TIP No. 63-001-0322
## Annual Eye Injury Surveillance Report – CY 2020
## Active Components of the U.S. Armed Forces

**MILITARY SIGNIFICANCE**

This document describes eye injury medical encounters, including deployment-associated medical encounters, of Active Duty (AD) Service members (SMs) in the Department of Defense (DOD) in calendar year (CY) 2020. The purpose of this annual surveillance report is to inform military commanders of their most common types of eye injuries and at-risk occupations. Additional information about installation-specific eye injury rates are provided in separate quarterly updates (described in Appendix A).

**ABSTRACT**

Eye injuries, as the primary medical diagnosis, accounted for 6,761 Military Treatment Facility (MTF) ambulatory encounters and 416 deployment-associated healthcare encounters in the Active Component of the U.S. Armed Forces in CY 2020. There were 28 hospitalizations that eye injury was the primary diagnosis (n=1) or all medical diagnoses (n=27). The most common type was "Superficial" eye injury and causes of the injury were mostly unknown (i.e., no coding documentation in the medical record).

The "Craftwork & Construction," followed by the "Healthcare" and "Electrical Mechanical Repair" enlisted occupational groups had the highest eye injury rate in the DOD. The "Healthcare," "Scientists & Professional," and "Engineering & Maintenance" officers had higher rates of eye injury. The Students, Trainees & Unknown Officer or Enlisted groups had the lowest eye injury rate.

The overall eye injury rate in the AD SM population showed a weak, but significantly downward trend from CY 2008 to 2020 ($R^2$=.344, P=.035). The slope coefficient was -21.72, which indicates that the overall eye injury rate in the DOD decreased by 21.72 per 100,000 person-years each year. The downward time trend was statistically significant in the U.S. Navy (P=.015) but not statistically significant in other military services (p>.05).

**BACKGROUND**

During the Operation Iraqi Freedom and Operation Enduring Freedom, about 13% of the U.S. military SMs who were medically evaluated had significant eye injuries and about a third of these injuries led to legal blindness.[1,2] Since the implementation of new vision conservation and Military Combat Eye Protection (MCEP) policies in 2004,[3] overall eye injuries among the U.S. AD military SMs have decreased.

Monitoring of public health outcomes is one of the 10 essential public health services according to the Centers for Disease Control and Prevention (CDC) (www.cdc.gov). In addition to providing routine monitoring and surveillance of eye injuries, the objectives of this report were to recognize trends, define magnitude and distribution of eye injuries, and identify emerging issues for guiding military injury prevention policies and priorities.

An analysis of military eye injury trends from 1996 to 2005 was published in the peer review literature in 2010.[4] That same year, the Tri-Service Vision Conservation and Readiness Branch

(TSVCRB) of the U.S. Army Public Health Center (APHC) and the Armed Forces Health Surveillance Division (AFHSD) of the Defense Health Agency (DHA) developed a standard surveillance report called the *Annual Military Active Duty Eye Injury Summary*. Additionally, military installation quarterly eye injury surveillance started in 2012 (Appendix A).

Though the format of the standardized report has undergone some minor changes since its first edition in 2011, the products continue to provide military service with an overview of the types of eye injuries most currently being experienced by different military occupational groups. The following are resources where the report data are found:

- The surveillance data presented in this document, along with past annual military eye injury surveillance and quarterly military installation eye injury surveillance summaries, are also available on the APHC Periodic Publications page: https://phc.amedd.army.mil/news/Pages/PublicationDetails.aspx?type=Active%20Duty%20Eye%20Injury%20Report%20Summary

- Military service eye injury rates and case counts can be found at: https://www.sms.army.mil/, and navigating the menus to Dashboards (from the top left drop-down) > Army Enterprise (from the left menu pane) > OTSG/MEDCOM > OTSG/MEDCOM HQ > DCS, Public Health > Occupational & Environmental Medicine Portfolio (OEM) > OEM Vision Readiness & Eye Injury Surveillance > Eye Injury Surveillance - Overall by Service. Deployment-associated eye injury can be found at https://www.sms.army.mil/, and navigating the menus to Dashboards (from the top left drop-down) > Army Enterprise -> User Workspace > OTSG/MEDCOM >OTSG/MEDCOM HQ > DCS Public Health > Occupational & Environmental Medicine Portfolio (OEM) > OEM Vision Readiness & Eye Injury Surveillance > Eye Injury Surveillance - Annual Deployment-Associated.

- Quarterly eye injury installation surveillance can be found at https://www.sms.army.mil/, and navigating the menus to Dashboards (from the top left drop-down) >Army Enterprise > User Workspace > OTSG/MEDCOM > OTSG/MEDCOM HQ > DCS Public Health > Occupational & Environmental Medicine Portfolio (OEM) > OEM Vision Readiness & Eye Injury Surveillance > Eye Injury Surveillance – Installation.

**METHODS**

**Surveillance Population.** The surveillance population included members who served in the Active Component of the U.S. Armed Forces at any time during the surveillance period. Eye injury diagnoses were derived from standardized records of medical encounters that occurred in (a) fixed military and non-military medical treatment facilities (MTF) in the U.S., and (b) overseas and deployed military medical facilities.

**Data Source.** Surveillance data were from the Defense Medical Surveillance System (DMSS),[5] which included medical encounters from the new DOD electronic health record (i.e., Military Health System (MHS) Genesis). The DMSS receives data feeds from the Defense Manpower Data Center (DMDC). All data include military population counts, military occupational specialty (MOS) grouping, and deployment-associated medical encounters that were from the DMDC. Data used for this reporting period was extracted from the DMSS as of 16 June 2021.

**Data Analysis.** The AFHSD provided data analysis for this report. Linear regression analysis was used to assess time trends of overall eye injuries occurring since CY 2008. Two tailed, paired-t tests were used to compare differences in eye injury rates between CY 2020 and CY

2019. Statistical significance was set at P<.05.

**Case definition.** For both annual and quarterly reports, an eye injury was defined as a hospitalization or ambulatory encounter with at least one diagnosis indicative of an eye injury.

The diagnoses for both annual and quarterly eye injury reports use the International Classification of Diseases (ICD)-10 and ICD-9 codes specified in Table 1.[3] The "Corneal Disorders Due to Contact Lens" ICD codes are for quarterly installation level surveillance only. Because of the Lifetime Incidence rule, the ICD-9 codes were to assess historic data to determine if an SM ever had one of the qualifying conditions.

If more than one eye injury diagnosis was reported during a single medical encounter, only the first listed of the diagnoses was included. For individuals with more than one eye injury documented in different clinical settings, hospitalizations in fixed medical facilities were prioritized over deployed-setting medical encounters, which were then prioritized over outpatient encounters in fixed medical facilities.

**Table 1. Eye Injury Categories and ICD Code Description**[a]

| INJURY TYPE | DESCRIPTION | ICD-10 CODE | ICD-9 CODE[a] |
|---|---|---|---|
| **High Risk Blindness** | ocular laceration and rupture with prolapse or loss of intraocular tissue | S05.2 | 871.0 871.1 |
| | ocular laceration without prolapse or loss of intraocular tissue | S05.3 | 871.2 871.3 |
| | penetrating wound with foreign body of eyeball | S05.5 | 871.4 871.5 |
| | penetrating wound without foreign body of eyeball | S05.6 | 871.6 |
| | avulsion of eye | S05.7 | 871.7 |
| | other injuries of eye and orbit. lacks specificity and is not included in the code set | S05.8 | 871.9 |
| **Anterior Segment** | hyphema | H21.0 | 364.41 366.21 |
| | iridodialysis | H21.53 | 366.22 |
| | unspecified traumatic cataract | H26.10 | 364.76 |
| | localized traumatic opacities | H26.11 | |
| | total traumatic cataract | H26.13 | |
| **Burns** | burn of eyelid and periocular area | T26.0 | 940.0 940.1 |
| | burn of cornea and conjunctival sac | T26.1 | 940.2 |
| | burn with resulting rupture and destruction of eyeball | T26.2 | 940.3 |
| | burns of other specified parts of eye and adnexa | T26.3 | 940.4 940.5 |
| | burn of eye and adnexa, part unspecified | T26.4 | 940.9 |
| | corrosion of eyelid and periocular area | T26.5 | 941.02 941.12 |
| | corrosion of cornea and conjunctival sac | T26.6 | 941.22 |
| | corrosion with resulting rupture and destruction of eyeball | T26.7 | 941.32 941.42 |
| | corrosion of other specified parts of eye and adnexa | T26.8 | 941.52 |
| | corrosion of eye and adnexa, part unspecified | T26.9 | |
| **Contusion** | contusion of eyelid and periocular area | S00.1 | 921.0 921.1 |
| | contusion of eyeball and orbital tissues | S05.1 | 921.2 |
| | unspecified injury of eye and orbit ( lacks specificity and is not included in the code set ) | S05.9 | 921.3 921.9 |

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| INJURY TYPE | DESCRIPTION | ICD-10 CODE | ICD-9 CODE[a] |
|---|---|---|---|
| **Lid/Adnexa** | unspecified open wound of eyelid and periocular area | S01.10 | 870.0 870.1 870.2 870.8 870.9 |
| | laceration without foreign body of eyelid and periocular area | S01.11 | |
| | laceration with foreign body of eyelid and periocular area | S01.12 | |
| | puncture wound without foreign body of eyelid and periocular area | S01.13 | |
| | puncture wound with foreign body of eyelid and periocular area | S01.14 | |
| | open bite of eyelid and periocular area | S01.15 | |
| **Optic/Cranial Nerve** | injury of optic nerve | S04.01A | 950.0 950.1 950.9 951.0 951.1 951.3 |
| | injury of oculomotor nerve | S04.1 | |
| | injury of trochlear nerve | S04.2 | |
| | injury of abducent nerve | S04.4 | |
| **Orbit** | fracture of orbital floor | S02.3 | 802.6 802.7 802.8 870.3 870.4 376.32 |
| | unspecified fracture of facial bones | S02.92 | |
| | penetrating wound of orbit with or without foreign body | S05.4 | |
| | hemorrhage of orbit | H05.23 | |
| **Posterior Segment** | unspecified choroidal hemorrhage | H31.30 | 362.81 361.0 361.00 361.01 361.02 361.03 361.04 361.05 361.06 361.07 363.61 363.63 379.23 360.00 360.01 |
| | expulsive choroidal hemorrhage | H31.31 | |
| | choroidal rupture | H31.32 | |
| | retinal detachments and breaks | H33.0 | |
| | retinal detachment with retinal break | H33.00 | |
| | retinal detachment with single break | H33.01 | |
| | retinal detachment with multiple breaks | H33.02 | |
| | retinal detachment with giant retinal tear | H33.03 | |
| | retinal detachment with retinal dialysis | H33.04 | |
| | total retinal detachment | H33.05 | |
| | other retinal detachments | H33.8 | |
| | retinal hemorrhage | H35.6 | |
| | vitreous hemorrhage | H43.1 | |
| | unspecified purulent enophthalmitis | H44.00 | |
| **Superficial** | other and unspecified superficial injuries of eyelid and periocular area | S00.2 | 918.0 918.1 918.2 918.9 930.0 930.1 930.2 930.8 930.9 |
| | unspecified superficial injuries of eyelid and periocular area | S00.20 | |
| | abrasion of eyelid and periocular area | S00.21 | |
| | blister | S00.22 | |
| | superficial foreign body of eyelid and periocular area | S00.25 | |
| | insect bite | S00.26 | |
| | other superficial bite of eyelid and periocular area | S00.27 | |
| | injury of conjunctiva and corneal abrasion without foreign body | S05.0 | |
| | foreign body on external eye | T15 | |
| | foreign body in cornea | T15.0 | |

| INJURY TYPE | DESCRIPTION | ICD-10 CODE | ICD-9 CODE[a] |
|---|---|---|---|
| | foreign body in conjunctival sac | T15.1 | |
| | foreign body in other and multiple parts of external eye | T15.8 | |
| | foreign body on external eye, unspecified eye, initial encounter | T15.9 | |
| Corneal Disorders due to Contact Lens[b] | corneal edema secondary to contact lens | H18.21 | None |
| | corneal disorder due to contact lens | H18.82 | |
| | corneal disorder due to contact lens, unspecified eye | H18.829 | |

Notes:

[a] The AFHSD case definition[6] was updated in January 2016 and is currently used in the annual report and quarterly eye injury reports. Though a broader list of ICD-10 codes was identified by the taxonomy of injuries developed by the APHC,[7,8] because of the Lifetime Incidence rule (for which the ICD-9 codes were necessary to assess historic data), both the ICD-9 and ICD-10 codes identified by the AFHSD are currently used for specific eye-injury surveillance analyses.

