Military Acute Concussion Evaluation 2 (MACE 2)

Date
Time
<table>
<thead>
<tr>
<th>Name, credentials</th>
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<tbody>
<tr>
<td>Discipline</td>
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“Medically Ready Force...Ready Medical Force”
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Learning Objectives

At the conclusion of this training, participants will be able to:

- Utilize the Military Acute Concussion Evaluation 2 (MACE 2) as an acute assessment tool in order to screen for and identify concussion/mTBI

- Identify improvements to the MACE 2

- Understand how the MACE 2 improves the standard of care for traumatic brain injury (TBI) identification among service members

- Use the Tri-Service Workflow (TSWF) mTBI AIM form to document the MACE2 in AHLTA and review accurate mTBI ICD-10 coding
DoD Definition of Traumatic Brain Injury

- A traumatically induced **structural injury or physiological disruption of brain function**, as a result of an external force, that is indicated by new onset or worsening of **at least one** of the following clinical signs immediately following the events:

  - Loss of Consciousness (LOC)
  - Alteration of Consciousness (AOC)
  - Post-Traumatic Amnesia (PTA)
Traumatic Brain Injury Severity

Mild TBI/Concussion
- LOC: ≤ 30 min.
- AOC: < 24 hours
- PTA: ≤ 24 hours

Moderate TBI
- LOC: >30 min., but < 24 hours
- AOC: >24 hours
- PTA: >24 hours but < 7 days

Severe TBI
- LOC: >24 hours
- AOC: >24 hours
- PTA: >7 days
When to complete the MACE 2

- After sustaining a direct blow to your head or your head hitting an object
- After involvement in a potentially concussive event (PCE)
  - Motor vehicle collision or rollover accident
  - Presence within 50m of a blast
  - Involvement in a vehicle blast event
  - Sustaining a direct blow to the head or your head hitting an object
  - Witnessed LOC
- Command Directed
Improvements to the MACE 2

Concussion screening:
- Red flags
- Observable signs checklist
- Inclusion of symptom checklist
- More detailed history and follow-up instructions

Neurologic exam:
- Expanded speech and balance testing

Vestibular/Ocular-Motor Screening (VOMS)

Updated diagnostic codes
Administration of the MACE 2

- MACE 2 is used to identify concussion and guide initial assessment
  - Most effective when used as close to time of injury as possible
  - May be repeated to evaluate recovery
- Administer in sequence, using scripts as indicated
- Clinical judgment always supersedes any MACE 2 findings
- Use in conjunction with clinical recommendations
- Only complete if Glasgow Coma Scale is between 13–15
Conducting Concussion Screening

Patient Demographics

Red Flags

Concussion Screening

1. Description of Incident
2. Alteration of Consciousness or Memory
3. Symptoms
4. History
Concussion Screening Results

Confirmation of concussion by identification of injury event and presence of at least one of the clinical indicators of concussion.

- Examiner instructions
- Rest recommendations
- Leadership communication
- Documentation

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. |

| 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 service member in accordance with the Progressive Return to Activity (PRA). |
| 3. Communicate findings to line leadership. |
5. Orientation

- Assesses how aware the SM is of the time, where they are, and who they are
- This is most reliable within 12 hours of injury

6. Immediate Memory

- Tests the ability to remember a small amount of information over a few seconds/minutes
- Chosen list used for remainder of screening
- Use scripts for each of the three required trials
Neurological Exam

7. Speech Fluency
   - Stuttering or struggling to speak is abnormal

8. Word Finding
   - Inability to identify common objects or repeat a sentence is abnormal

9. Grip Strength
   - Unequal or weak grip strength is abnormal

10. Pronator Drift
    - Hold for 5–10 seconds, any arm or palm drift is abnormal
Neurological Exam (cont.)

11. Single Leg Stance
   ▪ Hold for 15 seconds, a loss of balance before 8 seconds is abnormal

12. Tandem Gait
   ▪ Stumbling or shifting feet is abnormal

13. Pupil Response
   ▪ Unequal pupil size, dilation or constriction delay is abnormal

14. Eye Tracking
   ▪ Assess extra-ocular movements, noting that both eyes move together
   ▪ Note if the head tilts or any abnormal eye movements such as repetitive, uncontrolled movements or nystagmus
15. Concentration

A. Reverse Digits
   - Tests concentration by having the SM repeat back a string of numbers in reverse order
   - Trial 2 only required if Trial 1 incorrect
   - If both attempts at a digit string are incorrect, STOP and record 0 for that string and any remaining

B. Months in Reverse Order
   - Tests central processing speed for both focused and sustained attention

<table>
<thead>
<tr>
<th>List A</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trial 1</strong></td>
<td><strong>Trial 2</strong></td>
</tr>
<tr>
<td>4-9-3</td>
<td>6-2-9</td>
</tr>
<tr>
<td>3-8-1-4</td>
<td>3-2-7-9</td>
</tr>
<tr>
<td>6-2-9-7-1</td>
<td>1-5-2-8-5</td>
</tr>
<tr>
<td>7-1-8-4-6-3</td>
<td>5-3-9-1-4-8</td>
</tr>
</tbody>
</table>
16. Delayed Recall

