# EXECUTIVE CONTROL FUNCTION
# CLOX 1 AND EXIT15

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### 1. Background and rationale

While the significance of dementia and marked cognitive decline for the health and functioning of older adults is well-established, the contribution of less severe deficits in cognitive function to the disabling process has received limited attention.  Specifically, impairments in executive function, higher-order cognitive processes including initiation, planning, judgment, decision making, mental flexibility, regulation and self-perception, may influence physical decline through their effect on a broad range of behaviors and lifestyle factors such as, diet and eating behavior; physical, recreational, intellectual and social activity; and help-seeking and self-care practices.  In a similar way, behaviors and lifestyle factors can influence age-related cognitive decline.  Few longitudinal studies have been conducted in this area and all lack or have weak assessment of one or more of the following: disease, impairments and physical function; cardiovascular fitness, health behaviors, and lifestyle factors; cognitive and psychosocial function.  Health ABC is strong in all these areas.

Regarding executive control function (ECF) specifically, community prevalence of impairment in ECF is unknown, but likely to be high.  Measures of ECF have not been included in large-scale epidemiologic studies, due to, in part, the absence of  a brief, reliable, and valid assessment method. Commonly used measures such as the MMSE do not tap ECF, and deficits in ECF are often seen in persons with intact MMSE scores. Impairment in ECF is thought to contribute to loss of independence through interference with the ability to initiate, direct, plan, and execute complex goal-directed activities, such as preparing meals, following a medication regimen, etc.  Clearly, impairment in ECF could have a substantial impact on the disabling process.

Over the past several years, Donald Royall and colleagues,[1-4] have developed and field tested protocols for assessing ECF.  The measures selected for Health ABC include a clock drawing test, the CLOX 1, and a modification of the EXIT25, the EXIT15.  Clock drawing is a well-established clinical tool used to screen for visuospatial and constructional disabilities. When administered and scored following the CLOX 1 criteria, the clock drawing task can help identify deficits in ECF.  In addition, when spontaneous clock drawing ability is compared with copying tasks, such as the overlapping pentagons in the MMSE and 3MS, it can help discriminate cerebrovascular dementias from those of the AD type.  The EXIT25 is a relatively brief assessment of ECF consisting of several commonly used clinical measures that has been tested in geriatric psychiatry patients as well as independently living, well-functioning residents of a retirement community.

A shortened version, the EXIT15 has been developed recently and is undergoing reliability and validity testing (data from studies using the EXIT25 are being reanalyzed).  Although untested in large scale epidemiologic studies, the EXIT25 is rapidly gaining acceptance as a valid research tool.

## 2.  Equipment and supplies

- Plain 8 1/2" X 11" white paper
- Sharpened No. 2 pencil
- Stop watch
- Laminated copies of Thematic Perception picture and the word "brown"

## 3.  Safety issues and exclusions

None.

## 4.  Participant and exam room preparation

Testing should be performed in a quiet, well-illuminated room with the participant seated at a desk or table.  There should not be a clock that is visible to the participant in the room.

## 5. Detailed measurement procedures

CLOX 1

Place a blank white sheet of paper and pencil in front of the participant and say:

Script: *"Draw me a clock that says 1:45.  Set the hands and numbers on the face so that a child could read them."*

Repeat the instructions until they are clearly understood. The words in this command have been carefully selected to influence the participant's behavior. Do not change the instructions and do not prompt the participant. Once the participant begins to draw, no further assistance is allowed. If the participant asks a question, respond by repeating,

 "Draw me a clock that says 1:45…."

