



**VISION CENTER  
OF EXCELLENCE**



# **Population Health and Vision: A Vision Center of Excellence (VCoE) Initiative**

**COL Mark E. Reynolds, MD, MPH**

**22 August 2019**

**0855 - 0955**



**Mark E. Reynolds, MD, MPH**

COL MC USA

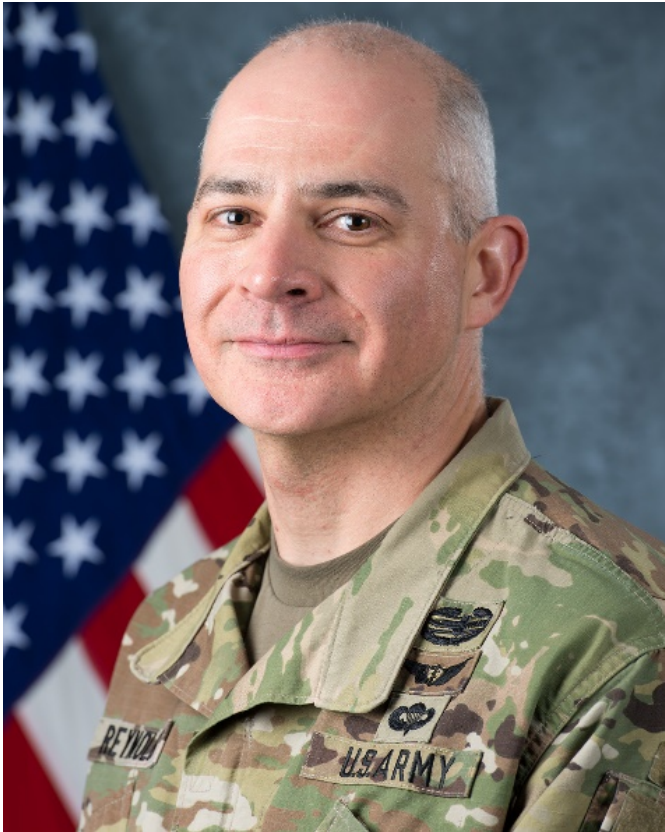
Chief, Vision Center of Excellence (VCE)

Research and Development

Defense Health Agency (DHA), J-9

Silver Spring, MD

# COL Mark Reynolds, MD, MPH



- COL Reynolds is board certified in ophthalmology and public health/preventive medicine and has served in a variety of positions across the Army.
- He has deployed as both an ophthalmologist and command surgeon.
- His current focus at the Vision Center of Excellence is the prevention, mitigation, and rehabilitation of ocular injuries and vision-threatening conditions across the continuum of eye care.

# Learning Objectives

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

1. Summarize the functions and goals of VCoE.
2. Identify key features and interventions for ocular injuries.
3. Recognize the characteristics of visual dysfunction following Traumatic Brain Injury (TBI).
4. Describe the impact of vision on readiness and performance.



# Disclosures

- COL Mark Reynolds has no relevant financial or non-financial relationships to disclose relating to the content of this activity; or presenter(s) must disclose the type of affiliation/financial interest (e.g. employee, speaker, consultant, principal investigator, grant recipient) with company name(s) included.
- The views expressed in this presentation are those of the author and do not necessarily reflect the official policy or position of the Department of Defense, not the U.S. Government.
- This continuing education activity is managed and accredited by the Defense Health Agency J-7 Continuing Education Program Office (DHA J-7 CEPO). DHA J-7 CEPO and all accrediting organizations do not support or endorse any product or service mentioned in this activity.
- DHA J-7 CEPO staff, as well as activity planners and reviewers have no relevant financial or non-financial interest to disclose.
- Commercial support was not received for this activity.

# Polling Question: Operational Environment



Concerning ocular trauma and vision issues, how would you rate your comfort:

- a. I can freely converse with eye care providers in their native language
- b. I know enough to prevent further harm to an injured eye
- c. I could expand my knowledge in that particular area
- d. I would cover an eye injury as quickly as possible because it freaks me out

# Overview

- VCE Background, functions, goals
- Overview of efforts
- Ocular Injuries
- Laser Exposure
- Visual dysfunction after TBI
- Blindness and Low Vision
- Disease Non-battle Injuries (DNBI)
- Visual Performance

# VCE Establishment

- Establishment of a Center of Excellence
  - Prevention, diagnosis, mitigation, treatment, and rehabilitation of military eye and vision injuries
- Implementation of a Vision Registry
  - Collect longitudinal data on eye injuries to guide
  - Clinical education
  - Promote best practices
  - Inform policy
- Maximum extent practicable collaboration
  - Secretary of Veterans Affairs
  - Institutions of higher education
  - Public and Private entities (including international)

# Defense and Veterans Eye Injury and Vision Registry (DVEIVR)



- Provides the Department of Defense (DoD) and the U.S Department of Veterans Affairs (VA) vision care community with a health registry consisting of DoD and VA ocular clinical and related data
- Enable tracking of eye injuries of active duty Service Members to inform
  - Coordination of care
  - Longitudinal analysis
- Ongoing outcome analysis of diverse injury types to inform treatment recommendations

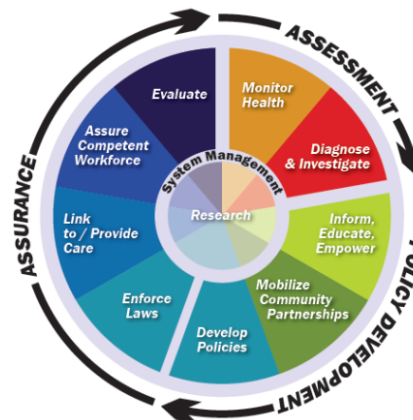
<https://visionregistry.informatics.afms.mil>

## VCE Goals

- Characterize the magnitude of vision-threatening battle injuries and disease/non-battle injuries (DNBI) and the respective impacts on readiness and retention.
- Identify key interventions or knowledge gaps in prevention, mitigation, and optimal treatment across the spectrum of care