[b] The "Corneal Disorders Due to Contact Lens" ICD codes are used only for quarterly eye injury surveillance and are not included in the annual report.

**Incidence Rules**:
For AD SMs who met the case definition above, the following rules would apply:

- 60-day incidence rule. For "superficial" or "Contact Lens" eye injuries, an individual may be considered an incident case only once every 60 days.
- Lifetime rule. For non-superficial eye injuries, an individual may be considered an incident case only once per lifetime. It applies to eye injury categories: Contusion, Orbit, Lid/adnexa, Posterior Segment, High Risk of Blindness, Burns, Anterior Segment, and Optic/cranial Nerve injuries.
- Incidence date. The date of the first hospitalization or outpatient medical encounter that includes a defining diagnosis of eye injury. If more than one ocular injury diagnosis is reported during a single hospitalization or outpatient encounter, only the first listed of the diagnoses is included.

Rates of eye injuries in fixed medical facilities were calculated as incident medical encounters per 100,000 person-years in the Active Component of the U.S. Armed Forces. Rates of injuries diagnosed in deployed settings were not calculated due to lack of reliable person-time estimates for denominators.

Causes of injury were assessed using external cause of injury codes (ICD-9/10-CM "E codes") for eye injuries treated in ambulatory settings and standardization agreement (STANAG) (NATO STANAG No. 2050) codes for hospitalized eye injuries.

Causes of eye injury included:

(1) Guns and explosives;
(2) Sports;
(3) Machinery and tools;
(4) Land transport;
(5) Other transport;
(6) Slips, trips and falls;

(7) Fighting, assault and horseplay; and
(8) Other and unknown causes.

Enlisted occupational groups based on the U.S. MOS codes included:

(1) Infantry, Guncrew, Seamen;
(2) Electronic Equipment Repair;
(3) Communications & Intelligence;
(4) Healthcare;
(5) Technical & Other Professional;
(6) Functional Support & Admin;
(7) Electrical/Mechanical Repair;
(8) Craftwork & Construction;
(9) Service, Transport & Supply; and
(10) Students, Trainees & Unknown Enlisted.

Officer occupational groups included:

(1) General/Flag Officers & Executives;
(2) Tactical Operations Officers;
(3) Intelligence Officers;
(4) Engineering & Maintenance Officers;
(5) Healthcare Officers;
(6) Scientists & Professional Officers;
(7) Administrative Officers;
(8) Supply & Logistics Officers; and
(9) Students, Trainees & Unknown Officers.


## RESULTS

The CY 2020 eye injury rates by injury category, causes of injury, and occupational groups as well as percentage of deployment-associated eye injuries were summarized for (1) the DOD in Figures 1-5, (2) the Air Force in Figures 6-10, (3) the Army in Figures 11-15, (4) the Navy in Figures 16-20, and (5) the Marine Corps in Figures 21-25.

### Department of Defense

As the primary medical diagnosis, eye injuries accounted for 6,761 MTF ambulatory encounters and 416 deployment-associated healthcare encounters in the Active Component of the U.S. Armed Forces in CY 2020. As all medical diagnoses (i.e., primary, secondary, tertiary, and more diagnoses), eye injuries accounted for 7,569 MTF ambulatory medical encounters and 430 deployment-associated healthcare encounters. There were 28 hospitalizations that eye injury was the primary diagnosis (n=1) or all medical diagnoses (n=27).
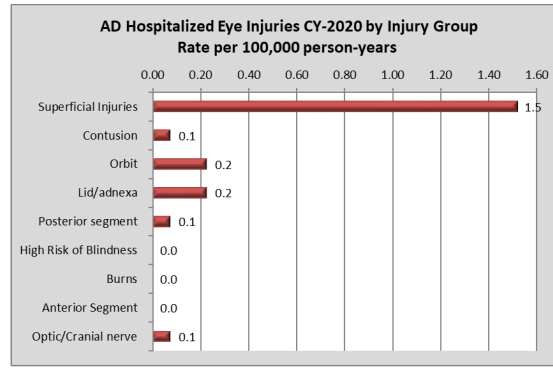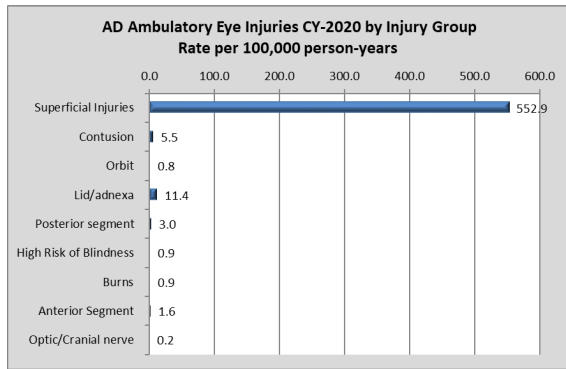
**AD Ambulatory Eye Injuries CY-2020 by Injury Group**
Rate per 100,000 person-years

| Injury Group | Rate |
| --- | --- |
| Superficial Injuries | 552.9 |
| Contusion | 5.5 |
| Orbit | 0.8 |
| Lid/adnexa | 11.4 |
| Posterior segment | 3.0 |
| High Risk of Blindness | 0.9 |
| Burns | 0.9 |
| Anterior Segment | 1.6 |
| Optic/Cranial nerve | 0.2 |

**AD Hospitalized Eye Injuries CY-2020 by Injury Group**
Rate per 100,000 person-years

| Injury Group | Rate |
| --- | --- |
| Superficial Injuries | 1.5 |
| Contusion | 0.1 |
| Orbit | 0.2 |
| Lid/adnexa | 0.2 |
| Posterior segment | 0.1 |
| High Risk of Blindness | 0.0 |
| Burns | 0.0 |
| Anterior Segment | 0.0 |
| Optic/Cranial nerve | 0.1 |

**Figure 1. Eye Injury Rates by Injury Category, U.S. DOD AD SMs, CY 2020**

*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *"Superficial injuries" had the highest incidence rate.*
- *The "Lid/adnexa" (i.e., open wound of ocular adnexa) and "Contusion" (i.e., bruise or "black eye") incidence rates were relatively higher than that of the remaining injury categories.*
- *Incidence rate of severe injury, such as the "High Risk of Blindness," "Burns," or "Optic/Cranial Nerve" was low.*

**AD Ambulatory Eye Injuries CY-2020 by Injury Cause**
Rate per 100,000 person-years

| Injury Cause | Rate |
| --- | --- |
| Guns and explosives | 0.1 |
| Sports | 0.3 |
| Machinery and tools | 0.2 |
| Land transport | 0.4 |
| Other transport | 0.1 |
| Slips, trips and falls | 1.4 |
| Fighting, assault and horseplay | 1.2 |
| Other and unknown causes | 573.6 |

**AD Hospitalized Eye Injuries CY-2020 by Injury Cause**
Rate per 100,000 person-years

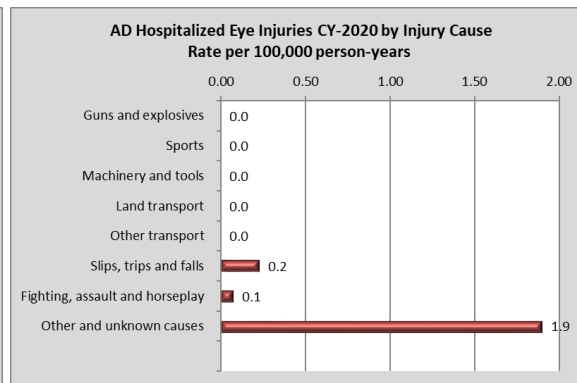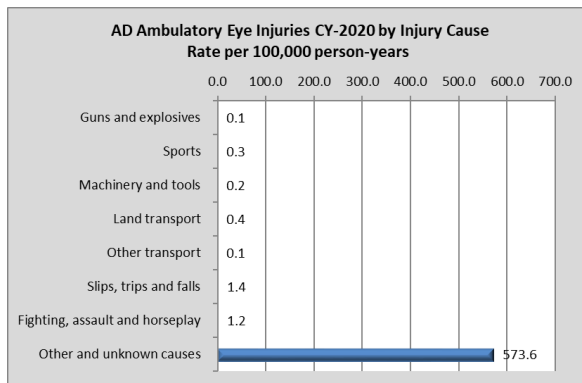| Injury Cause | Rate |
| --- | --- |
| Guns and explosives | 0.0 |
| Sports | 0.0 |
| Machinery and tools | 0.0 |
| Land transport | 0.0 |
| Other transport | 0.0 |
| Slips, trips and falls | 0.2 |
| Fighting, assault and horseplay | 0.1 |
| Other and unknown causes | 1.9 |

