Military Acute Concussion Evaluation 2 (MACE 2): Revision Update and Tutorial

Training current as of March 2019

"Medically Ready Force…Ready Medical Force"

Learning Objectives

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

- Distinguish high level changes in the Military Acute Concussion Evaluation 2 (MACE 2) including specific updates and evidence to support:
  - Red flags
    - Structural brain injury detection device
  - History questions
  - Expanded assessment by the addition of the Vestibular/Ocular-Motor Screening (VOMS), cervicogenic symptoms and enhanced balance assessment
- Show how MACE 2 improves the current standard of care for traumatic brain injury (TBI) management.

Key Changes

Concussion screening:

- Red flags added indicating when to stop the MACE 2 and immediately consult higher level of care and consider urgent evacuation
  - New observable signs checklist added
  - Symptoms checklist moved to screening section
  - More detailed history and follow-up instructions

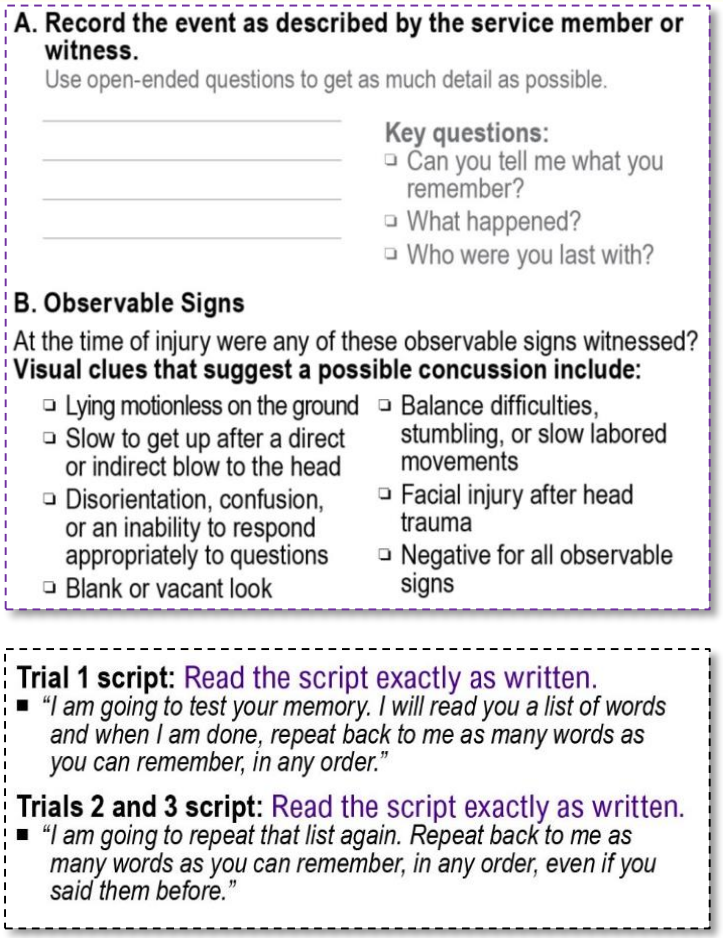
Neurologic exam: expanded speech and balance testing

Vestibular/Ocular-Motor Screening (VOMS): added

Updated diagnostic codes

Card Features

- MACE 2 card design easier to use:
  - **Black text → action**
  - Gray text → Key questions (helpful hints & assessment tips - typically appear on the right side of the card)
  - *Italics text → Cue to read instructions exactly as written*
  - Check boxes □
    - New check boxes replaced bullets to ensure attention and action



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

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."*

How to Administer the MACE 2

- 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
- Administer in sequence
- Use scripts when provided
- Use in conjunction with clinical judgment, the Concussion Management Tool (CMT) and clinical recommendations
- Factors such as sleep deprivation, medications, or pain may affect MACE 2 results

Conducting Concussion Screening

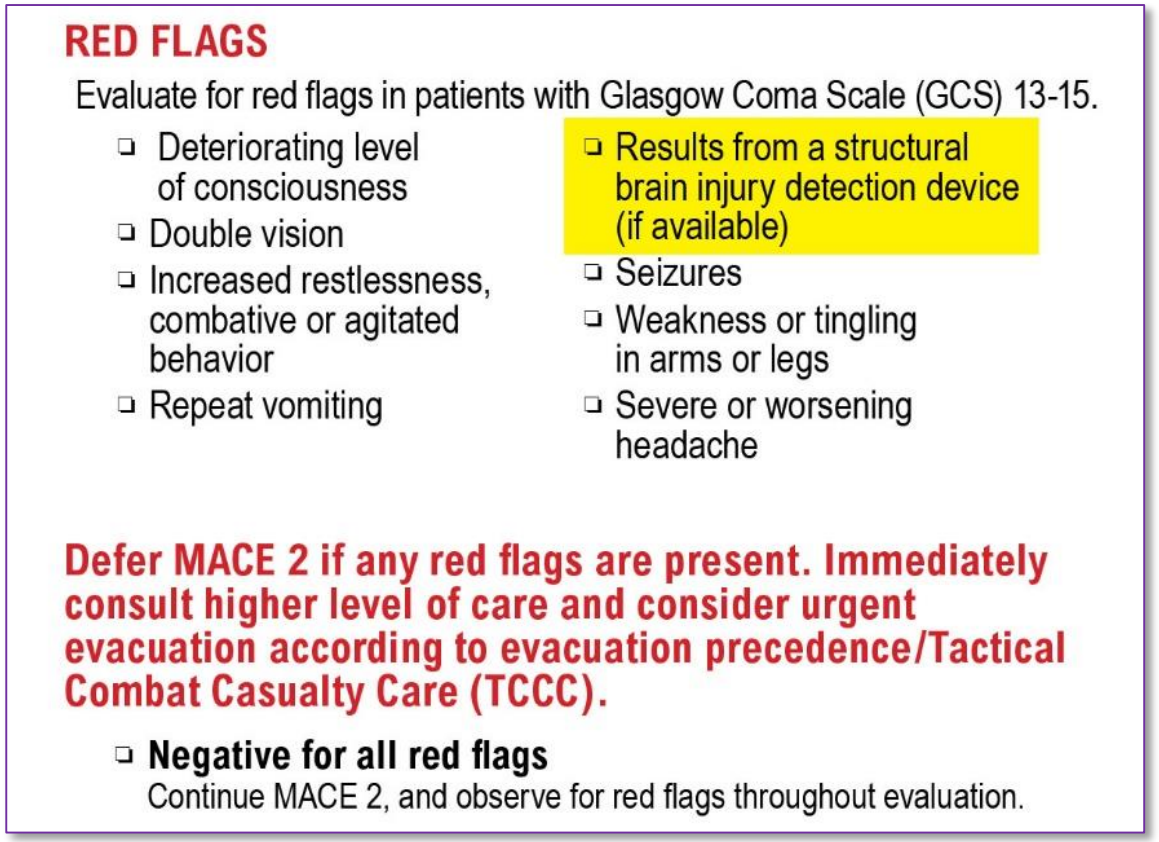
MACE 2 is to be used as close to time of injury as possible.

Concussion Screening

- Red Flags
- Concussion Screening
  - Description of incident (includes new observable signs list)
  - Alteration of conscious or memory
  - Symptoms
  - History
- Screening Results
  - Service Member (SM) Instructions

Identify Red Flags

New Red Flag: Abnormal result from structural brain injury detection device (if available)



Identifying Concussion

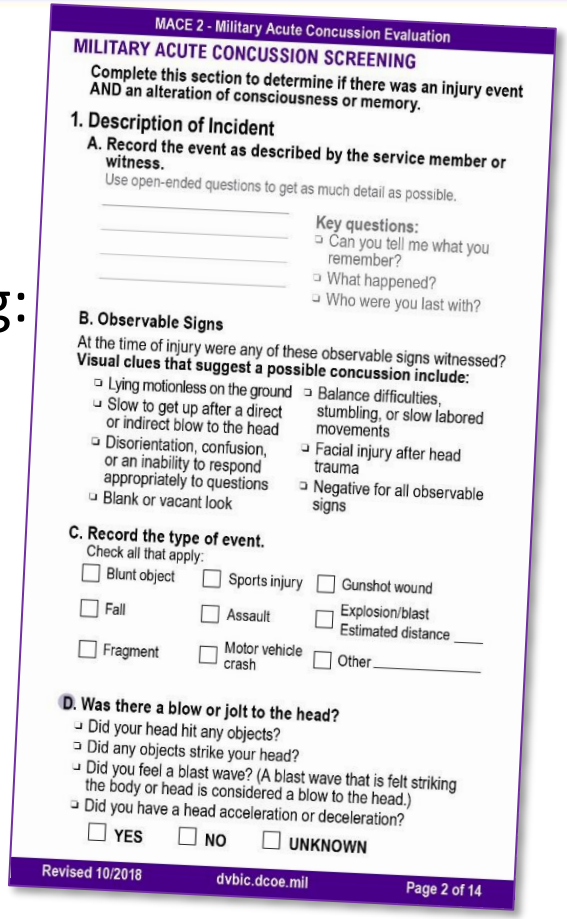
- Concussion screening should determine:
  - If emergent care should be provided to the SM
  - If the SM meets Department of Defense (DoD) concussion criteria

DVIDS photo by SSgt Dana Cable

Concussion Screening

1. Description of Incident

- Complete this section to determine if there was both an injury event and an alteration of consciousness (AOC)
- Establish details of the latest incident, including:
  - A. Record the event as described by the SM or witness.
  - B. Record observable signs.
  - C. Record the type of event.
  - D. Was there a blow or jolt to the head?
- Use "Key Questions" to get as much detail as possible



MACE 2 - Military Acute Concussion 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:

☐ Blunt object ☐ Sports injury ☐ Gunshot wound
☐ Fall ☐ Assault ☐ Explosion/blast Estimated distance ___
☐ Fragment ☐ Motor vehicle crash ☐ 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

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Concussion Screening

2. Alteration of Consciousness or Memory

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

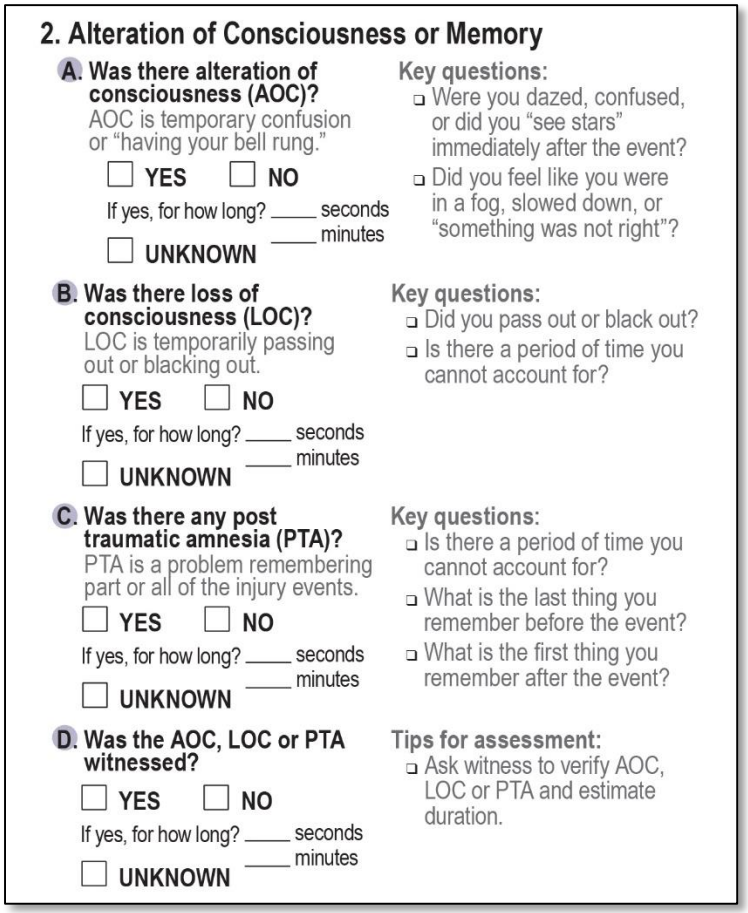
B. Was there loss of consciousness (LOC)?*

C. Was there post-traumatic amnesia (PTA)?*

D. Was an AOC/LOC/PTA witnessed or observed?

Reminder: Use the key questions to ensure the SM provides yes or no answers.