# VCE Goals (continued)

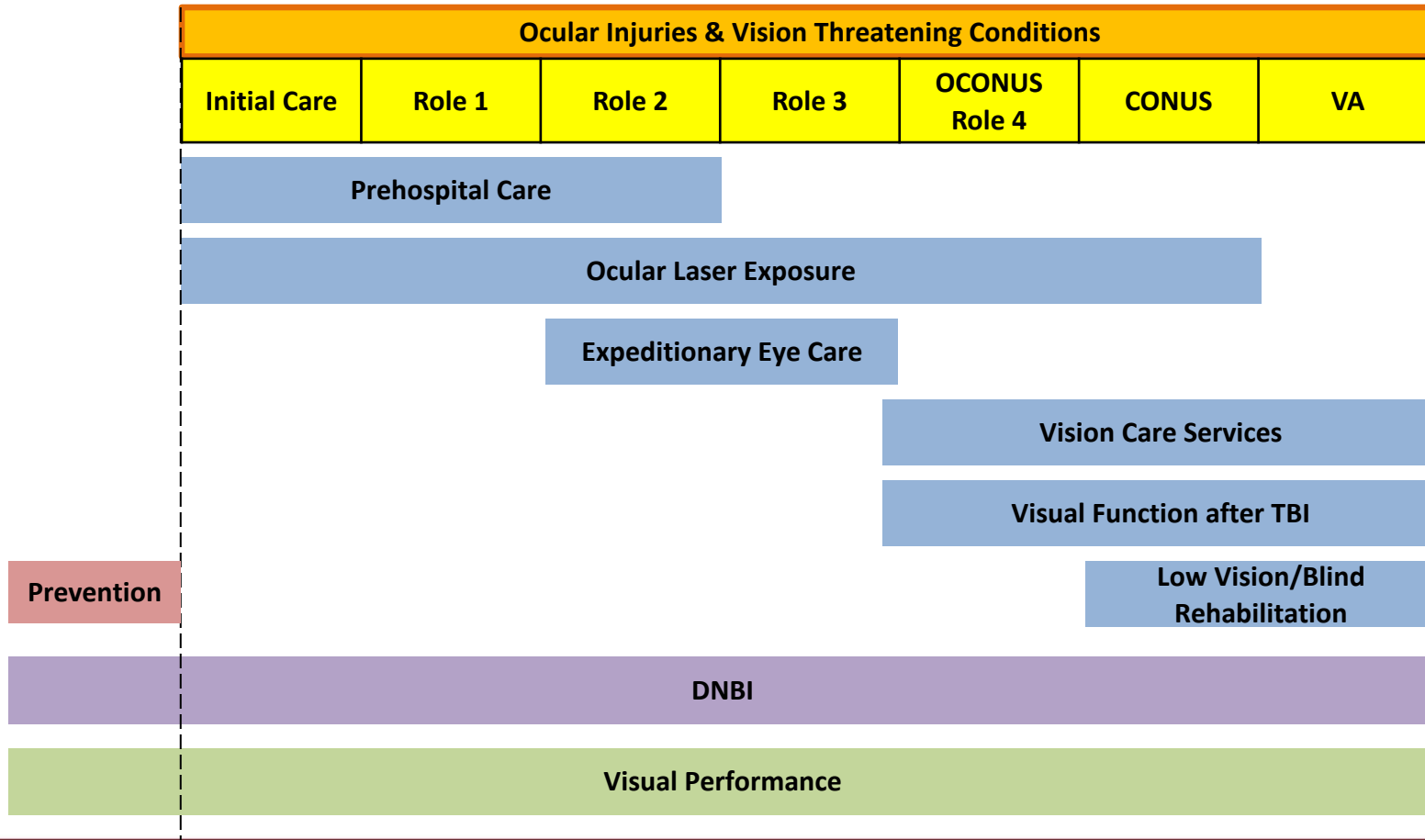
- Produce and disseminate guidelines, training, and standards of care to Service Members, leaders, and providers
- Evaluate the utilization and effectiveness of interventions on the incidence and outcomes of vision-threatening battle injuries and DNBI



<https://www.cdc.gov/publichealthgateway/publichealthservices/pdf/essential-phs.pdf>



# Efforts across the Continuum



# Ocular Injuries Epidemiology



## Cost of Military Eye Injury and Vision Impairment Related to Traumatic Brain Injury: 2001–2017 (1)

*Frick KD, Eric L. Singman EL*

**TABLE IA.** Incident Eye Injury

Type of Eye Injury	2000–2017Q1 Ambulatory	2000–2017Q1 Hospitalized	2000–2017Q1 Total
Total	270,505	5,237	275,742
Superficial	193,658	701	194,359
Non-Superficial	76,847	4,536	81,383
High risk of blindness	5,144	943	6,087
	<b>Annualized</b>	<b>Hospitalized</b>	<b>Annualized</b>
Total	15,681	304	15,985
Superficial	11,227	41	11,267
Non-Superficial	4,455	263	4,718
High risk of blindness	298	55	353



# Prolonged Field Care (PFC)

- Field medical care applied beyond doctrinal planning time-lines in order to decrease patient mortality and morbidity
- Utilizes limited resources, and is sustained until the patient arrives at the next appropriate level of care (2)
- Ocular Injuries and Vision-Threatening Conditions in PFC Clinical Practice Guidelines (CPG) (3)
  - Essential information on the recognition and treatment of ocular conditions when evacuation to an eye specialist is delayed
  - Addresses multiple ocular injuries and vision-threatening conditions
  - Provides recommendations for treatment or stabilization with Minimal, Better, and Best resources

[https://jts.amedd.army.mil/index.cfm/PI\\_CPGs/cpgs](https://jts.amedd.army.mil/index.cfm/PI_CPGs/cpgs)

