

# MACE 2

Military Acute Concussion Evaluation



## Use MACE 2 as close to time of injury as possible.

Service Member Name: \_\_\_\_\_

DoDI/EDIPI/SSN: \_\_\_\_\_ Branch of Service & Unit: \_\_\_\_\_

Date of Injury: \_\_\_\_\_ Time of Injury: \_\_\_\_\_

Examiner: \_\_\_\_\_

Date of Evaluation: \_\_\_\_\_ Time of Evaluation: \_\_\_\_\_

**Purpose:** MACE 2 is a multimodal tool that assists providers in the assessment and diagnosis of concussion. The scoring, coding and steps to take after completion are found at the end of the MACE 2.

**Timing:** MACE 2 is most effective when used as close to the time of injury as possible. The MACE 2 may be repeated to evaluate recovery.

## RED FLAGS

Evaluate for red flags in patients with Glasgow Coma Scale (GCS) 13-15.

- Deteriorating level of consciousness
- Double vision
- Increased restlessness, combative or agitated behavior
- Repeat vomiting
- Results from a structural brain injury detection device (if available)
- Seizures
- Weakness or tingling in arms or legs
- Severe or worsening headache

**Defer MACE 2 if any red flags are present. Immediately consult higher level of care and consider urgent evacuation according to evacuation precedence/Tactical Combat Casualty Care (TCCC).**

- Negative for all red flags**  
Continue MACE 2, and observe for red flags throughout evaluation.

**MILITARY ACUTE CONCUSSION SCREENING**

Complete this section to determine if there was an injury event AND an alteration of consciousness or memory.

**1. Description of Incident****A. Record the event as described by the service member or witness.**

Use open-ended questions to get as much detail as possible.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Key questions:**

- Can you tell me what you remember?
- What happened?
- Who were you last with?

**B. Observable Signs**

At the time of injury were any of these observable signs witnessed?

**Visual clues that suggest a possible concussion include:**

- Lying motionless on the ground
- Slow to get up after a direct or indirect blow to the head
- Disorientation, confusion, or an inability to respond appropriately to questions
- Blank or vacant look
- Balance difficulties, stumbling, or slow labored movements
- Facial injury after head trauma
- Negative for all observable signs

**C. Record the type of event.**

Check all that apply:

- |                                       |   |  |
|---------------------------------------|---|--|
| <input type="checkbox"/> Blunt object | <input type="checkbox"/> Sports injury          | <input type="checkbox"/> Gunshot wound                               |
| <input type="checkbox"/> Fall         | <input type="checkbox"/> Assault                | <input type="checkbox"/> Explosion/blast<br>Estimated distance _____ |
| <input type="checkbox"/> Fragment     | <input type="checkbox"/> Motor vehicle<br>crash | <input type="checkbox"/> Other _____                                 |

**D. Was there a blow or jolt to the head?**

- Did your head hit any objects?
- Did any objects strike your head?
- Did you feel a blast wave? (A blast wave that is felt striking the body or head is considered a blow to the head.)
- Did you have a head acceleration or deceleration?

YES       NO       UNKNOWN

## 2. Alteration of Consciousness or Memory

### A. Was there alteration of consciousness (AOC)?

AOC is temporary confusion or "having your bell rung."

YES  NO

If yes, for how long? \_\_\_\_\_ seconds  
\_\_\_\_\_ minutes

UNKNOWN

#### Key questions:

- Were you dazed, confused, or did you "see stars" immediately after the event?
- Did you feel like you were in a fog, slowed down, or "something was not right"?

### B. Was there loss of consciousness (LOC)?

LOC is temporarily passing out or blacking out.

YES  NO

If yes, for how long? \_\_\_\_\_ seconds  
\_\_\_\_\_ minutes

UNKNOWN

#### Key questions:

- Did you pass out or black out?
- Is there a period of time you cannot account for?

### C. Was there any post traumatic amnesia (PTA)?

PTA is a problem remembering part or all of the injury events.