**** If the SM responds "yes" ask how long they were affected (seconds, minutes)***



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

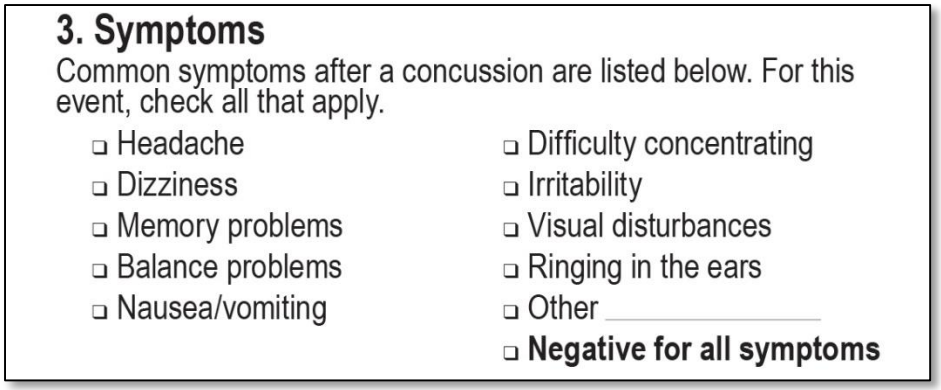
Tips for assessment:
- Ask witness to verify AOC, LOC or PTA and estimate duration.

Concussion Screening

3. Symptoms

Screens for common concussion symptoms:

- Read list of symptoms to the SM
- Check the box if they answer ***"yes"*** (symptoms are either present or not)
- Check "Negative for all symptoms" if no symptoms are present



3. Symptoms

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

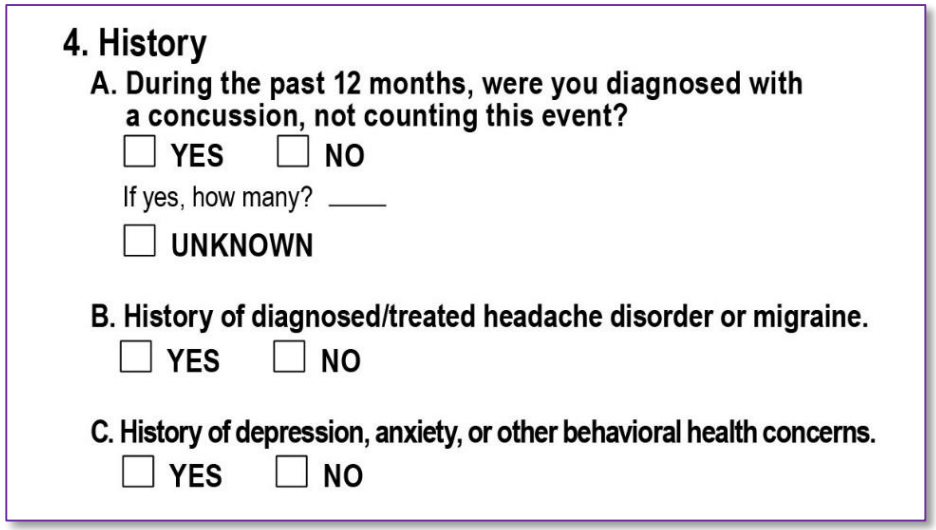
- ❑ Headache
- ❑ Dizziness
- ❑ Memory problems
- ❑ Balance problems
- ❑ Nausea/vomiting
- ❑ Difficulty concentrating
- ❑ Irritability
- ❑ Visual disturbances
- ❑ Ringing in the ears
- ❑ Other _____
- ❑ **Negative for all symptoms**

Concussion Screening

4. History

Ask the SM if they had a concussion during the last 12 months, had headaches prior to the injury and if they have been diagnosed with depression, anxiety or another behavior disorder.

- The answer to question 4.A impacts minimum mandatory recovery time and overall rest and recovery time.



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

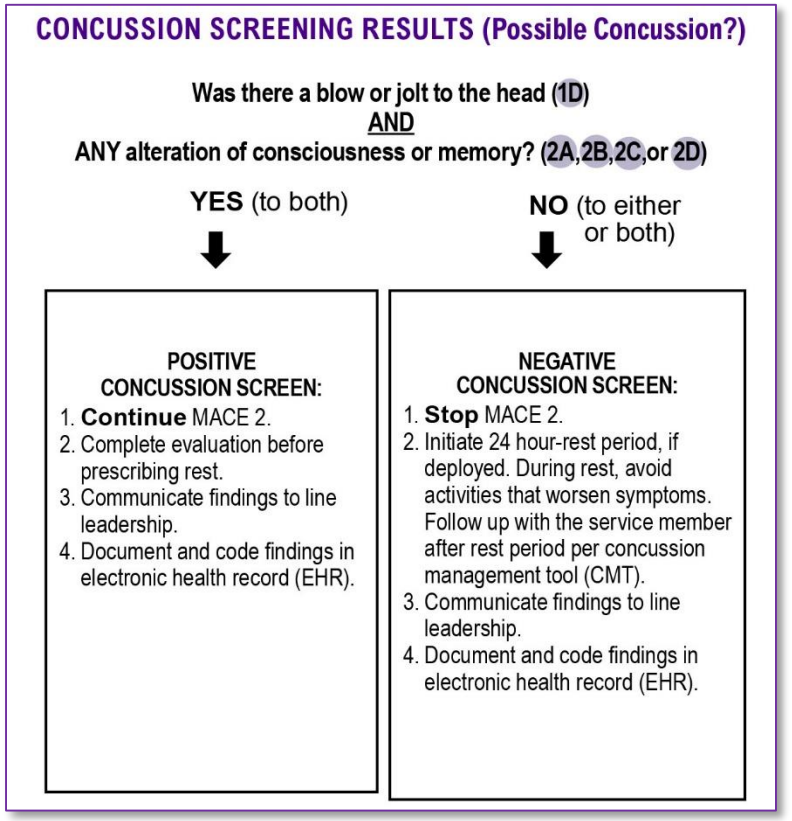
C. History of depression, anxiety, or other behavioral health concerns.

☐ YES ☐ NO

Concussion Screening Results

Positive concussion criteria:

- A blow or jolt to the head **1D** *and*
- If the patient experienced any *one* of these conditions: (answered Yes)
  - An alteration of consciousness (AOC) **2A**
  - A loss of consciousness (LOC) **2B**
  - Post traumatic amnesia (PTA) **2C**
  - The patient's AOC/LOC/PTA was observed by someone at the scene of the injury event or during the screen **2D**



Practice Activity 1

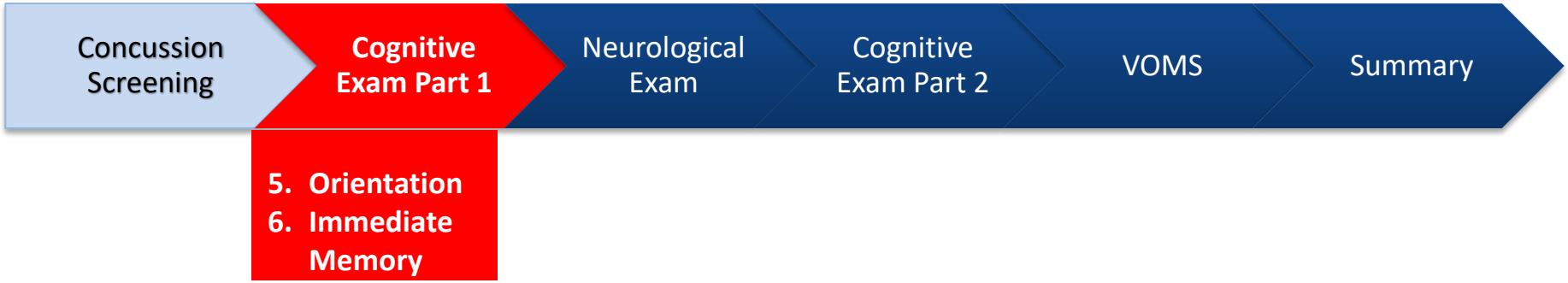
Please refer to workbook

Red Flags

Concussion Screening:

- Description of Incident
- Observable Signs
- Alteration of Consciousness or Memory
- Symptoms
- History
- Screen Results

CONDUCTING COGNITIVE EXAM



Cognitive Exam
5. Orientation

- The first part of the cognitive exam assesses orientation (i.e. how aware the SM is of the time, where they are, and who they are).
- Words in *italics* are said exactly as written.
- Score a point for each correct answer; maximum score is **5**.
- This cognitive exam is most reliable <u>within 12 hours</u> of injury.

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

Cognitive Exam
6. Immediate Memory

- The second part of the cognitive exam tests immediate memory: The ability to remember a small amount of information over a few seconds/minutes.

- Example:
  - Select a word list
  - Use the same word list (matching color and letter) for the remainder of the MACE 2

List A
Jacket
Arrow
Pepper
Cotton
Movie

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

Cognitive Exam

6. Immediate Memory (continued)

- Read the script as written in immediate memory section.
- Three trials are required, even if all answers are correct in Trial 1 and 2.
- Score a point for each correct word recalled; the maximum score is **15**.
- Read the words at a rate of **one word per second**.