# PFC Goals of Ocular Care

1. Maintain high suspicion for ocular injuries
2. Assess and document visual function
3. Examine for critical findings
4. Maintain patient comfort and prevent further damage to eye
5. Establish contact with eye care specialist and prioritize evacuation (integrated system of care)

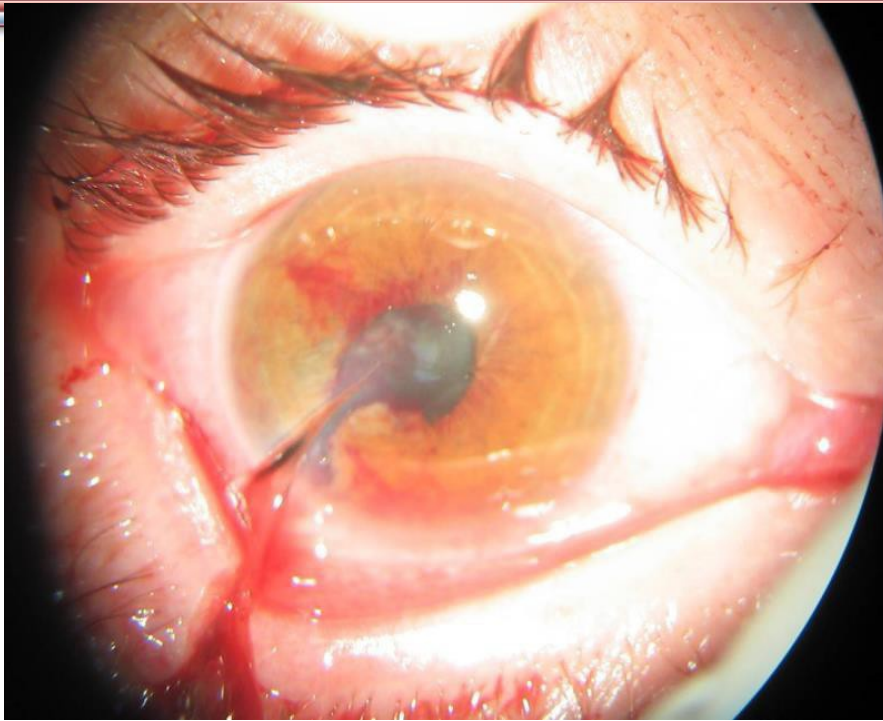


*Photo by Petty Officer 2nd Class Timothy Black  
Fleet Combat Camera Pacific*

# Open Globe Injury (OGI)

- Result of penetrating/perforating trauma or from rupture of the globe due to massive compressive forces
- Prompt surgical exploration and repair are crucial to restore or salvage vision
- Goal: Prevent further damage to the eye, prevent infection in the eye (endophthalmitis), and evacuate to an eye surgeon as soon as possible
  - Rigid shield (no pressure on eye!)
  - Antibiotic prophylaxis
  - Pain control, comfort, prevention of vomiting
  - Exploration and repair as soon as possible

