APPENDIX A. TECHNICAL EXPERT PANEL

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APPENDIX B. SEARCH STRATEGIES

Concept	Mesh terms	Free language terms		
TBI 77364	"Brain Injuries"[Mesh] OR "Head Injuries, Closed"[Mesh] OR "Blast Injuries"[Mesh]	("head injury" OR "head injuries" OR concussion OR concusses OR concussive OR "brain trauma" OR "head trauma" OR "traumatic Brain injury" OR "traumatic brain injuries" OR "traumatic-brain-injury" OR tbi OR mtbi OR stbi OR "blast injury" OR "blast injuries" OR blast-injury)[Title/Abstract]		
Vision 73480	"Eye Movement Measurements"[Mesh] OR "Ocular Motility Disorders"[Mesh] OR "Ocular Physiological Processes"[Mesh] OR "Visual Perception"[Mesh] OR "Visual Acuity"[Mesh] OR "Eye"[Mesh] OR "Vision Disorders"[Mesh] OR "Vision, Ocular"[Mesh]	(amblyopia OR binocular vision dysfunction OR binocular vision dysfunctions OR binocular visual dysfunction OR binocular visual dysfunctions OR blind* OR blindness OR convergence insufficiency OR cranial nerve evaluation OR cranial nerve evaluations OR dark adapt* OR diplopia OR facial recognition OR fixation defect OR fixation defects OR hemianopsia OR light sensitiv* OR nystagmus OR ocular disease surface index OR ocular examination OR ocular examinations OR ocular health OR ocular migraine OR ocular migraines OR ocular pain OR ocular surface stain* OR ocular trauma OR oculo-motor disorder	OR photosensitivities OR photosensitivity OR pursuit abnormalit* OR quadrantonopsia OR spatial neglect OR strabismus OR tear film break-up time OR tear osmolarity OR tear production OR TFBUT OR vertical heterophoria OR vision accommodation OR vision acuity OR vision acuity loss OR vision agnosia OR vision deficit OR vision deficits OR Vision disorder OR Vision disorders OR vision disturbance OR vision disturbances OR vision field defect OR vision field defect OR vision field defects OR vision field defects OR vision function OR vision motor OR vision perception OR Vision problem OR Vision problems OR vision process OR vision processes OR vision processing OR vision reflex OR vision reflexes	OR vision scanning OR vision sequelae OR vision system OR vision system dysfunction OR vision system dysfunctions OR visiospatial ability OR visual accommodation OR visual acuity OR visual acuity loss OR visual agnosia OR visual deficit OR visual deficits OR Visual disorder OR Visual disorders OR visual disturbance OR visual disturbances OR visual field defect OR visual field defects OR visual function OR visual motor OR visual perception OR Visual problem OR Visual problems OR visual process OR visual processes OR visual processing OR visual reflex OR visual reflexes OR visual scanning OR visual sequelae OR visual system OR visual system dysfunction

		OR oculo-motor disorders OR oculo motor disorders OR oculo motor disorder OR ODSI OR ophthalmolog* OR optometr* OR photic stimulation		OR visual system dysfunctions OR visuospatial abilities OR visuo-spatial abilities)[Title/Abstract]
Above Combined with AND N= 3991				
Limited to 2009 and beyond N=932				

Medline (PubMed) Searched March 27, 2014 from January 1st, 2009 on
Saved as "TBI EYE" final in PubMed porvaesp myNCBI account
N=932

Additional Databases
Cochrane Central Register of Controlled Trials (OVID)

1. exp Visual Perception/
2. exp Visual Acuity/
3. exp Eye/
4. exp Vision Disorders/
5. exp Vision, Ocular/
6. 1 or 2 or 3 or 4 or 5
7. (amblyopia or binocular visionsysfunction or binocular vision dysfunctions).mp.
8. (binocular visual dysfunction or binocular visual dysfunctions or blind*).mp.
9. (blindness or convergence insufficiency or cranial nerve evaluation or cranial nerve evaluations).mp.
10. (dark adapt* or diplopia or facial recognition or fixation defect or fixation defects).mp.
11. (hemianopsia or light sensitiv* or nystagmus or ocular disease surface index).mp.
12. (ocular examination or ocular examinations or ocular health or ocular migraine or ocular migraines).mp.
13. (ocular pain or ocular surface stain* or ocular trauma or oculo-motor disorder).mp.
14. (oculo-motor disorders or ODSI or ophtahlmolog* or optometr* or photic stimulation).mp.
15. (photosensitivities or photosensitivity or pursuit abmormalit* or quadrantonopsia).mp.
16. (spacial neglect or strabismus or tear film break-up time or tear osmolarity or tear production or tfbut).mp.
17. (vertical heterophoria or vision accomidation or vision acuity or vision acuity loss).mp.
18. (vision agnosia or vision deficit or vision deficits or vision disorder or vision disorders).mp.
19. (vision disturbance or vision disturbances or vision field defect or vision field defects or vision function or vision motor).mp.
20. (vision perception or vision problem or vision problems or vision process or vision proccesses).mp.
21. (vision proccessing or vision reflex or vision reflexes or vision scanning or vision sequelae or vision system).mp.
22. (vision system dysfunction or vision system dysfunctions or visiospacial ability or visual accomidation or visual acuity).mp.