**Figure 2. Eye Injury Rates by Injury Causes, U.S. AD SMs, CY 2020**

*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *Most causes of eye injury (99.4%) were not recorded in the medical encounter.*
- *Among those that were documented in the medical records, "Slips, Trips and Falls" and "Fighting, Assault and Horseplay" categories were the common causes of eye injury.*
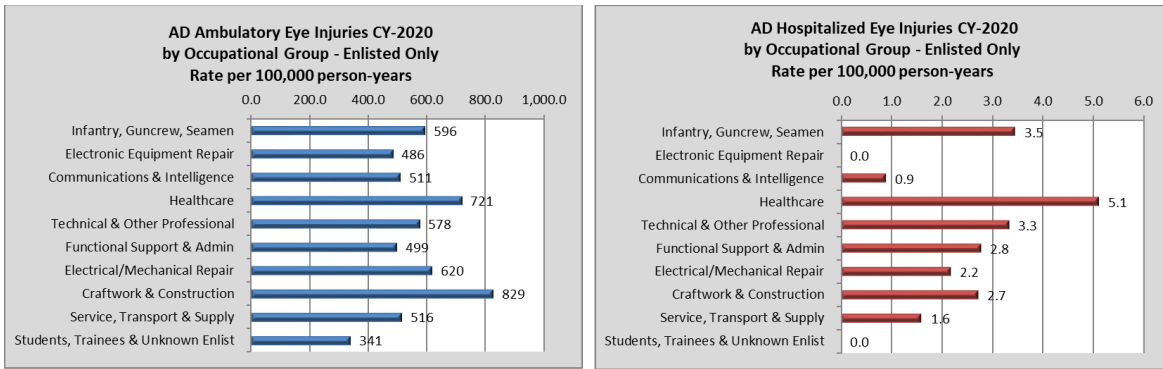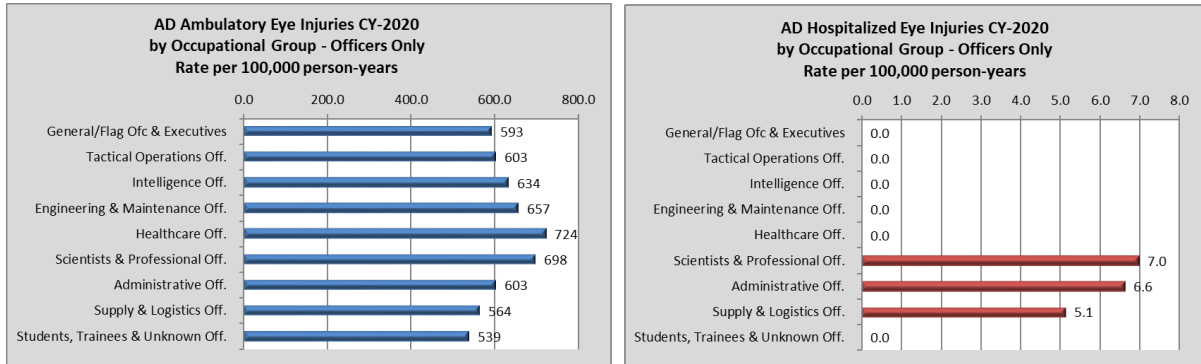
**AD Ambulatory Eye Injuries CY-2020**
**by Occupational Group - Enlisted Only**
**Rate per 100,000 person-years**

| Occupational Group | Rate |
|---|---|
| Infantry, Guncrew, Seamen | 596 |
| Electronic Equipment Repair | 486 |
| Communications & Intelligence | 511 |
| Healthcare | 721 |
| Technical & Other Professional | 578 |
| Functional Support & Admin | 499 |
| Electrical/Mechanical Repair | 620 |
| Craftwork & Construction | 829 |
| Service, Transport & Supply | 516 |
| Students, Trainees & Unknown Enlist | 341 |

**AD Hospitalized Eye Injuries CY-2020**
**by Occupational Group - Enlisted Only**
**Rate per 100,000 person-years**

| Occupational Group | Rate |
|---|---|
| Infantry, Guncrew, Seamen | 3.5 |
| Electronic Equipment Repair | 0.0 |
| Communications & Intelligence | 0.9 |
| Healthcare | 5.1 |
| Technical & Other Professional | 3.3 |
| Functional Support & Admin | 2.8 |
| Electrical/Mechanical Repair | 2.2 |
| Craftwork & Construction | 2.7 |
| Service, Transport & Supply | 1.6 |
| Students, Trainees & Unknown Enlist | 0.0 |

**Figure 3. Eye Injury Rates by Enlisted Occupational Groups, U.S. DOD AD SMs, CY 2020**
*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *The "Craftwork & Construction," followed by the "Healthcare" and "Electrical Mechanical Repair" enlisted occupational groups had the highest rate of eye injury.*
- *The "Students, Trainees & Unknown Enlisted" group had the lowest eye injury rate.*

**AD Ambulatory Eye Injuries CY-2020**
**by Occupational Group - Officers Only**
**Rate per 100,000 person-years**

| Occupational Group | Rate |
|---|---|
| General/Flag Ofc & Executives | 593 |
| Tactical Operations Off. | 603 |
| Intelligence Off. | 634 |
| Engineering & Maintenance Off. | 657 |
| Healthcare Off. | 724 |
| Scientists & Professional Off. | 698 |
| Administrative Off. | 603 |
| Supply & Logistics Off. | 564 |
| Students, Trainees & Unknown Off. | 539 |

**AD Hospitalized Eye Injuries CY-2020**
**by Occupational Group - Officers Only**
**Rate per 100,000 person-years**

| Occupational Group | Rate |
|---|---|
| General/Flag Ofc & Executives | 0.0 |
| Tactical Operations Off. | 0.0 |
| Intelligence Off. | 0.0 |
| Engineering & Maintenance Off. | 0.0 |
| Healthcare Off. | 0.0 |
| Scientists & Professional Off. | 7.0 |
| Administrative Off. | 6.6 |
| Supply & Logistics Off. | 5.1 |
| Students, Trainees & Unknown Off. | 0.0 |

**Figure 4. Eye Injury Rates by Officer Occupational Groups, U.S. AD SMs, CY 2020**
*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *Among the nine military officer occupational groups, the "Healthcare," "Scientists & Professional," and "Engineering & Maintenance" officers had higher rates of eye injury.*
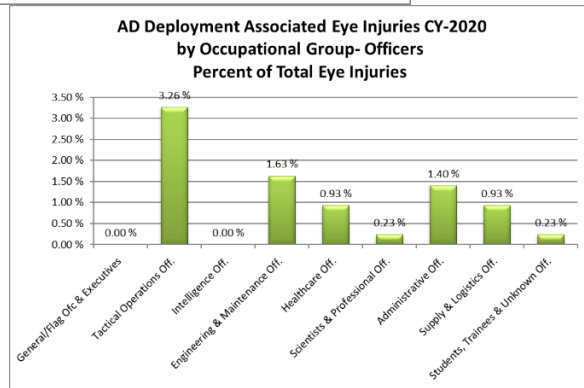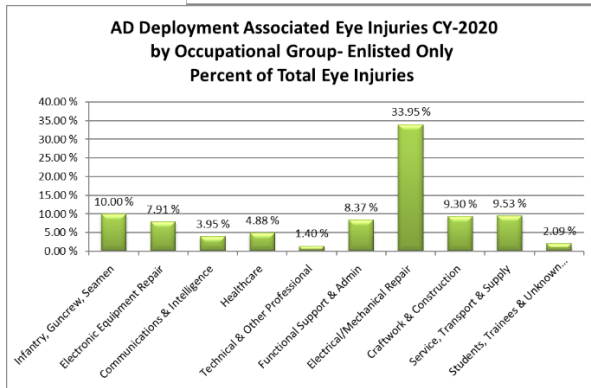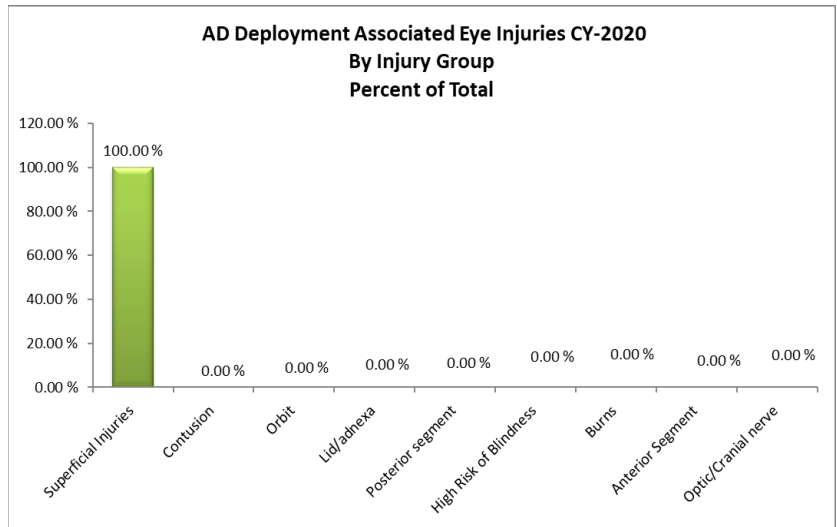- *The "Students, Trainees & Unknown Officer" group had the lowest eye injury rate.*

**Figure 5. Percentage of Deployment-associated Eye Injuries by Injury Category (top) and by Occupational Group of the Enlisted (left) and Officer (right) Personnel, U.S. DOD AD SMs, CY 2020**

- *Deployment-associated eye injuries were all "Superficial Injuries."*
- *Eye injuries occurred the most often among enlisted personnel of the "Electrical/Mechanical Repair" (33.95%), "Infantry, Guncrew, Seamen" (10.00%), and "Service, Transport & Supply" (9.53%) occupational groups.*
- *The "Tactical Operation" officers had the most deployment-associated eye injuries (3.26%) among the officer occupational groups.*

## U.S. Air Force

As the primary medical diagnosis, eye injuries accounted for 1,665 MTF ambulatory encounters and 122 deployment-associated healthcare encounters in the Active Component of the U.S. Air Force in CY 2020. As all medical diagnoses (i.e., primary, secondary, tertiary, and more diagnoses), eye injuries accounted for 1,864 MTF ambulatory medical encounters and 126 deployment-associated healthcare encounters. There were five hospitalizations that eye injury was the primary diagnosis (n=0) or all medical diagnoses (n=5) in the Active Component of the U.S. Air Force in 2020.
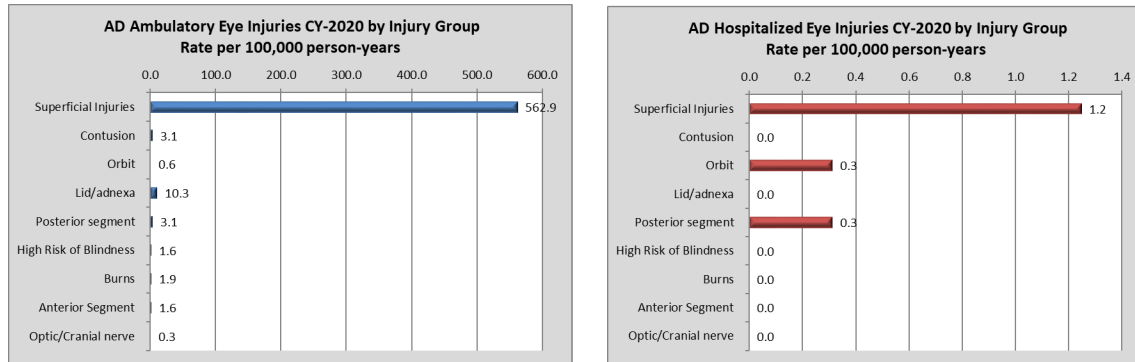


**Figure 6. Eye Injury Rates by Injury Category, U.S. Air Force AD SMs, CY 2020**
*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *"Superficial injuries" had the highest incidence rate.*
- *The "Lid/adnexa" (i.e., open wound of ocular adnexa) and "Contusion" (i.e., bruise or "black eye") incidence rates were relatively higher than that of the remaining injury categories.*
- *Incidence rate of severe injury, such as the "High Risk of Blindness," "Burns," or "Optic/Cranial Nerve" was low.*
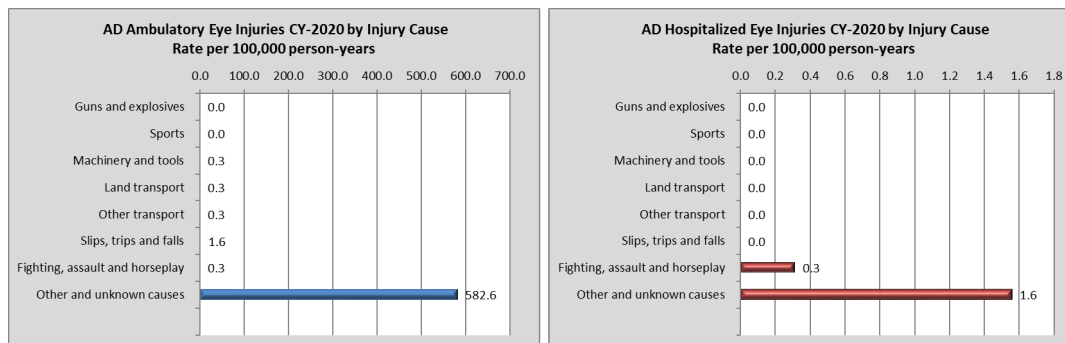


