

**NHANES 2001-2002 Data Release  
January 2005  
Household Interview Questionnaire**

**Cognitive Functioning (CFQ\_B)**

Survey Years Included in this File: 2001-2002

**Questionnaire Section Characteristics:**

**Questionnaire Section Description:**

This section contains the results of a version of the WAIS III (Wechsler Adult Intelligence Scale, Third Edition) Digit Symbol – Coding module conducted during the household interview. The subtest was administered under a licensing agreement with The Psychological Corporation. In this coding exercise, participants copy symbols that are paired with numbers. Using the key provided at the top of the exercise form, the participant draws the symbol under the corresponding number. The score is the number of correct symbols drawn within a period of 120 seconds. One point is given for each correctly drawn symbol completed within the time limit. The maximum score is 133. Sample items are provided for initial practice. Participants who are unable to complete any of the sample items do not continue with the remainder of the exercise.

The protocol for administering this exercise can be found in Appendix 1 at the end of this document. Scoring guidelines are found in Appendix 2. These protocols are based on instructions found in the WAIS III Administration and Scoring Manual (see References).

**Interview Setting:**

Household interview

**Eligible Sample and Section-Specific Exclusion Criteria:**

60+ years. Proxy interviews are ineligible.

**Quality Control:**

10% of the forms were scored independently for a second time, and the two scores were compared and reconciled when necessary.

**Additional links:**

None

**Analytic Notes:**

Due to the sensitive nature of this exercise, non-response was relatively high, and varied by race-ethnicity, age and possibly other factors. Analysts are encouraged to conduct a thorough non-response bias analysis of these data as part of their preliminary research plan.

CFD030: Instructions for the exercise were given at this time. Persons who refused the sample were coded as “7” and did not continue with the remainder of the exercise.

CFD040: Other reasons for not completing the sample included literacy issues (i.e., unable to read or write), home environment issues (writing table or surface for exercise was unavailable), or that the survey participant was in a hurry to complete the interview and did not have the time to do the exercise.

CFDFINSH and CFDRIGHT: There are some few instances where both of these scores are 0 even though the data show that participants used the full two minutes to complete the exercise (CFD050=1). There are also a small number of cases for which the DSS form was misplaced so that these scores are shown as missing.

**Data Access:**

The CFQ data are publicly available at [www.cdc.gov/nchs/nhanes.htm](http://www.cdc.gov/nchs/nhanes.htm)

**References:**

WAIS-III WMS-III Technical Manual. The Psychological Corporation, Harcourt Brace and Company. San Antonio:1997

Wechsler, David. Administration and Scoring Guide, WAIS – III, Wechsler Adult Intelligence Scale – Third Edition. The Psychological Corporation, Harcourt Brace and Company. San Antonio:1997

## NHANES DIGIT SYMBOL SUBSTITUTION EXERCISE (CFQ\_B) : Interviewer Instructions

### Introduction

Cognitive functioning in age 60 years old and older will be assessed using the Digit Symbol Substitution Test (DSS). The DSS requires that the SP correctly code a series of symbols in 120 seconds. This exercise is generally thought to be a more sensitive measure of dementia than the widely used Mini-Mental Status Exam, and has been administered in the National Institute on Aging's Health ABC study. The DSS requires response speed, sustained attention, visual spatial skills, associative learning, and memory. The more blocks correctly completed, the higher the score. If necessary, you can refer to it as an exercise or an activity but do not use the word "test" in front of the SP.

Diminishing cognitive skills have been associated with many medical conditions and illnesses. Further, cognitive functioning in the aging population may significantly decline as a result of certain risk factors which can have a significant impact on physical functioning and the quality of a person's life. In NHANES, we have a unique opportunity to study how mental or cognitive functioning is related to illnesses and conditions. The results of this exercise will also help researchers understand the relationship between diminishing mental capacity and mortality.

It is **critical** that each SP who is 60 years old or older be given the opportunity to complete this exercise. Just as reading questions exactly as worded is critical throughout the interview, it is also critical that each SP receives the same instructions so that results are valid.

The computer assisted personal interview software installed on your computer will automatically skip the DSS section for proxy interviews. The DSS exercise should be done through interpreters when it is necessary.

### Exercise Environment

Before starting the exercise, you need to determine whether it can be done in a quiet place with minimal distractions at a desk or table the participant can use as a writing table. If possible, find out if there is someone else at home that can answer the phone or the door to avoid interruptions or if there is an answering machine that can take calls. Explain that the activity requires two or three minutes of quiet, uninterrupted time. If necessary, ask if there is another room where distractions will be fewer and the situation quieter.