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

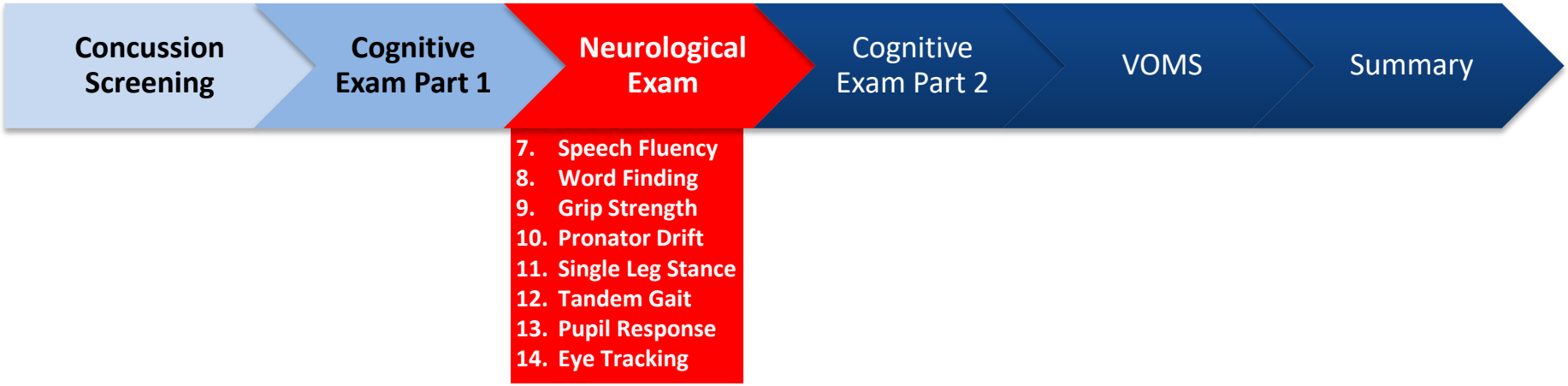
Practice Activity 2

Please refer to the workbook

Cognitive Exam (part 1):

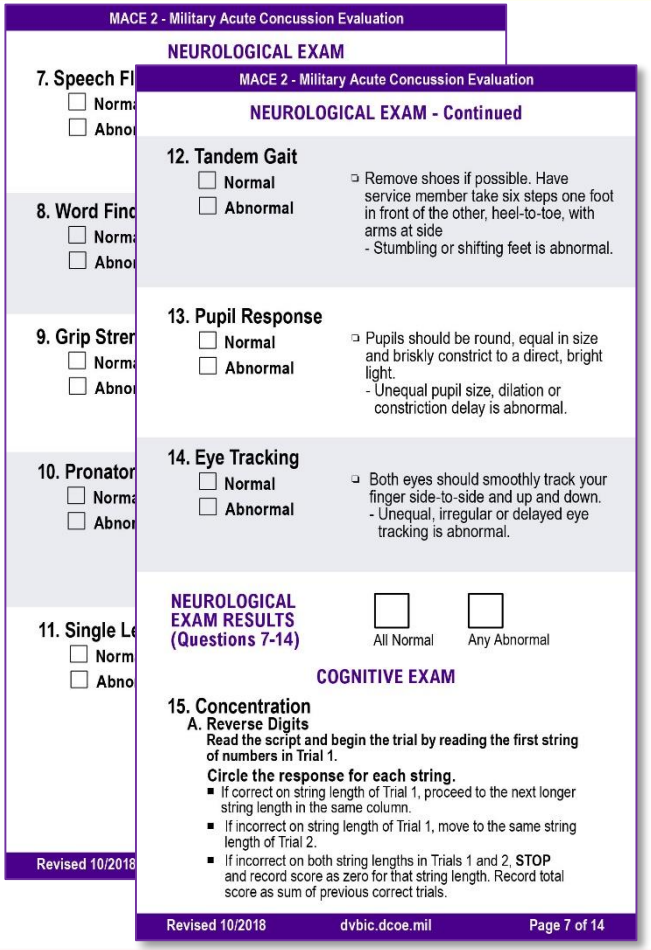
- Orientation
- Immediate Memory

Conducting Neurological Tests



Neurological Exam

- The neurological exam tests overall sensory and motor functions. It is placed in the middle of the cognitive exam to allow time to pass to test delayed recall accurately. The exam consists of:
  - **Speech Fluency**
  - **Word Finding**
  - **Grip Strength**
  - **Pronator Drift**
  - **Single Leg Stance**
  - **Tandem Gait**
  - **Pupil Response**
  - **Eye Tracking**



MACE 2 - Military Acute Concussion Evaluation

NEUROLOGICAL EXAM

7. Speech Fl
Norma
Abnor

8. Word Finc
Norma
Abnor

9. Grip Stren
Norma
Abnor

10. Pronator
Norma
Abnor

11. Single Le
Norm
Abno

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MACE 2 - Military Acute Concussion Evaluation

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.

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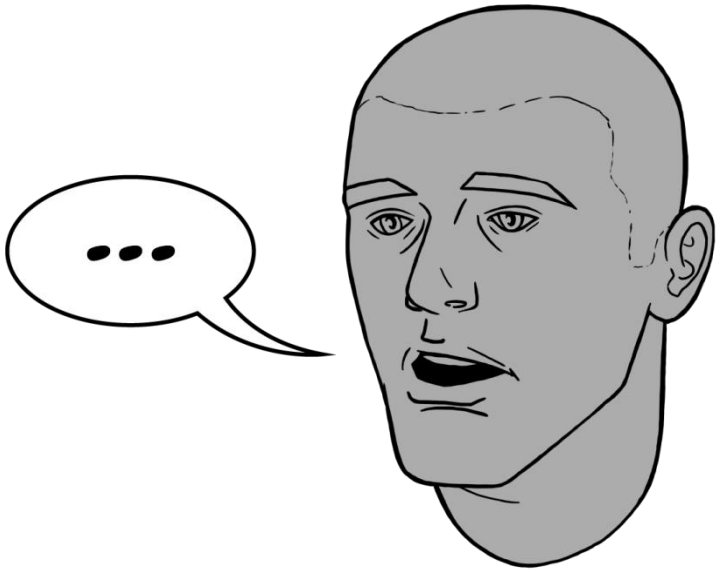
Neurological Exam -
7. Speech Fluency

- Note abnormal speech during conversation.
- During open-ended questions, listen for pauses or unnatural breaks in speech.
- Stuttering or struggling to speak is abnormal.

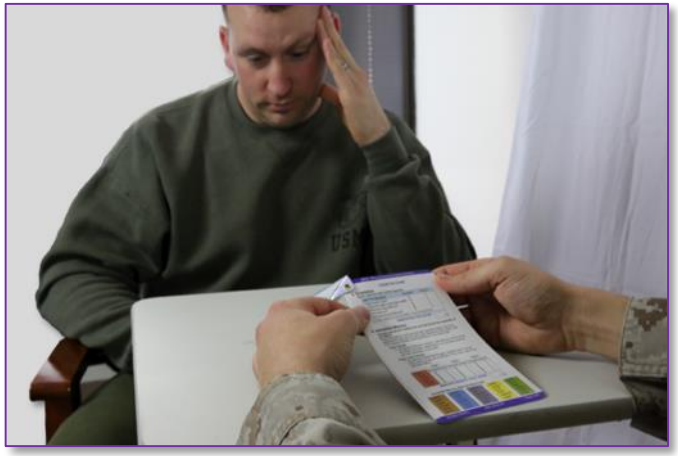


DVBIC image by Kori Zick

Neurological Exam -
8. Word Finding

Assess word finding difficulties:

- Does service member have trouble coming up with the name of a common object?
- Ask the SM to repeat a sentence or name an object in view. Example: "I got a haircut today and they did it way too short."



Courtesy photo by Melanie Sexton

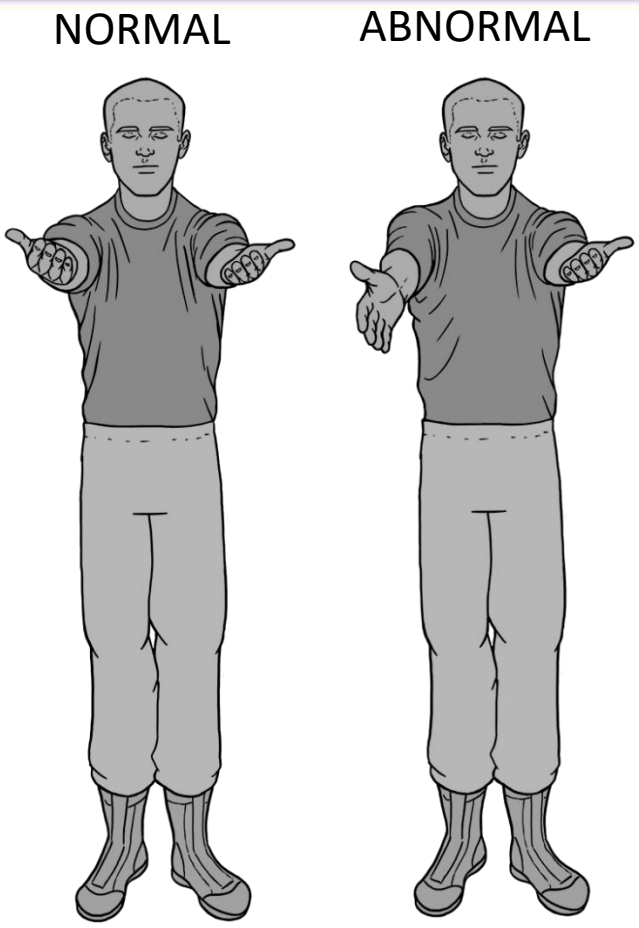
Neurological Exam -
9. Grip Strength

Assess grip strength

- Grip strength should be strong and equal on both sides.
- Unequal or weak limb strength is abnormal.

Neurological Exam -
10. Pronator Drift

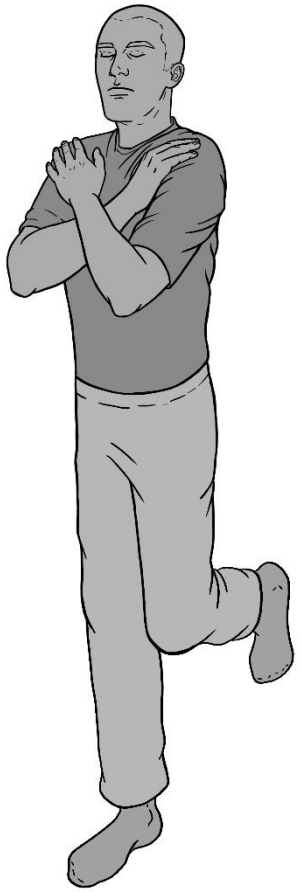
- Direct patient to stand with eyes closed and arms extended forward, parallel to the ground with palms up. Assess for **five** to **10** seconds:
  - Does either palm turn inward?
  - Does either arm drift down?
  - Any arm or palm drift is abnormal.



