Eye Injury Surveillance in the U.S. Department of Defense, 1996–2005

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Background: Consistent with the public health approach to prevention, surveillance analyses are needed to fully understand a health problem. U.S. military eye injury rates have not been fully described using medical surveillance data.

Methods: Medical visit data on active duty personnel, 1996–2005, and causes of eye injury hospitalizations (identified by Standard NATO Agreement injury cause codes) were obtained from the Defense Medical Surveillance System. Eye injury–related ICD-9-CM codes beyond the traditional 800–999 injury code set were included. Rates by age and gender are reported for 1996–2005, along with the frequency of causes of injury hospitalizations and leading eye injury diagnoses for 2005.

Results: Eye injury rates among active duty military personnel increased from 1996 to 2005 among both men and women ($p<0.001$), with the highest rates in 2004 (26/1000 person-years and 21/1000 person-years, women and men, respectively). Women consistently had 7%–21% higher rates than men (rate ratios=1.07; 95% CI=1.04, 1.11) to 1.21 (95% CI= 1.17, 1.25). From 1996–2005, eye injury rates increased among all age groups ($p<0.001$). From 2002–2005, rates were highest for those aged ≥40 years compared to those aged 17–19 years (rate ratios=1.17 [95% CI=1.11, 1.24] to 1.24 [95% CI=1.18, 1.31]). Leading causes of eye injury hospitalizations were ordnance handling (16.9%), enemy action (13.1%), and fighting (11.9%).

Conclusions: Medical surveillance data enable the assessment and monitoring of overall active duty eye injury rates, trends, and causes. Outpatient data could be improved with the addition of cause of injury codes and eye protection use. Current data suggest that continued use of eye protection during ordnance handling, combat, motor vehicle use, and sports could help reduce eye injury rates.

(Am J Prev Med 2010;38(1S):S78–S85) Published by Elsevier Inc. on behalf of American Journal of Preventive Medicine

Introduction

In the U.S., nearly 2 million individuals experienced an eye injury requiring treatment in an emergency department, inpatient or outpatient facility, or private physician's office in 2001, for a rate of 7.0 per 1,000 people.[1] A second study performed by the same authors using the same data sources analyzed the trend in U.S. eye injuries from 1992 to 2001 and found an estimated 3 million individuals experienced an eye injury annually. In addition they estimated an overall injury rate ranging from 8.2 to 13.0 per 1000 people and an overall downward trend during this time period, with 2001 having the lowest rate.[2] Both studies used a distinct set of ICD-9-CM 800 and 900 series eye-injury codes to identify patients with eye injuries. Both studies found the most common civilian eye injuries to be (1) superficial injuries to the eye and adnexa, (2) foreign bodies on the external eye, and (3) contusions of the eye and adnexa. Both studies noted the most common causes of civilian eye injuries to be (1) foreign bodies, (2) struck against or by an object, and (3) fights and assaults.

In the military, several studies have provided a range of rates for eye injuries. A study of Department of Defense (DoD) injuries using safety center data from fiscal years

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0749-3797/00/$17.00
doi: 10.1016/j.amepre.2009.10.015

(FY) 1988–1998 showed a range of eye-injury incidence from 44.0 per 100,000 service members in FY 1988 to 8.0 per 100,000 service members in FY 1998.[3] Two additional studies identified eye injuries using code sets similar to those used in the civilian studies noted above. The first study looked at work-related, U.S. Army, active duty eye injuries resulting in hospitalization over the period 1980–1997 and found an overall rate for hospitalized eye injuries of 27.6 per 100,000 person-years.[4] The second study looked at all U.S. Armed Forces active duty members during 1998 who were either hospitalized or seen on an ambulatory basis for an eye injury and found a rate of 17.0 per 100,000 person-years for hospitalized injuries and 983.0 per 100,000 person-years for ambulatory injuries.[5] This study found the most common types of eye injuries seen in ambulatory clinics (98.3% of the total) for the military to be the same as the civilian studies cited above. The most common causes for military inpatient eye injuries were (1) motor vehicle crashes, (2) fights, and (3) sports. While the previous studies looked at the entire U.S. Armed Forces or U.S. Army population retrospectively, a study done in 1989 looked at active duty U.S Army eye injuries treated at inpatient, outpatient, and unit-based treatment sites at three installations over a 5-month period and determined an overall eye injury rate of 1420 per 100,000 person-years.[6]

The purposes of this paper are to describe a methodology for monitoring eye injury rates among active duty service members using existing medical surveillance data and to provide an overview of historic eye injury rates, trends, and causes. Recommendations for improving surveillance of eye injuries are also discussed. This analysis was originally conducted for and reported to the Defense Safety Oversight Council.