23. (visual acuity loss or visual agnosia or visual deficit or visual deficits or visual disorder or visual disorders).mp.
24. (visual disturbance or visual disturbances or visual field defect or visual field defects or visual function).mp.
25. (visual motor or visual perception or visual problem or visual problems).mp.
26. (visual process or visual proccesses or visual processing or visual reflex).mp.
27. (visual reflexes or visual scanning or visual sequelae or visual system or visual system dysfunction or visual systems dysfunctions or visuospacial abilities or visuo-spacial abilities).mp.
28. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27
29. exp Brain Injuries/
30. exp Head Injuries, Closed/
31. exp Blast Injuries/
32. (traumatic brain injury or traumatic brain injuries or traumatic-brain-injury or tbi or mtbi or stbi or blast injury or blast injuries or blast-injury).mp.
33. 29 or 30 or 31 or 32
34. 28 and 33
35. limit 34 to yr="2009"

Searched March 27, 2014 from January 1st, 2009 on
(Saved in OVID as "TBI EYE _2009")
N=123(before deduplication with Medline Search)
N=89 (after deduplication with Medline Search)

PsycINFO (OVID)

1. exp Visual Perception/
2. exp Visual Acuity/
3. exp Vision Disorders/
4. (amblyopia or binocular visionsysfunction or binocular vision dysfunctions).mp
5. (binocular visual dysfunction or binocular visual dysfunctions or blind*).mp
6. (blindness or convergence insufficiency or cranial nerve evaluation or cranial nerve evaluations).mp
7. (dark adapt* or diplopia or facial recognition or fixation defect or fixation defects).mp
8. (hemianopsia or light sensitiv* or nystagmus or ocular disease surface index).mp
9. (ocular examination or ocular examinations or ocular health or ocular migraine or ocular migraines).mp
10. (ocular pain or ocular surface stain* or ocular trauma or oculo-motor disorder).mp
11. (oculo-motor disorders or ODSI or ophtahlmolog* or optometr* or photic stimulation).mp
12. (photosensitivities or photosensitivity or pursuit abmormalit* or quadrantonopsia).mp
13. (spacial neglect or strabismus or tear film break-up time or tear osmolarity or tear production or tfbut).mp
14. (vertical heterophoria or vision accomidation or vision acuity or vision acuity loss).mp
15. (vision agnosia or vision deficit or vision deficits or vision disorder or vision disorders).mp
16. (vision disturbance or vision disturbances or vision field defect or vision field defects or

vision function or vision motor).mp
17. (vision perception or vision problem or vision problems or vision process or vision proccesses).mp
18. (vision proccessing or vision reflex or vision reflexes or vision scanning or vision sequelae or vision system).mp
19. (vision system dysfunction or vision system dysfunctions or visiospacial ability or visual accomidation or visual acuity).mp
20. (visual acuity loss or visual agnosia or visual deficit or visual deficits or visual disorder or visual disorders).mp
21. (visual disturbance or visual disturbances or visual field defect or visual field defects or visual function).mp
22. (visual motor or visual perception or visual problem or visual problems).mp
23. (visual process or visual proccesses or visual processing or visual reflex).mp
24. (visual reflexes or visual scanning or visual sequelae or visual system or visual system dysfunction or visual systems dysfunctions or visuospacial abilities or visuo-spacial abilities).mp
25. (traumatic brain injury or traumatic brain injuries or traumatic-brain-injury or tbi or mtbi or stbi or blast injury or blast injuries or blast-injury).mp
26. exp "Eye (Anatomy)"/
27. exp Vision/
28. exp Traumatic Brain Injury/
29. exp Head Injuries/
30. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 26 or 27
31. 25 or 28 or 29
32. 30 and 31
33. limit 32 to yr="2009 -Current"

Searched March 27, 2014 from January 1st, 2009 on
(Saved in OVID as "TBI EYE _2009 PsycINFO")
N=240 (before deduplication with Medline & Cochrane Searches)
N=130 (after deduplication with Medline & Cochrane Searches)

SPORTDiscus with Full Text, Rehabilitation & Sports Medicine Source (EBSCO)

Rehabilitation & Sports Medicine Source & SportDiscus with Full Text (searched together) (EBSCO)

S14 Limiters - Publication Date: 20090101-20141231
S13 S6 AND S12
S12 S7 OR S8 OR S9 OR S10 OR S11
S11 TI blast OR AB blast
S10 TI tbi OR AB tbi OR TI mtbi OR AB mtbi OR TI stbi OR AB stbi
S9 TI traumatic brain injury OR AB traumatic brain injury OR TI traumatic brain injuries OR AB traumatic brain injuries OR TI traumatic-brain-injury OR AB traumatic-brain-injury
S8 DE "HEAD injuries" OR DE "HEAD injuries -- Complications" OR DE "HEAD injuries -- Prevention"

S7 DE “BRAIN -- Wounds & injuries” OR DE “BRAIN -- Concussion” OR DE “BRAIN damage” OR DE “CHRONIC traumatic encephalopathy”
S6 S1 OR S2 OR S3 OR S4 OR S5
S5 TI visual OR AB visual
S4 TI vision OR AB vision
S3 (eye) OR (DE “EYE” OR DE “INTRAOCULAR pressure”)
S2 DE “VISION disorders” OR DE “BLINDNESS” OR DE “EYE -- Refractive errors” OR DE “HYPERMETROPIA”
S1 DE “VISION” OR DE “MOTION perception (Vision)” OR DE “VISUAL acuity” OR DE “VISUAL discrimination” OR DE “VISUAL evoked response” OR DE “VISUAL fields” OR DE “VISUAL perception” OR DE “VISUALIZATION”

Searched March 14, 2014 from January 1st, 2009 on
(Saved in EBSCO as “TBI EYE >2009 ”)
N= 130 (before deduplication with Medline & Cochrane Searches & PsycINFO)
N= 125 (after deduplication with Medline & Cochrane Searches & PsycINFO)

Rehabdata (National Rehabilitation Information Center http://www.naric.com/?q=en/REHABDATA)

Search Strategy: Visual Impairment (descriptor) AND Brain Injuries (descriptor) 2009 to present

Searched March 14, 2014
N=22 (after deduplication with all above searches)