YES  NO

If yes, for how long? \_\_\_\_\_ seconds  
\_\_\_\_\_ minutes

UNKNOWN

#### Key questions:

- Is there a period of time you cannot account for?
- What is the last thing you remember before the event?
- What is the first thing you remember after the event?

### D. Was the AOC, LOC or PTA witnessed?

YES  NO

If yes, for how long? \_\_\_\_\_ seconds  
\_\_\_\_\_ minutes

UNKNOWN

#### Tips for assessment:

- Ask witness to verify AOC, LOC or PTA and estimate duration.

## 3. Symptoms

Common symptoms after a concussion are listed below. For this event, check all that apply.

- Headache
- Dizziness
- Memory problems
- Balance problems
- Nausea/vomiting
- Difficulty concentrating
- Irritability
- Visual disturbances
- Ringing in the ears
- Other \_\_\_\_\_
- Negative for all symptoms**

#### 4. History

A. During the past 12 months, were you diagnosed with a concussion, not counting this event?

YES     NO

If yes, how many? \_\_\_\_\_

UNKNOWN

B. History of diagnosed/treated headache disorder or migraine.

YES     NO

C. History of depression, anxiety, or other behavioral health concerns.

YES     NO

### CONCUSSION SCREENING RESULTS (Possible Concussion?)

Was there a blow or jolt to the head (1D)

AND

ANY alteration of consciousness or memory? (2A, 2B, 2C, or 2D)

**YES** (to both)



**NO** (to either or both)



#### POSITIVE CONCUSSION SCREEN:

1. **Continue** MACE 2.
2. Complete evaluation before prescribing rest.
3. Communicate findings to line leadership.
4. Document and code findings in electronic health record (EHR).

#### NEGATIVE CONCUSSION SCREEN:

1. **Stop** MACE 2.
2. Initiate 24 hour-rest period, if deployed. During rest, avoid activities that worsen symptoms. Follow up with the service member after rest period per concussion management tool (CMT).
3. Communicate findings to line leadership.
4. Document and code findings in electronic health record (EHR).

## COGNITIVE EXAM

## 5. Orientation

Score one point for each correct response.

Ask This Question	Incorrect	Correct
"What month is this?"	0	1
"What is the date or day of the month?"	0	1
"What day of the week is it?"	0	1
"What year is it?"	0	1
"What time do you think it is?"	0	1

Correct response must be within one hour of actual time.

## ORIENTATION TOTAL SCORE

5

## 6. Immediate Memory

Choose one list (A-F below) and use that list for the remainder of the MACE 2.

Read the script for each trial and then read all five words. Circle the response for each word for each trial. Repeat the trial three times, even if the service member scores perfectly on any of the trials.

**Trial 1 script:** Read the script exactly as written.

- "I am going to test your memory. I will read you a list of words and when I am done, repeat back to me as many words as you can remember, in any order."

**Trials 2 and 3 script:** Read the script exactly as written.

- "I am going to repeat that list again. Repeat back to me as many words as you can remember, in any order, even if you said them before."

	Trial 1		Trial 2		Trial 3	
List A	Incorrect	Correct	Incorrect	Correct	Incorrect	Correct
Jacket	0	1	0	1	0	1
Arrow	0	1	0	1	0	1
Pepper	0	1	0	1	0	1
Cotton	0	1	0	1	0	1
Movie	0	1	0	1	0	1

## IMMEDIATE MEMORY TOTAL SCORE

15

## Immediate Memory Alternate Word Lists

List B	List C	List D	List E	List F
Dollar	Finger	Baby	Candle	Elbow
Honey	Penny	Monkey	Paper	Apple
Mirror	Blanket	Perfume	Sugar	Carpet
Saddle	Lemon	Sunset	Sandwich	Saddle
Anchor	Insect	Iron	Wagon	Bubble

## NEUROLOGICAL EXAM

### 7. Speech Fluency

 Normal Abnormal

- Speech should be fluid and effortless
  - no pauses or unnatural breaks.
  - Stuttering or struggling to speak is abnormal.