DVBIC image by Kori Zick

Neurological Exam -
11. Single Leg Stance

- Have service member remove shoes if possible and have them stand on one leg with arms across chest and hands touching shoulders, eyes open initially.
- Once patient is balanced, have them close their eyes and time for 15 seconds how long they can maintain their balance. Repeat test with opposite leg.
- If they lose their balance before **8** seconds, it is abnormal.



DVBIC image by Kori Zick

Neurological Exam -
12. Tandem Gait

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

DVBIC image by Kori Zick

Neurological Exam

13. Pupil Response

- Pupils should be equal size, normal is **2-6** mm.
- Pupils should be round.
- Pupils should get smaller with bright light and become larger in dim light or darkness.
- Pupils should quickly respond to changes in light.
- Unequal pupil size, dilation or constriction delay is abnormal.

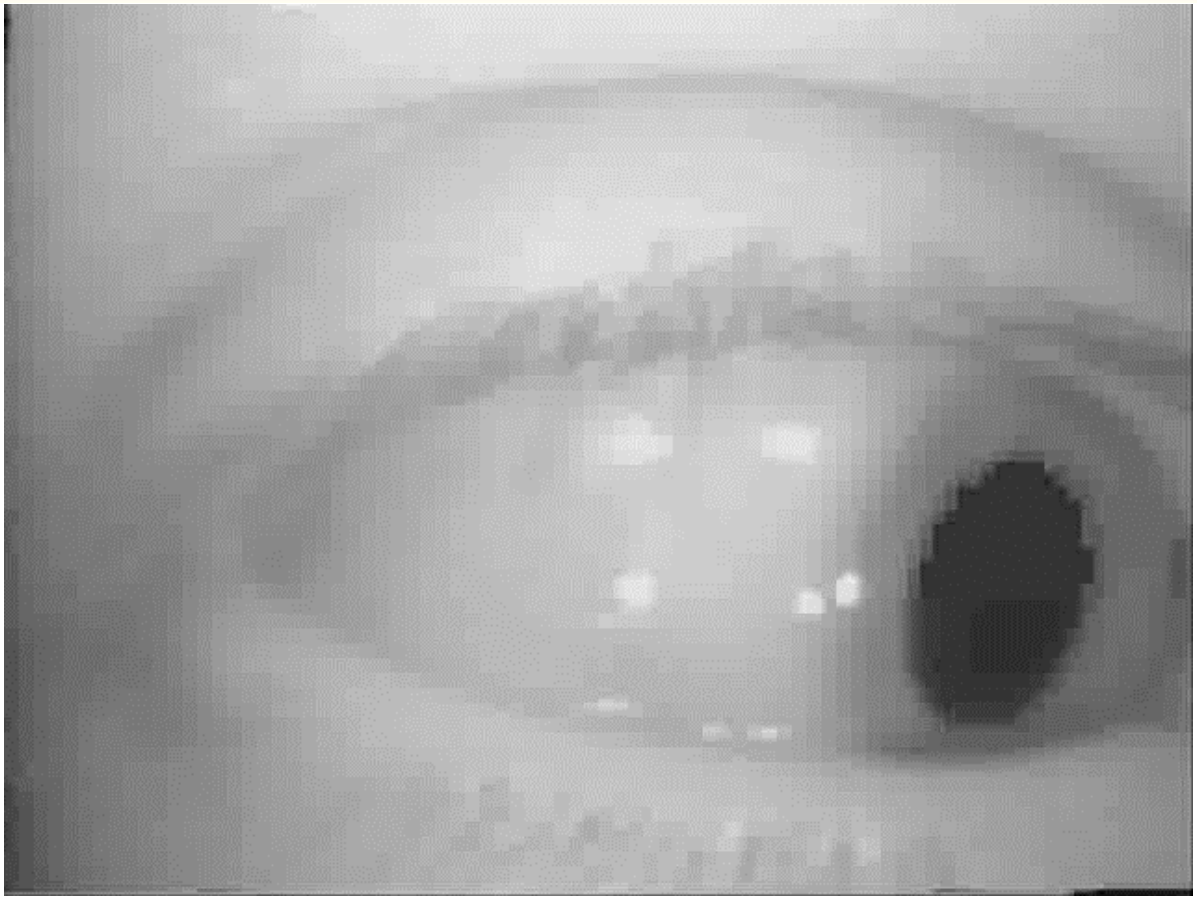
Neurological Exam

14. Eye Tracking

Extra-ocular eye movement

- Check movement to all vision field areas in both "**H**" and "**X**" test patterns.
- Check that both eyes move together.
- Note if the head tilts or any abnormal eye movements such as repetitive, uncontrolled movements or nystagmus.

Acute Nystagmus



Video courtesy of Dr. Sue Whitney, University of Pittsburgh

Neurological Exam - Results

- If *all* sections are normal, check the **All Normal** box.
- If *any* section is abnormal, check the **Any Abnormal** box.

Practice Activity 3

Please refer to workbook

Neurological Exam:

- Speech Fluency
- Word Finding
- Grip Strength
- Pronator Drift
- Single Leg Stance
- Tandem Gait
- Pupil Response
- Eye Tracking

FINISHING THE COGNITIVE EXAM

Defense Health Agency

Cognitive Exam Part 1 → **Neurological Exam** → **Cognitive Exam Part 2**

Concentration

15. A. Reverse Digits
    B. Months in Reverse Order
16. Delayed Recall

Cognitive Exam
15. Concentration- Reverse Digits

A. Reverse Digits

Tests concentration by having the SM repeat back a string of numbers in reverse order:

- Use the color number list (A-F) that matches the word list color you used before in the memory section (Question # 6).
- Read the script on the card word-for-word.
- Read the digits at a rate of one-per-second.
- **Do NOT group the digits in any way.**
- Allow the SM two attempts at repeating each digit string (trials 1 and trial 2).

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

Cognitive Exam

Concentration- Reverse Digits Correct Results

- If ***correct*** on 1st or 2nd attempts at that digit string:
  - Score one point for that string.
  - Move to the next longer string (4) in the Trial 1 column, in this case: "3-8-1-4."
- If both attempts at a digit string are incorrect, **STOP** and record a zero for that string *AND* all the strings that remain.

Cognitive Exam

Concentration- Reverse Digits Incorrect Results

- Read the 1st 3-digit string: "4-9-3."
  - Correct response would be: "3-9-4."
- If ***incorrect*** on the 1st string:
  - Go to the 1st string in the Trial 2 column.
  - Read that 3-digit string: "6-2-9."
  - Record the score after 2nd attempt.

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

B. Months in Reverse Order

- Instruct the SM to state the months of the year in reverse order.
  - Score 1 for correctly reciting the entire sequence.
  - Score **0** (zero) if **1** or more months is out of sequence or omitted.

Cognitive Exam -
Concentration Scoring

- **Total scores for 15.A and 15.B**

  A. Reverse Digits: maximum score **4** points.

  B. Months in Reverse Order: entire sequence correct maximum score **1** point.

  - Recite the entire sequence correctly for a maximum score of **5** points.

Cognitive Exam -

16. Delayed Recall

- Use the same five-word-list as in earlier immediate memory test from page 5 of the MACE 2.
- Do **NOT** repeat the word list this time or indicate how many words are on the list.
- Ask the SM to recall as many words as they can in any order.
- Allow only **one** trial.
- Score **1** point for each word remembered correctly for a maximum score of **5.**

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

DELAYED RECALL TOTAL SCORE ___/5

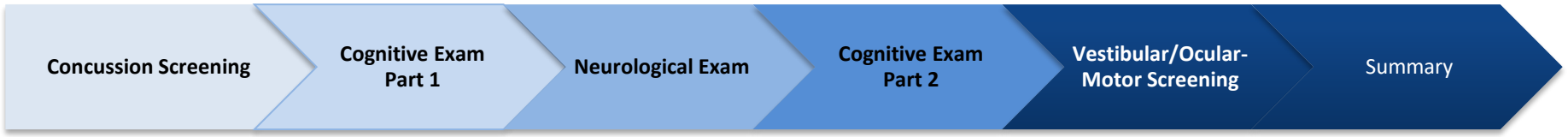
Practice Activity 4

Please refer to the workbook

Cognitive Exam (part 2):

- Concentration
- Months in Reverse Order
- Delayed Recall

CONDUCTING VESTIBULAR/OCULAR-MOTOR SCREENING



VOMS Contraindication: Unstable Cervical Spine

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 Test:	Not Tested	Headache 0-10	Dizziness 0-10	Nausea 0-10	Fogginess 0-10	Comments
BASELINE SYMPTOMS:	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						
Total						

Any score above baseline is considered abnormal

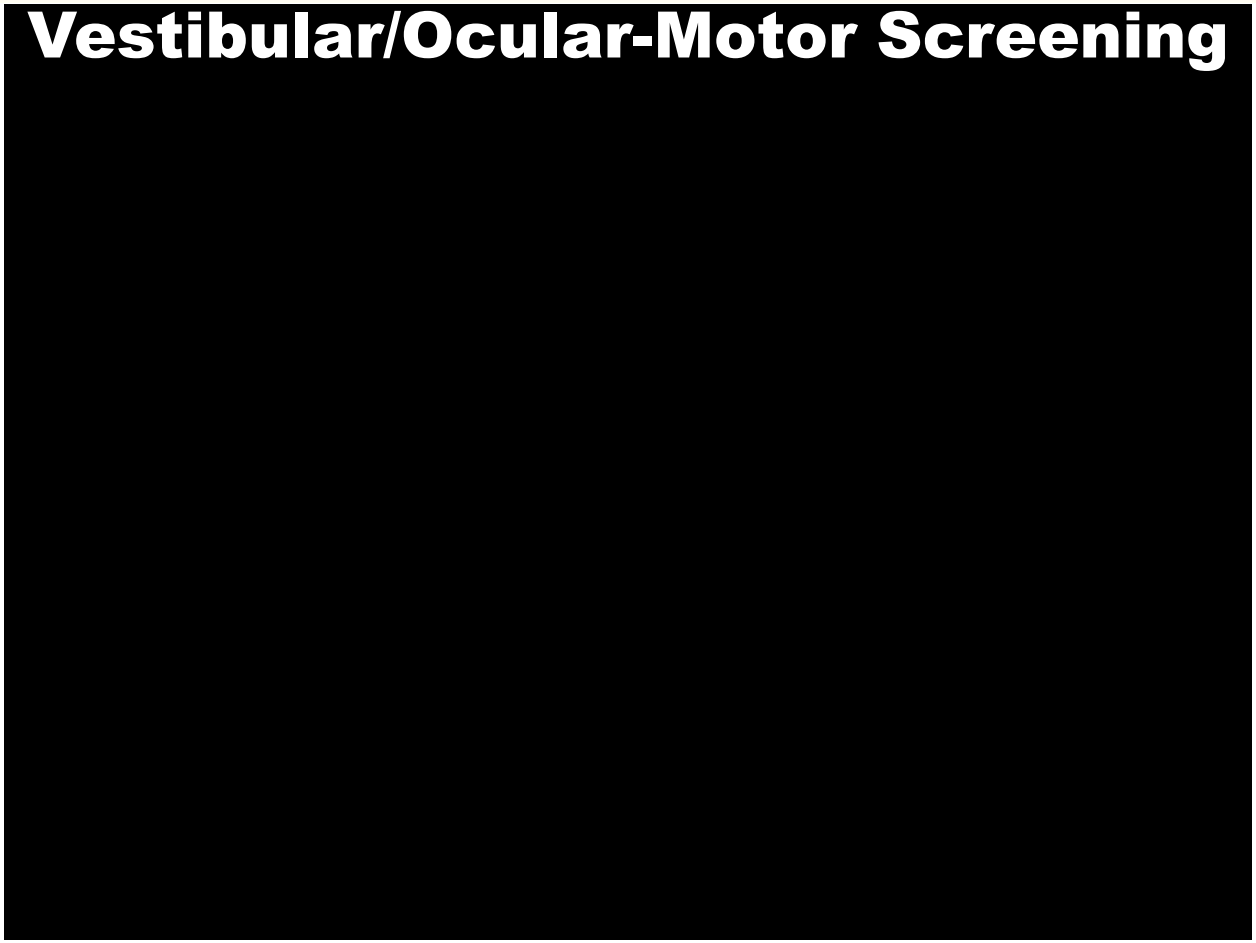
VOMS RESULTS ☐ All Normal ☐ Any Abnormal