APPENDIX C. PEER REVIEW COMMENTS AND RESPONSES

	Reviewer	Comment	Response
	Question 1: Are the objectives, scope, and methods for this review clearly described?		
1.	1	Yes	Noted.
2.	2	Yes	Noted.
3.	3	Yes	Noted.
4.	4	Yes	Noted.
5.	5	Yes	Noted.
6.	6	Yes	Noted.
7.	7	Yes	Noted.
8.	8	Yes. Clearly described	Noted.
	2. Is there any indication of bias in our synthesis of the evidence?		
9.	1	No	Noted.
10.	2	No	Noted.
11.	3	No	Noted.
12.	4	No	Noted.
13.	5	No. There may be a potential bias in the report due to the small total number of accepted publications with a significant percentage from the same location. Of 13 accepted articles, at least 5 (38%) include the Palo Alto Polytrauma Rehab Center patient population (Brahm 2009, Cockerham 2013, Goodrich in press, Lew 2009, and Lemke 2013- all author affiliations listed as Palo Alto and Stanford). It is not completely clear but there is some overlap in the time frame for patient recruitment from various studies raising the possibility of some patients being accounted for more than once in this limited body of literature. In addition the 2007 Lew study includes Veterans seen at the Palo Alto PNS which may include discharged PRC patients that remained in the area. This in no way diminishes the importance of the published work, it merely illustrates the productivity of a few capable researchers in this area. In addition there is potential bias in the report of dry eye following TBI in the Cockerham 2013 study. I am not certain if OEF/OIF/OND deployment is a risk factor for dry eye disease but it would seem that environmental exposure may be a factor, I do not see that analysis in the article other than blast vs non-blast tbi.	Noted. We have updated the discussion to reflect this point.

	Reviewer	Comment	Response
14.	6	Yes. There are a number of inherent problems from my perspective based on trying to research the literature myself and also from my experience on interviewing patients seen in our VA Eye Clinic. First, the denominator of the studies (number of people with TBI) is very difficult to assess. This is because the criteria for TBI (mild, moderate and severe) varies across medical systems in the US and the world, but even more importantly, IT REQURES THAT PATIENT ARE CODED IN THE ELECTRONIC DATABASE/MEDICAL RECORD AS HAVING TBI. This is a big problem, as it depends on the care giver coding this as one of the diagnoses. In addition, is speaking to many of the veterans with visual complaints, they deny having had "TBI" because in their minds, based on their criteria, they didn't lose consciousness or for only a brief time. Many of them have had multiple concussions or have been exposed to many blast injuries but do not "count" that as a TBI, so the diagnosis	Thank you for this comment. We have augmented information on visual tests and criteria in the tables when available from the original papers; however, often this information was not
		of whether they had TBI or concussion does not rest on firm ground. The net effect is that many veterans have had exposure to blast and/or concussion but are not part of the denominator. It would be helpful to explain this in the report in order to put some of the numbers into context. The other main problem with assessing visual disturbances is the definition. Many patients with vague visual symptoms are not tested with visual function and structure tests (visual fields, optical cohence tomography of the retinal nerve fiber layer and retinal ganglion cell layer, contrast sensitivity, low contrast visual acuity, accommodative and convergence amplitudes and ability to sustain them. In addition, you have excluded all patients with neurocognitive testing indicating visual processing problems from your analysis. Much of this explains the large range of prevalence and proportion of specific visual problems that were found in your analysis and this should be discussed to give a proper perspective. Also in your literature review of the prevalence of certain visual abnormalities, you have not specifically stated in many of the cases what were the criteria for being labeled abnormal. For example, in Table 10 listing Visual Field Defects, all of the defects cited were by confrontation or by Goldmann kinetic perimetry; there is no automated perimetry results and it is hard to ascertain how large and dense the defects needed to be in order to meet criteria for a defect. Similar problems with the other tables with respect to criteria used by each study cited which were used to classify the parameter being measured as abnormal.	reported. Additionally, we have included information on TBI diagnosis and selection factors which may impact prevalence estimates and updated our discussion to reflect these points.
15.	7	No	Noted.
16.	8	No. Report appears to be unbiased	Noted.
	3. Are there any <u>published</u> or <u>unpublished</u> studies that we may have overlooked?		
17.	1	No. Good literature review. A recent addition to the literature is: Magone, M.T., E. Kwon, and S.Y. Shin, *Chronic visual dysfunction after blast-induced mild traumatic brain injury.* JRRD, 2014. **51**(1): p. 71-80. In particular the study notes that binocular/oculomotor dysfunctions may not be detected in routine eye clinic appointments and that additional testing is needed to adequately screen this population. In addition, they not that almost half of their population did not report their TBI history during eye examinations.	Thank you for this suggestion. This study meets inclusion criteria for Key Question 2 and is now included in the final report.
18.	2	Yes. You may want to consider: Pogoda TK, Hendricks AM, Iverson KM, Stolzmann KL, Krengel MH, Baker E, Meterko M, Lew HL. Multisensory impairment reported by veterans with and without mild traumatic brain injury history. J Rehabil Res Dev. 2012;49(7):971-84.	We reviewed this study and because the results only reported MSI in aggregate without separating visual dysfunction, it did not meet inclusion criteria.
19.	3	No	Noted.