### 8. Word Finding

 Normal Abnormal

- Assess difficulties with word finding:
  - Difficulty in coming up with the name of an object or grasping to find words is abnormal.

### 9. Grip Strength

 Normal Abnormal

- Assess grip strength. Grip strength should be strong and equal bilaterally.
  - Unequal or weak grip strength is abnormal.

### 10. Pronator Drift

 Normal Abnormal

- Direct service member to stand with eyes closed and arms extended forward, parallel to the ground with palms up. Assess for five to 10 seconds:
  - Any arm or palm drift is abnormal.

### 11. Single Leg Stance

 Normal Abnormal

- Remove shoes if possible. Have service member stand on one leg, arms across chest, hands touching shoulders, eyes open initially. Once service member is balanced, have them close their eyes and time for 15 seconds how long they can maintain their balance. Repeat test with opposite leg.
  - Loss of balance on either leg before eight seconds is abnormal.

## NEUROLOGICAL EXAM - Continued

## 12. Tandem Gait

 Normal Abnormal

- Remove shoes if possible. Have service member take six steps one foot in front of the other, heel-to-toe, with arms at side
  - Stumbling or shifting feet is abnormal.

## 13. Pupil Response

 Normal Abnormal

- Pupils should be round, equal in size and briskly constrict to a direct, bright light.
  - Unequal pupil size, dilation or constriction delay is abnormal.

## 14. Eye Tracking

 Normal Abnormal

- Both eyes should smoothly track your finger side-to-side and up and down.
  - Unequal, irregular or delayed eye tracking is abnormal.

NEUROLOGICAL  
EXAM RESULTS  
(Questions 7-14)

All Normal

Any Abnormal

## COGNITIVE EXAM

## 15. Concentration

## A. Reverse Digits

Read the script and begin the trial by reading the first string of numbers in Trial 1.

**Circle the response for each string.**

- If correct on string length of Trial 1, proceed to the next longer string length in the same column.
- If incorrect on string length of Trial 1, move to the same string length of Trial 2.
- If incorrect on both string lengths in Trials 1 and 2, **STOP** and record score as zero for that string length. Record total score as sum of previous correct trials.

## COGNITIVE EXAM - Continued

### 15. Concentration - Continued

#### A. Reverse Digits

**Script:** Read the script exactly as written.

- “I am going to read you a string of numbers. When I am finished, repeat them back to me backward. That is, in reverse order of how I read them to you. For example, if I said 7 - 1 - 9, then you would say 9 - 1 - 7.”

List A			
Trial 1	Trial 2 (if Trial 1 is incorrect)	Incorrect	Correct
4-9-3	6-2-9	0	1
3-8-1-4	3-2-7-9	0	1
6-2-9-7-1	1-5-2-8-5	0	1
7-1-8-4-6-3	5-3-9-1-4-8	0	1

**REVERSE DIGITS SCORE (16A)**

4
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#### Concentration Alternate Number Lists

**Note:** Use the same list (A-F) that was used in Question 6.

List B	
Trial 1	Trial 2
5-2-6	4-1-5
1-7-9-5	4-9-6-8
4-8-5-2-7	6-1-8-4-3
8-3-1-9-6-4	7-2-7-8-5-6

List C	
Trial 1	Trial 2
1-4-2	6-5-8
6-8-3-1	3-4-8-1
4-9-1-5-3	6-8-2-5-1
3-7-6-5-1-9	9-2-6-5-1-4

List D	
Trial 1	Trial 2
7-8-2	9-2-6
4-1-8-3	9-7-2-3
1-7-9-2-6	4-1-7-5-2
2-6-4-8-1-7	8-4-1-9-3-5

List E	
Trial 1	Trial 2
3-8-2	5-1-8
2-7-9-3	2-1-6-9
4-1-8-6-9	9-4-1-7-5
6-9-7-3-8-2	4-2-7-9-3-8

List F	
Trial 1	Trial 2
2-7-1	4-7-9
1-6-8-3	3-9-2-4
2-4-7-5-8	8-3-9-6-4
5-8-6-2-4-9	3-1-7-8-2-6



**COGNITIVE EXAM - Continued**

**15. Concentration - Continued**

**B. Months in Reverse Order**

**Script:** Read the script exactly as written.

- "Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say: December, November...Go ahead."