Methods

For this study, the term "eye" referred to hard and soft tissues of the orbital cavity and/or the adjacent and associated structures. Active duty military personnel who obtained inpatient or outpatient treatment in military medical facilities, or other medical facilities for which the military was billed, for one or more injuries of the eye between 1996 and 2005 were identified in the Defense Medical Surveillance System (DMSS). A list of diagnoses indicative of eye injury from the ICD-9-CM diagnosis codes was selected by a group of optometrists and physicians (Table 1). DMSS, the central repository for medical surveillance data for the U.S. military, is maintained by the Armed Forces Health Surveillance Center (formerly, Army Medical Surveillance Activity). DMSS data contained medical encounters at fixed military medical treatment facilities only, therefore visits occurring in battalion aid stations or deployment settings were not included in

Table 1. ICD-9-CM codes used to identify eye injuries

ICD-9-CM code	Code description
360.3	Hypotony, primary (posttraumatic)
361.0	Retinal detachment with retinal defect unspecified
362.81	Hemorrhage, retinal
363.31	Solar retinopathy
363.61	Choriodal hemorrhage, unspecified
363.62	Choriodal rupture, expulsive
363.63	Choriodal rupture
363.7	Choriodal detachment, unspecified
363.71	Choriodal detachment, serous (not central serous)
363.72	Choriodal detachment, hemorrhagic
364.41	Hyphema/hemorrhage, anterior chamber (aqueous)
364.76	Iridodialysis
364.8	Iris prolapse, unspecified
365.65	Glaucoma, trauma (ocular), NEC
366.2	Cataract traumatic, unspecified
366.22	Cataract, total, traumatic
366.46	Cataract traumatic, radiation, and other physical influences
369.01	Blindness, total (both eyes)
369.03	Blindness, near total (better eye)/total (lesser eye)
370.03	Ulcer, central corneal
370.04	Ulcer, hypopyon
370.06	Ulcer, corneal perforation
370.2	Keratitis, superficial
370.21	Keratitis, punctate
370.24	Keratitis, actinic/welders'/photokeratitis
370.34	Keratoconjunctivitis, due to exposure
371.0	Corneal opacity, unspecified
371.22	Edema, secondary to injury
371.24	Corneal edema secondary to contact lens wear
371.82	Corneal disorder/injury due to contact lens
372.05	Conjunctivitis
372.39	Conjunctivitis, traumatic not elsewhere classified
372.72	Hemorrhage (ecchymosis), conjunctiva/subconjunctival
374.22	Lagophthalmos, mechanical

(continued on next page)