Score each element of the clock drawing according to the criteria in the table below. Scoring should be done after the participant leaves, but on the same day, if possible.

| RATING | | |
|---|---|---|
| **Organizational Elements** | **Yes or No** | **Point Value (for Coordinating Center use only)** |
| 1.  Does figure resemble a clock? | ○ Yes ○ No | **Yes=1** |
| 2.  Is a circular face present? | ○ Yes ○ No | **Yes=1** |
| 3.  Are the dimensions >1 inch? | ○ Yes ○ No | **Yes=1** |
| 4.  Are all numbers inside the perimeter? | ○ Yes ○ No | **Yes=1** |
| 5.  Is there sectoring or are there tic marks? | ○ Yes ○ No | **Yes=0; No=1** |
| 6.  Were 12, 6, 3, & 9 placed first? | ○ Yes ○ No | **Yes=0** |
| 7.  Is the spacing intact? (Symmetry on either side of 12 o'clock and  6 o' clock?) | ○ Yes ○ No | **Yes=1** |
| 8.  Were only Arabic numerals used? | ○ Yes ○ No | **Yes=1** |
| 9.  Are only the numbers 1 through 12 among the numerals present? | ○ Yes ○ No | **Yes=1** |
| *10.  Is the sequence 1 through 12 intact?  (No omissions or intrusions) | ○ Yes ○ No | **Yes=1** |
| 11.  Are there exactly two hands present? (ignore sectoring /tic marks) | ○ Yes ○ No | **Yes=1** |
| 12.  Are all  hands represented as arrows? | ○ Yes ○ No | **Yes=1** |
| 13.  Is the hour hand between 1 o'clock and 2 o'clock? | ○ Yes ○ No | **Yes=1** |
| 14.  Is the minute hand obviously longer than the hour hand? | ○ Yes ○ No | **Yes=1** |
| 15.  Are there any of the following?: | | |
| a) hand pointing to 4 or 5 o' clock? | ○ Yes ○ No | |
| b) "1:45" present? | ○ Yes ○ No | |
| c) Any other notation (e.g. " 9:00")? | ○ Yes ○ No | **Yes=0; No=1** |
| d) Any arrows point inward? | ○ Yes ○ No | |
| e) Intrusions from "hand" or "face" present? | ○ Yes ○ No | |
| f) Any letters, words or pictures? (e.g., feet or an alarm on the clock) | ○ Yes ○ No | |
| **TOTAL** | | **15** |

*Note: rarely, a participant may draw a clock counterclockwise;  in other words, the 11 is where the 1 should be, the 10 is where the 2 should be, and so on, all the way around the clock.  In this instance, the correct response option to the question "is the sequence 1 through 12 intact?" would be "Yes."

EXIT15

Make certain that the participant is seated comfortably, then say:

Script: *"I will be asking you to do some routine exercises that measure how well you pay attention. Are you ready? Any questions? "*

[Please note that although the points scored are included in the descriptions below, the response options are marked by the examiner and the scoring is done later, after the forms are scanned into the data system.]

# 1   NUMBER-LETTER TASK

"I'd like you to say some numbers and letters for me like this."

> "1-A, 2-B, 3-what would come next?"

> "C"

> "Now you try it starting with the number 1." Keep going until I say "stop."

```
   2   3   4   5
1  /                "STOP"
|
A   B   C   D   E
```
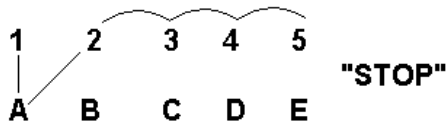
**SCORE:** 0   No errors

> 1   Completes task with prompting (or repeat instruction)

> 2   Doesn't complete task

Keep track of the participant's responses by drawing a line along the path followed, as shown in the example above. If the participant fails to complete the task on the first trial, you may prompt them once by repeating the instruction, e.g., "No, say them like *this* '1-A, 2-B, 3-C'." If the participant performs successfully on the second trial, they receive one point (i.e., mark the second response option). If they fail the second trial two points are awarded (i.e., mark the third response option).

## **2** <u>WORD FLUENCY</u>

"I am going to give you a letter. You will have one minute to name as many words as you can think of which begin with that letter."

"For example, with the letter `P' you could say `people, pot, plant' . . . and so on. "Do you have any questions? Are you ready?"

"The letter is - A -. Go!"