In almost all cases, you are expected to answer this question using code 1 (YES – THE TEST **CAN BE ADMINISTERED WITH MINIMAL DISTRACTION**). Unless there are obvious **serious** distractions that **cannot be eliminated**, attempt to do the sample block exercise with the SP. CFQ010 is **only** to be coded as a "2" (NO – THE TEST CANNOT BE ADMINISTERED WITH MINIMAL DISTRACTION) if there are definite distractions that cannot be eliminated. Otherwise, **always** continue with the administration of the sample and code CFQ010 as "1".

### Administering the Sample

In almost all cases, you should give the SP the opportunity to complete the sample. Do not assume that everyone who has a physical or mental impairment will be unable to do the sample.

To start the sample, be sure to have all your materials ready. These include a DSS coding sheet, the DSS hand cards, a stopwatch, at least two regular pencils with erasers, and a blue pencil. **Do not** allow the SP to use a pen for this exercise.

- Be certain that the SP wears his/her glasses if needed.

At this point you will go to the hard copy instructions for administering the sample exercise. These instructions are in your hand card booklet behind the tab labeled “DSS”. Speak deliberately and slowly. For those SPs who are hearing impaired, speak **low** not loudly. Read the script **exactly as it is written**.

Put the hardcopy exercise sheet in front of the SP. Point to the key above the test items. Say: *“Look at these boxes. Notice that each has a number in the upper part and a special mark in the lower part. Each number has its own mark.”* Point to 1 and its mark in the key, then 2 and its mark. Then point to the seven squares located to the left of the heavy black line and say: *“Now look down here where the squares have numbers in the top part but the squares at the bottom are empty. In each of the empty squares, put the mark that should go there. Like this.”*

Point to the first sample item, then point back to the key to show its corresponding mark. Say: *“Here is a 2: the 2 has this mark. I put it in this empty square, like this.”* You will then write in the symbol below the 2. Next, point to the second sample item. Say: *“Here is a 1; the 1 has this mark (point to the 1 and then to the mark below the 1 in the key), so I put it in this square.”* Fill in the symbol for a 1. Now, point to the third sample item. Say: *“This number is a 3; the 3 has this mark”* (point to the third square and to the mark below the 3 in the key). Say: *“So I put it in this square.”* Write in the symbol. After you have completed the first three sample items, say, *“Now you fill in the squares up to this heavy line.”*

If the **SP draws all sample figures correctly**, offer encouragement by saying “yes” or “right”. When all four of the sample items have been completed, say: *“Now you know how to do them. When I tell you to start, you do the rest of them.”*

If the **SP leaves any sample boxes empty**, ask the SP to complete them before you make any corrections. **If the SP draws some symbols incorrectly**, make corrections to the incorrect entries with your blue pencil and provide verbal instruction and help as necessary. (See examples #1 and #2.) Ask the SP if s/he has any questions before starting the actual timed exercise. You must evaluate the SP’s ability to understand the sample to determine whether s/he can continue with the timed exercise.

When making this evaluation, remember the following points:

- The criteria for determining whether the SP should proceed to the timed exercise is **not** whether s/he completes all four sample boxes correctly but rather whether, in your judgment, the SP understands the task.
- A successful completion of the sample is one where the SP understands the task at the end of the sample and understands why any corrections were made to the sample blocks he or she may have drawn erroneously. An SP can be considered to complete the sample correctly even if he or she draws 3 out of the four symbols incorrectly as long as you believe s/he understands the task after you have corrected him or her.

- If the SP draws **all four of** the symbols **incorrectly** (See example #3) the timed exercise should **not** be administered. Note: it may be difficult to prohibit the SP from continuing with the timed exercise under these circumstances. If you think it is too awkward to stop the SP at this point allow him/her to continue with the timed exercise. However if this is the case, code CFQ030 UNABLE TO COMPLETE THE SAMPLE (code 2) and record the situation in detail on the hard copy exercise.
- If the SP did most of the sample blocks wrong and even after correcting him or her you believe the SP still does not understand the task s/he should not continue with the timed exercise.

In **rare** cases you may determine that the SP is unable to do this exercise before the section is introduced or the sample is administered. Examples of this are when the SP is blind, unable to use his/her hands, or is bedridden. If this is the case, code CFQ010 as “1” and skip the reading of the screen statements at screen CFQ020 and enter a “2” at CFQ020 **without asking** about glasses. This will allow you to continue to the next screen. At CFQ025, press ENTER without reading any instructions to the SP. This will take you to CFQ030 where you can enter the fact that the SP did not complete the sample and then go to screen CFQ040 where you can enter a specific reason.