***Ultrasound contraindicated for suspected OGI***



1



2

*Photographs (1 & 2) by COL Mark Reynolds*

# Polling Question: Open Globe

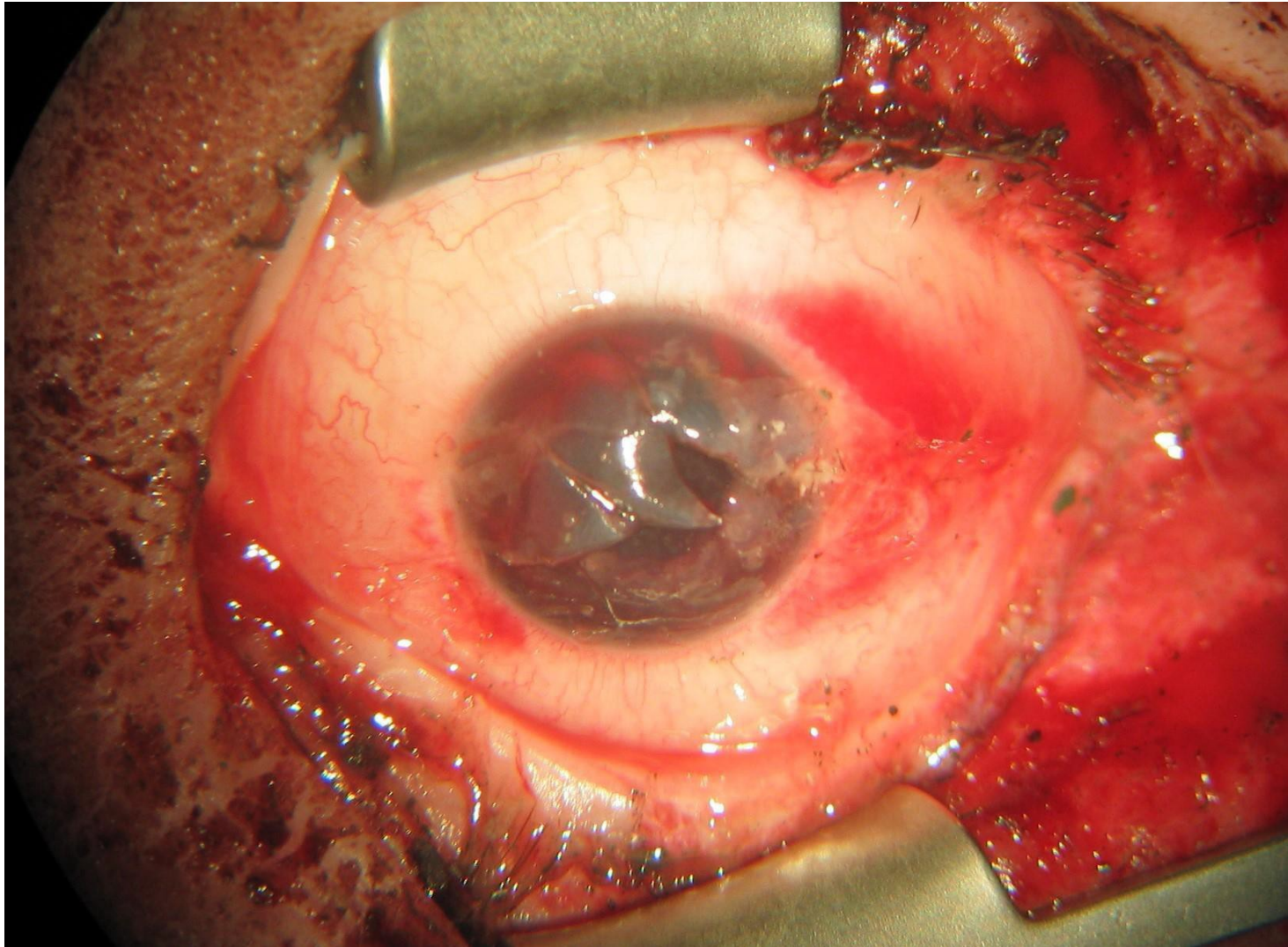


Proper steps in initial management of an open globe injury include:

- a. Placement of a rigid shield over the injured eye
- b. Antibiotic prophylaxis to prevent intraocular infections
- c. Management of nausea and vomiting to prevent spikes in eye pressure
- d. Rapid evacuation to an ophthalmologist for surgical closure
- e. All of the above



Unclassified



*Photograph by COL Mark Reynolds*



VISION CENTER  
OF EXCELLENCE

***“Medically Ready Force...Ready Medical Force”***

# Retrobulbar Hemorrhage/Orbital Compartment Syndrome



- Vision-threatening condition causing increased pressure in the eye, leading to irreversible vision loss
- Vision loss typically will occur after 90 minutes of increased pressure
- Retrobulbar hemorrhage is the most common cause of orbital compartment syndrome (OCS)
- Other causes of OCS include orbital congestion secondary to burn resuscitation and significant orbital emphysema after orbital fracture



# Retrobulbar Hemorrhage/Orbital Compartment Syndrome

- Goal: Lower the orbital compartment pressure as soon as possible to prevent tissue damage.
  - Prompt recognition (vision, pressure, pupil) and intervention with Lateral Canthotomy/Cantholysis
  - Monitor for recurrence and medically decompress

1



2



Photographs (1 & 2) by COL Mark Reynolds





# Ocular Laser Exposure

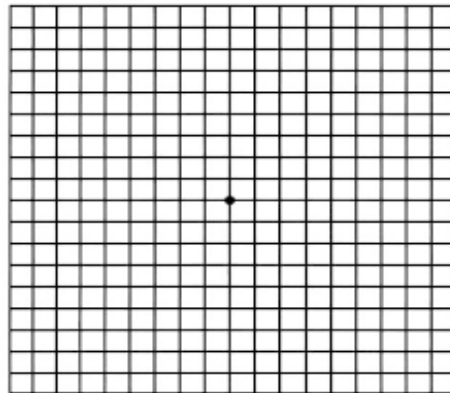
- Directed energy threats to the visual system
- Weapons systems from both friendly and hostile forces (infrared wavelengths) and commercially available (visible wavelengths)
- Immediate visual effects, including flash blindness, glare, and startle that can interfere with critical functions
- Recovery of optimal visual function can take from seconds to minutes, and alterations in visual function can last from several minutes to several hours
- Permanent injury rare



<https://www.dailystar.co.uk/news/latest-news/493013/Laser-light-dangers-aeroplane-cockpit-pilot-blinded-police-warning>

# Post-Exposure Evaluation

- Exposure description (color, brightness and duration of light/exposure)
- Presenting Symptoms (blurred vision, headache, blind spots)
- Visual Acuity, Amsler Grid (macular function), Color Vision, Ocular examination with available capabilities (4)



<https://www.aao.org/eye-health/tips-prevention/facts-about-amsler-grid-daily-vision-test>

# Post-Exposure Disposition

- Worsening visual acuity or visual symptoms should be considered for priority evacuation
- Visual symptoms that persist beyond 24 hours despite initial treatment
- **All** symptomatic exposures should have comprehensive evaluation by an eye care provider in theater or upon redeployment
- Repeated exposures should be evaluated for symptoms after each incident, and each evaluation documented and treated as an additional exposure



# Visual Dysfunction after TBI

- Includes a wide range of symptoms, including photophobia (light sensitivity), loss of visual acuity, visual field deficits, and difficulty with focusing (5)
- Visual dysfunctions vary across individuals and situations and can continue to be symptomatic years after recovery from other TBI symptoms (6)
- Can interfere with rehabilitation and reintegration
- Screening for visual dysfunction after TBI not consistent