	Reviewer	Comment	Response
20.	4	No	Noted.
21.	5	No	Noted.
22.	6	Yes. See DOD report on eye movements and pupil abnormalities that I am attaching and the email from the VA regarding number of patients with visual disorders coded that had also a coded dx of TBI that was solicited by VA Blinded Veterans Association. There were not any references on pupil abnormalities found in TBI (see DOD report attached).	We examined the studies described in this report and did not identify additional studies meeting our inclusion criteria. However, we have referenced this report and included the citation for readers who would like additional information on research related to oculomotor tracking as a way of detecting mild TBI.
23.	7	No	Noted.
24.	8	No. Please ask additional stakeholders listed below. The studies of which I was aware have been included.	Noted.
	4. Please write additional suggestions or comments below. If applicable, please indicate the page and line numbers from the draft report.		
25.	1	1. Page 1 lines 3 – 11. In the executive summary the estimated number of U.S. TBIs is reported, however it goes on to state 15% of OEF/OIF/OND services members incurred TBI. Essentially the reader is asked to compare apples (number) to oranges (percent). It is possible to provide the estimated number of OEF/OIF/OND TBIs and this should be done. Ideally both the estimate number and percentage would be provided for both the civilian and OEF/OIF/OND population. Currently the report does not accurately reflect the rate at which TBIs occurred in OEF/OIF/OND which is significantly higher than in the civilian population. (Comment relevant to the Introduction on page 3 lines 3 – 11)	Thank you for this suggestion. We have added numbers and proportions reflecting both general population and OEF/OIF/OND TBI incidence.
26.	1	2. Page 5, lines 11 – 13. It is stated that the study included "visual dysfunction outcomes that would likely be diagnosed or treated in a vision clinic". I would question the accuracy of this statement in two respects. First, visual acuity loss and visual field loss are not dysfunctions, although they would likely be diagnosed in a "vision clinic". Second, whether the visual dysfunctions (accommodation, pursuits, strabismus, convergence insufficiency, etc.) would be detected in a "vision clinic" examination depends upon how you define "vision clinic". Most military and VA clinics (and indeed civilian clinics) are not designed to detect visual dysfunctions without the patient reporting specific symptoms and then only if a binocular/ oculomotor examination (or screen) were performed. Hence these dysfunctions would likely go undiagnosed in most "vision clinics". This is why virtually all papers cited in the report conclude that patients with a TBI history should be screened based upon the TBI diagnosis.	Thank you for this comment. We have clarified the examples of visual problems that are included to make this more explicit and hopefully better understood by readers.
27.	1	3. Page 9, lines 28 & 29. The sentence states that 0.1% - 7.3% rates of visual dysfunction were found in the Dougherty, et al (2011) study. This is accurate for individual dysfunctions, but somewhat misleading in that over-all the study reported 11% were diagnosed with a visual dysfunction within 12 months of combat injury (Dougherty, page 10).	We have added this data to this section.

	Reviewer	Comment	Response
28.	1	4. Page 9, lines 29 – 31. The sentence states "Unlike studies in which all participants are screened, this study may provide more accurate assessments of clinically significant impairment because patients experienced visual dysfunction to a degree that resulted in clinical presentation and diagnosis." Whether the Dougherty study is "more accurate" is subject to debate on several points. First, The authors do not report specifics of who conducted the vision exam (optometrist, ophthalmologist, or ??). Second, the specifics of the exam are not reported. This is particularly important since, as noted previously, "routine" eye exams are not likely to uncover many binocular/oculomotor dysfunctions. Obviously, some binocular/oculomotor problems were documented, however it is not possible to determine how many were missed simply because the vision exam was not sufficiently comprehensive. Third, the study was published in 2011, however the study relied on medical record data for the time period 1 March 2004 to 28 February 2007. This fact is important for two reasons. One reason is that this time period was prior to any professional awareness (published literature) of the relationship between TBI and visual dysfunctions in this population. Thus the examining clinician would likely not be "on the lookout" for these conditions and might only detect the most obvious cases and overlook others. A second reason is that the military culture of the time discouraged reporting of any symptoms. The DoD has acknowledge this and taken active steps to encourage reporting of symptoms. The patient history is an essential part of accurate diagnosis for any medical examination. In a culture where symptom reporting is "frowned upon" symptoms aren't reported and the examination is impaired. Related to this is that even TBI patients with visual symptoms often do not associate the symptoms with their visual status (their vision remains 20/20 or better "so what could be wrong?") and therefore do not equate a vision examination with a step in correcting their symptom. In short, while the Dougherty et al study is commendable, it does not rise to the level of a "gold standard" simply because it has a large N, and perhaps the review should include a discussion of potential limitations and hence generalizability to all "US Service Members".	We have altered this section slightly to better emphasize that we are referring to accurate assessment of *clinically significant impairment,* and not accuracy in general. We have also updated the discussion to reflect these points.
29.	1	5. Page 27. I wonder if the Lew, et al (2007) and portions of the Brahm (2009) should be included in the discussion of Key Question 2. The vision data in the Lew paper was based upon patients seen in a VA PNS clinic. The Brahm (2009) paper presented data on both PRC and PNS patients and data was reported separately.	We considered reporting these data for KQ2 as well, but determined that they best fit with KQ1 and are included in that section.
30.	1	6. Essentially all of the papers cited (including Dougherty, et al) include a statement recommending that a comprehensive visual examination of patients experiencing a TBI should be provided a comprehensive vision examination. As the manuscript represents a synthesis of these papers would a similar statement be appropriate? Perhaps on page 32 lines 15 – 22 "Applicability of Findings to the VA Population"	Though we try not to make clinical recommendations in our reports, we are hoping to collaborate on dissemination efforts such as cyber-seminars with TEP members and stakeholders who are better able to make clinical recommendations.
31.	1	7. Page 34 References. There are some formatting issues; see lines 26 – 34	Thank you, this has been addressed