### **Coding the Completion of the Sample**

Use code 1 (COMPLETED SAMPLE) if the SP has drawn all symbols correctly or s/he has drawn some symbols incorrectly but, you believe s/he understands the task.

When the SP **refuses** to complete the sample, use the F5 key (REFUSED) when coding CFQ030.

**Only use code “2”** (UNABLE TO COMPLETE SAMPLE) when the SP did not successfully complete the sample due to physical, cognitive, mental, or other reasons. CAPI will then display screen CFQ040 and you will be required to code the reason the SP was unable to complete the sample.

At CFQ040, be sure to choose a 1 or a 2 for any physical or cognitive impairment that caused the sample to be skipped. When an SP has both a physical and a cognitive limitation that prevents him/her from completing the sample, choose cognitive over physical. **ONLY** use code 3 (other, specify) for reasons that are neither physical nor cognitive. Be sure to distinguish between physical and cognitive limitations. Examples of physical limitations are arthritis, Parkinson’s disease, stroke or vision problems, cerebral palsy, injury to the writing hand and paralysis. An example of a cognitive limitation is the inability to understand the instructions. An example of another reason is when there is no table or flat surface for writing.

### **Administering the Timed Exercise**

Go on to the administration of the timed exercise if the SP seems to understand the task.

Use the hard copy instructions printed on the back of the DSS hand card to administer the exercise. Point to the first square to the right of the heavy line and say: *“Begin here and fill in as many as you can, one after the other without skipping any. Keep working until I tell you to stop. Work as quickly as you can without making any mistakes.”* Sweep across the first row with your

finger and say: *“When you finish this line, go on to this one.”* Point to the first square in the second row. Then point to the heavy black line and say: *“Go ahead.”* Begin timing.

If the SP asks what they should do if they make a mistake, encourage them to work as fast as they can. They are permitted to use the eraser to correct their mistakes but speed is more important. You can tell them the exercise is timed but do not tell them what the time limit is. If they use the eraser excessively or make spontaneous corrections that slow them down, remind them that speed is more important than neatness.

If the SP omits an item or starts to do only one type (see example #4), point to the first skipped block and say: *“Do them in order. Don’t skip any.”* If the SP skips an entire line (see example #5), allow him or her to continue without interruption. If the SP tries to complete a row in reverse order, point to the first block in the row, remind them to start at the beginning of the row and not to skip any. Do not stop the timer if you have to correct the SP during the exercise. If the SP volunteers the information that s/he is dyslexic, record that on the hard copy DSS coding sheet after you leave the household. The scorer will use this information.

Provide no further assistance except to remind the SP to continue until instructed to stop. Interviewers must watch the SP closely during the entire 2 minutes of the test in order to catch any skipped blocks right away. At the end of 120 seconds, say “Stop”.

Record the participant number from the CAPI screen on the hard copy form and circle the NO next to the words BREAK OFF on the hard copy form (see example #6).

Also record the SP ID on the form if it is available.

### **Coding the Completion of the Timed Exercise in CAPI**

When coding the completion of the sample use 2 MINUTES COMPLETED (code 1) in CAPI if the SP has worked for the **entire 2 minutes** regardless of the number of items completed.

**If the SP could/would not start the timed exercise after successfully completing the sample or if the SP quits once the test has begun and the 2 minutes are not up**, be sure to note this as a BREAK OFF to the timed exercise in CAPI. Also note this on the hardcopy form by circling the YES next to the words BREAK OFF. This will save the scorer and the data entry person time since break offs are not scored. All DSS sheets are to be placed in the household folders and returned to the field office. Sheets will be scored at the home office.

## Guidelines for Scoring the NHANES Digit Symbol Substitution Test (DSST)

There are several functions that are involved in the DSST. The ability to associate or pair a symbol to the correct digit (Pairing) and the ability to remember the pairs (Free Recall) are two of the functions. The other functions involved are perception and graphomotor speed. We have chosen to emphasize associative learning over graphomotor speed. This is done by our being lenient in scoring the symbols. It must be noted, however, that leniency has its limits. If we were to accept almost anything as correct, there would be no validity to the data collected and examinees who took the time to draw clearly recognizable symbols would be penalized compared to faster but very imprecise examinees.