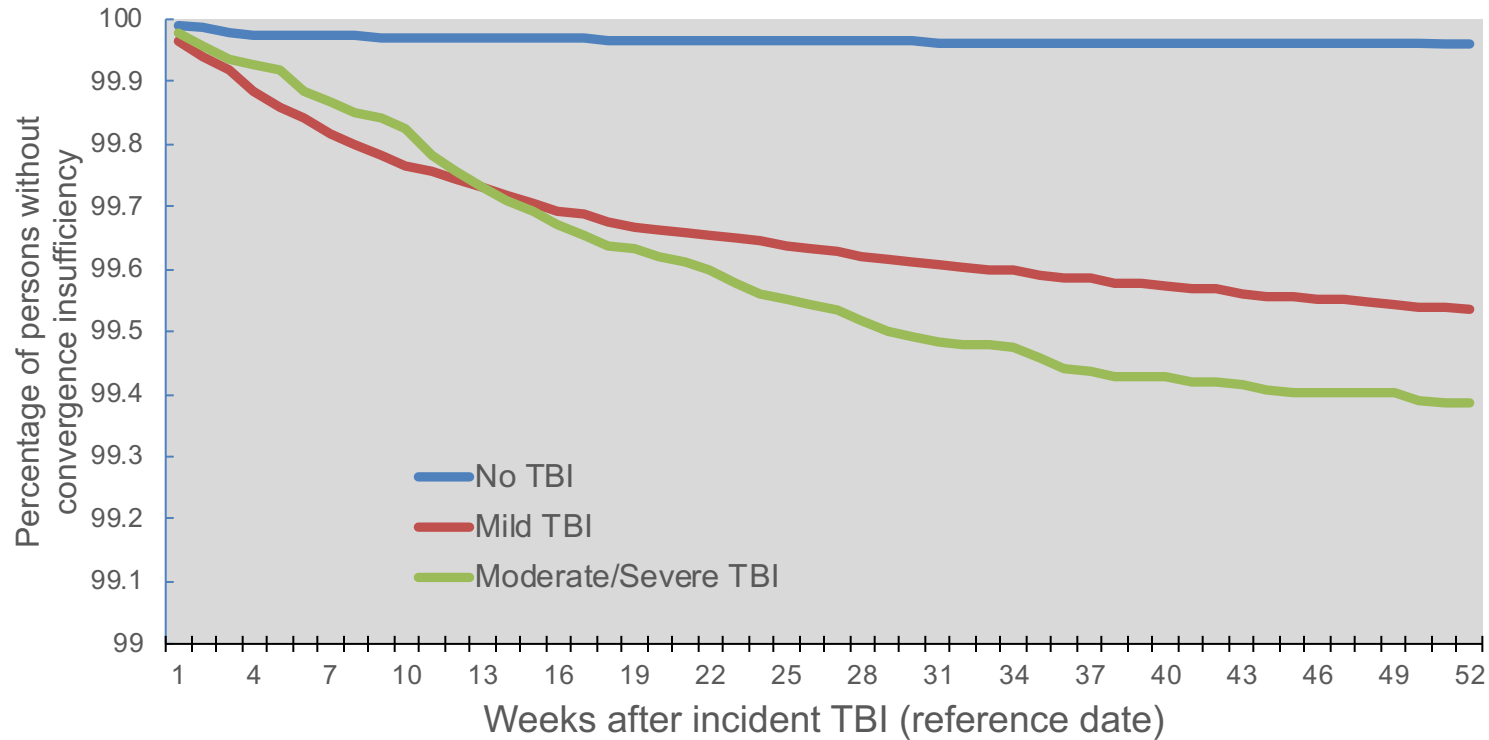


*Photo by Patricia Beal, Womack Army  
Medical Center*

# Visual Dysfunction Surveillance

- Incidence and Temporal Presentation of Visual Dysfunction following Diagnosis of TBI, Active Component, U.S. Armed Forces, 2006-2017
- Visual dysfunctions were diagnosed at increased relative rate in Service members with a history of TBI compared to no TBI
  - Mild TBI: 2.3x rate
  - Moderate/severe TBI: 3.5 rate
- Visual dysfunctions can be present at any time after the TBI
- Generally more common in Moderate/severe TBI

# Visual Dysfunction after TBI



*Data from the Defense Medical Surveillance System, The Armed Forces Health Surveillance Branch, Defense Health Agency, Silver Spring, Maryland [2001-2018]*

# Polling Question: Visual Dysfunction after TBI



When is the ideal time to screen SM with TBI for visual dysfunctions?

- a. 6 months following the TBI event
- b. Not until at least 12 months after the TBI event
- c. When the SM complains of decreased visual acuity
- d. Early and often following a TBI event

# Accommodative Dysfunction & Convergence Insufficiency



## Adjusted Incidence Rates

	Accommodative dysfunction			
	AIR	LL	UL	p-val
Mild TBI vs No TBI	3.58	2.7	4.76	<.0001
Moderate/Severe TBI vs No TBI	4.68	3.29	6.66	<.0001
	Convergence insufficiency			
	AIR	LL	UL	p-val
Mild TBI vs No TBI	3.98	3.09	5.13	<.0001
Moderate/Severe TBI vs No TBI	5.64	4.16	7.65	<.0001

*Data from the Defense Medical Surveillance System, The Armed Forces Health Surveillance Branch, Defense Health Agency, Silver Spring, Maryland [2001-2018]*

# Visual Dysfunction Screening

- Service members should be evaluated for visual dysfunction following diagnosis of TBI
- Certain dysfunctions, such as accommodative dysfunction and convergence insufficiency are significantly associated with TBI
- Recommend providers to evaluate for occult or unreported TBI in patients with accommodative dysfunction or convergence insufficiency

# Blindness and Low Vision

## ■ Definition of Legal Blindness (7)

- A visual acuity of 20/200 or less in the better-seeing eye with best conventional correction (meaning with regular glasses or contact lenses).
- OR a visual field (the total area an individual can see without moving the eyes from side to side) of 20 degrees or less (also called tunnel vision) in the better-seeing eye

## ■ Low vision is uncorrectable vision loss that interferes with daily activities. It is better defined in terms of function, rather than [numerical] test results

<https://www.afb.org/blindness-and-low-vision/eye-conditions/low-vision-and-legal-blindness-terms-and-descriptions>



# Blindness and Low Vision



## Burden of Low Vision & Blindness 2018

	ACTIVE COMPONENT	FAMILY MEMBERS	RETIREES
<b>Documented Low Vision</b>			
Direct care only	31 (62.0%)	109 (9.1%)	45 (8.8%)
Outsourced care only	20 (40%)	1,098 (91.3%)	467 (91.4%)
<b>Total</b>	<b>50</b>	<b>1,202</b>	<b>511</b>
<b>Visual Field Defect</b>			
Direct care only	119 (74.8)	140 (8.7%)	107 (9.7%)
Outsourced care only	51 (32.1%)	1,483 (92.1%)	999 (91.0%)
<b>Total</b>	<b>159</b>	<b>1,611</b>	<b>1,098</b>
<b>At Risk for Blindness/Low Vision</b>			
Direct care only	170 (65.6%)	756 (3.0%)	706 (3.9%)
Outsourced care only	95 (36.7%)	24,758 (97.4%)	17,620 (96.4%)
<b>Total</b>	<b>259</b>	<b>25,427</b>	<b>18,280</b>