	Reviewer	Comment	Response
32.	1	8. Page 23 "Future Research Needs". 9.1. I believe it would be worth considering a recommendation of a longitudinal study of patients with visual dysfunctions be undertaken to determine if, over time, these conditions recover or whether they are "permanent" and the effect they have on employment, quality of life, education, utilization of VA services, etc.. The literature indicates visual dysfunctions are associated with reduced quality of life, impair reading and near tasks (hence employment and vocations), negatively impact social function, self-esteem, driving, etc. and so may impact the ability of those affected over their entire lifetimes. Given the relatively young age of OEF/OIF/OND Service Members these conditions may present substantial challenges to the VA over the next half century and beyond thus a longitudinal study would be relevant to VA. 9.2. I believe the question of how prevalent binocular/oculomotor dysfunctions are following blast or non-blast TBI remains an important question to be answered. 9.3. Given that a) mTBI post-2001 veterans have presented to the VA with high rates of binocular/oculomotor dysfunctions and b) the literature indicates that conditions can be treated, studies should be undertaken to determine the most effective treatments VA can provide to address these dysfunctions to maximize the veteran's return to normal visual functioning.	Thank you. We have added these suggestions to the FRN section of the report.
33.	2	1. Page 1, line 17, instead of "2009 systematic review," what about, "a systematic review conducted in 2009"	Thank you for the suggestion. This has been addressed.
34.	2	2. Page 1, line 37, can you indicate "Department of Veterans Affairs (VA)" before mentioning the PRCs?	Thank you for the suggestion. This has been addressed.
35.	2	3. Page 1, line 39, consider using "Conditions" instead of "outcomes"	Thank you for the suggestion. This has been addressed.
36.	2	4. Page 1, line 7, "ongoing post-concussive symptoms" – please see next comment.	Noted and addressed.
37.	2	5. Page 2, lines 7-9, I think we have to be careful about using the term "ongoing post-concussive symptoms" especially when referring to patients seen in the PNSs. Without longitudinal data, it's difficult to determine whether symptoms being experienced months to years after a TBI are related to the TBI event or to other conditions. If the articles that you cite specify that these are postconcussive symptoms (with the implication that they're related to the TBI), then the terminology is fine. If the linkage can't be established, then I wouldn't use this phrase. In addition, these clinics can serve Veterans who haven't experienced TBI. Frequently TBI occurs in polytrauma, but it doesn't have to: http://www.polytrauma.va.gov/system-of-care/ You might want to consider rephrasing, "clinics that primarily serve Veterans who have incurred serious injury and experience current symptoms that may be related to TBI, other comorbid conditions, or both."	Noted and addressed.
38.	2	6. Page 2, line 12, "current symptoms" instead of "ongoing post-concussive"	Thank you for the suggestion. The document has been edited to reflect this throughout.
39.	2	7. Table 1, column headings: the term "ongoing post-concussive symptoms" is used. Maybe consider "current symptoms" instead?	Thank you for the suggestion. The document has been edited to reflect this throughout.

	Reviewer	Comment	Response
40.	2	8. Page 3, line 3, you can place (TBI) after this first mention of traumatic brain injury, and then in line 5, you only need to use "TBI since it will have been defined in line 3.	Thank you for the suggestion. This has been addressed.
41.	2	9. Page 3, line 9, consider putting (mTBI) after "mild TBI" since it's used as a search term later?	Thank you for the suggestion. This has been addressed.
42.	2	10. For Figure 1, in the Exclusion boxes, what does "Background" refer to?	We have clarified this diagram.
43.	2	11. Page 9, lines 13-14: consider using a phrase other than "ongoing post-concussive symptoms." Another phrase might be "suspected TBI-related symptoms"	Thank you for the suggestion. The document has been edited to reflect this throughout.
44.	2	12. Page 9, line 15, I think there should be a 1:1 match with this section title and what's described in line 13. The title should match what's described in line 12. So, something like: Studies of patients in settings that treat patients regardless of suspected TBI-related symptoms"	We have made this change
45.	2	13. Page 9, lines 17-18, Can you explain what "over a set time period" means?	We agree that this was confusing and removed it as it was irrelevant.
46.	2	14. Page 9, lines 22: With regard to the comprehensive TBI evaluation, one of the biggest criticisms has been that it's unclear whether the symptoms that patients are asked to self-report on the 22-item Neurobehavioral Symptom Inventory are related to TBI or to other conditions, because patients can have this evaluation months to years after a suspected TBI event. Because of this lack of specificity, clinicians can't, with confidence, link these symptoms with a TBI. I would be more literal and state something like, "…were screened for neurobehavioral symptoms, including vision-related symptoms." The VA/DoD clinical guidelines (p. 21) state: Most symptoms and signs that occur in the acute period following a single concussion resolve quickly (within hours or days) after the injury. There is debate about the incidence of developing persistent symptoms after concussion, largely due to the lack of an accepted case definition for persistent symptoms and the fact that none of the symptoms are specific to concussion. There is no consensus on a case definition for persistent symptoms attributed to concussion/mTBI and no consensus on the time course when acute symptoms should be considered persistent. As a result, the important focus should be on treating the symptoms rather than on determining the etiology of the symptoms.	We agree and have made this change.
47.	2	15. Page 9, line 24, these two references should be after "studies," rather than after "which." "Which" should be deleted from this sentence.	Thank you for the suggestion. This has been addressed.
48.	2	16. Page 9, line 26-31: Here you talk about a clinical diagnosis in an unscreened (line 26) group. This refers to being unscreened for visual dysfunction? The paragraph then continues that this study may "provide more accurate assessments of clinically significant impairment." Do you mean that it might provide a more accurate prevalence estimate, or that the visual examinations were a more accurate assessment? Could you clarify what the comparison is – why this study may be "more accurate"?	We have edited this section for clarity.