This test is administered to people 60 years and older who may be physically impaired and imprecise in drawing due to arthritis, tremors or weakness in their hands. However, if their cognitive function is still sharp, they will be able to draw symbols using memory and will not have to keep referring to the key. The symbols they draw may be shaky or imprecise but we will accept those as correct as long as the symbol is clearly identifiable.

Scoring is always to be done with the use of a template. A single skipped block should be **circled** in colored pencil or marker. Be careful not to obscure any part of symbols drawn in adjacent blocks. Incorrectly drawn symbols should be marked with a small x above the block containing the symbol. The x may be placed either in the block containing the digit or directly above the digit. **It is essential that these x marks be prominent enough so they are not missed when counting the number of incorrect symbols.**

A single blank block, skipped by the examinee, is not counted as incorrect. It is also not counted as completed. Thus, in using the template, if the examinee completed up to and including block number 49 but skipped two (non-consecutive) blocks (for instance, #12 and #23) and got all the rest correct, the score is 47/0. The maximum score is 133 points since there are 133 blocks.

Two consecutive blank blocks indicate the end of the completed items. Any blocks filled in after the two blank blocks are not to be counted at all. **Exception:** If SP has skipped an entire line of blocks and then completed several consecutive blocks on the following line, score as though the blank line of blocks does not exist. This exception also applies if there is a systematic pattern to the line completion that involves skipped blocks, e.g., if the SP completes only the blocks on each line that are to the right of the “end-of-sample” heavy black line.

NCHS will publish the number of correctly drawn symbols which is calculated as the number of blocks completed minus the number wrong. The score is to be written at the lower RIGHT of the test sheet to the right of the SP ID and consists of the number of blocks completed, a slash, and then the number of incorrect blocks within the completed blocks.

### Variations from perfection

All of the following are acceptable variations from perfection when considered individually. However, if a symbol is drawn with more than two of these variations, then it becomes a borderline symbol and other criteria must be used to decide how to score it. For example, if a block contains a symbol that has a correction, and it also is drawn at a slight angle, and it also contains rounded corners, it might require a second opinion.

## 1. Corrections

If it appears that the examinee has tried to correct a symbol, score it correct if all the strokes necessary to make a correctly drawn symbol are present, even if there are extra strokes. Try to determine if some strokes are darker or more emphasized than others; this would indicate an attempt to make a correction. Although you won't know which stroke was drawn first, it is unlikely an examinee would change a correct symbol into an incorrect symbol.

## 2. Extra "tails"

If a symbol has a tail on any of the strokes, the symbol is to be scored correct if the tail is shorter than the stroke it is connected to. The symbol for a 5, for example, can be drawn as the letter "U". A "U" with a tail is acceptable.

## 3. Openings in symbols

If a symbol is drawn with an opening where two strokes should have been connected, the symbol is scored correct as long as it does not resemble the symbol for another digit. For example, if the examinee draws an "O", which is the symbol for a 6, the symbol is scored correct even if the circle or oval is slightly open. However, if the circle is left so open at the top as to resemble a U or is so open on the left side so as to resemble the symbol for a 3, then it is scored incorrect. The symbol for a 5 or a 3 cannot be drawn as a completely enclosed square because a closed square is a different symbol from one that is open at the left side or at the top. A HARD CALL: There are times when a symbol drawn for a 5 and a symbol drawn for a 6 are nearly identical. They both look like a U or an oval that is slightly open at the top. The scorer can decide to score both instances as correct, under the "leniency" guideline. Similarly, the symbol for a 4 and the symbol for a 5 may be drawn so they are nearly indistinguishable. The scorer may use his/her judgment and allow both blocks to be scored as correct. There are other symbols that may fall into this same situation. It is important to view the symbol drawn in light of how the SP drew the symbol for the same digit elsewhere.

## 4. Different angles

A symbol is scored correct even if the strokes are at a different angle from the key symbol as long as the symbol drawn is not more than 45 degrees off. Rotation errors are symbols that have been rotated more than 45 degrees. Sometimes, incorrect symbols are rotated 90 or even 180 degrees. This amount of rotation is a cognitive error. If and only if the examinee tells the interviewer that he/she is dyslexic and the interviewer has noted this on the test sheet, then symbols which are drawn exactly backward are scored correct. An L is the symbol for a 4 and the key shows the two strokes form a 90 degree angle. An examinee may draw the L so that it forms an angle slightly more or less than 90 degrees. This is to be scored correct unless the angle is off by more than 45 degrees. If the L looks more like a V, then it is incorrect. If the L looks more like a straight line or a U, then it is incorrect. An X must not be rotated so much that it looks like a cross in a Red Cross symbol. Anything short of that is acceptable.