Table 1. ICD-9-CM codes used to identify eye injuries *(continued)*

ICD-9-CM code	Code description
374.33	Ptosis, mechanical
374.81	Hemorrhage, eyelid
374.86	Foreign body, eyelid retained
376.3	Globe, displacement (lateral)
376.32	Orbital hemorrhage
376.36	Lateral displacement of globe
376.47	Orbit deformity secondary to trauma/surgery
376.52	Enophthalmos, secondary to trauma/surgery
379.23	Hemorrhage, vitreous
379.32	Subluxation of lens
802.6	Blowout fracture floor of orbit, closed
802.7	Blowout fracture floor of orbit, open
802.8	Fracture not otherwise specified/other than roof or floor
870.0	Laceration/open wound, eyelid and periocular area
870.1	Laceration/open wound, eyelid full thickness
870.2	Laceration/open wound, eyelid involving lacrimal passages
870.3	Open wound, orbit (penetrating) without foreign body
870.4	Open wound, orbit (penetrating) with foreign body
870.8	Laceration/open wound, ocular adnexa other specified
870.9	Laceration/open wound, ocular adnexa, unspecified
871.0	Laceration/open wound, eyeball without prolapse
871.1	Laceration/open wound, eyeball with prolapse of intraocular tissue
871.2	Rupture with partial loss of intraocular tissue eye
871.3	Avulsion/traumatic enucleation
871.4	Laceration, unspecified
871.5	Foreign body, intraocular penetrating (magnetic)
871.6	Foreign body, penetration of eyeball with nonmagnetic
871.7	Open wound, eyeball (penetrating)
871.9	Open wound, eyeball (unspecified)
918.0	Abrasion, periocular area
918.1	Abrasion/laceration, cornea
918.2	Abrasion, conjunctival
918.9	Abrasion, eye, unspecified superficial injury to eye
921.0	Contusion/hematoma, eye and adenexa (black eye unspecified)
921.1	Contusion/hematoma, periocular
921.2	Contusion, orbital tissue
921.3	Contusion/hematoma, cornea/eyeball
921.9	Hematoma, traumatic, adnexa eye unspecified
925.1	Crushing injury
930.0	Foreign body, cornea
930.1	Foreign body, conjunctiva
930.2	Foreign body, lacrimal punctum (external)
930.8	Foreign body, external eye through orifice other and combined sites
930.9	Foreign body, external eye unspecified
940.0	Burn, chemical burn of eyelids and periocular area
940.1	Burn, other burn of eyelids and periocular area
940.2	Burn, alkaline chemical burn, cornea and conjunctiva
940.3	Burn, acid chemical burn of cornea and conjunctival
940.4	Burn, other burn of cornea and conjunctival
940.5	Burn, with resulting rupture and destruction of eyeball
940.9	Burn, unspecified burn of eye and adnexa
950.0	Injury, optic nerve and pathways
950.9	Injury, optic nerve and pathways, unspecified traumatic blindness
951.0	Injury oculomotor (3rd cranial nerve)
951.1	Injury trochlear (4th cranial nerve)
951.2	Injury trigeminal (5th cranial nerve)
951.3	Injury abducens (6th cranial nerve)
951.4	Facial nerve (7th) injury

NEC, not elsewhere classifiable

this analysis. DMSS data are routinely evaluated for consistency and accuracy, as described elsewhere.[7]

In order to provide a comprehensive view of eye injuries among U.S. military personnel, the authors consulted Army

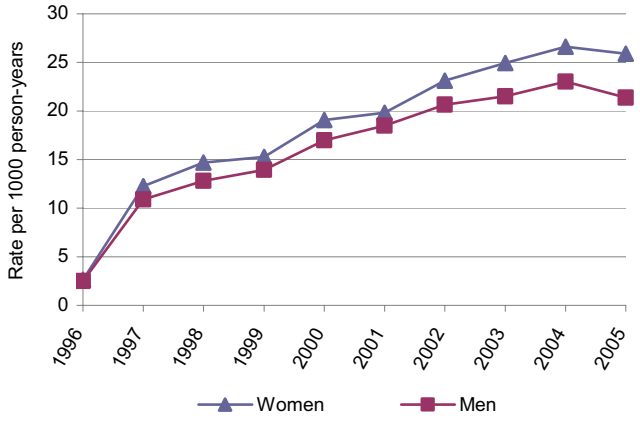

Figure 1. Rates of eye injuries by gender, DoD active duty military, 1996–2005
DoD, Department of Defense

and Navy optometrists, who reviewed the ICD-9 code set and selected common comorbidities seen with eye injuries that, based on their professional experience, had a greater than 50% chance of being the result of an eye injury. Thus, eye injury–related ICD-9 codes beyond the traditional 800–999 ICD-9 injury code set were included. To ensure capture of all eye injury visits, visits with either a primary diagnosis or secondary eye injury–diagnosis code(s) were requested. Multiple visits for the same eye-injury diagnosis within 60 days of the initial visit were excluded to enhance capture of incident injuries only. Rates were calculated by dividing the number of injuries by the person-years of the DoD active duty population at risk, and are presented by gender and age group. Given the small proportion of hospitalizations (4% of all acute eye injury visits in 2005), rates include both inpatient and outpatient medical encounters. Rate ratios (with 95% CIs) were used to assess statistical differences between rates by gender and age group within each year. Linear regression analyses were used to assess the significance of trends in gender and age group rates. For the last year in the study period, 2005, the top ten eye-injury diagnoses are presented.