Correct Response:

Dec – Nov – Oct – Sep – Aug – Jul –  
Jun – May – Apr – Mar – Feb – Jan

	Incorrect	Correct
ALL months in reverse order	0	1

**MONTHS IN REVERSE ORDER (16B)**

**CONCENTRATION TOTAL SCORE**

Sum of scores:

15A (0-4 points) and 15B (0 or 1 point)

**16. Delayed Recall**

Read the script and circle the response for each word. Do NOT repeat the word list.

**Note:** Use the same list (A-F) that was used in Question 6.

**Script:** Read the script exactly as written.

- "Do you remember that list of words I read a few minutes earlier? I want you to tell me as many words from that list as you can remember. You can say them in any order."

List A	Incorrect	Correct
Jacket	0	1
Arrow	0	1
Pepper	0	1
Cotton	0	1
Movie	0	1

**DELAYED RECALL TOTAL SCORE**

Delayed Recall Alternate Word Lists

**List B**

Dollar  
Honey  
Mirror  
Saddle  
Anchor

**List C**

Finger  
Penny  
Blanket  
Lemon  
Insect

**List D**

Baby  
Monkey  
Perfume  
Sunset  
Iron

**List E**

Candle  
Paper  
Sugar  
Sandwich  
Wagon

**List F**

Elbow  
Apple  
Carpet  
Saddle  
Bubble

## 17. Vestibular/Ocular-Motor Screening (VOMS) for Concussion Instructions

### VOMS Contraindication: Unstable Cervical Spine.

Consider deferring VOMS if patient is overtly symptomatic or a trained provider unavailable. VOMS should be completed before return to duty. Use comment section for any provider-observed difficulty with specific VOMS tasks.

- A. Baseline symptoms.** Record headache, dizziness, nausea and foginess (HDFN), on zero to 10 scale prior to screening.
- B. Smooth pursuits.** Service member and examiner are seated. Hold fingertip three feet from patient. Service member focuses on fingertip target as examiner moves fingertip smoothly horizontally one and a half feet right and left of midline at rate requiring two seconds to go fully from left to right and right to left. Perform twice. Repeat in vertical direction one and a half feet above and one and a half feet below midline up and down, moving eyes two seconds fully up and two seconds down. Perform twice. Record HDFN on a zero to 10 scale.
- C. Saccades.** Service member and examiner are seated.
- 1) **Horizontal saccades:** Hold two fingertips horizontally at a distance of three feet from service member, and one and a half feet left and right of midline so service member gazes 30 degrees left and right. Service member moves eyes as quickly as possible from point to point. Perform 10 times. Record HDFN on a zero to 10 scale.
  - 2) **Vertical saccades:** Repeat with two fingertips vertically three feet from service member, and one and a half feet above and below midline so service member gazes 30 degrees upward and downward. Service member moves eyes as quickly as possible from point to point. Perform 10 times. Record HDFN on a zero to 10 scale.
- D. Convergence.** Service member and provider are seated facing each other. Service member focuses on font target (page 14) at arm's length and slowly brings toward tip of nose. Service member stops target when two distinct images seen or when outward deviation of eye observed. Repeat and measure three times. Record centimeters between target and tip of nose for each trial. A near point of convergence  $\geq$  five centimeters from the tip of the nose is considered abnormal. Record HDFN on a zero to 10 scale.

## 17. Vestibular/Ocular-Motor Screening (VOMS) for Concussion Instructions (Continued)

**E. Vestibular-ocular reflex (VOR) test.** Service member and examiner are seated. Examiner holds font target (page 14) in front of service member in midline at three feet, rotation speed set with metronome.

**1) Horizontal VOR test:** Service member rotates head horizontally focusing on target at 20 degrees to each side. Rotation = 180 beats per minute (bpm). Perform 10 times. Record: HDNF 10 seconds after test.