*Data from the Defense Medical Surveillance System, The Armed Forces Health Surveillance Branch, Defense Health Agency, Silver Spring, Maryland [2018]*



# VCE Fact Sheets

- Caring for Patients Who are Blind or Visually Impaired (inpatient and outpatient care teams)
- best practices for supporting blind and visually impaired patients in safely maintaining or regaining independence and quality of life during hospitalization and medical encounters
  - Interaction & orientation
  - Physical environment
  - Mobility assistance



<https://vce.health.mil/Resources/Products>

Images taken from "Caring for Patients Who are Blind or Visually Impaired" VCE factsheets

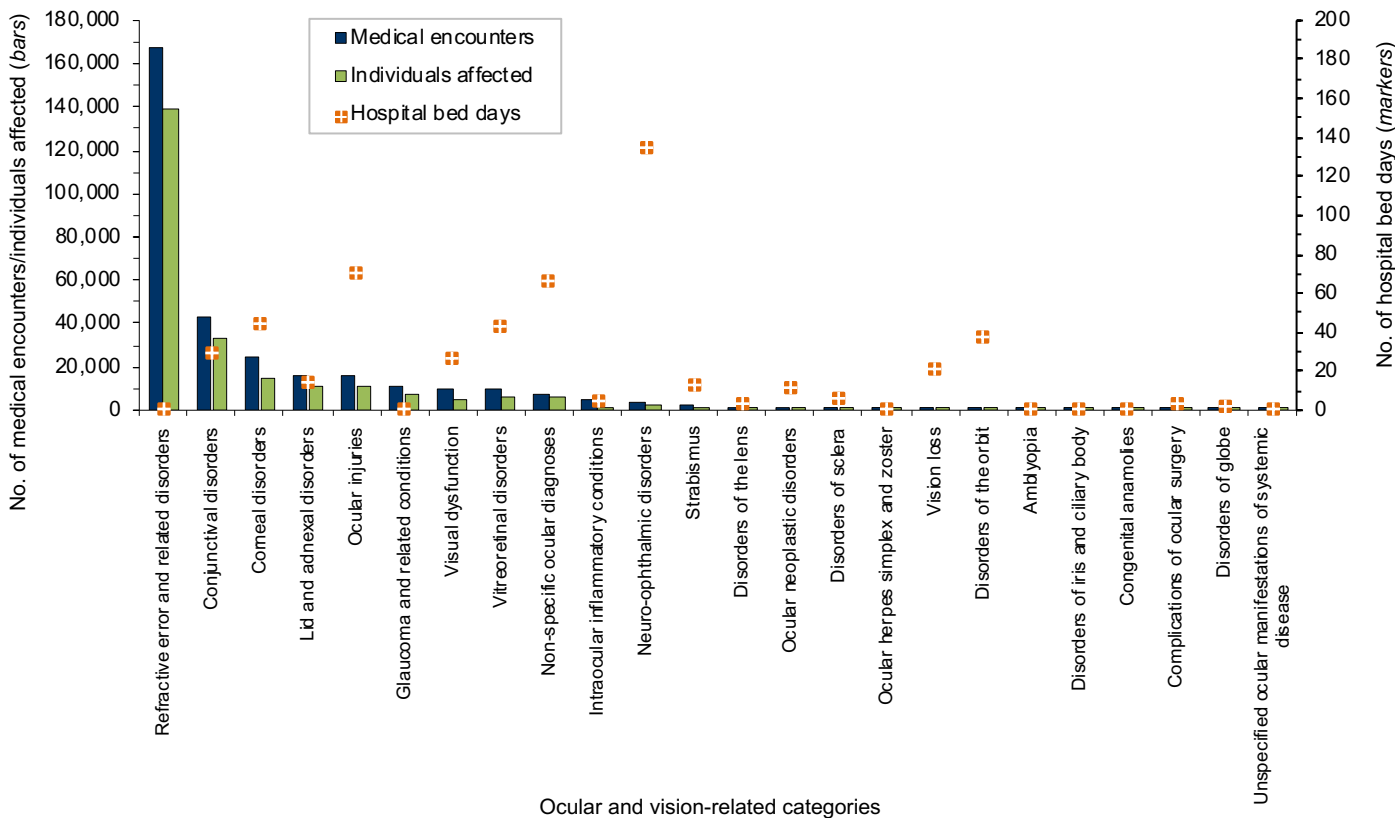
# Disease/Non-battle Injuries

- Significant effects on readiness in all environments
- Acute and chronic conditions
- Frequent cause of medical evacuation
- Challenges in defining magnitude and risk factors