## 5. Different proportions

A symbol is scored as correct even if the strokes are not in the same proportion to one another as the strokes in the key symbol as long as the symbol drawn does not resemble the symbol for another digit. For example, the two strokes that make up the symbol for the digit 7 may not be exactly the same length. The same is true of an X which is the symbol for 8. The X is correct even if it leans at an angle and the strokes are not of equal length. However, if one of the



strokes of the X is so short that it doesn't cross and go slightly beyond the other stroke, then it is scored incorrect. The strokes of an equal sign, the symbol for 9, do not have to be the same length in order to be scored correct.

#### 6. Placement of strokes relative to one another

A symbol is correct even if the placement of the strokes is somewhat different from the key symbol. For example, if the horizontal stroke of an upside-down T does not cross the vertical stroke precisely in the center, the symbol is still correct. However, if the bottom horizontal stroke of an upside-down T (the symbol for 2) does not extend, however slightly, beyond the vertical stroke on both sides, then it is scored incorrect, since the symbol drawn would resemble an L (the symbol for 4). The horizontal stroke of an upside-down T does not necessarily have to cross the vertical stroke at the very base. It is acceptable for it to cross the vertical stroke somewhat higher. However, if it crosses the vertical stroke more than halfway up, it is incorrect since this would be a rotation error. It would look more like a right-side up T and that would be unacceptable.

#### 7. Extra marks that are not connected to a stroke

Sometimes an examinee will make a stray mark that is not connected to any other stroke. The symbol drawn is to be scored correct as long as it is drawn in an acceptable manner, ignoring the stray mark. If an upside-down V, the symbol for 7, is drawn with a line that connects the two sides of the V so that the symbol looks like an A, the symbol is scored incorrect. If the line does not completely connect to both sides of the upside-down V, then the symbol is scored correct.

#### 8. Rounding of square corners or sharp angles

The symbols for the digits 3, 4, and 5 all appear in the key as figures made up of strokes at 90 degree angles. Symbols drawn so the strokes are curved rather than straight are correct as long as the symbol drawn does not resemble the symbol for another digit. Thus, the symbol for 3 can be a square with an open side on the left or a backwards C. The symbol for 4 can be an L or a curve. The symbol for 5 can be a "squared-off" U (a box open at the top) or a rounded U. Straight and curved strokes can be combined and still be scored correct so long as the symbol doesn't resemble the symbol for another digit. For example, in drawing the symbol for 3, the top may be curved while the bottom stroke is straight. This is acceptable. Likewise, an upside-down V, the symbol for 7, can look like an upside-down U and that will be scored correct.

#### 9. Symbols that can be confused with other symbols

Symbols that are to be created using two strokes are not correct if more than two strokes are used (excluding stray, unattached marks). For example, the symbol for 7 cannot be drawn as a square that is open at the bottom. Symbols that are to be created using three strokes cannot be drawn using only two strokes. For example, the symbol for 5 cannot be drawn as a V. The symbol for 3 cannot be drawn as a "greater than" symbol.

#### 10. Shaky strokes

Symbols that are drawn with shaky strokes are scored correct as long as the symbol drawn does not resemble the symbol for another digit or a symbol that looks like a different digit or alphabet letter. For example, if the symbol for a 6 looks like a "6", it is incorrect. If the symbol for a 7 looks like a lower case r, it is incorrect. If the symbol for a 5 looks like a W, it is incorrect. It depends on how far from correct the drawn symbol deviates.

11. Strokes that extend outside the block

Symbols should be scored correct if part of the symbol is overlapping the neighboring block or extends into the space between rows as long as it is clear that the stroke belong to that symbol.

12. Unacceptable symbols are those that are familiar symbols but not the correct symbol for that digit. Some examples are: the Red Cross symbol, the Christian cross symbol, an asterisk, a square, an exclamation point, an alphabetic letter (other than X), a digit other than zero, a “greater than” or “less than” sign, etc.

**Additional Guidelines for Imperfectly Drawn Symbols  
(If none of the above guidelines are decisive)**

A symbol is to be scored correct if it conforms to the both of the following:

- a. The symbol resembles the key symbol -- **similarity** AND
- b. The symbol does not resemble the symbol for a different digit -- **uniqueness**

If and only if a symbol is borderline acceptable, a third criterion may be applied: **consistency**. If a symbol is distorted, look to see if it is drawn consistently that way. If it is drawn the same way in at least three blocks, then lean toward scoring it correct. If it is only drawn that way in one or two places and drawn correctly in two or more other places, then score it incorrect.