Vestibular/Ocular-Motor Screening
Instructions

VOMS Contraindication: Unstable Cervical Spine

- Consider deferring VOMS if:
  - patient is overtly symptomatic *or*
  - trained provider is unavailable.
- VOMS must be completed before return to duty.
- Use the comment section of score card to record any observed difficulties the patient has performing the VOMS tasks.

Vestibular/Ocular-Motor Screening-
VOMS Overview



Vestibular/Ocular-Motor Screening
Recording Results

- Perform each of the VOMS test as described in the MACE 2, and in the order they appear in the table.

- Record the answers in the applicable rows for each test. If any VOMS test was ***not*** performed, indicate that in **"Not Tested"** column.

- Any score **above** the baseline scores, or convergence **≥ 5** centimeters (cm) is abnormal.

Vestibular/Ocular-Motor Screening
Scoring Chart

Vestibular/Ocular Motor Test:	Not Tested	Headache 0-10	Dizziness 0-10	Nausea 0-10	Fogginess 0-10	Comments
BASELINE SYMPTOMS:	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						
Total						

Any score above baseline is considered abnormal

VOMS RESULTS ☐ All Normal ☐ Any Abnormal

Vestibular/Ocular-Motor Screening

A. Baseline Symptoms

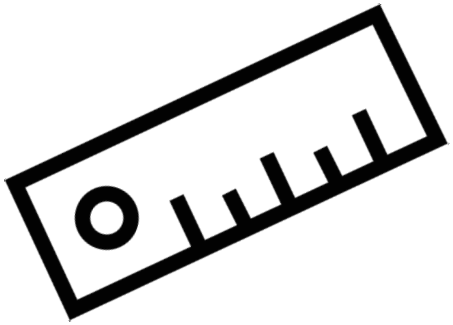
First ask the patient to rate their headache, dizziness, nausea, and fogginess (HDNF) on a scale of **1 to 10** to establish a baseline before testing begins.

Vestibular/Ocular Motor Test:	Not Tested	Headache 0-10	Dizziness 0-10	Nausea 0-10	Fogginess 0-10	Comments
BASELINE SYMPTOMS:	N/A					

Vestibular/Ocular-Motor Screening
Equipment

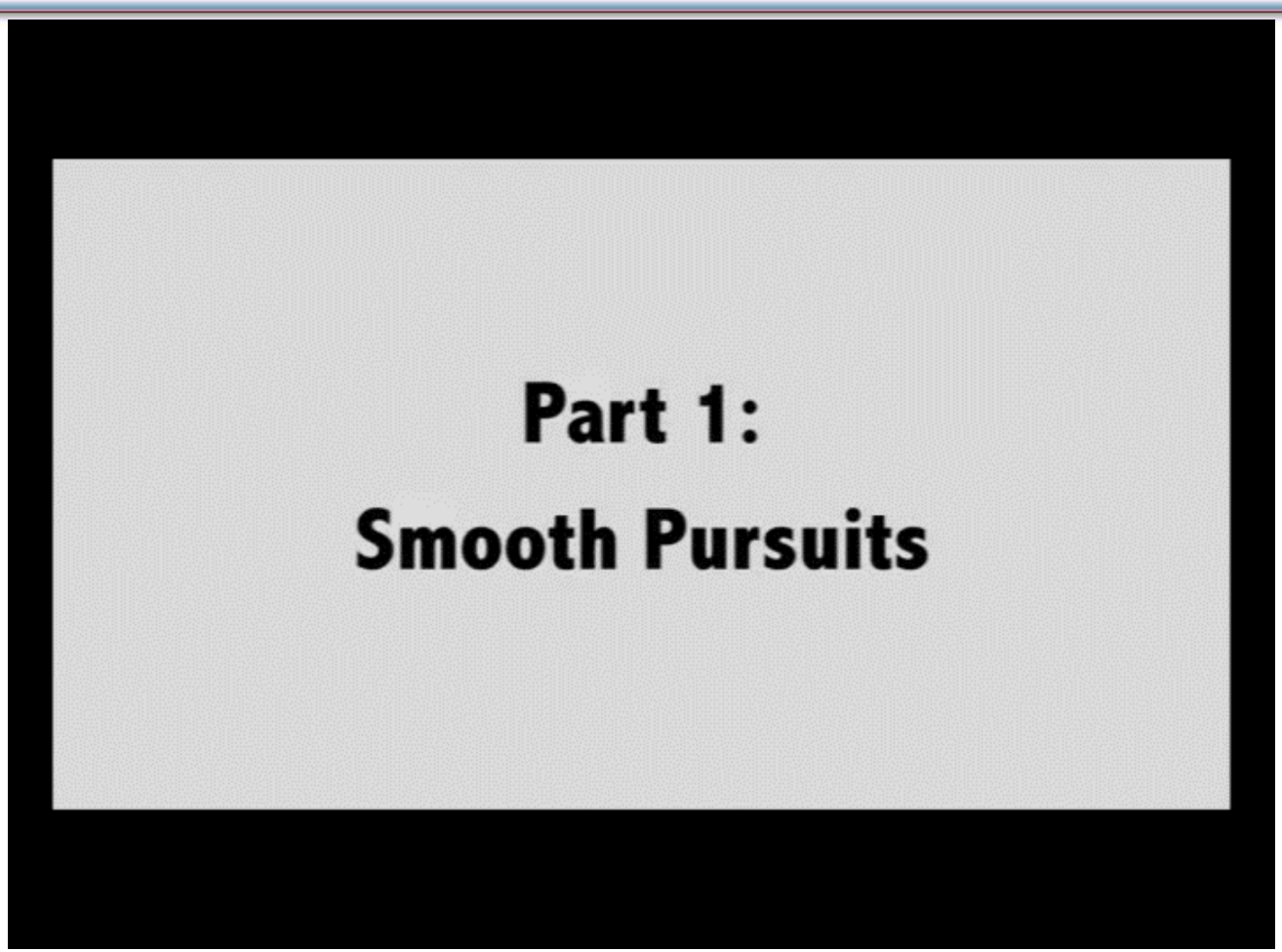
To perform the VOMS tests, you need the following:

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



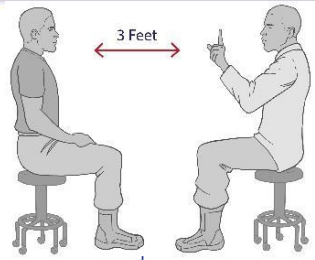
Note: a 14pt target and a cm scale can be found on the last page of the MACE 2.

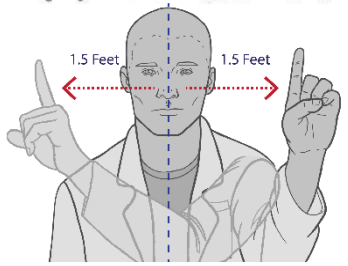
Vestibular/Ocular-Motor Screening - Smooth Pursuits

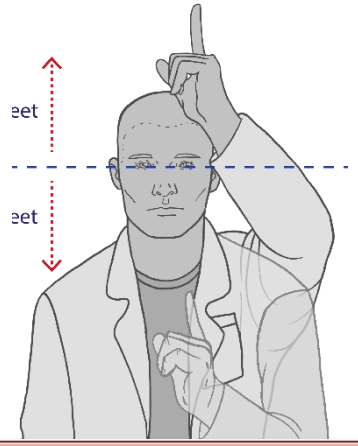


Vestibular/Ocular-Motor Screening - B. Smooth Pursuits

- 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 zero to 10 scale.