Causes of acute injury hospitalizations (i.e., those coded using ICD-9-CM 800–999 codes) were also obtained from the DMSS for the last year in the study period, 2005. Intentional and unintentional injuries were included in the data obtained. Injury hospitalization cause codes in DMSS are consistent with the North Atlantic Treaty Organization (NATO) Standardization Agreement (STANAG) No. 2050, a coding scheme developed to capture military-relevant causes of injury.[8,9] Cause codes were grouped according to major STANAG cause categories, as follows: "Military aircraft" (000–059), "Land transport" (motor vehicle traffic and nontraffic incidents) (100–139), "Water transport" (150–199), "Athletics/sports" (220–239), "Medical complications" (250–299), "Instrumentalities of war—enemy" (e.g., bombs, weapons, chemical agents employed by the enemy) (300–479), "Instrumentalities of war—self/accidents" (480–499), "Guns/explosives" (handling and training) (500–599), "Machinery/tools" (600–699), "Poisons/fire/corrosives" (700–799), "Environmental factors" (800–899), "Falls/jumps" (900–929), "Lift/push/pull" (950–959), "Hanging/suffocation" (960–969), "Fighting/horseplay" (includes intentional and unintentional rough play or pranks) (970–979), "Other/unspecified" (980–999). (Note: codes 060–099 are not used in the STANAG coding system). Causes were not routinely recorded in the electronic medical records for (1) injuries outside the ICD-9-CM Injury and Poisoning (800–999) code group or (2) for outpatient visits, and thus these data could not be obtained or reported.

Results

Total eye injury visits for all active duty military from 1996 to 2005 were 229,717 (n=192,397 men and 37,320 women), for a rate of 2204 visits/100,000 personnel. Figure 1 shows the rates of eye injuries by gender. Eye injury rates for women are consistently higher than those for men ($p<0.001$), with the exception of 1996 ($p>0.05$). During the analysis period, rate ratios ranged from a low of 1.07 in 2001 (95% CI=1.04, 1.11) to a high of 1.21 in 2005 (95% CI=1.17, 1.25). The injury rate for women rose from 1996 to 2005, ranging from 2.5 injuries/1000 person-years in 1996 to just over 26.0 injuries/1000 person-years in 2005 ($p<0.001$). The injury rate for men rose from 1996 to 2005, from 2.5 injuries/1000 person-years in 1996 to just a little over 21.0 injuries/1000 person-years in 2005 ($p<0.001$). Over the last 4 years observed, 2001–2005, rates for men remained relatively stable ($p>0.05$), while rates for women continued to in-

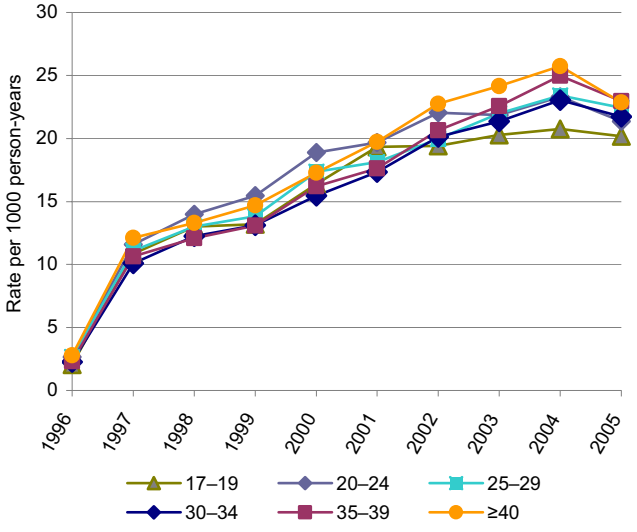

Figure 2. Rates of eye injuries by age group, DoD active duty military, 1996–2005
DoD, Department of Defense

crease ($p<0.05$). The rate of injuries for women and men both peaked in 2004 at approximately 26 /1000 person-years for women and 21 injuries/1000 person-years for men.

Figure 2 shows the rates of eye injuries by age group. Overall, the injury rate patterns were relatively similar across age groups. From 1996 to 2005, all age groups experienced a rise in injury rates ($p<0.001$). For the last 4 years observed, 2001–2005, increases were not significant ($p>0.05$), with the exception of those aged 25–29 years ($p<0.05$). Eye injury rates were highest in 2004, ranging from approximately 21 injuries/1000 person-years (those aged 17–19 years) to approximately 26 injuries/1000 person-years (those aged ≥40 years). For each year during the study period, differences between age groups were significant ($p<0.001$). Those aged 17–19 years consistently had the lowest injury rates, while those aged ≥40 years had the highest injury rates for 7 of the 10 years (1996–1997 and 2001–2005). From 2002–2005, rates for those aged ≥40 years ranged from 1.17 (95% CI=1.11, 1.24) to 1.24 (95% CI=1.18, 1.31) times greater than rates for those aged 17–19 years.