**Figure 7. Eye Injury Rates by Injury Causes, U.S. Air Force AD SMs, CY 2020**
*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *Most causes of eye injury (99.5%) were not recorded in the medical encounter.*
- *Among those that were documented in the medical records, "Slips, Trips and Falls" and "Fighting, Assault and Horseplay" categories were the common causes of eye injury.*

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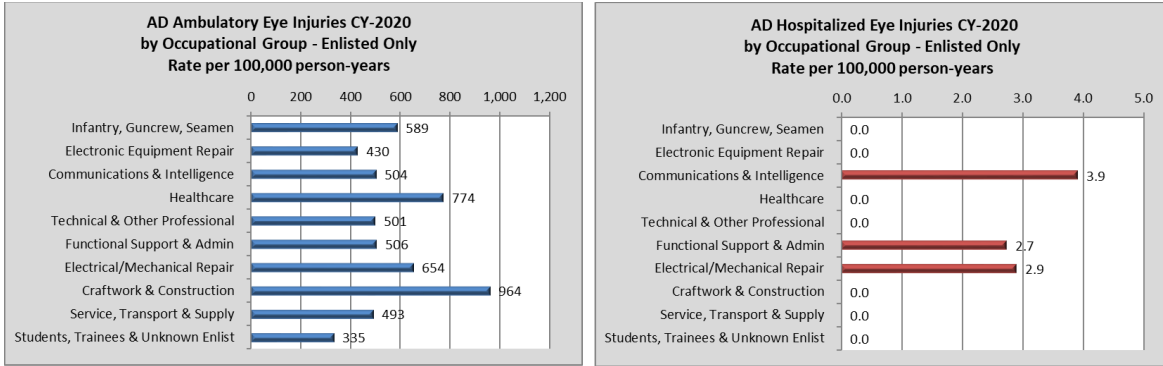
**Figure 8. Eye Injury Rates by Enlisted Occupational Groups, U.S. Air Force AD SMs, CY 2020**

*Medical treatment facility ambulatory visits (left) and hospitalization (right):*

- *The "Craftwork & Construction" group had the highest rate of eye injury, followed by the "Healthcare" and "Electrical/Mechanical Repair" occupational groups.*
- *The "Students, Trainees & Unknown Enlisted" personnel had the lowest eye injury rate.*
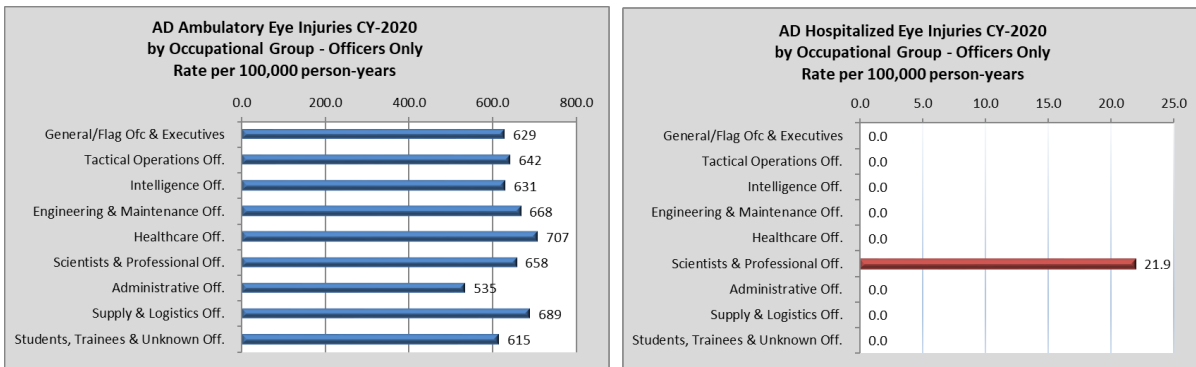


**Figure 9. Eye Injury Rates by Officer Occupational Groups, U.S. Air Force AD SMs, CY 2020**

*Medical treatment facility ambulatory visits (left) and hospitalization (right):*

- *Among the nine U.S. Air Force officer occupational groups, the "Healthcare," "Supply & Logistics," and "Engineering & Maintenance" officers had higher rates of eye injury, while the "Administrative" officers had the lowest rate.*
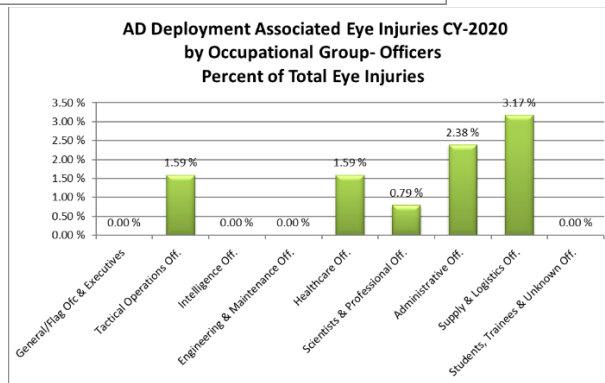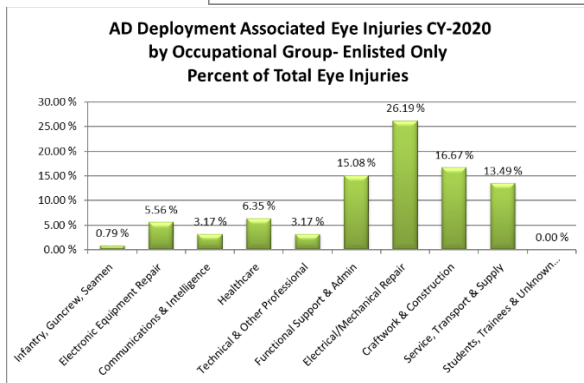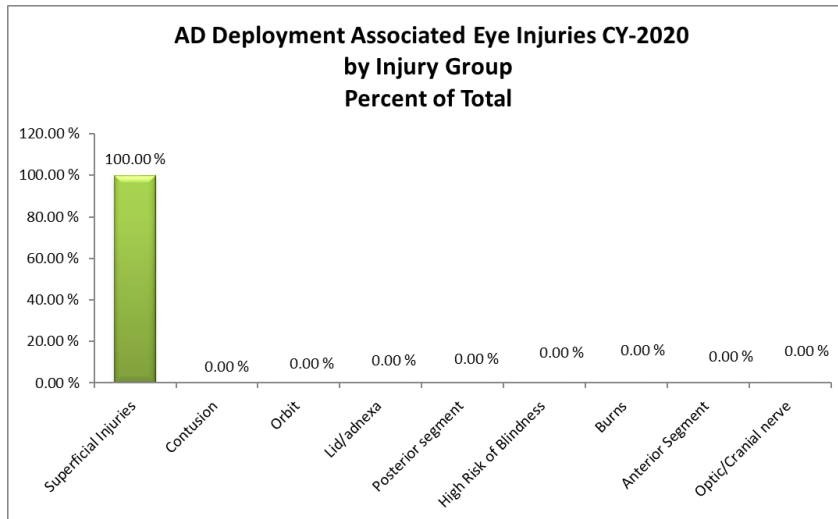
**Figure 10. Percentage of Deployment-associated Eye Injuries by Injury Category (top) and by Occupational Group of the Enlisted (left) and Officer (right) Personnel, U.S. Air Force AD SMs, CY 2020**

- *Deployment-associated eye injuries were all "Superficial Injuries."*
- *Eye injuries occurred the most often among enlisted personnel of the "Electrical/Mechanical Repair" (26%), "Craftwork & Construction" (17%), and "Functional Support & Administration" (15%) occupational groups.*
- *The "Supply & Logistics" officers had the most deployment-associated eye injuries (3.2%) among the officer occupational groups.*

## U.S. Army

As the primary medical diagnosis, eye injuries accounted for 2,705 MTF ambulatory encounters and 93 deployment-associated healthcare encounters in the Active Component of the U.S. Army in CY 2020. As all medical diagnoses (i.e., primary, secondary, tertiary, and more diagnoses), eye injuries accounted for 3,016 MTF ambulatory medical encounters and 97 deployment-associated healthcare encounters. There were 11 hospitalizations that eye injury was the primary diagnosis (n=0) or all medical diagnoses (n=11) in the Active Component of the U.S. Army in 2020.
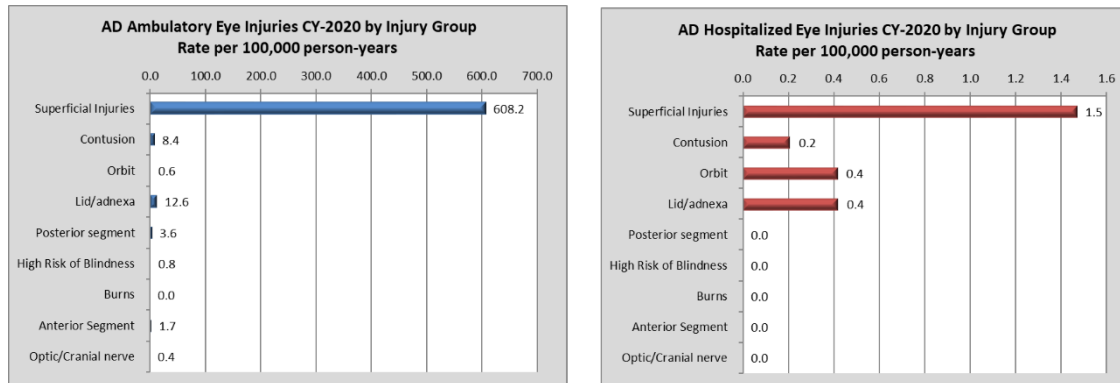


**Figure 11. Eye Injury Rates by Injury Category, U.S. Army AD SMs, CY 2020**
*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *"Superficial injuries" had the highest incidence rate.*
- *The "Lid/adnexa" (i.e., open wound of ocular adnexa) and "Contusion" (i.e., bruise or "black eye") incidence rates were relatively higher than that of the remaining injury categories.*
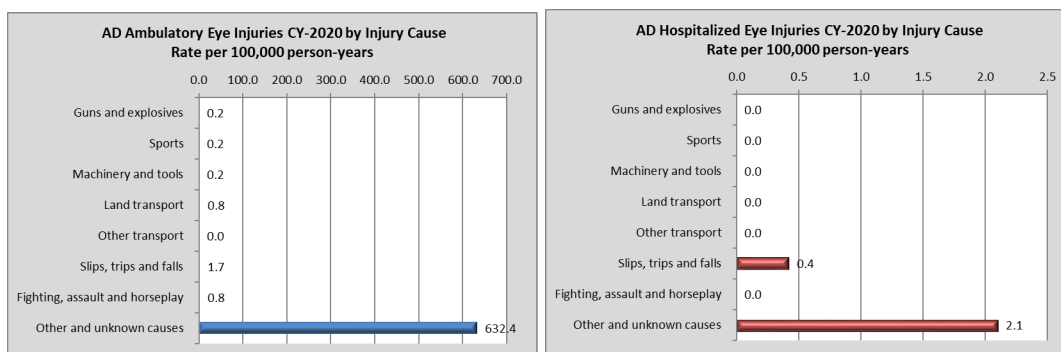- *Incidence rate of severe injury, such as the "High Risk of Blindness," "Burns," or "Optic/Cranial Nerve" was low.*