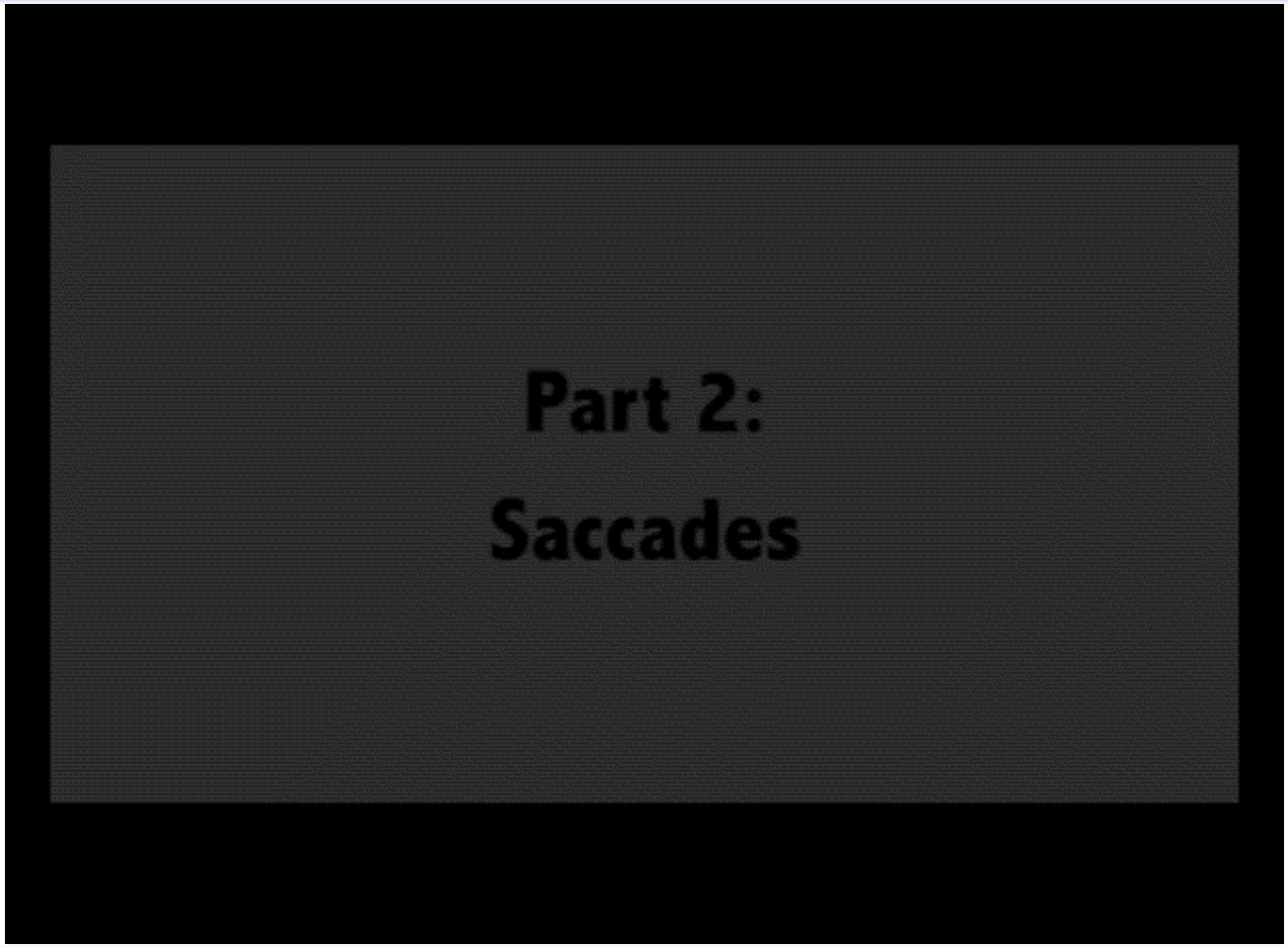


Practice Activity 5

Please refer to workbook

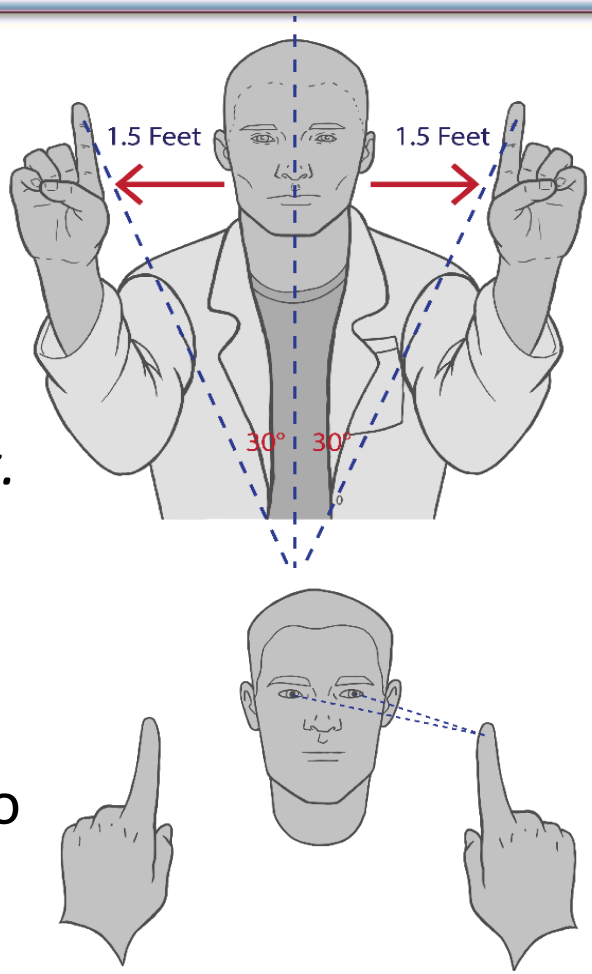
VOMS: Smooth Pursuits

Vestibular/Ocular-Motor Screening - Horizontal and Vertical Saccades



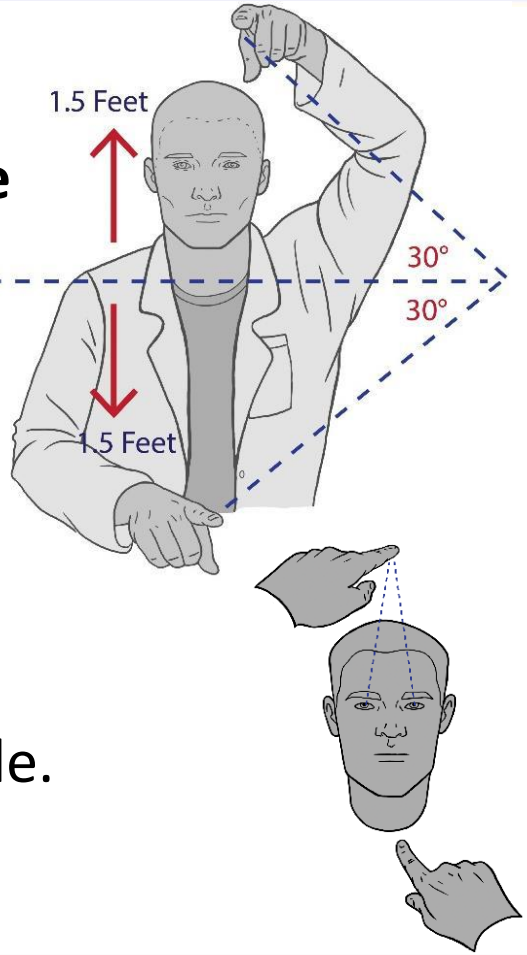
Vestibular/Ocular-Motor Screening - C. 1 Horizontal Saccades

- 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°** to the *left* and **30°** to the *right.*
- Instruct service member to move eyes as quickly as possible from *point-to-point*.
- **Perform 10 times in each direction.**
- Re-assess and record **HDNF** on a scale of zero to 10 scale.



Vestibular/Ocular-Motor Screening - C. 2 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** in each direction.
- Re-assess and record **HDNF** on a zero to 10 scale.

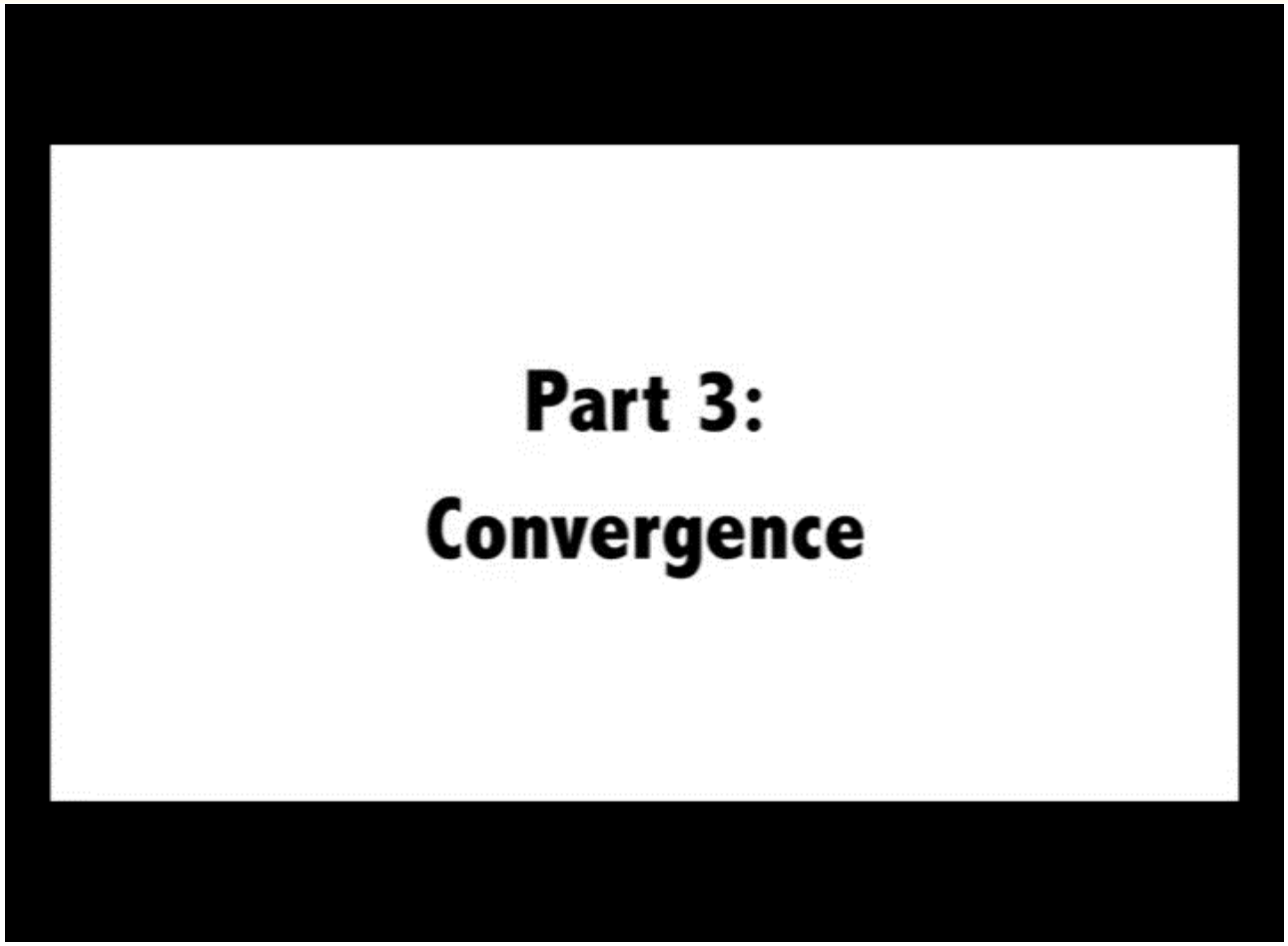


Practice Activity 6

Please refer to workbook

VOMS: Saccades

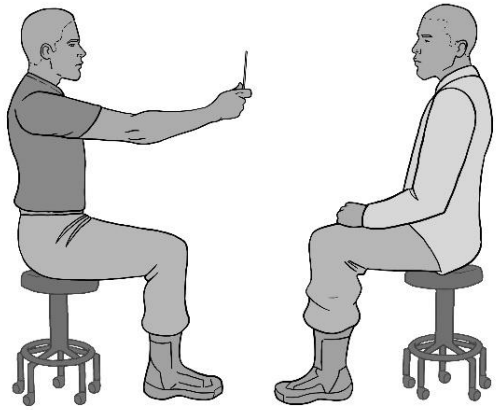
Vestibular/Ocular-Motor Screening - Convergence