	Reviewer	Comment	Response
49.	2	17. Page 9, line 34: the "on unscreened patients" makes it unclear whether the unscreened patients are part of the three studies cited or Dougherty's study. I think I would reword: The other three studies used self-report measures to screen participants[15,19,23] and found higher rates of visual dysfunction (8.8% – 54%, see Table 1) than the data from Dougherty and colleagues THAT REPORTED ON unscreened patients with diagnosed visual dysfunction."	Thank you for the suggestion. This has been addressed.
50.	2	18. Page 10, lines 1-2: Similar to my statement about PCS, I would stick with language consistent with the PsoC directive: http://www.va.gov/optometry/docs/VHA_Handbook_1172_01_Polytrauma_System_of_Care.pdf Suggested rewording: "…designed to serve Veterans with polytrauma and TBI, they serve…"	We agree and have made this change, as below.
51.	2	19. Page 10, lines 1-5: suggested rewording: Both types of treatment facilities provide interdisciplinary, rehabilitation care to Veterans who experienced TBI or polytrauma, but serve populations with different care needs. The five PRCs provide acute, inpatient care to those with more complex and severe TBI or polytrauma. The 23 PNSs provide care to those who are discharged from PRCs and need continued rehabilitation services, as well as to Veterans who require less intensive care for their TBI or polytrauma.	Thank you for this suggestion. We have made this change.
52.	2	20. Page 10, line 8: instead of "differ greatly," what about "differ in symptom severity and complexity,"	Thank you for the suggestion. This has been addressed.
53.	2	21. Page 10, line 12: Because we don't know (especially for the PNSs) if they're post-concussive, I might say something like based on "current" or "ongoing" symptoms	Thank you for the suggestion. The document has been edited to reflect this throughout.
54.	2	22. Page 10, line 13: What do you mean by "screening eye exams?" I'm not sure about the extent of screening for visual problems at PNSs (or PRCs), but if this phrase is referring to the NSI, I wouldn't call this an "eye exam." Rather, I would say something like, "because the patients are only screened for vision symptoms, rather than given a comprehensive eye examination,"	We have clarified the meaning of this phrase.
55.	2	23. Page 10, line 15: "generally much higher" than… "general patient populations?" or patient populations seen in a general primary care clinic? What comparison is being made?	We have clarified this sentence.
56.	2	24. Page 10, line 17 "included" is included twice in the same sentence. For the second one, say "illustrated" or "shown" or "displayed" in Table 1"	Thank you for the suggestion. This has been addressed.
57.	2	25. Page 10, Table 1 title: Maybe expand to say: Summary of Findings: Ranges of Visual Dysfunction Frequencies Across Studies…""…for patients who were screened or not screened clinically for visual dysfunction."	Noted. We retained the original title for space reasons, but the subheadings reflect screening.
58.	2	Please see previous comments about "ongoing post-concussive symptoms:.	Thank you for the suggestion. The document has been edited to reflect this throughout.
59.	2	26. Page 11, line 4 – because assessment is used a few words earlier, what about use "evaluate different" rather than "assess different"	Thank you for the suggestion. This has been addressed.
60.	2	27. Page 11, line 4 – what do you mean by visual dysfunction "outcome"? Would it be appropriate to say "evaluate different types of visual dysfunction"	Thank you, we have made this change.
61.	2	28. Table 2, first row – since this column extends beyond one page, can you repeat the header row on each page?	Thank you for the suggestion. This has been addressed.

	Reviewer	Comment	Response
62.	2	29. Page 17, line 18 – should this be optical "strain?"	Thank you for the suggestion. This has been addressed.
63.	2	30. Page 17, line 24, just a thought, but instead of saying "were more and less commonly," what about saying "Different studies of dry eye yielded mixed findings among blast-exposed subgroups…."	Thank you for the suggestion. This has been addressed.
64.	2	31. Table 6, p. 20, first row: What does 1.25 M letter size mean? Would the average reader know this?	We have updated the table to clarify this outcome.
65.	2	32. P. 24, line 13 "Compared to comparable controls" sounds a bit funny to the ear. Maybe you can describe some characteristics of how the controls are comparable? Perhaps something like, "….compared to a control group without a TBI history that had similar characteristics…"	Thank you for the suggestion. This has been addressed.
66.	2	33. Table 11 – repeat column headings across pages	Thank you for the suggestion. This has been addressed.
67.	2	34. Page 26, For the Lew, 2011 reference, no need to spell out the NSI 22 again, already identified in Bulson 2012 row.	Thank you for the suggestion. This has been addressed.
68.	2	35. Page 26, Stelmack 2009 reference. No need to spell out NSI-22	Thank you for the suggestion. This has been addressed.
69.	2	36. Page 28, Table 12, please copy column headings across pages. Page 29, Alvarez 2012 row (patient sensitivity to direct light" - in the p-value column, Bonferroni is misspelled.	Thank you for the suggestion. This has been addressed.
70.	2	37. Page 31, line 17 – unless the study specifically identifies these as "ongoing post-concussive symptoms" I wouldn't refer to them as that, since we can't be certain that symptoms are related to concussion, which I think this phrase implies. Maybe use the term "current symptoms" instead?	Thank you for the suggestion. The document has been edited to reflect this throughout.
71.	2	38. Page 32, lines 1-2: Instead of "ongoing post-concussive symptoms" consider something else, like "current symptoms"	Thank you for the suggestion. The document has been edited to reflect this throughout.
72.	2	39. Page 32, line 18, Prevalence estimates OF(?) a broad group…? (Is "of" missing?)	Thank you for the suggestion. This has been addressed.
73.	2	40. Page 32, line instead of "many comorbid conditions," what about "multiple"?	Thank you for the suggestion. This has been addressed.
74.	2	41. Page 32, line 37: I think there can be a period after "studies," rather than a colon.	Thank you for the suggestion. This has been addressed.
75.	2	42. Page 32, line 37-38: I'd suggest using a term other than "ongoing post-concussive symptoms." In fact, that might be a point to make for future research directions – conducting longitudinal studies to determine whether symptoms following TBI persist over time, and for how long.	Thank you for the suggestion. The document has been edited to reflect this throughout.
76.	2	43. Page 32, line 39, "ongoing post-concussive symptoms" – maybe consider "Veterans with a TBI history who may have persistent TBI-related symptoms".	Thank you for the suggestion. The document has been edited to reflect this throughout.
77.	2	44. Page 33, lines 4-5 "ongoing post-concussive symptoms" – consider using "and who are experiencing current symptoms"	Thank you for the suggestion. This has been addressed.