- Tests the ability to recall previously learned information
- Using script and no additional prompts, identify if SM can recall the same words from list previously used in the immediate memory test

**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**

**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.*

<table>
<thead>
<tr>
<th>List A</th>
<th>Incorrect</th>
<th>Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacket</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Arrow</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Pepper</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Cotton</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Movie</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**DELAYED RECALL TOTAL SCORE**

5

**Delayed Recall Alternate Word Lists**

<table>
<thead>
<tr>
<th>List B</th>
<th>List C</th>
<th>List D</th>
<th>List E</th>
<th>List F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dollar</td>
<td>Finger</td>
<td>Baby</td>
<td>Candle</td>
<td>Elbow</td>
</tr>
<tr>
<td>Honey</td>
<td>Penny</td>
<td>Monkey</td>
<td>Paper</td>
<td>Apple</td>
</tr>
<tr>
<td>Mirror</td>
<td>Blanket</td>
<td>Perfume</td>
<td>Sugar</td>
<td>Carpet</td>
</tr>
<tr>
<td>Saddle</td>
<td>Lemon</td>
<td>Sunset</td>
<td>Sandwich</td>
<td>Saddle</td>
</tr>
<tr>
<td>Anchor</td>
<td>Insect</td>
<td>Iron</td>
<td>Wagon</td>
<td>Bubble</td>
</tr>
</tbody>
</table>
Conducting Vestibular/Ocular-Motor Screening

VOMS Contraindication: Unstable Cervical Spine
What is the Vestibular/Ocular-Motor System?

Complex network that connects sensory organs of inner ear to the brain stem, cerebellum, cerebral cortex, ocular system and postural muscles

Responsible for integrating balance, gaze stabilization, and visual and spatial orientation
Why Complete the VOMS?

Among concussed patients

- Dizziness is reported by nearly 50%
- Visual problems are reported in approximately 30%

Early identification of vestibular and ocular motor symptoms allows for development of targeted treatment and early referral if needed.

U.S. Army photo by Sgt. Paige Behringer, Fort Bragg, NC
Vestibular/Ocular-Motor Screening (VOMS)

Goal: **Symptom provocation**

VOMS consists of these **seven** tests after evaluating for baseline symptoms (HDNF):

- Smooth Pursuits
- Saccades
  - Horizontal Saccades
  - Vertical Saccades
- Convergence
- Vestibular-Ocular Reflex (VOR)
  - Horizontal VOR Test
  - Vertical VOR Test
- Visual Motion Sensitivity (VMS)
Vestibular/Ocular-Motor Screening

The following equipment is recommended in order to perform the VOMS tests:

- A target with a **14-point font** (for the **Convergence** and VOR tests)
- A tape measure with centimeter increments (for the **Convergence** test)
- A **metronome** (for the VOR and VMS tests)

**Note:** a 14pt target and a cm scale can be found on the last page of the MACE 2.
Vestibular/Ocular-Motor Screening

Instructions

VOMS Contraindication: Unstable Cervical Spine

- Perform each of the VOMS tests in the order they appear in the table.
- VOMS must be completed before return to duty.
- Any increase in symptom score above baseline, or convergence \( \geq 5 \) centimeters (cm) is abnormal.
- Patient should be wearing glasses or corrective lenses during VOMS tests.
# Vestibular/Ocular-Motor Screening Scoring Chart

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

Any score above baseline is considered abnormal

**VOMS RESULTS**

- [ ] All Normal
- [ ] Any Abnormal

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Vestibular/Ocular-Motor Screening

Smooth Pursuits

- Service member and examiner are seated.
- Hold fingertip 3 feet from patient.
- Service member focuses on target as examiner moves target smoothly horizontally 1.5 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 1.5 feet above and 1.5 feet below midline, *up and down* moving eyes two seconds fully up and two seconds down. **Perform twice.**
- Re-assess and record HDNF on a scale of zero to 10.
Vestibular/Ocular-Motor Screening

Horizontal Saccades

- Service member and examiner are seated.
- Hold 2 fingertips horizontally at a distance of three feet from service member, and move hand 1.5 feet to the right and 1.5 feet to the left of midline, so service member must gaze $30^\circ$ to the left and $30^\circ$ to the right.
- Instruct service member to move eyes as quickly as possible from point-to-point.
- Perform 10 times from point to point.
- Re-assess and record HDNF on a scale of zero to 10.
Vestibular/Ocular-Motor Screening

Vertical Saccades

- Service member and examiner are seated.
- Repeat with two fingertips held vertically three feet from service member, and 1.5 feet above and 1.5 feet below midline, so service member gazes 30° upward and then 30° downward.
- Service member moves eyes as quickly as possible from point-to-point.
- Perform 10 times from point to point.
- Re-assess and record HDNF on a scale of zero to 10.
Vestibular/Ocular-Motor Screening