<u>**SCORE:**</u>    0    10 or more words

1    5 - 9 words

2    Less than 5 words

Write down the responses in the order they occur. To keep scoring as simple as possible, no distinction is made between nouns, proper nouns, place names, verbs or adjectives. Any word beginning with the target letter is acceptable. Timing, however, begins with the first word, and no further prompting is allowed. The participant has one minute to complete the task.

## **3** <u>DESIGN FLUENCY</u>

"Look at these pictures. Each is made with only four (4) lines. I am going to give you one minute to draw as many DIFFERENT designs *(Examiner Note: You may say "pictures" instead of "designs")* as you can. The only rule is that they must each be different and be drawn with four lines. (Model this task by drawing the figure below:)



Now  go!"

<u>**SCORE:**</u>  0    10 or more unique drawings (no copies of examples)

1    5 - 9 unique drawings

2    Less than 5 unique drawings

As in VERBAL FLUENCY, no prompting is allowed once the participant begins to draw.  If a participant asks for feedback on their drawings, you may repeat the instructions.  Any figure that has only four lines, and is not a copy of either of the examples you provided, or a previous figure, is acceptable.  It does not matter whether the figures are open, closed, drawn with curved lines, or stick figures.  A circle with three lines coming out is acceptable, as are four arcs.  The lines do not have to be connected to count.  Rotations are acceptable.  It is important that you model this task before the participant starts. Use the figures illustrated above to model the task.

## **4** <u>**ANOMALOUS SENTENCE REPETITION**</u>

"Listen very carefully and repeat these sentences exactly . . ."  (Read the sentence in its original tone of voice.)

> 1. "I pledge allegiance to those flags."
>
> 2. "Mary fed a little lamb."
>
> 3. "Throw, throw, throw your boat."
>
> 4. "Tinkle tinkle little star."
>
> 5. "A B C D U F G"

<u>**SCORE:**</u>     0    No errors

            1    Fails to make one or more changes

            2    Continues with one or more expressions (e.g. "Mary had a little lamb *whose fleece was white as snow")*

Two types of errors are possible. A participant may fail to make the obvious word substitution in one or more sentences (e.g. Mary *had* a little lamb). Even the participant's attempt to correct a sentence (rather than repeat it as requested), is an error (e.g. "Oh no! A step in time always saves *nine*!"). Award such errors one point (mark the second response option). A more dramatic error is to continue on with one or more expressions (e.g. "Mary had a little lamb *whose fleece was white as snow, and everywhere that Mary went the lamb was sure to go*"). These errors are worth the full two points (third response option). Because over-learned materials are sensitive to the familiarity of the cues to which they have been associated, the anomalous sentences should be delivered

with their original prosody.  In other words, the changed word <u>should not</u> be emphasized.



## 5  <u>THEMATIC PERCEPTION</u>

Hold up the laminated sheet (Card D of the Year 3 Clinic Visit Workbook Response Cards) containing this picture in front of the participant and say: *"Tell me what is happening in this picture."*  The picture should be left in front of the participant until this task is completed.

**<u>SCORE:</u>**    0    Tells spontaneous story (story = setting, 3 characters, action)

1    Tells story with prompting once ("anything else?")

2    Fails to tell story despite prompt

To pass this item, the participant must name all three characters correctly (girl/boy/child; cat; bird), name the two major relationships (girl ↔cat; cat ↔bird), and make some mention of the setting (tree /winter /cold /snow).  Clothing (e.g., coat, boots, mittens) does not count as part of the setting. If the participant fails to mention all three of these elements in the first trial, you may prompt them once by saying "Anything else?". Getting the missing element(s) after a prompt is worth one point (second response option).  Failure to get all elements even after a prompt is worth two points (third response option).

## 6  <u>MEMORY/DISTRACTION TASK</u>

"Remember these three words:"

       "**APPLE, TABLE, PENNY**"

(Participant repeats words until all three are registered.)

"Remember them - I'll ask you to repeat them for me later."