*Photo by Tech. Sgt. Robert Cloys  
386th Air Expeditionary Wing Public Affairs*

# Burden of Ocular and Vision Conditions 2018

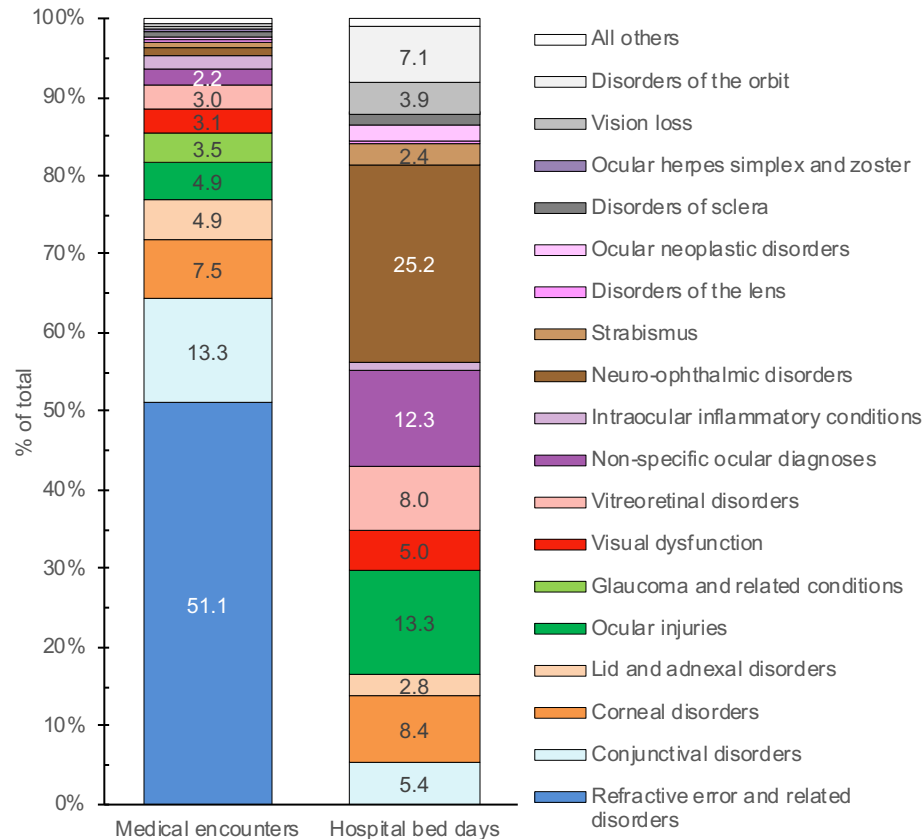


Data from the Defense Medical Surveillance System, The Armed Forces Health Surveillance Branch, Defense Health Agency, Silver Spring, Maryland [2018]

# Burden of Ocular and Vision Conditions



Figure 1b. Percentage of medical encounters, a and hospital bed days, attributable to ocular and vision-related categories, active component, U.S. Armed Forces, 2018



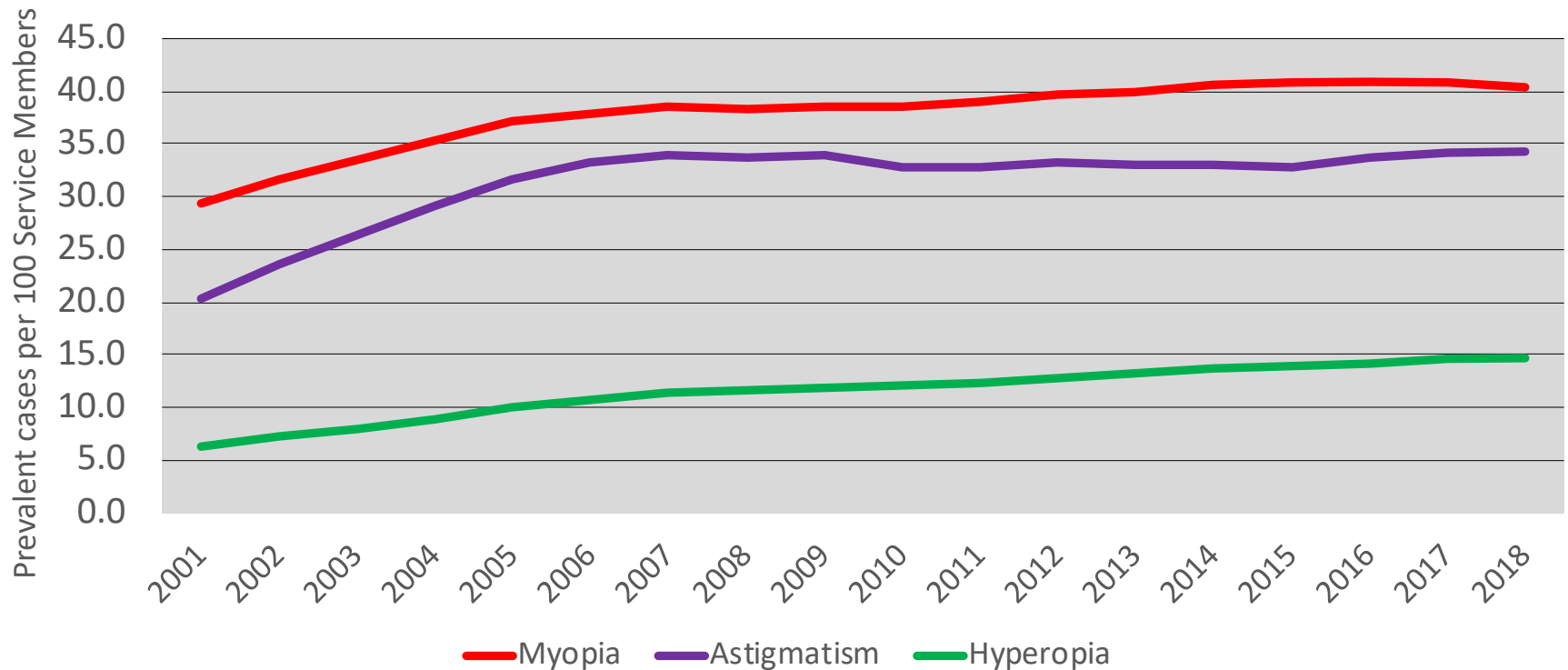
Data from the Defense Medical Surveillance System, The Armed Forces Health Surveillance Branch, Defense Health Agency, Silver Spring, Maryland [2018]

# Visual Performance

- Refractive error has been shown to affect target discrimination and marksmanship performance among military personnel (8)
- Refractive error, even when corrected, has been shown to negatively affect both depth perception and peripheral vision in young athletes (9)
- Many athletes will prefer either contact lenses use or refractive surgery over spectacle correction (10)
- For active component Service Members, contact lens use is not authorized while deployed (11)
- Refractive surgery has been associated with both improved military readiness and vision-related quality of life (including military-specific tasks of use of night vision goggles use and weapons-based tasks) (12)