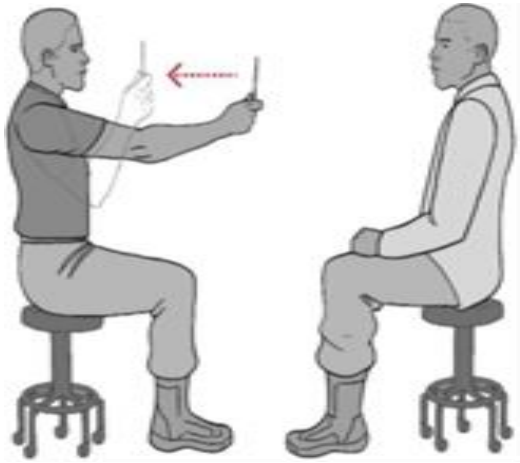


Vestibular/Ocular-Motor Screening

D. 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 zero to 10 scale.



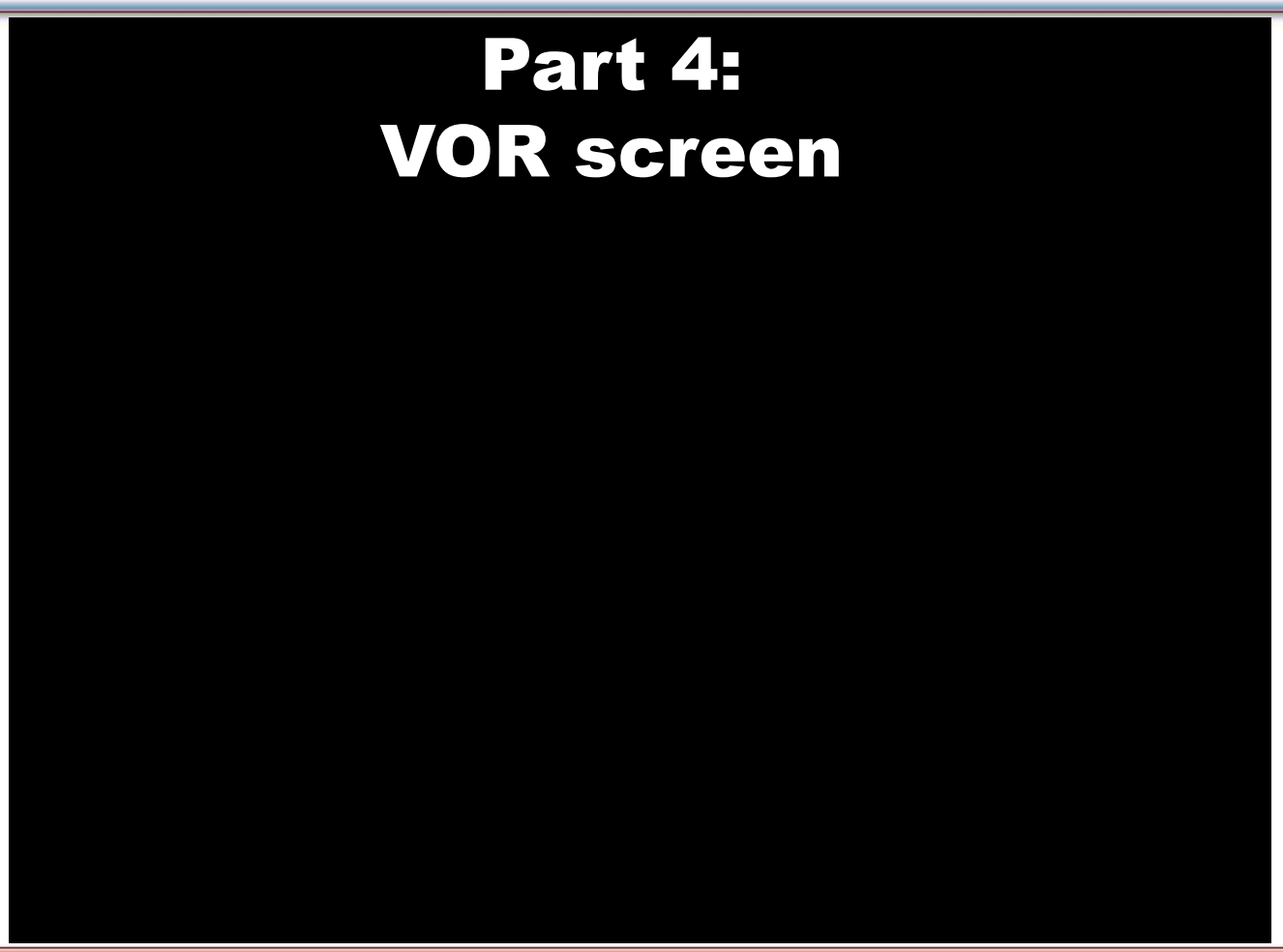


Practice Activity 7

Please refer to workbook

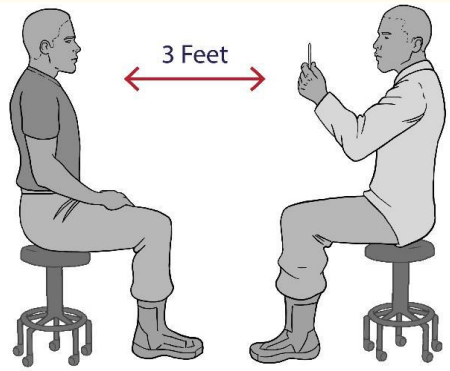
VOMS: Convergence

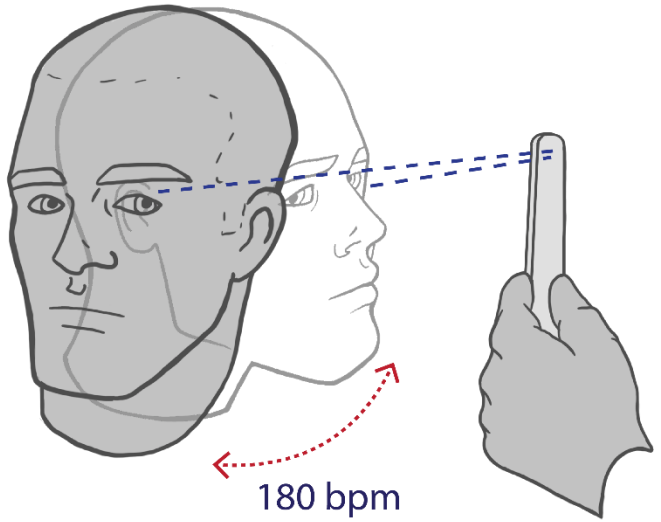
Vestibular/Ocular-Motor Screening -
Vestibular-ocular reflex test



Vestibular/Ocular-Motor Screening -
E.1 Horizontal Vestibular-ocular reflex

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 HNDF score.

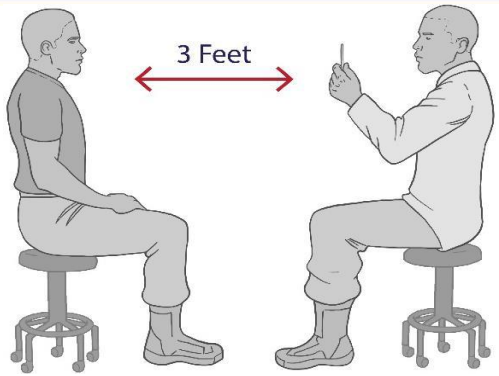


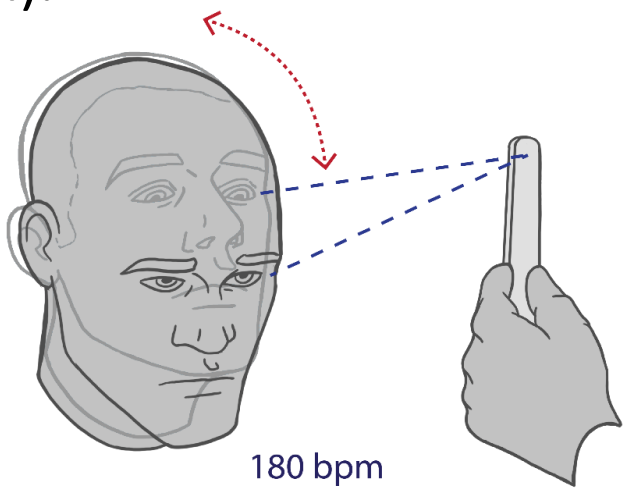


Vestibular/Ocular-Motor Screening - E.2 Vestibular-ocular reflex Test

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).
- **Perform 10 times**.
- **Wait 10 seconds**, re-assess and record HDNF score.