"Now - spell CAT for me . . ."

"Good.  Now spell it backwards . . ."

"OK.  Tell me the three words I asked you to remember."


**SCORE:**       0   Participant names some or all of the three words correctly
                      without naming CAT

            1   Other responses  (Examiner may prompt:  "Anything else?")

            2   Participant names CAT as one of the three words (intrusion)

The MEMORY/DISTRACTION TASK is not meant to measure recall. A participant is not penalized for failure to recall all the objects, as long as they name at least one, and "CAT" is not mentioned. Failure to recall even one object is worth one point (second response option).  Naming "CAT" is worth two points (third response option). Participants who may be slow to respond, and say "CAT" almost as an afterthought, still get the full two points (third response option).

Note:
- When a participant is asked to spell "CAT" backwards, since the script is:          ". . . Now spell it backwards . . ." very rarely, the participant may spell "IT" backwards. Whether the participant spells "CAT" backwards or spells "IT" backwards will not affect the score since the score is based upon the participant remembering at least one of the three words read to them before they were instructed to spell "CAT."
- Rarely, a participant may not respond at all when asked to tell the three words they were asked to remember.  In this instance, mark the second response option (Other responses).

## 7 <u>INTERFERENCE TASK</u>

"What color are these letters?"



(Show the participant the laminated sheet (Card E) containing the word "brown" and sweep hand back and forth over all letters as illustrated above)

**SCORE:**     0    "black"

1    "brown" (Prompt: "Are you sure?") then "black"

2    "brown" (Prompt: "Are you sure?") then "brown" (intrusion)

How the examiner behaves can affect performance. Some participants will say "WHITE" if you run your finger vertically over the text. Leading the eye horizontally avoids this problem. Score only what the participant does after the instructions are given. You may prompt an incorrect response. Score one point if the participant corrects their error (mark the second response option). Score two points if the error isn't corrected (mark the third response option). A participant who commits an error, but spontaneously corrects it before you can prompt, scores one point (second response option). If the participant gives a color that is not brown or black, but charcoal grey or blue, or even green, they get full credit (mark the first response option – Score: 0).

## 8 <u>MOTOR IMPERSISTENCE</u>

"Stick out your tongue and say `aah.' Keep going until I say "STOP" . . ." (The examiner should model a short "ah" sound, but expect a long "ahhhh.")

"Go!" (count to three silently. Participant must sustain a constant tone, not "ah . . . ah . . . ah . . .")

**SCORE:**     0    Completes task spontaneously

1    Completes task with examiner modeling task

    2   Fails task despite modeling by the examiner


# 9 GO/NO-GO TASK

"Now . . .
When I touch my nose, you raise your finger like this."  (Raise index finger.)
"When I raise my finger, you touch your nose like this." (Touch nose with index finger.)
Have participant repeat instructions if possible.

(Begin task.  Leave finger in place while awaiting participant's response. Put your
finger back in your lap between trials to reduce the potential for confusion.)


|  **Examiner**  |  **Participant**  |
| :---: | :---: |
| F | **N**  F |
| N | **F**  N |
| F | **N**  F |
| F | **N**  F |
| N | **F**  N |


**SCORE:**     0   Performs sequence correctly

           1   Correct, requires prompting/repeat instructions

           2   Fails sequence after one minute despite prompting/repeat
               instructions

1.  During the instructions, and again while testing, put your hand back down in your
    lap after each step. This signals to the participant that the last step is completed, and
    that a new one is about to begin. Wait for slower participants to put their hand
    down before proceeding.
2.  The participant has only a minute to catch on. Time spent on repeat instructions is
    included in this. If they can't demonstrate their competence after a minute has
    elapsed, they fail (two points – third response option).
3.  Prompting is allowed, but only in the form of repeating the instructional sequence.
    Go ahead and prompt if the participant has made no progress in 30 seconds. Any
    time spent prompting is deducted from the test time. If the participant completes
    the task after prompting, they get one point (second response option). Otherwise,
    they get two points (third response option).

