



MOSAAC Cognitive Battery

1. Semantic (animal) fluency (60 seconds, about 2 minutes total)
2. COMT learning (Common Objects Memory Test, modified, 3 immediate recall trials, about 3 minutes total)
3. Symbol Digit Modalities Test (SDMT) (90 seconds, about 3 minutes total)
4. Clock drawing (about 3 minutes total)
5. Digits backwards (about 3 minutes total)
6. COMT memory (delayed recall trial, about 1 minute total)

Materials

- Stopwatch or timer
- MOSAAC Cognitive Assessment Answer sheets
 - Animal fluency worksheet
 - COMT worksheet
 - Digits backwards scoring sheet
 - Clock drawing test scoring sheet
- Spiral bound COMT pictures (12 pictures x 3 sets)
- SDMT Participant Form & scoring sheet
- Unlined sheet of paper, approximately 8.5" x 11" (clock drawing)
- Pen (ball point pen or felt tip pen with a medium point; dark ink color)
- Millimeter ruler (clock drawing)
- Protractor (clock drawing)
- iPad (for audio recording of semantic animal fluency task)



General procedures

The battery should be administered in order during a single session lasting approximately 15-20 minutes. The battery should be administered in a quiet setting with good ambient lighting, free from distractions, preferably without others present. If feasible, administer the battery in the morning. Avoid the mid to late afternoon. Fatigue later in the day could affect cognitive performance. The MOSAAIC examination involves fasting. Make sure participants have a chance for a snack before starting the cognitive battery.

Participants should be asked to bring glasses or hearing aids, if used. Tests can be administered if these are missing, but the examiner should ascertain that the participant can see sufficiently well to view stimulus materials and to hear and understand the examiner's instructions. This judgement may be based on preceding interactions with the participant. Each scoring form should allow the examiner to indicate if a participant's responses on the particular test was likely to have been compromised or invalidated because of poor vision, hearing impairment, physical or mental disability, distractions, or other reason.

There should not be a clock visible in the examination room. If a clock is present and cannot be removed or obscured, position the participant so that he/she is not facing the clock. If the participant is wearing an analog watch, instruct the participant not to look at the watch. When it is not feasible to obscure a clock, testing can still proceed, but the examiner should note if a participant looked at a clock or watch during the Clock Drawing task.

Instructions should be given in English, or one of the MOSAAIC translated languages if a bilingual staff is available at the site. The instruction language should be the one in which the participant is most fluent. This is often the first language or the language spoken at home and not necessarily the language spoken, e.g., at the place of employment. Confirm the participant's response from the Enrollment survey (Part 1 Question 9) for the preferred spoken language. Correct answers can be in English or another preferred language. For example, on the semantic animal fluency task, a participant may provide most animal names in English but might provide a Mandarin name when unable to come up with the English equivalent. Similarly, on the COMT both the English word "comb" or the Mandarin word "梳子" would be scored as correct.

Language familiarity could affect the participant's performance on cognitive assessment tasks. For that reason, make sure to document the participant's languages at the start of the cognitive assessments. For example, if a participant is most fluent in a language not supported by MOSAAIC, it is important to document that the cognitive assessment battery is being administered in a language common to the MOSAAIC staff and the participant (often English), not necessarily the participant's most fluent language.

There are different pieces of worksheets and scoring forms required for the individual cognitive tests. Before starting the cognitive assessment, write down the participant ID AND the date of assessment at the top of ALL worksheets (including the clock drawing page).

Some tests may take additional time to score. You will need to complete scoring after the participant is done with the cognitive battery. In these cases, be sure to allocate time to score, **preferably immediately afterwards and certainly before the end of the day**. The scoring should take less than 5 minutes.



UG3 Sampling Method

CCFCs should recruit at least 15 participants to complete the cognitive assessment by July 31. The pilot data will be used to gather feedback, assess the feasibility of the current test battery for the diverse population of MOSAAC, and make any necessary adjustments.

Whenever possible, participants should represent a diverse sample to support a more comprehensive data analysis, including:

- Individuals who are monolingual (English) and multilingual
- Range of years in the United States (recent migrant vs. long-term resident)
- Range of sexes, ages (above and under 40) and education levels.