Convergence

- Seated service member faces examiner.
- Service member focuses on target (MACE 2 page 14) at arm’s length and slowly brings toward tip of nose.
- Service member stops target when two distinct images are seen, or when outward deviation of one eye is observed. Repeat and measure three times.
- Record centimeters between target and tip of nose for each trial. A near point of convergence > 5 centimeters from the tip of the nose is considered abnormal.
- Re-assess and record HDNF on a scale of 0 to 10.
1) Horizontal VOR test:

- Service member and examiner are seated.
- Examiner holds font target three feet in front of service member at midline, and sets metronome to 180 beats per minute (bpm).
- While focusing on target, service member turns head 20° to each side (horizontally) in time to the beat of the metronome.
- Perform 10 times.
- Wait 10 seconds, re-assess and record HDNF on a scale of zero to 10.
Vestibular/Ocular-Motor Screening

Vertical Vestibular-ocular Reflex Test

2) Vertical VOR test:

- Service member and examiner are seated.
- Examiner holds target three feet in front of service member at midline, and sets the metronome to 180 beats per minute (bpm).
- While focusing on target, service member moves head up 20° and down 20° (vertically) in time to the beat of the metronome.
- Perform 10 times.
- Wait 10 seconds, re-assess and record HDNF on a scale of zero to 10.
Vestibular/Ocular-Motor Screening

VMS Test

- Service member stands with feet shoulder width apart, facing a busy area.
- Examiner stands next to and slightly behind service member. Sets metronome to 50 bpm.
- Service member outstretches arm. Focusing on their thumb, the service member turns head, eyes and trunk as a unit 80° right and 80° left in time to the metronome.
- Perform five times.
- Record HDNF on a scale of zero to 10.
Final MACE 2 Scoring

- **Exam Summary**
  Guides provider through scoring

- **Cognitive Results**
  Scoring and results = __/30

- **Neurological Results**
  Check + (Abnormal) or - (Normal)

- **Symptom Results**
  Check + (1 or more symptoms) or - (No symptoms)

- **History Results**
  Check + (Positive) or - (Negative)

- **VOMS Results**
  Check + (Positive) or - (Negative) or Deferred

- **MACE 2 RESULTS**
  Check + (Positive) or - (Negative)

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<table>
<thead>
<tr>
<th>EXAM SUMMARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record the data for correct MACE 2 documentation.</td>
</tr>
<tr>
<td>Cognitive Summary</td>
</tr>
<tr>
<td>Orientation Total Score - Q5</td>
</tr>
<tr>
<td>Immediate Memory Total Score (all 3 trials) - Q6</td>
</tr>
<tr>
<td>Concentration Total Score (Sections A and B) - Q15</td>
</tr>
<tr>
<td>Delayed Recall Total Score - Q16</td>
</tr>
<tr>
<td>COGNITIVE RESULTS</td>
</tr>
<tr>
<td>≤ 25 is abnormal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NEUROLOGICAL RESULTS (Q 7-14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal (+)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SYMPTOM RESULTS (Q 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 or more symptoms (+)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>HISTORY RESULTS (Q 4A-4C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive (+)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VOMS RESULTS (Q 17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal (+)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MACE 2 RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive (+)</td>
</tr>
</tbody>
</table>
The MACE 2 should be documented in the mTBI Tri-Service Workflow (TSWF) AIM form*

*For AHLTA users only. Please check back for details on MHS Genesis.

Consider adding both the TSWF Navigator and the TSWF mTBI form to your favorites.
The MACE 2 fields are located in the “Initial Visit” Tab of the TSWF mTBI AIM form.
TBI Coding

- Accurate coding is important for:
  - Surveillance
  - Continuity of Care
  - Reimbursement for care
  - Disability determination
  - Identification of trends
  - Improvement in patient outcomes

- Mild TBI 72-hour follow-up required after initial visit S06.ELS “E”
  - A = initial visit
  - D = subsequent/follow-up visit
  - S = sequela
Key Takeaways

- MACE 2 should be completed as close to the time of injury as possible, cognitive assessment is most reliable within 12 hours of injury event.
- MACE 2 confirms concussion diagnosis and guides initial assessment, but does not replace comprehensive medical examination.
- History impacts rest and recovery.
- MACE 2 identifies presence of symptom clusters to guide treatment.
- Use in conjunction with clinical judgment and clinical recommendations.
- Improvements to the MACE 2 screening improve the standard of care for concussed patients.
- Accurate coding and utilization of the mild TBI TSWF form is essential for continuity of care.
Questions?

- The MACE 2 in PDF format can be downloaded from the TBICoE website: www.health.mil/TBICoE
- If you have questions regarding the content of this presentation, please contact: dha.TBICOEinfo@mail.mil

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Contact

Insert presenter contact information


References (2)


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