**Figure 12. Eye Injury Rates by Injury Causes, U.S. Army AD SMs, CY 2020**
*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *Most causes of eye injury (99.4%) were not recorded in the medical encounter.*
- *Among those that were documented in the medical records, "Slips, Trips and Falls," "land transport," and "Fighting, Assault and Horseplay" categories were the common causes of eye injury.*
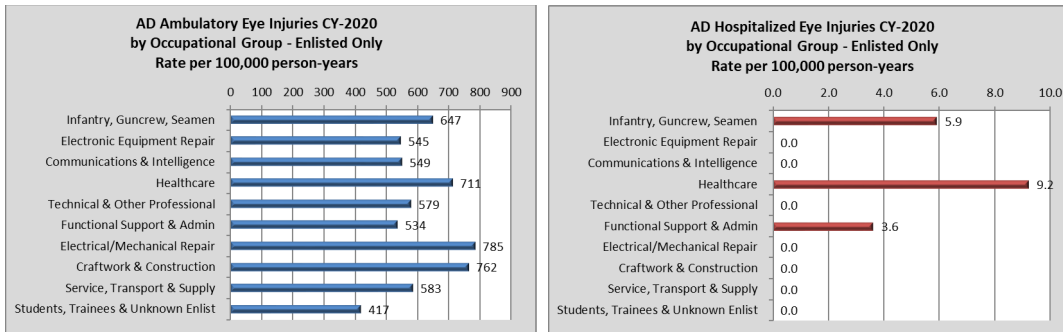
**Figure 13. Eye Injury Rates by Enlisted Occupational Groups, U.S. Army AD SMs, CY 2020**

*Medical treatment facility ambulatory visits (left) and hospitalization (right):*

- *The "Electrical/Mechanical Repair" group had the highest rate of eye injury, followed by the "Craftwork & Construction," "Healthcare," and "Infantry, Guncrew, Seamen" occupational groups.*
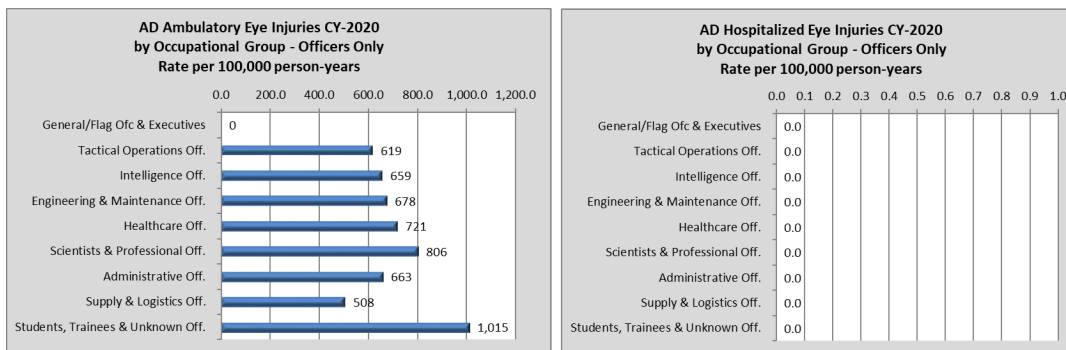- *The "Students, Trainees & Unknown Enlist" personnel had the lowest eye injury rate.*



**Figure 14. Eye Injury Rates by Officer Occupational Groups, U.S. Army AD SMs, CY 2020**

*Medical treatment facility ambulatory visits (left) and hospitalization (right):*

- *Among the nine U.S. Army officer occupational groups, "Students, Trainees & Unknown Officer" group had the highest eye injury rate, followed by the "Scientists & Professional," "Healthcare," and "Engineering & Maintenance" officers.*
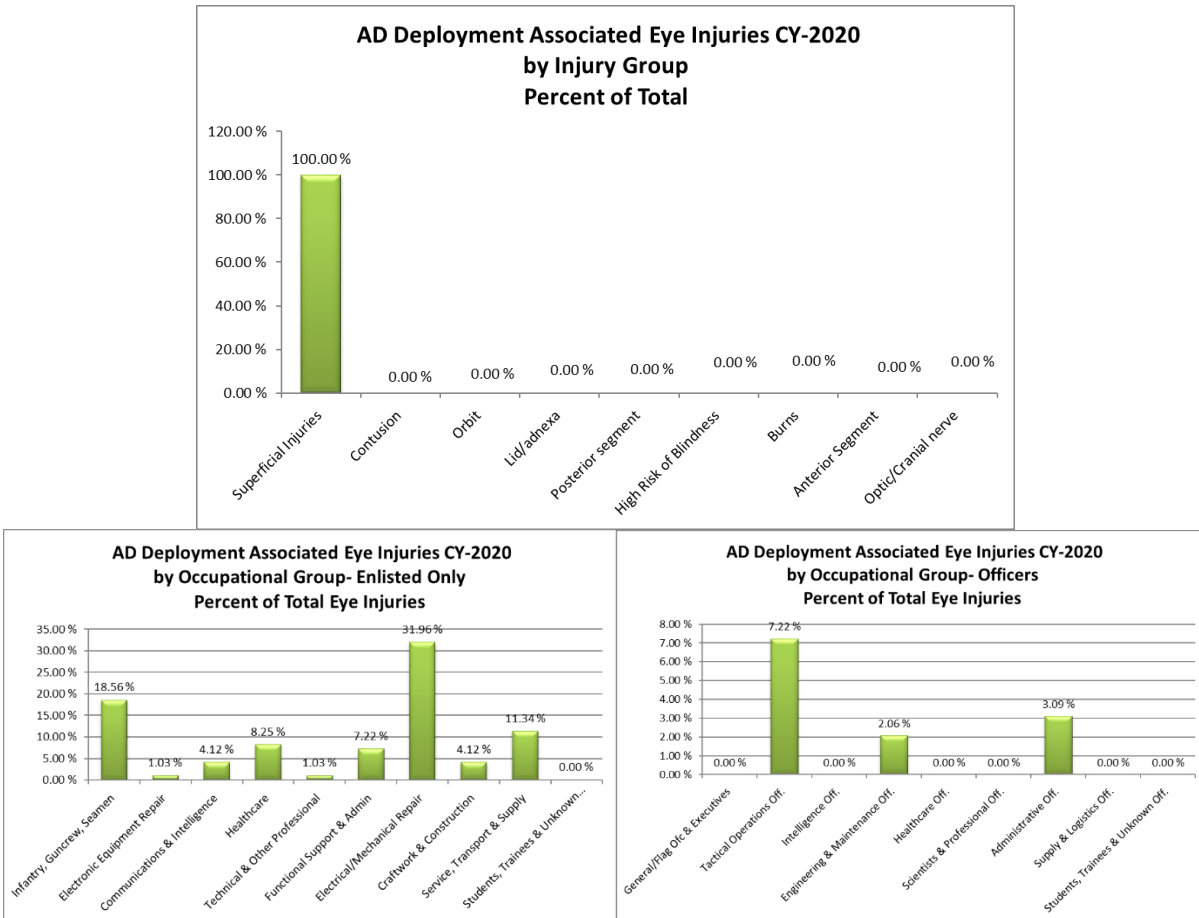
14

**Figure 15. Percentage of Deployment-associated Eye Injuries by Injury Category (top) and by Occupational Group of the Enlisted (left) and Officer (right) Personnel, U.S. Army AD SMs, CY 2020**

- *Deployment-associated eye injuries were all "Superficial Injuries."*
- *Eye injuries occurred the most often among enlisted personnel of the "Electrical/Mechanical Repair" (31.96%), "Infantry, Guncrew, Seamen" (18.56%), and "Service, Transport & Supply" (11.34%) occupational groups.*
- *The "Tactical Operation" officers had the most deployment-associated eye injuries (7.22%) among the officer occupational groups.*

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**U.S. Navy**

As the primary medical diagnosis, eye injuries accounted for 1,475 MTF ambulatory encounters and 195 deployment-associated healthcare encounters in AD Navy SMs in CY 2020. As all medical diagnoses (i.e., primary, secondary, tertiary, and more diagnoses), eye injuries accounted for 1,649 MTF ambulatory medical encounters and 201 deployment-associated healthcare encounters. There were five hospitalizations that eye injury was the primary diagnosis (n=0) or all medical diagnoses (n=5) of U.S. Navy AD SMs in 2020.
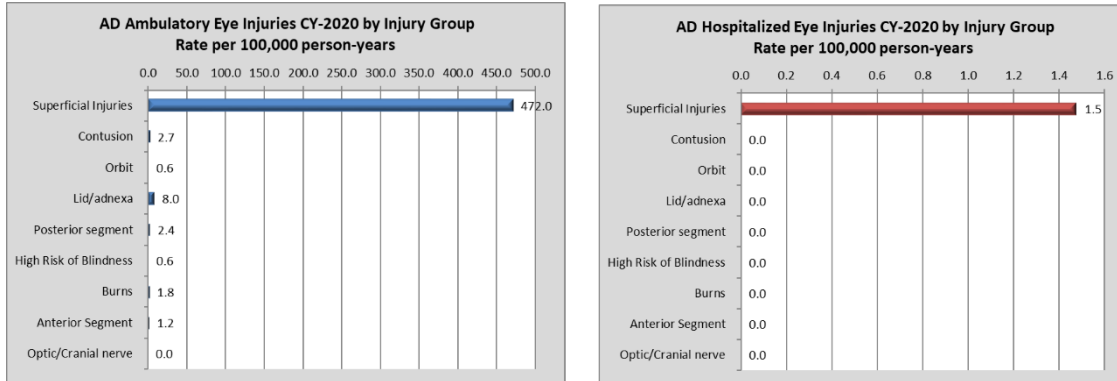


