic Guidelines: Creating Disability Status Identifiers Using the WG-SS***].

The WG-SS, comprised of questions on difficulty with functioning in six basic activity domains and each with four possible response categories [see Box 1], can also be used to create other indicators of disability status. The creation of other indicators may be based on the number of domains with functioning (at a level of interest) or on some subset of functioning domains, either alone or combination. Examples of these indicators include determining prevalence of those experiencing at least *a lot of difficulty* in two or more domains, those experiencing difficulty in a particular domain such as vision, or those experiencing difficulty in two specific domains such as vision and hearing. This report discusses the creation of **domain specific indicators**, indicators based on the number of domains where functional limitation is reported and indicators that include information on two or more indicators.

Box 1: The WG Short Set on Functioning (WG-SS)

1. Do you have difficulty seeing even if wearing glasses?
2. Do you have difficulty hearing even if using a hearing aid?
3. Do you have difficulty walking or climbing steps?
4. Do you have difficulty remembering or concentrating?
5. Do you have difficulty with (self-care such as) washing all over or dressing?
6. Using your usual language, do you have difficulty communicating (for example understanding or being understood by others)?

Response categories:
No difficulty; Some difficulty; A lot of difficulty; Cannot do at all

Creating Domain-Specific Measures of Difficulty

Each of the functioning domains in the WG-SS (seeing, hearing, mobility, cognition, self-care and communication) is assessed using the same four answer categories: *no difficulty, some difficulty, a lot of difficulty* and *cannot do at all*. Summary statistics can be created for each of these domain-specific *disability types* individually.

A frequency distribution for each independent domain will provide a breakdown of responses to the functioning questions – and domain-specific prevalence estimates for each level of difficulty. Results are independent of the other domains and do not account for the fact that an individual may have difficulty in more than one domain of functioning.

Table 1. Frequency distribution - difficulty seeing

Difficulty Seeing	Frequency	Percent
No difficulty	13,690	81.6
Some difficulty	2,708	16.1
A lot of difficulty	333	2.0
Cannot do at all	36	0.2
Unknown	10	0.0
Total	16,777	100.0

As shown in Table 1, 81.6% of this population had no difficulty seeing, 16.1% had some difficulty, 2% had a lot of difficulty and 0.2% reported cannot do at all. Using the WG-SS recommended cut point for creating a dichotomous disability status indicator, responses of *a lot of difficulty* or *cannot do at all*, the prevalence of seeing difficulty in this population would be 2.2% (combining the two rows in green).

Similar tables may be generated for each domain of functioning in the WG-SS.

Table 2 below provides an example of results for each of the six specific functional domains considered independently. Data are derived from a sample of the 2013 US National Health Interview Survey (NHIS) among the adult population 18 years and older.

Table 2. Prevalence (weighted %) by domain of functioning and degree of difficulty

Core Domain	No difficulty	Some difficulty	A lot of difficulty	Cannot do at all
Seeing	81.6	16.2	2.0	0.2
Hearing	81.6	16.4	1.8	0.1
Mobility	80.1	12.9	4.7	2.3
Cognition	81.9	15.7	2.3	0.1
Self-Care	95.7	3.2	0.7	0.4
Communicating	94.7	4.4	0.6	0.3

Indicators of difficulty/disability for each domain of functioning can be derived by adding across different column entries; so that for difficulty seeing, 2.2% have at least *a lot of difficulty* seeing (including those with *cannot do at all*); 18.4% have at least *some difficulty* seeing (including those with *a lot of difficulty* and *cannot do at all*).

Data like those presented above in Table 2 can answer the following questions:

- What percent of the population had *no difficulty* per domain of functioning?
  [Column 1: No difficulty]
- What percent of the population had only *some difficulty* in a given domain of functioning?
  [Column 2: Some difficulty]
- What percent of the population had at least *some difficulty* in a given domain of functioning?
  [Sum of Columns 2,3 and 4]

The same calculations can be made for other levels of difficulty: *a lot of difficulty* or *cannot do at all*.

Creating Indicators that Summarize Levels of Difficulty Across Domains of Functioning

1. An individual may have difficulty [at various levels] on one or more domains of functioning. Questions of interest might be:
   - What percent of the population had *some difficulty* on only one or two or more domains of functioning?
   - What percent of the population had *a lot of difficulty* on more than 1 domain of functioning?
   - What percent of the population had multiple domains that were answered *cannot do at all*?

To answer these types of questions, ***count*** the number of domains at the level of functioning of interest; that is, the number of domains (0 through 6) that are answered 1=*no difficulty*, or the number that are answered 2=*some difficulty*, 3=*a lot of difficulty or* 4=*cannot do at all*.