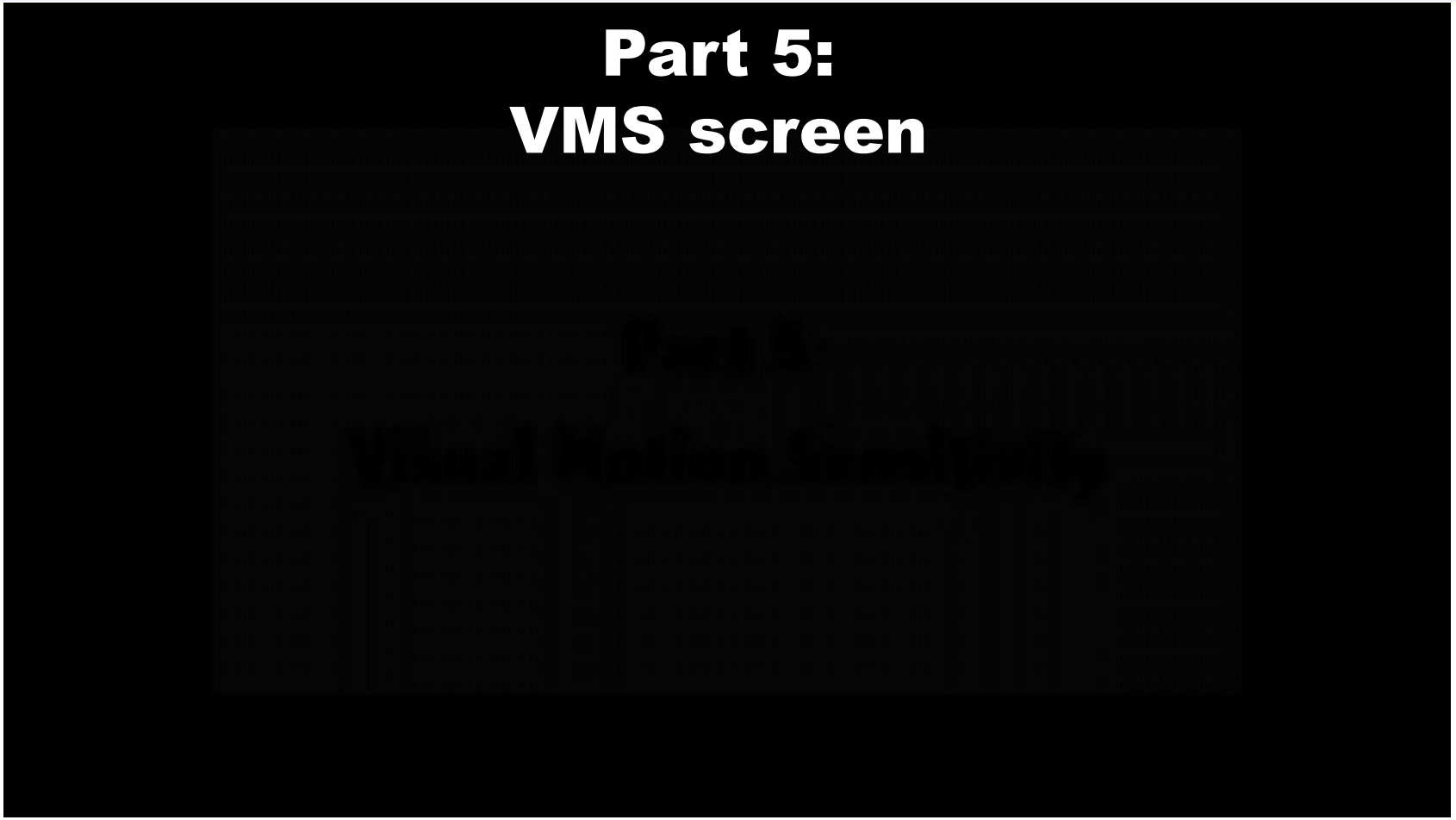


Practice Activity 8

Please refer to workbook

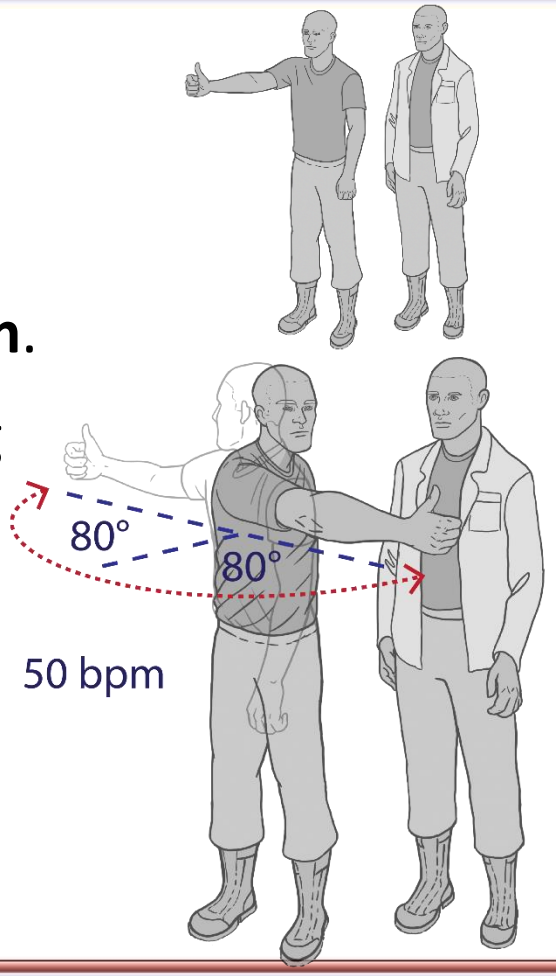
VOMS: VOR test

Vestibular/Ocular-Motor Screening - Visual Motion Sensitivity Test



Vestibular/Ocular-Motor Screening - F. 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 zero to 10 scale.



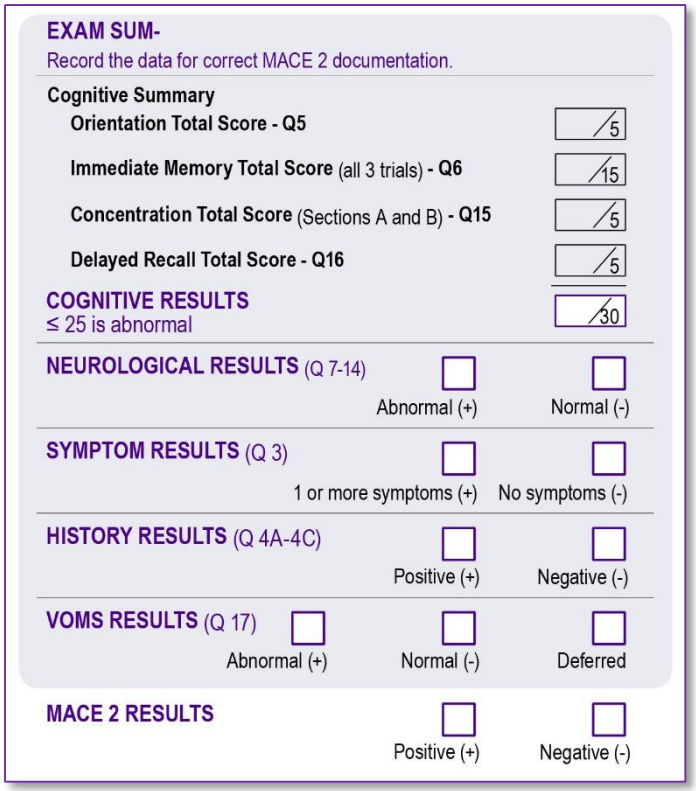
Practice Activity 9

Please refer to workbook

VOMS: VMS test

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)


EXAM SUM-
Record the data for correct MACE 2 documentation.

Cognitive Summary
Orientation Total Score - Q5 ___/5
Immediate Memory Total Score (all 3 trials) - Q6 ___/15
Concentration Total Score (Sections A and B) - Q15 ___/5
Delayed Recall Total Score - Q16 ___/5
COGNITIVE RESULTS ___/30
≤ 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 (-)

TBI Coding

TBI screening code*: Z13.850

Primary TBI diagnostic code: S06.ELSE**

1. **Primary symptom code**, if applicable: *(e.g., H53.2 diplopia)*
2. **Deployment status code**, if applicable*** *(e.g.,Z56.82 history of deployment)*
3. **TBI external cause of morbidity code:** *(e.g., Y36.290A)*

[A- initial visit] operations involving explosions and fragments, military personnel, initial encounter)

4. **Place of occurrence**, if applicable
5. **Activity code**, if applicable
6. **Personal TBI history:** 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.

Summative Clinical Case Scenario

Please refer to the workbook

- Symptom Screening
- Summary
- MACE 2 Results
- Concussion History

Clinical Case Scenario

Summative Assessment

22-year-old SM engaged in physical fitness training when he fell from the pull up bar and hit his face on the ground. The medic/corpsmen conducts an initial evaluation 30 minutes after injury.

DVBIC Education Division Image

Clinical Case Scenario

Screen Results

Observable signs: **3 cm** diameter bruise to left cheekbone, confusion during questioning.

AOC or Memory: SM does not recall how he was injured and reports "seeing stars."

Symptoms: Slow speech. Unsteady gait. Complaints of headache and dizziness

Concussion History: Had **two** other concussions in the last **12** months.

Clinical Case Scenario

Exam

Part 2:

After the positive concussion screen, the medic/corpsmen proceeds with the MACE 2 exam (starting on page 5).

DVBIC Education Division Image

Clinical Case Scenario

Exam Findings

Cognitive 1: Missed **1** orientation question. Incorrectly stated **two** words in each immediate memory trial.

Neurological: Slow and delayed speech. Unsteady balance on single leg stance and tandem gait.

Cognitive 2: Unable to correctly state the months backwards. Reverse Digits he was able to get to **four digits**, then failed on **five** digits. Could not remember **three** of the delayed recall words.

VOMS: **8 cm** for convergence, and symptom provocation of **+2** on two visual tests.

Clinical Case Scenario

Exam Summary

EXAM SUM-

Record the data for correct MACE 2 documentation.

Cognitive Summary

Orientation Total Score - Q5	4 /5
Immediate Memory Total Score (all 3 trials) **- Q6**	9 /15
Concentration Total Score (Sections A and B) **- Q15**	2 /5
Delayed Recall Total Score - Q16	2 /5
COGNITIVE RESULTS ≤ 25 is abnormal	17 /30

NEUROLOGICAL RESULTS (Q 7-14)	[X] Abnormal (+)	[ ] Normal (-)
SYMPTOM RESULTS (Q 3)	[X] 1 or more symptoms (+)	[ ] No symptoms (-)
HISTORY RESULTS (Q 4A-4C)	[X] Positive (+)	[ ] Negative (-)
VOMS RESULTS (Q 17)	[X] Abnormal (+)	[ ] Normal (-) [ ] Deferred
MACE 2 RESULTS	[X] Positive (+)	[ ] Negative (-)

Key Takeaways

- MACE 2 is to be used as close to time of injury as possible.
- Evaluate for red flags, including abnormal result from structural brain injury detection device (if available).
- Ask the SM if they had a concussion during the last 12 months, had headaches prior to the injury and if they have been diagnosed with depression, anxiety or another behavior disorder (impacts minimum mandatory recovery time and overall rest and recovery time).
- VOMS, Single Leg Stance, and Tandem Gait are new additions to the MACE 2 that support assessment in the vestibular and oculomotor domains.

Questions ?

- The laminated MACE 2 pocket guide is available for order. The MACE 2 in PDF format can also be downloaded from DVBIC website.
- These items are free upon request at: http://dvbic.dcoe.mil/education
- Contact the Defense and Veterans Brain Injury Center (DVBIC)
- If you have questions regarding the content of this presentation, please contact dvbic.dcoe.mil or info@dvbic.org

References

McCrea, M. (2001). Standardized mental status testing on the sideline after sport-related concussion. *Journal of Athletic Training*, 36(3), 274–279. Retrieved from www.journalofathletictraining.org

McCrory, P., Meeuwisse, W., Dvorak, J., Aubry, M., Bailes, J., Broglio, S.,… Vos, P. E. (2017). Consensus statement on concussion in sport—The 5th international conference on concussion in sport held in Berlin, *British Journal of Sports Medicine*. Retrieved from https://doi.org/10.1136/bjsports-2017-097699

Mucha, A., Collins, M. W., Elbin, R., Furman, J. M., Troutman-Enseki, C., DeWolf, R. M., ... Kontos, A. P. (2014). A brief vestibular/ocular motor screening (VOMS) assessment to evaluate concussions preliminary findings. American Journal of Sports Medicine, 40(10), 2479-2486. Retrieved from https://doi.org/10.1177/0363546514543775

DVBIC ID: 5003.1.1.20

References (2)

Steinhafel, N. W., Mucha, A., (2015) *Evaluation and treatment of visual dysfunctions following concussion — Concepts for the vestibular physical therapist* APTA Combined Sessions Meeting [PowerPoint presentation] retrieved from http://www.neuropt.org/docs/default-source/csm-2015-handouts/vestibular-sig-evaluation-and-treatment-of-visual-dysfunction-following-concussion.pdf?sfvrsn=2