**Figure 16. Eye Injury Rates by Injury Category, U.S. Navy AD SMs, CY 2020**
*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *"Superficial injuries" had the highest incidence rate.*
- *The "Lid/adnexa" (i.e., open wound of ocular adnexa) and "Contusion" (i.e., bruise or "black eye") incidence rates were relatively higher than that of the remaining injury categories.*
- *Incidence rate of severe injury, such as the "High Risk of Blindness," "Burns," or "Optic/Cranial Nerve" was low.*
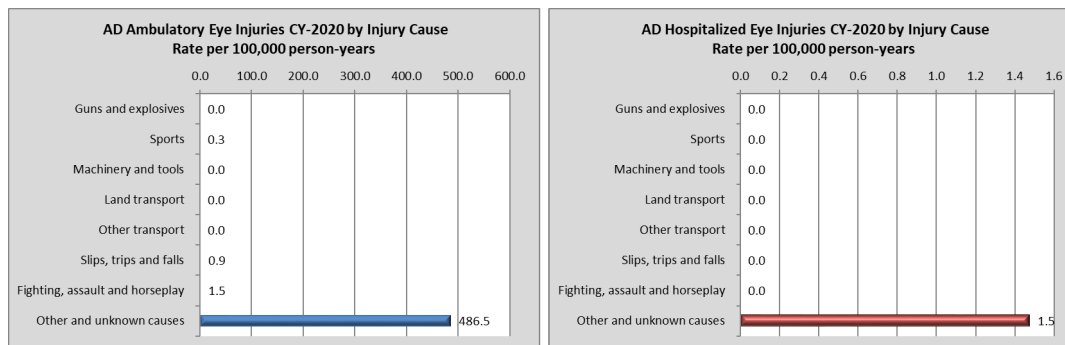


**Figure 17. Eye Injury Rates by Injury Causes, U.S. Navy AD SMs, CY 2020**
*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *Most causes of eye injury (99.5%) were not recorded in the medical encounter.*
- *Among those that were documented in the medical records, "Fighting, Assault and Horseplay," "Slips, Trips and Falls," and "Sports" categories were the common causes of eye injury.*
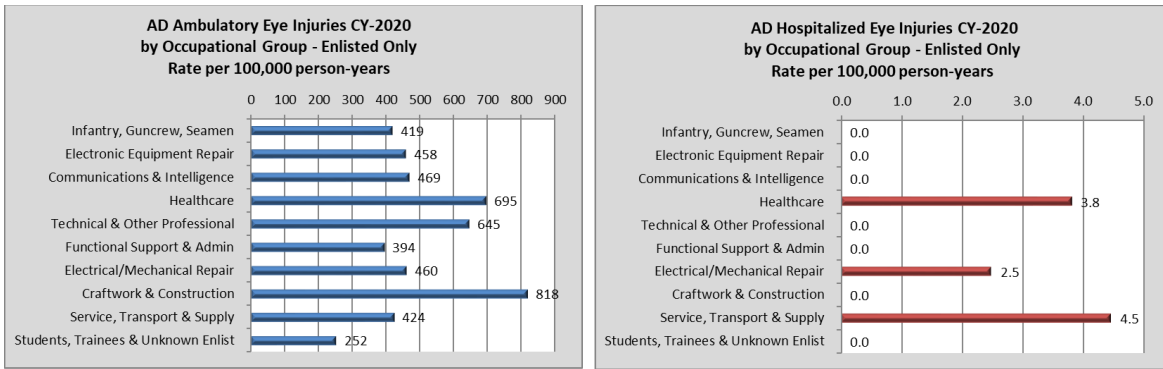
**Figure 18. Eye Injury Rates by Enlisted Occupational Groups, U.S. Navy AD SMs, CY 2020**
*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *The "Craftwork & Construction," followed by the "Healthcare" and "Technical & other Professional" occupational groups had the highest rate of eye injury.*
- *The "Students, Trainees & Unknown Enlist" personnel had the lowest eye injury rate.*



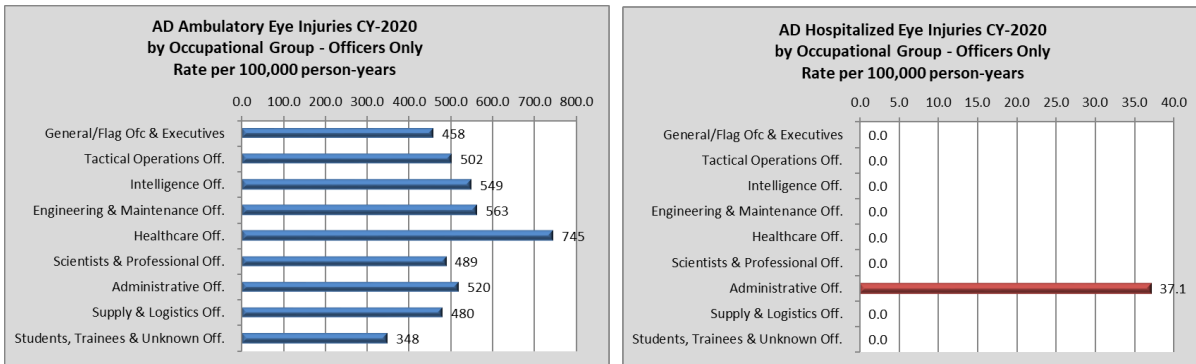**Figure 19. Eye Injury Rates by Officer Occupational Groups, U.S. Navy AD SMs, CY 2020**
*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *Among the nine U.S. Navy officer occupational groups, the "Healthcare" had the highest eye injury rate, followed by the "Engineering & Maintenance" and "Intelligence" groups.*
- *The "Students, Trainees & Unknown Officer" group had the lowest eye injury rate.*
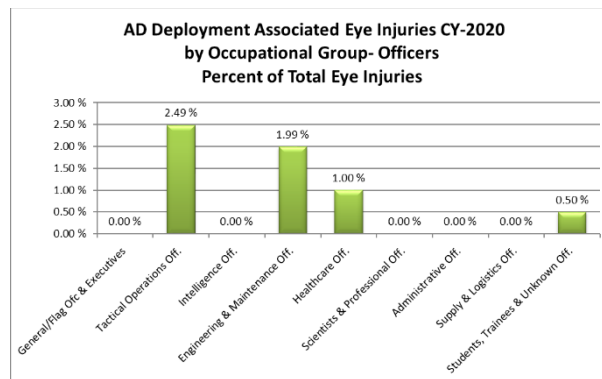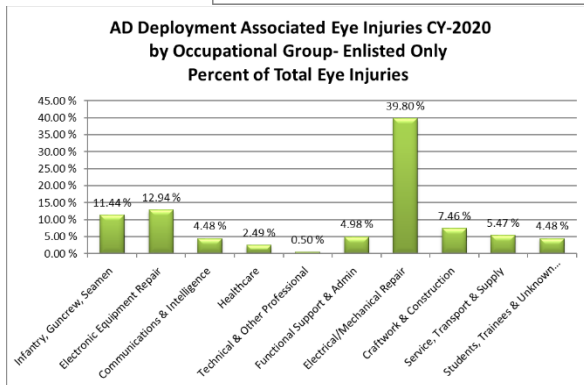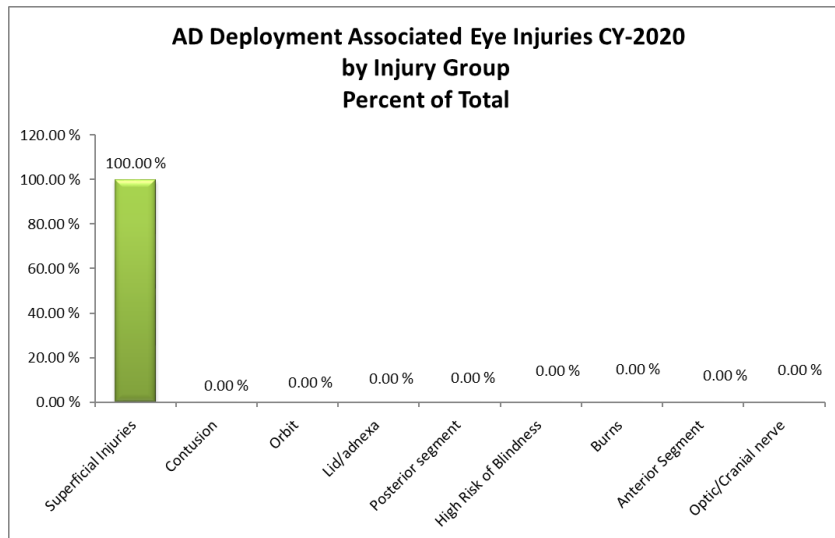
**Figure 20. Percentage of Deployment-associated Eye Injuries by Injury Category (top) and by Occupational Group of the Enlisted (left) and Officer (right) Personnel, U.S. Navy AD SMs, CY 2020**

- *Deployment-associated eye injuries were all "Superficial Injuries" in the Active Component of the U.S. Navy in CY 2020.*
- *Eye injuries occurred the most often among enlisted personnel of the "Electrical/Mechanical Repair" (39.80%), "Electronic Equipment Repair" (12.94%), and "Infantry, Guncrew, Seamen" (11.44%) occupational groups.*
- *The "Tactical Operation" officers had the most deployment-associated eye injuries (2.49%) among the officer occupational groups.*

## U.S. Marine Corps

As the primary medical diagnosis, eye injuries accounted for 916 MTF ambulatory encounters and 6 deployment-associated healthcare encounters in AD SMs of the U.S. Marine Corps in CY 2020. As all medical diagnoses (i.e., primary, secondary, tertiary, and more diagnoses), eye injuries accounted for 1,040 MTF ambulatory medical encounters and 6 deployment-associated healthcare encounters. There were seven hospitalizations that eye injury was the primary diagnosis (n=1) or all medical diagnoses (n=6) in the Active Component of the U.S. Marine Corps in 2020.
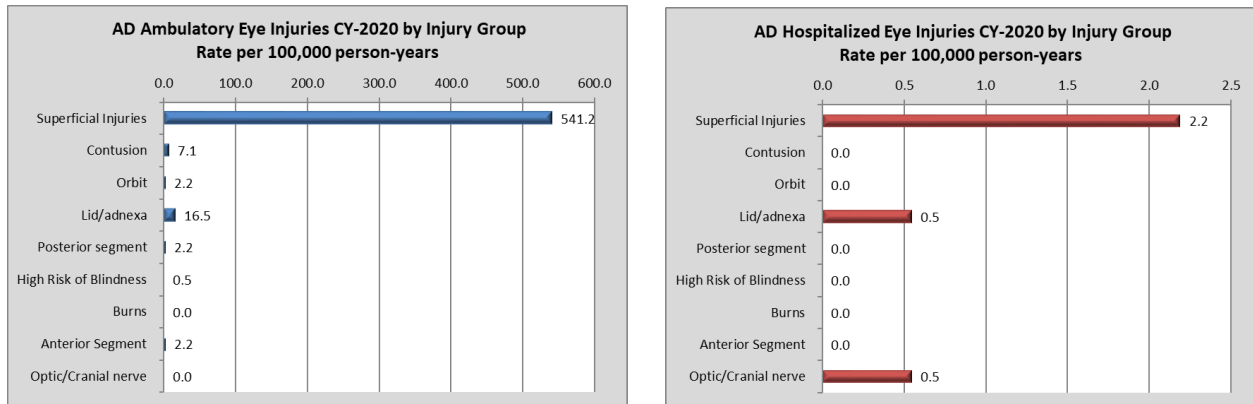