[SAS syntax for creation of the ***counts*** for each level of difficulty: SUM_1 for *no difficulty*, SUM_2 for *some difficulty*, SUM_3 for *a lot of difficulty* and SUM_4 for *cannot do at all*, is found in Appendix 1a.]

Frequency distributions of these four summation variables provides answers to the questions raised above. For example, the number of occurrences of the response *cannot do at all* (the variable label SUM_4 – see Appendix 1a) is seen in the table below. (Note: the variable labels SUM_1 – SUM_4 and SUM_234 relate to the SAS syntax; the choice of the variable label is up to the investigator).

Table 3. Frequency distribution of occurrences of the response *cannot do at all*.

Number of domains - *Cannot do at all*	**Frequency**	**Percent**
0	16,312	97.2
1	381	2.3
2	71	0.4
3	7	0.0
4	4	0.0
5	2	0.0
Total	16,777	100.0

From Table 3 we know that:

- 97.2% of the sample had none of the six questions with a response *cannot do at all*.
- 2.3% (n=381) had one domain coded *cannot do at all*.
- 2 individuals had 5 domains coded *cannot do at all* and
- no one had all six coded *cannot do at all.*

Similar results can be produced for each level of functioning: *a lot of difficulty* (SUM_3), *some difficulty* (SUM_2), and *no difficulty* (SUM_1) – as defined in Appendix 1a.

2. It is also possible to combine levels of functioning to determine functioning difficulty over multiple domains at more than one level of functioning to answer the question:

    - What percent of the population had at least *some difficulty* on one or more domains of functioning?

This question is answered by ***counting*** the number of domains (0 through 6) of functioning coded 2=*some difficulty*, 3=*a lot of difficulty* OR 4=*cannot do at all*.

[SAS syntax for creation of the ***count*** of the number of domains of functioning coded *some difficulty, a lot of difficulty* or *cannot do at all* – designated SUM_234, is found in Appendix 1b.]

A frequency distribution of this summation variable provides answers to the question raised above. The number of occurrences of the responses of at least *some difficulty* (the variable label SUM_234 – see Appendix 1b) is seen in the table below.

Table 4. Frequency distribution of occurrences of the response of at least *some difficulty*.

Number of Domains with at least *Some difficulty*	Frequency	Percent
0	9266	55.2
1	3839	22.9
2	1892	11.3
3	989	5.9
4	481	2.9
5	232	1.4
6	78	.5
Total	16777	100.0

From Table 4 we know that:

- 55.2% of the sample (n=9266) had none of the six questions with a response *some difficulty, a lot of difficulty* or *cannot do at all*.
- 22.9% (n=3839) had one domain coded *some difficulty, a lot of difficulty* or *cannot do at all*.
- 78 individuals (0.5% of the sample) had all six domains coded at least *some difficulty.*

Creating Disability Measures that Combine Information from Multiple Domains

In addition to providing information on single domains or across all domains as demonstrated above, it is possible to provide information on two or more selected domains as in this example which combines responses from the seeing and hearing domains to identify those who having seeing and hearing difficulties.

Example: Deafblindness

According to the first global report on deafblindenss: *At risk of exclusion from CRPD and SDGs implementation: Inequality and Persons with Deafblindness*[1]:

> Deafblindness is often underestimated and misunderstood, and this contributes significantly to the many barriers faced by persons with deafblindness. Some persons with deafblindness are completely deaf and blind, but many have a little sight and/or hearing they can use.
>
> Based on the Nordic definition[2], the World Federation of the Deafblind [WFDB] defines deafblindness as ***a distinct disability arising from a dual sensory impairment of a severity that makes it hard for the impaired senses to compensate for each other. In interaction with barriers in the environment, it affects social life, communication, access to information, orientation and mobility. Enabling inclusion and participation requires accessibility measures and access to specific support services, such as interpreter-guides, among others.***

Dual sensory loss and dual sensory impairment are other terms that are used for deafblindness.
The deafblind population includes more than the number of people who cannot see at all AND cannot hear at all.

Table 5. Cross-tabulation - difficulty seeing by difficulty hearing

		Difficulty Seeing					
		Unknown*	None	Some	A lot	Unable	**Total**
Difficulty Hearing	Unknown*	4	6	0	1	0	11
	None	3	11,734	1735	187	21	13,680
	Some	3	1,772	**869**	**102**	**7**	2,753
	A lot	0	167	**99**	**42**	**2**	310
	Unable	0	11	**5**	**1**	**6**	23
Total		10	13,690	2708	333	36	**16,777**

**Includes: Refused/Not ascertained/Don't know*

[1] Report available here: *https://senseinternational.org.uk/sites/default/files/WFDB_complete_Final.pdf*
[2] The Deafblind Nordic Cooperation Committee. *The Nordic definition of deafblindness*; Available from: *http://www.fsdb.org/Filer/DBNSK English.pdf*.