**2) Vertical VOR test:** Repeat test moving head vertically 20 degrees up and down at 180 bpm. Perform 10 times. Record HDNF 10 seconds after test.

**F. Visual motion sensitivity (VMS) test.** Service member stands with feet shoulder width apart, facing a busy area. Examiner stands next to and slightly behind service member. Service member outstretches arm. Focusing on their thumb, the service member rotates head, eyes and trunk as unit 80 degrees right and left. Rotation = 50 bpm. Perform five times. Record HDNF on a zero to 10 scale.

# 17. VOMS Score Card

Vestibular/Ocular Motor Test:	Not Tested	Headache 0-10	Dizziness 0-10	Nausea 0-10	Fogginess 0-10	Comments
<b>BASELINE SYMPTOMS:</b>	N/A					
Smooth Pursuits						
Saccades – Horizontal						
Saccades – Vertical						
Convergence (Near Point)						(Near Point in cm): Measure 1: _____ Measure 2: _____ Measure 3: _____
VOR – Horizontal						
VOR – Vertical						
Visual Motion Sensitivity Test						
<b>Total</b>						

Any score above baseline is considered abnormal

## VOMS RESULTS

All Normal

Any Abnormal

**EXAM SUMMARY**

Record the data for correct MACE 2 documentation.

**Cognitive Summary**

Orientation Total Score - Q5

Immediate Memory Total Score (all 3 trials) - Q6

Concentration Total Score (Sections A and B) - Q15

Delayed Recall Total Score - Q16

**COGNITIVE RESULTS**

≤ 25 is abnormal

**NEUROLOGICAL RESULTS (Q 7-14)**

Abnormal (+)

Normal (-)

**SYMPTOM RESULTS (Q 3)**

1 or more symptoms (+)

No symptoms (-)

**HISTORY RESULTS (Q 4A-4C)**

Positive (+)

Negative (-)

**VOMS RESULTS (Q 17)**

Abnormal (+)

Normal (-)

Deferred

**MACE 2 RESULTS**

Positive (+)

Negative (-)

**AFTER COMPLETING MACE 2:**

- Document MACE 2 results in the EHR with coding instructions.
- Initiate 24-hour rest.
- Refer to concussion management tool for the management recommendations based on MACE 2 results.
- After 24-hour rest period, evaluate for initiation into the Progressive Return to Activity (PRA) following the guidance of the PRA Clinical Recommendation.

Refer to Progressive Return to Activity Clinical Tool at

[dvbic.dcoe.mil/files/resources/2013\\_PRA\\_PCM\\_CST\\_FINAL.pdf](http://dvbic.dcoe.mil/files/resources/2013_PRA_PCM_CST_FINAL.pdf)

VOMS Equipment Sample 14 point font: **A**

Centimeter Ruler

0 cm

5 cm

15 cm

## TBI CODING INSTRUCTIONS

**Initial TBI screening code\*: Z13.850**

**TBI coding sequence:**

- 1. Primary TBI diagnostic code: S06. E L S E\*\***
- 2. Primary symptom code**, if applicable: (e.g., H53.2 - diplopia)
- 3. Deployment status code**, if applicable:\*\*\* (e.g., Z56.82 for deployed or Z91.82 for history of military deployment)
- 4. TBI external cause of morbidity code:** (For example, Y36.290A (A- use for initial visit) for war operations involving other explosions and fragments, military personnel, initial encounter)
- 5. Place of occurrence code**, if applicable
- 6. Activity code**, if applicable
- 7. Personal History of TBI code:** if applicable Z87.820

\* MACE 2

\*\* Etiology, Location, Severity, Encounter

\*\*\* Deployment code must fall within the first four codes when applicable

*For more information, see DVBIC ICD-10 Coding Guidance Tool.*

References available at <https://dvbic.dcoe.mil/material/military-acute-concussion-evaluation-2-mace-2-reference-list>.

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PUID 4901

Released: February 2012 | Revised October 2018  
by Defense and Veterans Brain Injury Center.

This product is reviewed annually and is current until superseded.