	Reviewer	Comment	Response
78.	2	45. Page 36, Should read: Terri K. Pogoda, PhD Research Health Scientist Center for Healthcare Organization and Implementation Research VA Boston Healthcare System Boston, MA	Thank you for the suggestion. This has been addressed.
79.	3	In addition to quality of data concerns due to generalizability of population and setting, there is also much heterogeneity in methodology between studies. This may account for a large percentage of variability seen across the reports. This is particularly true in testing for dry eye and with visual fields. Automated visual field testing (Humphrey or Octopus) has not been validated in brain injury patients, and modifications to the testing protocols should be described and justified in detail if used. In dry eye, no single test is sufficient for a diagnosis; that is why the Dry Eye Workshop in 2007 defined a battery of tests for research quality studies. Some studies did not define testing methodology at all. Possible reasons that prevalence estimates in unscreened military personnel may be artificially low include: reluctance to complain; desire to remain with teammates; intermittent symptomatology, such as intermittent diplopia; lifestyle modifications to adapt to dysfunctions, such as not reading because of near vision problems; or having been told that there is nothing wrong with their vision previously after taking a high-contrast visual acuity test, which is relatively insensitive to many of the reported vision problems in TBI. Despite assertions to the contrary in the report, not all inpatients within PRC were moderate or severe TBI; one third of the Palo Alto group were mild TBI who presented in ambulatory status, wishing workup for TBI after having been told by the military that there was nothing wrong with them. Palo Alto did stratify examinations by TBI Severity Rating, and have found no correlations in quality of life or dry eye (published) or afferent visual function (unpublished). A major area of weakness in current TBI Vision literature is lack of longitudinal data and visual outcomes	We agree, and have added information related to methods in the tables and text.
80.	4	This does not give much guidance to the field on where the gaps exist. What is the point of this exercise if recommendations on the type studies that are needed to improve the science or the healthcare of this condition? What about imaging studies to verify that central fiber loss or EEG studies indicating physiological loss that could consistent with visual dysfunction? Or potential studies that demonstrate therapies to overcome these deficits? The field as well as VA Central Office need that kind of objective input from a evidence synthesis review to make strategic research and funding decisions.	We are not able to address some of those questions due to the scope of this report and key questions, but agree that they may be very relevant to VA leadership.
81.	5	I would like to see better differentiation of studies looking at symptom report vs. confirmed clinical diagnosis (p9 line 32-37) as this has important implications for administrators looking at screening implications. VHA has a large data set of mandatory visual exams from TBI patients during an inpatient PRC stay. It is critical that this important data set be studied and published in order for VHA to determine the effectiveness and importance of this policy.	We have edited this section for clarity.
82.	6	There is no discussion of the possibility of progression of visual dysfunction after TBI – I know of no study yet published, but this is a big area of concern, especially in light of CTE where progressive dementia occurs over time after concussion.	We have included suggestions of longitudinal research in the FRN section of this report.

	Reviewer	Comment	Response
83.	7	This is a well done report. The breadth of the criteria is wide and thoroughly addresses the spectrum of problems encountered by our Veterans with TBI. The apparent discrepancy between the numbers of presenting individuals with various problems is well explained on the basis of clinical setting and natural recruitment bias. The relatively rare nature of the visual problems seen in the large data base study is explainable on the basis of emphasis of care being rendered that was not focused on vision assessment but also due to the expected lower rate of problem identification that is seen when surveying ICD entries. This begs the question for a prospective study to establish the actual prevalence rate of these problems since a more detailed vision assessment is likely to be informative, but this needs to be done for a large population not already pre-selected based on a priori vision criteria.	Noted, and we have added to the FRN section of this report.
84.	8	Entire document – capitalize the word “Veterans” throughout document; consistency	Thank you for the suggestion. The document has been edited to reflect this throughout.
85.	8	Entire document – correct capitalization of term “Service members” throughout document for consistency. “S” in Service should be capitalized.	Thank you for the suggestion. The document has been edited to reflect this throughout.
86.	8	Cover page – Notwithstanding the acknowledgement on page 4, would it be appropriate to include list of names of those that provided editorial / review assistance for the report.	We generally do not list the names of peer reviewers, but have included a list of TEP members and stakeholders who also review the report.
87.	8	Page 1, 1st paragraph, lines 3-6, first sentence – comment - need to include reference for the stats cited in the sentence that reads, “Approximately 1.7 million people experience…”	We include these references in the body of the report, though our formatting removes references from the executive summary.
88.	8	Page 1, 1st paragraph, line 6 – edit - suggest changing “vision” to “visual functioning”	Thank you for the suggestion. This has been addressed.
89.	8	Page 1, first paragraph, line 9 – edit - recommend adding “occupational and physical therapists, primary care providers” after “rehabilitation specialists.”	Thank you for the suggestion. This has been addressed.
90.	8	Page 1, Key Question 2, line 15 – edit – recommend changing “vision clinics” to “eye care clinics.”	Thank you for the suggestion. This has been addressed.
91.	8	Page 4, 1st paragraph, line 5 – edit - insert Dr. Barker’s title at the VCE after his name. His title is, “Associate Director, Research, Rehabilitation and Reintegration, Vision Center of Excellence.”	Thank you for the suggestion. This has been addressed.
92.	8	Page 9, 3rd paragraph, lines 24-31 – comment / recommendation – In reference to the study by Dougherty and colleagues, the severity of TBI was included in the study. The paper reports 8.9% were diagnosed with an ocular or visual disorder within 12 months of the blast injury. The odds of visual dysfunction increased with the severity of TBI. Recommend reviewing the Dougherty study to ensure data from it was accurately used and is accurately quoted in the report.	We have reexamined this study and report updated results in this revised report.
93.	8	Page 10, Table 1 – question – Are totals able to be calculated, i.e., total patients with some type of visual dysfunction?	We have presented this information in text in the revised report.
94.	8	Page 11, last paragraph – comment – This comment refers to both key questions; therefore, recommend repeating this language for Key Question 2 or place this paragraph after the paragraph on “Rating the Body of Evidence” on page 6 of the report.	We have included quality and methods considerations for both key questions.