In this sample of 16,777 individuals 18 years and older:

- **6** individuals or **0.04%** of the sample could not see or hear at all;
- but including those with *a lot of difficulty* on one or both domains increases count to **51** individuals – a prevalence of **0.3%**;
- **add** those with *a lot of difficulty* or *cannot do* on one and at least *some difficulty* on the other (**213**), the prevalence is **1.5%**;
- **add** those with at least *some difficulty* on BOTH (**869**), the prevalence is **6.8%** [likely not included among the deafblind community].

The global report on deafblindenss referenced above stated that around **0.2%** of the world's population is living with severe deafblindness. Analysis of prevalence data also found that **2%** of the world's population lives with 'milder forms' of deafblindness. [See: *https://senseinternational.org.uk/sites/default/files/WFDB_complete_Final.pdf*].

The sample estimates above [derived from Table 5] align closely with the reported global estimates mentioned above.

Example: Cognitive-Communication Disorders

Cognitive-communication disorders are problems with communication that have an underlying cause in a cognitive deficit rather than a primary language or speech deficit. A cognitive-communication disorder can result from a stroke, or from a traumatic brain injury, a brain infection, a brain tumor, or a degenerative disease such as multiple sclerosis, Parkinson's disease, Alzheimer's disease, or another form of dementia. Cognitive-communication disorders can occur alone or in combination with other conditions, such as dysarthia (slurred speech), apraxia (inability to move the face and tongue muscles correctly to form words), or aphasia (impaired language). [Reference: https://tactustherapy.com/what-is-cog-comm/] Since these types of disorders are often age related, the discussion below focuses on the population 65 years of age or older.

Table 6 below examines the combined difficulties of cognition (remembering or concentrating) and communication for those 65 years of age or older.

Table 6. Cross-tabulation - difficulty remembering or concentrating by difficulty communicating

		Difficulty Remembering or Concentrating					
		Unknown*	None	Some	A lot	Unable	**Total**
Difficulty Communicating	Unknown*	9	2	0	0	0	11
	None	2	2,664	730	72	2	3,470
	Some	0	89	**116**	**30**	**1**	236
	A lot	0	9	**14**	**15**	**5**	43
	Unable	0	10	**4**	**1**	**2**	17
Total		11	2,774	864	118	10	**3,777**

**Includes: Refused/Not ascertained/Don't know*

It is estimated that approximately 50% of those who suffer stroke in the USA will experience a cognitive-communication disorder, as will about 66% of those who sustain traumatic brain injuries each year. The number of individuals with Alzheimer's type dementia, and thus experiencing cognitive-communication disorders, is currently estimated at one in 10 (10%) age 65 and older; and the percentage of people with Alzheimer's dementia increases with age: 3% of people age 65-74, 17% of people age 75-84, and 32% of people age 85 and older have Alzheimer's dementia.

[Source: Christman Buckingham SS and Sneed KE. Cognitive-Communication Disorder. Springer International Publishing AG 2017, J. Kreutzer et al. (eds.), Encyclopedia of Clinical Neuropsychology. https://link.springer.com/content/pdf/10.1007%2F978-3-319-56782-2_872-3.pdf; and Alzheimer's Association. 2019 Alzheimer's Disease Facts and Figures. Alzheimers Dement 2019;15(3):321-87. https://www.alz.org/media/documents/alzheimers-facts-and-figures-2019-r.pd]

The prevalence of these domains (cognition and communication) for the population 65 years and older is as follows: 3.4% of the sample had *a lot of difficulty* or *could not remember or concentrate at all* [118 and 10 respectively in Table 6 above]. Including those with *some difficulty* [864 in Table 6], the prevalence is 26.3%. Among those with communication difficulties, 1.6% recorded responses *a lot of difficulty* or *cannot do at all* [43 and 17 respectively in Table 6], and with *some difficulty* [236 in Table 6], the prevalence was 7.8%. [Source: US National Health Interview Survey (NHIS), 2013 - adult population 18 years and older. Note: non-household populations, i.e., those residing in nursing homes, are not covered in the NHIS.]

Combining these results as illustrated in the cross-tabulation Table 6 above shows that among this sample of 3,777 individuals 65 years and older:

- **2** individuals or **0.05%** of those sampled could not communicate or remember or concentrate at all;
- but including those with *a lot of difficulty* on one or both domains increases count to **23** individuals – a prevalence of **0.6%**;
- **add** those with *a lot of difficulty* or *cannot do* on one and at least *some difficulty* on the other (**72**), the prevalence is **1.9%**;
- **add** those with at least *some difficulty* on BOTH (**188**), the prevalence is **5.0%**

The results presented here are for demonstrations purposes. They are based on a single year of data from the NHIS, and the sample is rather small. If overall disability prevalence based on all six WG-SS questions is low, then parsing results based on responses to a single domain of functioning or combinations of domains will be subject to error due to small numbers. More accurate results may be achieved through the combination of several years of data. Taking that into consideration, these data illustrate the strengths of the WG-SS in providing the ability to examine difficulties across single and/or multiple domains of functioning thus reinforcing the complex nature of disability and offering the means to analyze those data to address multiple issues and meet the needs of multiple users.