# Refractive Error

### Annual Lifetime Prevalence of Selected Refractive Errors, Active Component, U.S. Armed Forces, 2001–2018



Data from the Defense Medical Surveillance System, The Armed Forces Health Surveillance Branch, Defense Health Agency, Silver Spring, Maryland [2001-2017]



# Human Performance



*Photo by Airman 1st Class Joseph Barron  
100th Air Refueling Wing Public Affairs*



*Photo by Pfc. Rashene Mincy  
55th Combat Camera*





# Key Takeaways

- Ocular injuries, including laser exposures, must be evaluated and documented as soon as possible
- Visual dysfunctions after TBI require proper screening and evaluation
- Ocular and vision health and function is essential to readiness

# Questions

<https://vce.health.mil/>

[https://vce.health.mil/  
dha.ncr.dod-va.mbx.vce@mail.mil](https://vce.health.mil/dha.ncr.dod-va.mbx.vce@mail.mil)

# References

American Foundation for the Blind. (n.d.). *Low vision and legal blindness terms and descriptions*. Retrieved from:

<https://www.afb.org/blindness-and-low-vision/eye-conditions/low-vision-and-legal-blindness-terms-and-descriptions>

Armstrong, R.A. (2018). Visual problems associated with traumatic brain injury. *Clin Exp Optom*, 101: 716–726. Doi:

<https://doi.org/10.1111/cxo.12670>

Chang, S.T., Liu, Y.H., Lee, J.S., See, L.C. (2015). Comparing sports vision among three groups of soft tennis adolescent athletes:

Normal Vision, refractive error with and without correction. *Indian Journal of Ophthalmology*, 63(9):716-721. Doi:

10.4103/0301-4738.170974.

Department of the Army Medical Services. (2009). *The Army Vision Conservation and Readiness Program*: Department of the

Army Pamphlet 40-506. Accessed on 04 June 2019 at:

[https://armypubs.army.mil/epubs/DR\\_pubs/DR\\_a/pdf/web/p40\\_506.pdf](https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/p40_506.pdf)

Frick, K.D. & Singman, E.L. (2019). Cost of military eye injury and vision impairment related to traumatic brain injury: 2001–2017.

*Mil Med.*, 184(5–6):338–343. Retrieved from: <https://reference.medscape.com/medline/abstract/30690455>

# References



- Hatch, B.C., Hilber, D.J., Elledge, J.B., Stout, J.W., Lee, & R.B. (2009). The effects of visual acuity on target discrimination and shooting performance. *Optometry and Vision Science*, 86(12): E1359–E1367. Doi:10.1097/OPX.0b013e3181be9740.
- Magone, M.T., Kwon, E., & Shin, S.Y. (2014). Chronic visual dysfunction after blast-induced mild traumatic brain injury. *The Journal of Rehabilitation Research and Development*, 51(1): 71-80. Doi: 10.1682/JRRD.2013.01.0008.
- Reynolds, M.E., Auvil, J.R., Colyer, M.H., Danes, L., Jenkins, C., Kang, R.N. , , , Wood, R.L. *Evaluation and disposition of temporary visual interference and ocular injury after suspected ocular laser exposure*. Manuscript submitted for publication.
- Reynolds, M.E., Hoover, C., Reisberg, J., Mazzoli, R., Colyer, M., Barnes, S. , , , Shackelford, S. (2017). Evaluation and Treatment of Ocular Injuries and Vision-Threatening Conditions in Prolonged Field Care. *Journal of Special Operations Medicine*, 17(4): 115-126.
- Special Operations Medical Association. (2019). Prolonged Field Care Resources. Retrieved form:  
<http://www.specialoperationsmedicine.org/Pages/pfcresources.aspx>

# References

Sia, R.K., Ryan, D.S., Rivers, B.A., Logan, L.A., Eaddy, J.B., Peppers, L., Rodgers, S.B. (2018). Vision-related quality of life and perception of military readiness and capabilities following refractive surgery among active duty U.S. military service members. *Journal of Refractive Surgery*, 34(9):597-603.

Zeri, F., Pitzalis, S., Di Vizio, A., Ruffinatto, T, Egizi F, Di Russo, F. , , , Naroo, S.A. (2018). Refractive error and vision correction in a general sports-playing population. *Clinical and Experimental Optometry*, 101(2):225-236. Doi: 10.1111/cxo.12626.

# Questions?



- Please submit your questions in the Q&A pod in Adobe Connect

# How to Obtain CE Credits



To receive continuing education credit (CE), you must complete the program posttest and evaluation for each session of the event. The posttests and evaluations will be available through 3 October 2019 at 2359 ET. Please complete the following steps to obtain CE credit:

1. Go to URL <https://www.dhaj7-cepo.com/content/august-2019-dha-clinical-communities-speaker-series>
2. Click on the REGISTER/TAKE COURSE tab.
  - a. If you have previously used the CEPO LMS, click login.
  - b. If you have not previously used the CEPO LMS click register to create a new account.
3. Verify, correct, or add your profile information.
4. Follow the onscreen prompts to complete the post-activity assessments:
  - a. Read the Accreditation Statement
  - b. Complete the Evaluation
  - c. Take the Posttest
5. After completing the posttest at 80% or above, your credits will be recorded in the LMS. In addition, you will be able to print or download your certificate. Repeat this process for each session you wish to claim CE Credit.
6. You can return to the site at any time in the future to print your certificate and transcripts at <https://www.dhaj7-cepo.com/>
7. If you require further support, please contact us at [dha.ncr.j7.mbx.cepo-lms-support@mail.mil](mailto:dha.ncr.j7.mbx.cepo-lms-support@mail.mil)