General script

SAY: “Next, we will start the cognitive assessment. This helps us understand different aspects of thinking, like memory, attention, and problem-solving. It will take about 20 minutes.”

“I will ask you to answer some questions, look at some pictures, and write or draw things on a piece of paper. I will be writing down notes on a piece of paper (or on the computer). You wear glasses or hearing aids, please use them. If you don’t have them, we can continue as long as you can see and hear the instructions clearly.”

“I will give you instructions, and you can respond in the language you are most comfortable with. You can also mix languages in your answers, and that’s okay.”

SAY: “What language are you most comfortable with?” (*Record in answer sheet. If multiple languages were used to administer the test, then note this in the answer sheet.*)

“If you have any questions, just let me know.”

“Let’s get started.”



1. Semantic animal fluency

Materials

- Stopwatch or timer
- Animal Fluency Worksheet
- Pen (for staff)
- iPad (for audio recording)

Procedure

1. Practice

SAY: “I am going to give you a category, and I want you to name as fast as you can all of the things that belong in that category. For example, if I say ‘articles of clothing,’ you could say ‘shirt,’ ‘tie,’ or ‘hat.’ Can you think of other articles of clothing?”

Allow up to **20 seconds** for the subject to produce two responses.

Do not record this score. If the participant does not have any problems with this, move on to the animal naming.

2. Animal Naming

SAY: “Now I want you to name things that belong to another category: Animals. You will have one minute. I want you to tell me all the animals you can think of in one minute. Any kind of animal is correct.”

“Ready? Begin.”

Start the timer as you say “Begin.” Write actual responses as legibly as possible on the worksheet. Stop the procedure at **60 seconds**. One prompt is permitted (“Tell me all the animals you can think of”) if the participant makes no response for 15 seconds or expresses incapacity (e.g., “I can’t think of any more”). It is permissible to repeat the instructions or category if the participant specifically requests. It is also permissible to answer questions about categories of animals, e.g., “Do fish count as animals?” or “Do dinosaurs count as animals?” by responding, “Any kind of animal is all right.”

Names of unfamiliar animals are acceptable only if they can be verified in a dictionary. After completing the task, ask the participant to spell unfamiliar responses where you are unsure of the spelling.

Record the participant’s responses in 15 second bins.



Scoring

1. One point for each correct responses within each 15 second bin, excluding a repeated response (total of 4 scores). (The 60 second total will be summed automatically.)
2. One point for each incorrect, out of category response, total number in 60 seconds.

Scoring Specifications

- Self-corrections (e.g., “I guess sea kelp aren’t really animals”) are not scored as errors.
- The category of animals includes fish, birds, insects, extinct animals (e.g., wooly mammoth, brontosaurus), and mythical animals (e.g., dragon, unicorn).
- The following counts as one point. Other exemplars are not scored as errors.:
 - Different breeds of the same species (e.g., poodle, pug, German shepherd = 1 point total). Count the first exemplar (breed) as correct if the supraordinate category (e.g., dog) has not already been named.
 - Only the first response is counted for animals of the same species where there are different names based on sex or age (e.g., horse, mare, colt, foal).
 - Do not count repetition of the same animal in another language (e.g., dog, 狗, chó, aso are all the same animal).
 - If a participant names a general animal (e.g., elephant) and then provides highly similar variants (e.g., African elephant, Asian elephant), count only the first mention.
- Following count as separate points:
 - If a participant names a general group that is a commonly referenced animal word (e.g., “bird”) and then specific species within that group (e.g., falcon, eagle), count all as separate points.
- Scoring examples:
 - Sheep & Ram = 1 point (same species, different sex)
 - Hen & Rooster & chick = 1 point (same species, different sex, different development phase)
 - Monkey, Gorilla, Orangutan, Chimpanzee, Ape = 5 points (different species)
 - Fish (general), Eel, Salmon, Tuna, Shark = 5 points (eel, salmon, tuna, shark are different species; “fish” is a broad category but also a commonly referenced animal name)
 - Lizard & Chameleon = 2 points (different species)
 - Birds, Sparrows, Pigeons, Eag
- If participant lists a general class (e.g., mammals, insects, amphibians), these are generally not counted as valid animal names because it does not reference a distinct animal and is not used as a common name for an animal.
- When unsure if named animals are of the same species or not, write down the concerning word clearly, flag the ppt file as needing scoring verification, and check in with CC after the session. Note any questionable response, which might later be incorporated into the training manual.