Appendix 1: SAS Syntax

Appendix 1a:
SAS syntax to create counts for each level of difficulty, (SUM_1 to SUM_4).
Codes 7 (REFUSED), 8 (NOT ASCERTAINED) and 9 (DON'T KNOW) are coded as MISSING.

```
If VIS_SS in (1,2,3,4) then Vision= VIS_SS;
If HEAR_SS2 in (1,2,3,4) then Hearing=HEAR_SS2;
Else If HEAR_SS2 in (7,8,9  ) then Hearing=.;
If MOB_SS2 in (1,2,3,4) then Mobility=MOB_SS2;
Else If MOB_SS2 in (7,8,9) then Mobility=.;
 If COG_SS in (1,2,3,4) then Cognition=COG_SS;
Else If COG_SS in (7,8,9) then Cognition=.;
If COM_SS in (1,2,3,4) then Communication =COM_SS;
Else If COM_SS in (7,8,9) then Communication =.;
If UB_SS in (1,2,3,4) then Self_Care=UB_SS;
Else If UB_SS in (7,8,9) then Self_Care=.;

If missing (Vision) and missing(Hearing) and missing(Mobility) and
missing(Communication) and  missing(Cognition) and missing(Self_Care ) then
COUNT_SUM_1=.;
Else If (Vision in(2,3,4)) and (Hearing in(2,3,4)) and (Mobility in(2,3,4)) and
(Cognition in(2,3,4)) and (Self_Care in(2,3,4)) and (Communication  in(2,3,4))
then COUNT_SUM_1=0;
Else COUNT_SUM_1=SUM( (Vision =1), (Hearing =1), (Mobility =1), (Cognition =1),
(Self_Care=1),(Communication  =1) );

If missing (Vision) and missing(Hearing) and missing(Mobility) and
missing(Communication) and  missing(Cognition) and missing(Self_Care ) then
COUNT_SUM_2=.;
Else If (Vision in(1,3,4)) and (Hearing in(1,3,4)) and (Mobility in(1,3,4)) and
(Cognition in(1,3,4)) and (Self_Care in(1,3,4)) and  (Communication  in(1,3,4))
then COUNT_SUM_2=0;
Else COUNT_SUM_2=SUM( (Vision =2),(Hearing =2),(Mobility =2),(Cognition
=2),(Self_Care =2),(Communication  =2) );

If missing (Vision) and missing(Hearing) and missing(Mobility) and
missing(Communication) and  missing(Cognition) and missing(Self_Care ) then
COUNT_SUM_3=.;
Else If (Vision in(1,2,4)) and (Hearing in(1,2,4)) and (Mobility in(1,2,4)) and
(Cognition in(1,2,4)) and (Self_Care in(1,2,4)) and (Communication  in(1,2,4))
then COUNT_SUM_3=0;
Else COUNT_SUM_3=SUM( (Vision =3),(Hearing =3),(Mobility =3),(Cognition
=3),(Self_Care =3),(Communication  =3) );

If missing (Vision) and missing(Hearing) and missing(Mobility) and
missing(Communication) and  missing(Cognition) and missing(Self_Care ) then
COUNT_SUM_4=.;
Else If (Vision in(1,2,3)) and (Hearing in(1,2,3)) and (Mobility in(1,2,3)) and
(Cognition in(1,2,3)) and (Self_Care in(1,2,3)) and (Communication  in(1,2,3))
then COUNT_SUM_4=0;
Else COUNT_SUM_4=SUM( (Vision =4),(Hearing =4),(Mobility =4),(Cognition
=4),(Self_Care =4),(Communication =4) );
```

Appendix 1b:
SAS syntax to create a count of the number of domains of functioning coded some difficulty, a lot of difficulty or cannot do at all, (SUM_234).

```
If missing (Vision) and missing(Hearing) and missing(Mobility) and
missing(Communication) and  missing(Cognition) and missing(Self_Care ) then
SUM_234=.;
Else If (Vision =1) and (Hearing =1) and (Mobility =1) and (Cognition =1) and
(Self_Care =1) and
(Communication =1)   then SUM_234=0;
Else SUM_234=SUM( (Vision in(2,3,4)),(Hearing in(2,3,4)),(Mobility
in(2,3,4)),(Cognition in(2,3,4)),(Self_Care in(2,3,4)), (Communication  in(2,3,4))
);
```