	Reviewer	Comment	Response
95.	8	Page 15, 2nd paragraph, lines 13-15 – edit – sentence starting with, "The authors report…" delete "a moderating effect of blast exposure, with" and "reported" and rewrite sentence to read, "The authors report higher frequencies for blast-exposed inpatients than non-blast exposed inpatients, but lower frequencies for blast-exposed outpatients compared to non-blast exposed outpatients."	Thank you for the suggestion. This has been addressed.
96.	8	Page 15, 2nd paragraph, line 16 – comment / edit - referring to the word "similar" in this sentence…does this refer to other investigators findings or differences between blast & non-blast? Also, it may be noted that these differences may be due to selection bias as outpatients may have more visual demands. Recommend deleting the word "similar" on line 16 and insert "to be similar" between "dysfunction" and "for blast" on line 17.	We have clarified this paragraph.
97.	8	Page 15, 2nd paragraph, lines 16-17 – edit – replace "refraction dysfunction" with "refractive errors."	We have made this change.
98.	8	Page 32, last paragraph, line 40 – edit - delete the word "diagnosed."	Thank you for the suggestion. This has been addressed.
99.	8	Page 33, line 2 – edit - replace "infrequent, generally occurring in less than 1% of patients" with, "diagnosed with a frequency of 7.3% for disorders of accommodation and refractive errors and a frequency of less than 1% for other visual dysfunctions." Please refer to above comment regarding the Dougherty paper to check this sentence for accuracy.	Thank you for the suggestion. This has been addressed.
	Optional Dissemination and Implementation Questions		
100.	***5. Are there any VA clinical performance measures, programs, quality improvement measures, patient care services, or conferences that will be directly affected by this report? If so, please provide detail.***		
101.	1	1. The report is directly relevant to VA optometry and ophthalmology services as well as PRC and PNS programs or any program addressing veterans with TBI.	Noted.
102.	1	2. It is also applicable to neuropsychology and others who rely on assessments that include reading or near tasks as the presence of undetected visual dysfunction or visual loss has the potential to generate misleading test results.	Noted.
103.	1	3. Relevant to the DoD/VA Vision Center of Excellence	Noted.
104.	1	4. Relevant to VA Rehabilitation Research & Development and Health Services Research &Development.	Noted.
105.	1	5. The American Academy of Optometry, American Academy of Ophthalmology, and Association for Research on Vision and Ophthalmology (ARVO) would be receptive audiences for this information.	Noted.
106.	3	Not sure.	Noted.
107.	4	The way the report is currently written, the effect will be minimal.	Noted.
108.	5	There is currently a directive requiring Optho exam of all Veterans with inpatient rehabilitation stays at the PRCs with a TBI diagnosis. This directive is expiring and I believe the national Ophthalmology program will be promoting a clinical practice recommendation/guideline moving forward.	Noted.
109.	6	All blind rehabilitation centers within the VA will have an interest in this report. There will be an ARVO symposium on visual dysfunction and TBI chaired by Dr. John Clark John I Clark [clarkji@u.washington.edu]* that will be held in Denver first week of May 2015.	Noted.

	Reviewer	Comment	Response
110.	7	At present the eye care services (optometry and ophthalmology) of the VA would benefit from the results of this study in support of their efforts to detail recommended eye/vision assessments and the referral criteria for such assessments	Noted.
111.	8	Continual modification or rescinding of VA Directive 2008-065 (published 10/20/08).	Noted.
	6. Please provide any recommendations on how this report can be revised to more directly address or assist implementation needs.		
112.	1	Given that all studies recommend specific vision screening for mTBI patients this report could well echo that recommendation perhaps specifically targeting applicable services (optometry, ophthalmology, and the Polytrauma System of Care, to mention a few).	Though we try not to make clinical recommendations in our reports, we are hoping to collaborate on dissemination efforts such as cyber-seminars with TEP members and stakeholders who are better able to make clinical recommendations
113.	2	I will defer to the experts to determine how the findings impact the directive for PRCs to have ocular health and visual functioning examinations performed by optometrists or ophthalmologists.	Noted.
114.	3	Emphasize the research gaps	We have updated the FRN section of this report.
115.	4	See my suggestions under #4. At this point, I do not see any benefit to VA clinicians or investigators who would be the consumers of this review.	Noted.
116.	5	It would be helpful to include a description of eye care within VHA and provide some detail about the ability to treat and manage the listed diagnosis in this review (i.e. can every VA ophthalmologist and optometrist diagnose and treat convergence insufficiency or does a primary care clinician need to refer to a tertiary center). It would also be helpful to more clearly state that additional research is needed to establish referral guidelines for visual symptom complaints as the reader may assume that any complaint would trigger a referral to Eye clinic. In addition if there are any recommendations for Primary care providers to implement prior to referral there should be a reference included. The Office of Specialty care may want to consider implementing (or at least recommending) a national consult template for Eye clinics to direct the ordering clinician to identify Veterans with h/o TBI.	We have plans to address these clinical questions in a cyber-seminar with TEP members and stakeholders, and also updated the FRN section of this report to address some of these concerns.
117.	8	Well written and constructed. Minor comments, edits and revisions noted in item #4 above.	Noted.
	7. Please provide us with contact details of any additional individuals/stakeholders who should be made aware of this report.		
118.	2	Polytrauma/Blast-Related Injuries QUERI, PM&R Program Office	Noted.
119.	3	N/A	Noted.
120.	4	COL Dallas Hack 'dallas.c.hack.mil@mail.mil'	Noted.
121.	5	DCoE Vision Center of Excellence and Primary Care in VHA if not already involved.	Noted.
122.	6	VA Rehabilitaton Journal and possibly published in that journal	Noted.
123.	7	Dr John Townsend Optometry Consusltant and Dr Glenn Cockerham Ophthalmology Consultant	Noted.

	Reviewer	Comment	Response
124.	8	Mary Lynch, MD – mary.lynch4@va.gov Glenn Cockerham, MD – glenn.cockerham@va.gov John Townsend, MD – john.townsend@va.gov Robert Sergott, MD – rcs220@comcast.net Amy Chomsky, MD – amy.chomsky@va.gov Randy Kardon, MD – randy.kardon@va.gov Robert Ruff, MD – Robert.ruff1@va.gov Gregory Goodrich, PhD – Gregory.goodrich@va.gov	Noted.