**Figure 21. Eye Injury Rates by Injury Category, U.S. Marine Corps AD SMs, CY 2020**
*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *"Superficial injuries" had the highest incidence.*
- *The "Lid/adnexa" (i.e., open wound of ocular adnexa) and "Contusion" (i.e., bruise or "black eye") incidence rates were relatively higher than that of the remaining injury categories.*
- *Incidence rate of severe injury, such as the "High Risk of Blindness," "Burns," or "Optic/Cranial Nerve" was low.*
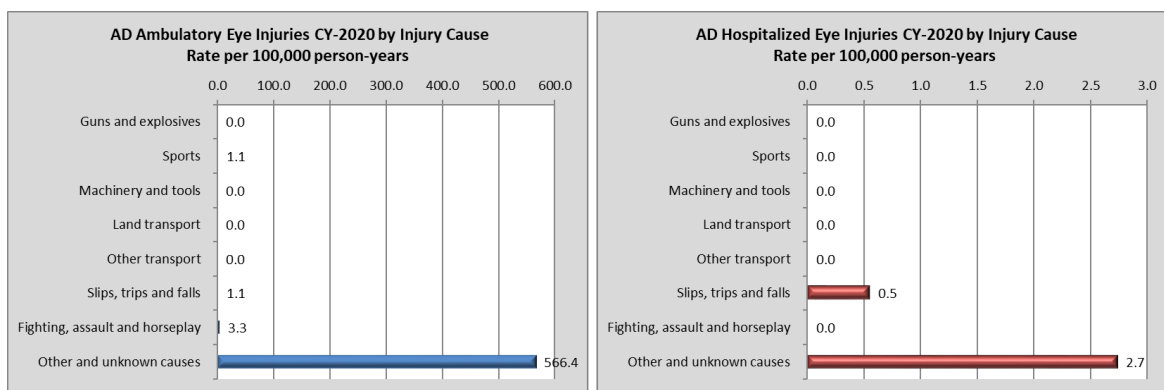


**Figure 22. Eye Injury Rates by Injury Causes, U.S. Marine Corps AD SMs, CY 2020**
*Medical treatment facility ambulatory visits (left) and hospitalization (right):*
- *Most causes of eye injury (99.0%) were not recorded in the medical encounter.*
- *Among those that were documented in the medical records, "Fighting, Assault and Horseplay," "Slips, Trips and Falls," and "Sport" categories were the common causes of eye injuries.*

**AD Ambulatory Eye Injuries CY-2020
by Occupational Group - Enlisted Only
Rate per 100,000 person-years**

| Occupational Group | Rate |
|---|---|
| Infantry, Guncrew, Seamen | 589 |
| Electronic Equipment Repair | 626 |
| Communications & Intelligence | 461 |
| Healthcare | 0 |
| Technical & Other Professional | 683 |
| Functional Support & Admin | 517 |
| Electrical/Mechanical Repair | 689 |
| Craftwork & Construction | 691 |
| Service, Transport & Supply | 508 |
| Students, Trainees & Unknown Enlist | 389 |

**AD Hospitalized Eye Injuries CY-2020
by Occupational Group - Enlisted Only
Rate per 100,000 person-years**

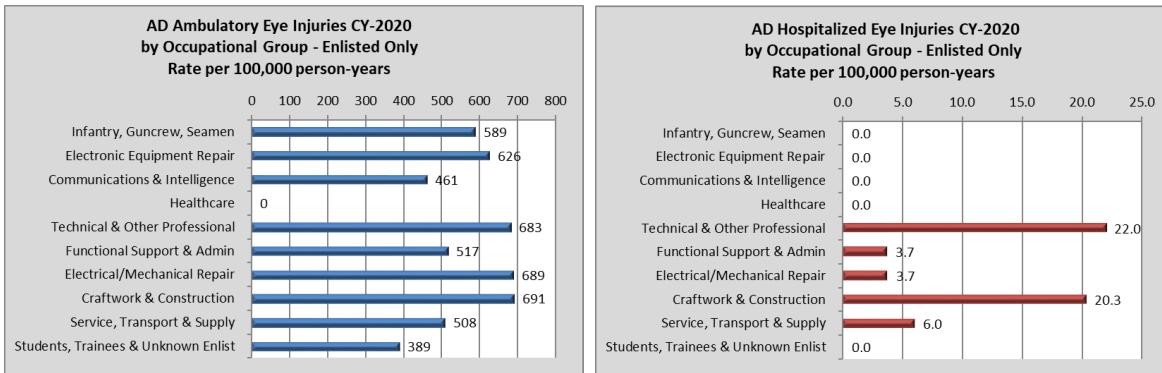| Occupational Group | Rate |
|---|---|
| Infantry, Guncrew, Seamen | 0.0 |
| Electronic Equipment Repair | 0.0 |
| Communications & Intelligence | 0.0 |
| Healthcare | 0.0 |
| Technical & Other Professional | 22.0 |
| Functional Support & Admin | 3.7 |
| Electrical/Mechanical Repair | 3.7 |
| Craftwork & Construction | 20.3 |
| Service, Transport & Supply | 6.0 |
| Students, Trainees & Unknown Enlist | 0.0 |

**Figure 23. Eye Injury Rates by Enlisted Occupational Groups, U.S. Marine Corps AD SMs, CY 2020**

*Medical treatment facility ambulatory visits (left) and hospitalization (right):*

- *The "Craftwork & Construction," "Electrical Mechanical Repair," and "Technical & other Professional" enlisted occupational groups had the highest rate of eye injury.*
- *The rate of the "Healthcare" category is zero because the "Healthcare" enlisted personnel were from the U.S. Navy (see Figure 18).*

**AD Ambulatory Eye Injuries CY-2020
by Occupational Group - Officers Only
Rate per 100,000 person-years**

| Occupational Group | Rate |
|---|---|
| General/Flag Ofc & Executives | 885 |
| Tactical Operations Off. | 685 |
| Intelligence Off. | 736 |
| Engineering & Maintenance Off. | 738 |
| Healthcare Off. | 0 |
| Scientists & Professional Off. | 648 |
| Administrative Off. | 626 |
| Supply & Logistics Off. | 598 |
| Students, Trainees & Unknown Off. | 488 |

**AD Hospitalized Eye Injuries CY-2020
by Occupational Group - Officers Only
Rate per 100,000 person-years**

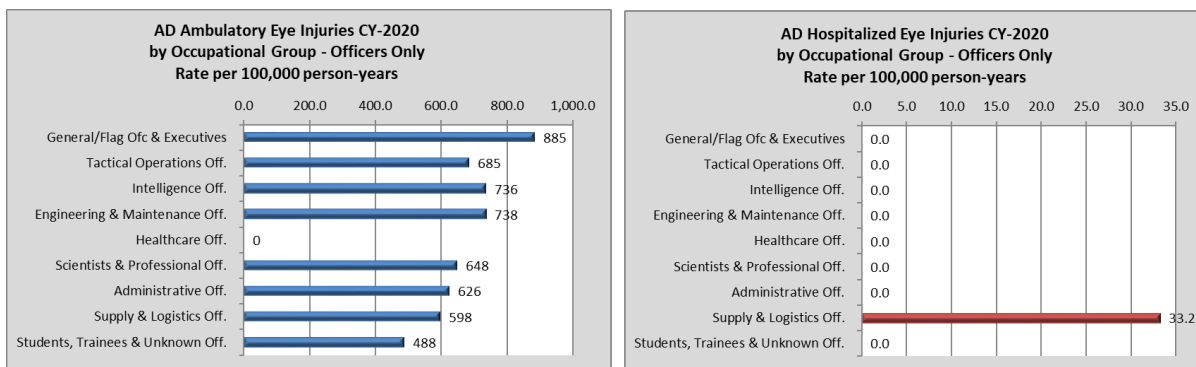| Occupational Group | Rate |
|---|---|
| General/Flag Ofc & Executives | 0.0 |
| Tactical Operations Off. | 0.0 |
| Intelligence Off. | 0.0 |
| Engineering & Maintenance Off. | 0.0 |
| Healthcare Off. | 0.0 |
| Scientists & Professional Off. | 0.0 |
| Administrative Off. | 0.0 |
| Supply & Logistics Off. | 33.2 |
| Students, Trainees & Unknown Off. | 0.0 |

**Figure 24. Eye Injury Rates by Officer Occupational Groups, U.S. Marine AD SMs, CY 2020**

*Medical treatment facility ambulatory visits (left) and hospitalization (right):*

- *Among the nine military officer occupational groups, the "General/Flag Officer & Executives," "Engineering & Maintenance," and "Intelligence" officers had higher eye injury rates.*
- *The rate of the "Healthcare" category is zero because the "Healthcare" officers were from the U.S. Navy (see Figure 19).*

**AD Deployment Associated Eye Injuries CY-2020 by Injury Group Percent of Total**

**AD Deployment Associated Eye Injuries CY-2020 by Occupational Group- Enlisted Only Percent of Total Eye Injuries**

**AD Deployment Associated Eye Injuries CY-2020 by Occupational Group- Officers Percent of Total Eye Injuries**
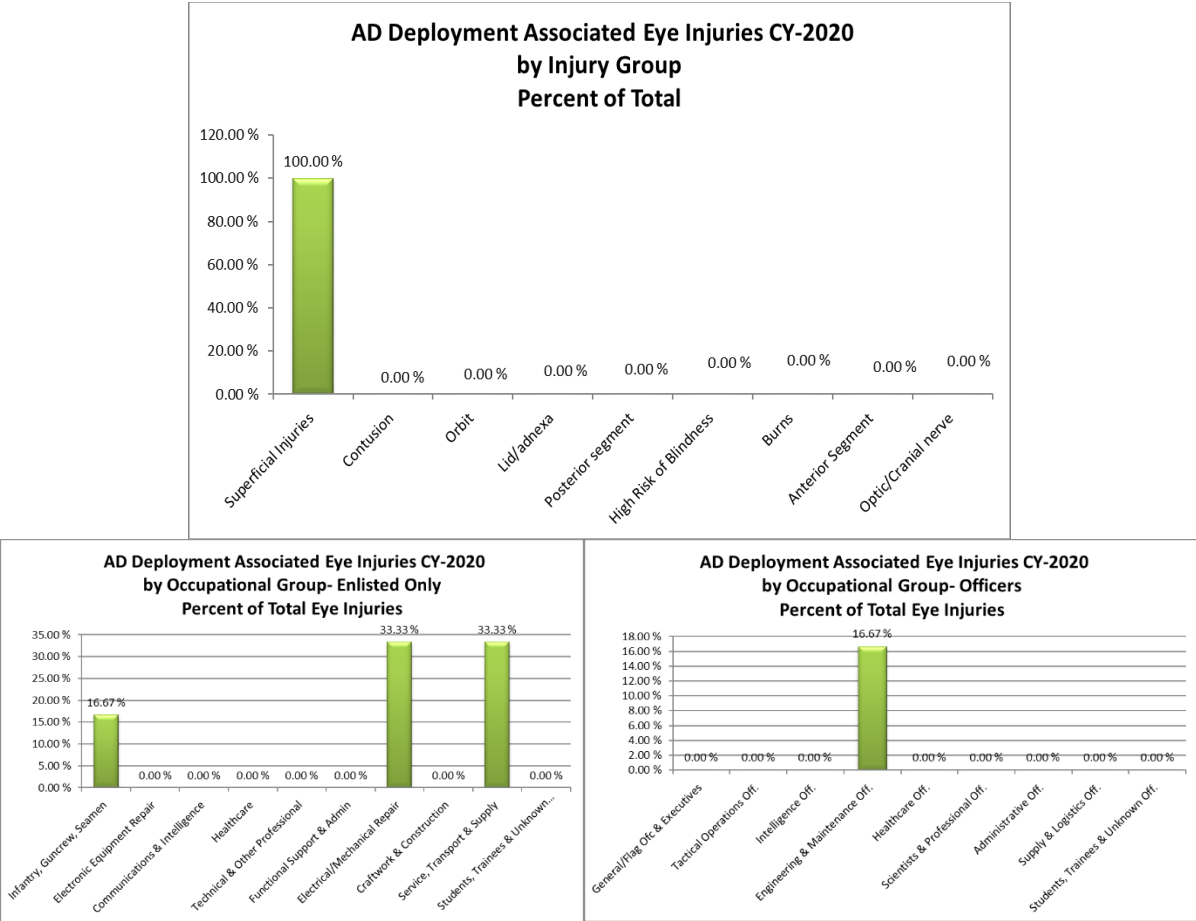
**Figure 25. Percentage of Deployment-associated Eye Injuries by Injury Category (top) and by Occupational Group of the Enlisted (left) and Officer (right) Personnel, U.S. Marine Corps AD SMs, CY 2020**