2. COMT, 3 immediate recall trials

Materials

- Stopwatch or timer
- Printed COMT Pictures (12x3 pictures in the specified order)
- COMT Worksheet
- Pen (for staff)

Procedure

The following is true for all 3 learning trials: Show each picture for two seconds. If a participant can't name the object, name it for the participant. The two second limit can be extended if the participant is in the process of naming. Do not alter the picture order. During the recall, do not tell participants the items they missed.

Learning Trial 1

SAY: "I'm going to show you pictures of objects. I'd like you to name each object as I show it to you. Do your best to remember each object, because I'm going to ask you to recall them later."

Show each picture and have the participant name them. Then, put the pictures away.

SAY: "Now tell me all the objects you can remember. You have 60 seconds. Go."

Allow up to **60 seconds** to name all 12 objects. Check off the correct answers on the worksheet. As noted above, correct answers need not be in the same language. Write down incorrect responses.

Scoring, learning trial 1

Recall: One point for each correct response, range 0 to 12.

Intrusions: The total number of intrusion errors (incorrect responses) is also recorded. Maximum 12, range 0 to 12. More than 12 intrusions are scored as 12.

Learning Trial 2

SAY: "I am going to show you the same pictures again. As before, tell me the name of each object as I show it to you and try to remember it. When I am finished, tell me as many of the objects as you can remember, including the ones you said the first time."

As before, each picture is presented for two seconds. The two second limit can be extended if the participant is in the process of naming. Do not record naming errors, but if the participant makes a mistake or is unable to name the object, provide him or her with the correct name. After the last item is presented,



SAY: "Now tell me all the objects you can remember. Go."

As before, check off correct answers on the answer form. If the participant only names items that were missed on the previous trial, remind the participant to name all of the objects that the participant can remember.

Once the participant cannot recall any additional items, or if the maximum time of **60 seconds** has elapsed, proceed to Trial 3.

Scoring, learning trial 2

Recall: One point for each correct response, range 0 to 12.

Intrusions: One point for each intrusion error, maximum of 12, range 0 to 12.

Learning Trial 3

SAY: "I am going to show you the same pictures one last time. As before, tell me the name of each object as I show it to you and try to remember it. When I am finished, tell me as many of the objects as you can remember including the ones you've said before."

SAY: "Now tell me all the objects you can remember."

As before, check off correct answers on the answer form. If the participant only names items that were missed on the previous trial, remind the participant to name all of the objects that the participant can remember.

Once the participant cannot recall any additional items, or if the maximum time of **60 seconds** has elapsed .

Scoring, learning trial 3

Recall: One point for each correct response, range 0 to 12.

Intrusions: One point for each intrusion error, maximum of 12, range 0 to 12.

At the end of Learning Trial 3, note down the current time on the worksheet. This is important for the delayed recall component at the end of the cognitive battery.

Make sure to put the pictures away out of sight.



3. Symbol Digit Modalities Test

Materials

- Stopwatch or timer
- SDMT participant form and scoring sheet (separate from the MOSAAC Cognitive Assessment Battery Answer sheets)
- Pen (for participant use)

Procedure

The SDMT requires a participant to substitute a written number for randomized presentations of arbitrary geometric figures, or symbols. In this measure of visual scanning and processing speed, the participant is given 90 seconds to match digits 1 through 9 with corresponding symbols.

On the SDMT test form, fill out the “Date of administration” field and write the participant ID in the “Name;; field. Leave the remaining fields blank.

The test form is handed to the participant. The key, specifying which number is assigned to which symbol, is located at the top of the page.

SAY: “Please look at the boxes at the top of the page. Notice that each box has a symbol in the upper part and a number in the lower part. Each symbol has its own number.”

Point to symbol and 1, then to the next symbol and 2.

SAY: “Now, look down here to where the boxes have symbols in the top part, but the squares at the bottom are empty.”

Point to the sample items.