4. The sequence followed by the examiner is less important than getting the participant to demonstrate their competence. If you get lost or distracted, don't start over, just make up a sequence and observe the participant's ability to keep up with it. However, regardless of the sequence you propose, the participant must complete five iterations without error to pass.
5. If the participant self corrects an error, they still get full credit (mark the first response option – Score: 0).

# 10   ECHOPRAXIA

"Now listen carefully.  I want you to do exactly what I say.  Ready?"
"Touch your ear."  (Touch your nose and keep your finger there.)

**SCORE:**      0   Participant touches their ear

              1   Other response _____
                  (look for "mid-position" stance)

              2   Participant touches their nose

Echopraxia is a specific form of imitation behavior where the participant (incorrectly) follows what you do, not what you say.  The discrepancy between your command and actions can lead to a "mid-position stance," where the participant fails to resolve the ambiguity, and instead, "compromises" by touching their cheek, for example.  Such a response is awarded one point (second response option).

# 11   LURIA HAND SEQUENCE I

**Palm/Fist**

ECF.OM3

"Can you do this?"
(Model: a. palm, b. fist) "Now, follow me." (Begin to repeat sequence)

Once the participant appears to have mastered the task, have them demonstrate it. Tell the participant to "keep going" after you stop. Start timing when the participant starts on their own. Count the number of successive palm/fist cycles.
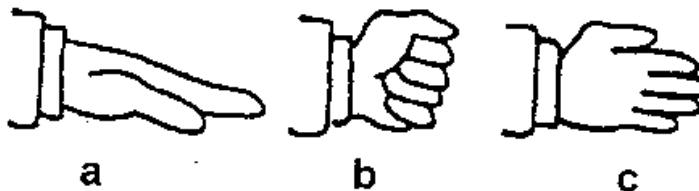
Prompting is allowed at 30 seconds "Are you sure you've got it?"

Stop after one minute.

**SCORE:** 0 5 cycles without error after examiner stops

1 5 correct cycles with additional verbal prompt.

2 Unsuccessful despite prompting (watch for "mid-position" stances)

1. Move at a slow, but deliberate pace when demonstrating the task.
2. The participant has only a minute to catch on. Time spent on repeat instructions is included in this. If they cannot demonstrate competence after a minute has elapsed, award two points (third response option).
3. Prompt the participant if they have made no progress by about 30 seconds. Try saying: "Are you sure you've got it? Show me." If the participant cannot perform correctly, say: "I don't think that's right." Any time spent prompting is deducted from the total time. If the participant completes the task after prompting at 30 seconds, score one point (second response option). Otherwise, award two points after a minute has elapsed (third response option).

## **12** **LURIA HAND SEQUENCE II**



a b c

"Can you do this?"

(Model: a. slap, b. fist, c. cut - while participant imitates each step)

---

ECF.OM3

"Now follow me." (Begin to repeat sequence.)

Once the participant appears to have mastered the task, have them demonstrate it. Tell the participant to "Keep going" after you stop. Start timing when the participant starts on their own.  Count the number of successive cycles.

Prompting is allowed at 30 seconds: "Are you sure you've got it?"

Stop after one minute.

**SCORE:**          0     4 cycles without error after  examiner stops

                   1     4 correct cycles with additional verbal prompt

                   2     Unsuccessful


1.  During the instructions, and again while testing, put your hand back down in your lap after each sequence. This signals to the participant that the sequence step is completed, and that a new one is about to begin.
2.  Move at a slow, but deliberate pace during the demonstration.
3.  The participant has only a minute to catch on. Time spent on repeat instructions is included in this. If they cannot demonstrate competence after a minute has elapsed, they get two points (mark the third response option).
4.  Prompt the participant if  they have made no progress in about 30 seconds. Try saying: "Are you sure you've got it? Show me." If the participant cannot perform correctly, say: "I don't think that's right." Repeat the instructional sequence.
    Any time spent prompting is deducted from the total time. If the participant completes the task after prompting at 30 seconds, score one point (mark the second response option). Otherwise, score two points (mark the third response option) after a minute has elapsed.