- *Deployment-associated eye injuries were all "Superficial Injuries."*
- *Eye injuries occurred the most often among enlisted personnel of the "Electrical/Mechanical Repair" (33.33%), "Service, Transport & Supply" (33.33%), and "Infantry, Guncrew, Seamen" (16.67%) occupational groups.*
- *The "Engineering & Maintenance" officers had the most deployment-associated eye injuries (16.67%) among the officer occupational groups.*

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**Time Trend of Overall Eye Injuries**

Figure 26 shows the time trend of the overall eye injury rate and case count in the **AD SM population**. Simple linear regression analysis showed that there was a weak, but significantly negative relationship between the overall DOD eye injury rate and time ($R^2$=.344, *P=.035*). $R^2$ of 0.344 indicates that 34.4% of the variation in DOD overall eye injury rate can be explained by the model containing only time. The slope coefficient was -21.72, which indicates that the overall eye injury rate in the DOD decreased by 21.72 per 100,000 person-years for each extra year since CY 2008.

Rates of eye injuries were not significantly different between CY 2019 and CY 2020 (P=*.621*). A time trend analysis shows that the downward trend was not statistically significant without CY 2020 ($R^2$=.178, P=*.172*).

By military service, the downward time trend was statistically significant in the U.S. Navy (*P=.015*) but not statistically significant in other military services (P>*.05*).
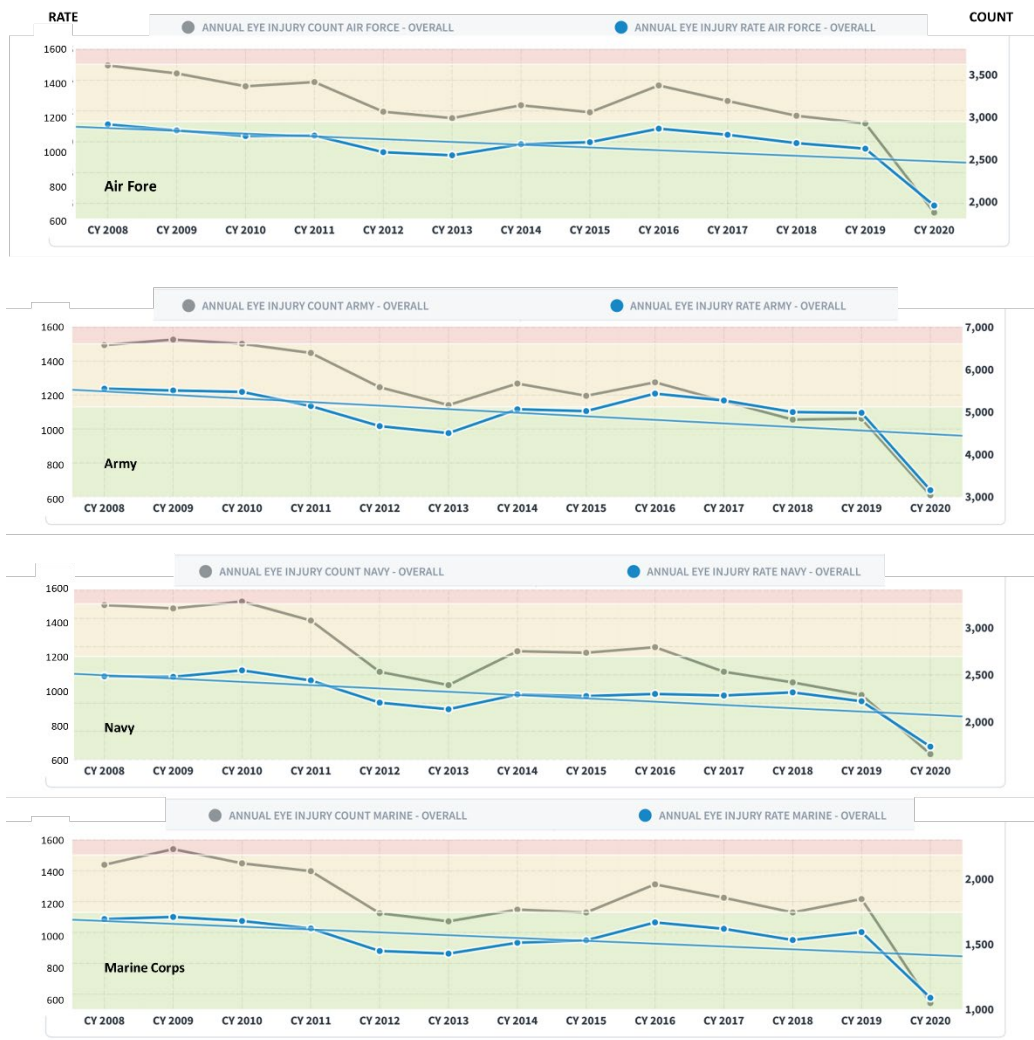


**Figure 26. Time Trend of the Overall Eye Injury Rate (left axis) and Case Counts (right axis) of DOD AD SMs, from CY 2008 to CY 2020;** Injury rate per 100,000 person-years.

**DISCUSSION**

The report shows magnitude, type, and causes of eye injuries in the AD military population in CY 2020. Results are provided for all individual Services as well as the combined DOD AD population. Though Service-specific findings are included, results were generally similar across the AD population. Eye injury-related hospitalizations were rare and 99.7% of the eye injury cases were ambulatory (outpatient) encounters. Furthermore, there was a weak but significant downward trend of overall eye injury rate in the DOD since CY 2008; however, it was primarily due to the lowest eye injury rate in CY 2020, which was the first year of the COVID-19 pandemic.

The most common category of eye injury among all Services was "Superficial Injury" (553 per 100,000 person-years). In comparison, severe and potentially sight-threatening eye injuries, such as the "High Risk of Blindness" (0.9 per 100,000 person-years), the "Ocular Burns" (0.9 per 100,000 person-years), or the "Optical or Cranial nerve injury" (0.2 per 100,000 person-years) were rare. However, it is noted that not all superficial eye injuries are benign because about 9% of superficial eye injuries may later develop more severe ocular complications (private communication, COL Mark Reynolds).

**Mechanism of Eye Injury**. Most (99.4%) of the medical encounters did not document any codes for causes of eye injuries. In the cases that did include documented codes, "Slips, Trips and Falls," "Fighting, Assault and Horseplay," "Sports," "Machinery and Tools," "Land Transport," and "Other Transport" were the common mechanism of eye injuries in CY 2020. Though the value of this finding is limited, it hints to the importance of ensuring eye protection is worn during combat drills, sports, occupational settings, and when performing tactical training or combat.

**Occupational Group**. Among enlisted occupational groups, the "Craftwork & Construction" (829 per 100,000 person-years), "Healthcare" (721 per 100,000 person-years), and "Electrical Mechanical Repair" (620 per 100,000 person-years) had the highest eye injury rates. Among the officer occupational groups, the "Healthcare" (724 per 100,000 person-years), "Scientists & Professional" (698 per 100,000 person-years), and "Engineering & Maintenance" (657 per 100,000 person-years) had the highest eye injury rates.

**Deployment-Associated Eye Injury**. Enlisted personnel accounted for 91.4% of all deployment-associated eye injuries. The "Electrical/Mechanical Repair" (33.95%), "Infantry, Guncrew, Seamen" (10.00%), and "Service, Transport & Supply" (9.53%) had the most eye injuries among enlisted occupational groups. The "Technical & Other Professional" group had the lowest eye injury cases. The "Tactical Operations" (3.26%) had the most deployment-associated eye injuries among officer occupational groups.

**Trend over Time**. There was a weak but significant downward trend of overall eye injury rate in the DOD since CY 2008; however, the team concludes that it was primarily due to the lowest eye injury rate in CY 2020, which was the first year of the COVID-19 pandemic.

**Limitations**. This report does not contain comprehensive medical record review or safety incidence reports that may provide further information on causes and outcomes of the injury.

Moreover, rates of injuries that diagnosed in deployed settings were not calculated due to lack of reliable person-time estimates.

## CONCLUSION

Eye injury led to over 8,000 medical encounters in CY 2020. In addition to direct and indirect costs to the MHS, the operational impacts of these injuries can be significant due to personnel and mission readiness, unit morale, and extra logistical burden from casualty evacuation from deployment settings.

Though the majority of eye injuries identified in CY 2020 were superficial injuries, some of these injuries may become long-term medical problems. Severe injuries, such as high risk of blindness continue to be rare.

Commanders, leadership, and Warfighters should routinely evaluate the safety of a workplace, understand hazards, and implement protections to reduce and eliminate hazards; this aims to prevent future workplace injuries and illnesses. To further assist with local assessments of the eye injury problem, the TSVCRB also provides quarterly installation eye injury surveillance reports (Appendix A).

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8.      U.S. Army Public Health Center (APHC). 2021. Public Health Information Paper (PHIP) No.12-01-0717, *Fiscal Year (FY) 2022 UPDATE: A Taxonomy of Injuries for Public Health Monitoring and Reporting Public Health.* https://apps.dtic.mil/sti/citations/AD1150155.

**Appendix A**

**Military Installation Quarterly Eye Injury Surveillance**

In addition to the Annual Eye Injury Surveillance Reports, the TSVCRB also provides quarterly military installation eye injury surveillance updates.

The quarterly update highlights overall eye injury rate, case count, and time-trend of the last 12 quarters at the level of individual military installation. The purpose of the quarterly update is to provide installation commanders and safety officers with installation-specific eye injury quarterly surveillance.

The methodology used to determine installation-specific rates in the quarterly reports is similar to that described in this annual eye injury report, with the following exceptions: In addition to the nine categories and associated ICD diagnoses codes analyzed for annual reports, the quarterly reports include diagnoses codes for a 10th category, "Corneal Disorders Due to Contact Lens." The 60-day incidence rule applies to both these and the "Superficial" eye injury categories in the quarterly reports. Moreover, the quarterly update provides a rolling average of the DOD eye injury rate of the last five quarters. Commanders may use it as a dynamic DOD reference (i.e., a moving DOD average) for their assessment of eye injuries on the installation.

Quarterly eye injury installation surveillance can be found at https://www.sms.army.mil/; navigating the menus to Dashboards (from the top left drop-down) > Army Enterprise > User Workspace > OTSG/MEDCOM > OTSG/MEDCOM HQ > DCS Public Health > Occupational & Environmental Medicine Portfolio (OEM) > OEM Vision Readiness & Eye Injury Surveillance > Eye Injury Surveillance – Installation.