SAY: “I want you to put in each of the empty squares the number that should go there, up to this line.”

Point out the line that divides the first 10 symbols.

After the practice items during which the examiner checks to see that the participant understands the task, the examiner continues with the instructions.

SAY: “Now when I say, ‘Go’ write in the numbers just like you have been doing as fast as you can until I say, ‘Stop!’. When you come to the end of the first line, go quickly to the next line without stopping. Go.”

SAY: “Stop!” exactly 90 seconds from starting.

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Scoring



1. Correct responses: One point for each correct digit within the specified time. The score does not include substitutions during the preceding practice period.
2. Incorrect responses: One point for each incorrect response.
3. Omissions: One point for each omission. Omissions refer to skipped items (i.e., blank boxes between written responses) NOT the remaining blank spaces after time runs out. If the participant did not fill the first 5 numbers in the first line and starts on the second line, do not mark the first 5 empty boxes as omissions.



4. Clock Drawing Task

Materials

- Stopwatch or timer
- Unlined sheet of paper (for participant)
- Pen (for participant)
- Millimeter ruler and protractor (for staff scoring)
- Clock drawing scoring sheet

SAY: “Please draw the face of an analog clock, put in all of the numbers, and set the hands to 11:10 [eleven-ten]” *or, optionally,* “Set the hands to ten minutes past eleven.”

You may repeat the instructions as needed. Allow up to **3 minutes**. If the participant is done before the 3 minutes, you can move on to the next test.

There is no loss of points for a more elaborate drawing, e.g., a grandfather’s clock. Self-corrections are allowed. One start-over attempt is allowed, e.g., if the participant decides the clock face is too small, in which case best attempt is scored. An additional 1 minute (up to 4 minutes total) is allowed for a second attempt.

Scoring

Total number of correct responses, range 0 to 15.

Refer to scoring table in the answer sheet.



5. Digits Backwards

Materials

- Digits backwards scoring sheet
- Pen (for staff use)

Procedure

SAY: "Now I'm going to say some numbers. When I stop, I want you to say them back to me in reverse order. For instance, if I say 1-2-3, then you would say 3-2-1. If I say, 4-8-5, what would you say?"

If the participant responds correctly (5-8-4), say, "That's right", and proceed. If the participant fails to answer or provides an incorrect answer, say, "No, I said 4-8-5, so you would say 5-8-4. Now, try this one: What is 9-2-6 in reverse order?" Correct the response if necessary, and proceed.

SAY: "Now I have more numbers. We will use one language for this task. I will give you instructions in [language] and you will respond in the same language. Are you comfortable continuing in [language] or do you have another language you prefer?"

Record the language of administration and continue.

Participant must use the same language for numbers throughout this task. If the instructions were provided in English, then the participant will respond in English. If the numbers were read out in another language, then the participant is expected to respond in that language. There is no interchanging of languages. Correct or reinstruct as needed.

SAY: "Now I have some more numbers. Remember, you are to say them in reverse order."

Scoring

Primary outcome for digits backwards: Total number of correct responses, range 0 to 14.

Alternative (secondary) scoring: Longest span with at least one correct response, range 0, 2 to 8.



6. COMT, memory, delayed recall

Materials

- COMT worksheet
- Pen (for staff use)

Procedure

Check the time that has elapsed since the end of COMT Learning Trial 3. If the time from the end of the COMT learning trials to the start of the delayed recall trial is less than 8 minutes, chat or have a short conversation until reaching the 8 minute mark. If the time is more than 11 minutes, note the time interval on the scoring sheet but administer the delayed recall trial anyway.

SAY: “Remember when I showed you pictures of those objects a few minutes ago? Please name as many as you can now.”

Allow up to **45 seconds**. Check off correct answers on the answer form. Correct answers need not be in the same language. Record incorrect responses.

Scoring

One point for each correct response, range 0 to 12.

The total number of intrusion errors is also recorded, maximum 12, range 0 to 12.



After the cognitive battery:

- Thank the participant.
- Complete scoring immediately after participant testing or before the end of the day (5 min). The participant should not be in the room.
- Store ALL paper answer sheets and scoring sheets with other participant documents. Enter answer sheet data into clinic app along with the audio recording of the semantic animal fluency task.