# 13   COMPLEX COMMAND TASK

"Put your left hand on top of your head and close your eyes.  That was good . . ."

(Remain aloof.   **(Quickly go on to next task)**

**SCORE:**     0   Participant stops when next task began

1    Equivocal - holds posture during part of next task

2    Participant maintains posture (eyes /hands or both) through
completion of next task - has to be told to cease

Those who tend towards perseveration may have to be told when to take their hand down and /or open their eyes (third response option – two points).  Some participants peek out, or ask if it's OK to stop. Don't give any feedback. Keep a neutral facial expression and go on with the next item (SERIAL ORDER REVERSAL TASK). Go quickly. "That was good…" is the only clue that the first task is over.  If the participant doesn't close their eyes, they still get full credit (first response option – Score: 0), provided they discontinue the posture before the next task.

# 14    SERIAL ORDER REVERSAL TASK

(Have participant recite the months of the year.)

"Next, I would like you to recite all the months of the year."

"Now start with January and say them all <u>backwards</u> . . ."

**SCORE:**        0    No errors, at least past September

1    Gets past September but requires repeat instructions ("Just start with January and say them all backwards.")

2    Can't succeed despite prompting

Many begin the task correctly, but then "lose set" by reverting to the over-learned forward sequence.  Some will seek confirmation of their strategy. "You mean, December, November..like that?" Give no specific feedback. Prompting is allowed, but only repeat instructions.

# 15    IMITATION BEHAVIOR

(Flex wrist up and down and point to it asking:)
        "What is this called?"

**SCORE:**   0   "Wrist"

          1   Other response - describe _____

          2   Participant flexes wrist up and down (echopraxia)

Only one point (second response option) is given for misnaming a "wrist." If the participant imitates the examiner's hand movements by flexing their wrist or waving their hand, they receive two points (third response option).

## 6. Procedures for performing the measurements at home (if applicable)

Follow instructions for clinic administration.

## 7. Alert values/follow-up/reporting to participants

When testing is completed, thank the participant without offering specific feedback on their performance.

There are no alert values.

## 8. Quality assurance

## 8.1 Training requirements

The examiner requires no special qualifications or prior experience to perform this assessment. Training should include:

- Reading and studying manual
- Attending Health ABC examiner training session or observing administration by experienced examiner
- Practicing on volunteers
- Discussing problems and questions with local expert or QC officer

## 8.2 Certification requirements

- Completes training requirements
- Conducts exam correctly on one participant while being observed by a QC officer using the QC checklist.
- Obtains the same score as QC officer on three sample exams viewed on videotape.

## 8.3 Quality assurance checklist

☐ Exam performed in quiet, private area without interruptions

☐ Recites CLOX 1 instructions correctly without prompting participant

☐ Recites instructions for letter/number task correctly

☐ Recites word fluency instructions correctly

☐ Recites design fluency instructions and models task correctly. Does not prompt participant once the participant begins to draw

☐ Recites anomalous sentences (e.g., "Tinkle tinkle little star.")
in correct tone of voice

☐ Correctly sweeps hand back and forth over the word "brown"

☐ Recites instructions for finger to nose test (go/no-go task) correctly

☐ Luria hand sequence tests explained and demonstrated to participant correctly with prompting at 30 seconds, if necessary

☐ Quickly goes on to next task after instructing participant to put
their left hand on top of their head and close their eyes and telling them
"That was good."

☐ No specific feedback given (other than repeat instructions) for instructing participants to recite the months of the year backwards

☐ Responses correctly coded (QC officer should independently fill out scoring sheet)

☐ Reviews form for completeness

☐ Correctly completes form

## 9. References

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5. Spreen O, Strauss E.  A Compendium of Neuropsychological Tests: Administration, Norms, and Commentary (2nd, ed). 1998; New York: Oxford University Press.