Figure 3 shows the distribution of eye injury (hospital and outpatient) visits by ICD-9-CM diagnosis code description, in 2005, for active duty military personnel. The most common diagnoses were abrasion/superficial lacerations of the cornea. Corneal abrasions and lacerations accounted for 26.7% of all patient visits for eye injuries, with an incidence rate of 5.89 per 1000 personnel. Corneal abrasions were over three times as common as the next leading diagnoses, punctate keratitis, which accounted for 7.6%, at a rate of 1.67 per 1000. These diagnoses were followed by other conjunctivitis (6.3%, 1.40/1000), conjunctival hemorrhage (5.7%, 1.25/1000), and corneal foreign bodies (4.9%, 1.07/1000).

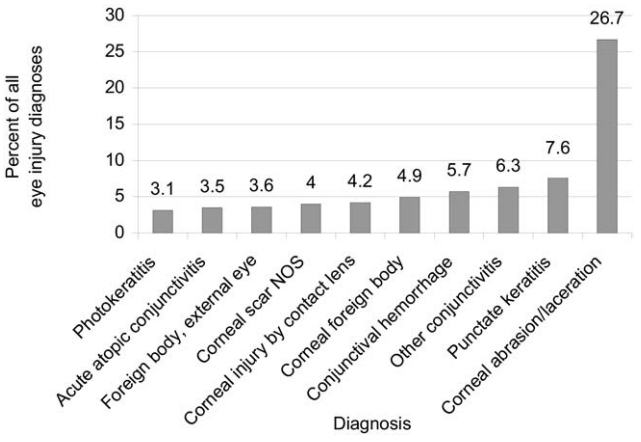

Figure 3. Top ten most frequent diagnoses of eye injury visits, DoD active duty military, 2005
Includes hospitalizations and outpatient visits ($n=30,354$)
Total eye injury visit rate (2005)=2204 visits/100,000 personnel
DoD, Department of Defense; NOS, not otherwise specified

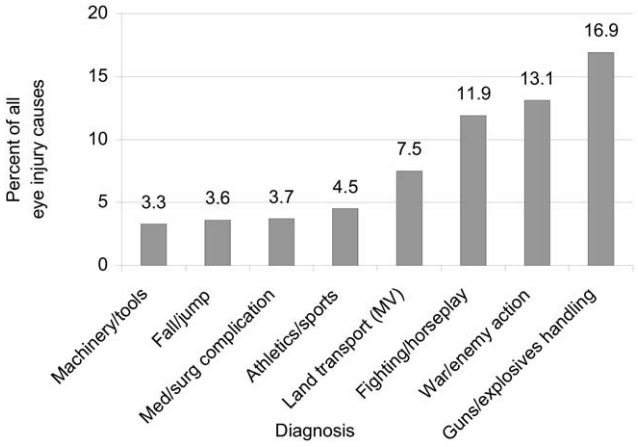

Figure 4. Causes of eye injury hospitalizations, DoD active duty military, 2005
North Atlantic Treaty Organization (NATO) Standardization Agreement (STANAG) No. 2050 cause codes. Eye injury hospitalizations coded as an acute injury (ICD-9-CM 800–999)=704. Thirty percent ($n=203$) did not receive a cause code.
DoD, Department of Defense; MV, motor vehicle

The leading causes of hospitalization due to eye injury among DoD active duty personnel in 2005 are shown in Figure 4. "Guns/explosives," or ordnance handling and training, was the leading cause of eye injury hospitalizations (16.9%), followed by "Instrumentalities of war" (injuries due to enemy action) (13.1%) and "Fighting/horseplay" (11.9%). "Land accidents" (i.e., motor vehicle crashes and other motor vehicle–related incidents) was the fourth leading cause of eye injury hospitalizations (7.5%), followed by "Athletics/sports" (4.5%), "Medical complications" (3.7%), "Falls/jumps" (3.6%), and "Machinery/tools" (3.3%).

Discussion

This analysis presents an overall picture of eye injuries in the U.S. active duty military population, providing baseline eye injury rates and a code set on which future surveillance efforts can build. Overall, eye injury rates among U.S. active duty military personnel increased from 1996 to 2005. Most of the rise in rates across DoD may be attributable to changes in military outpatient clinic data reporting, improvements in clinic data ascertainment/collection, and enhanced capture of care received in nonmilitary healthcare settings during this time period (M Rubertone, J Brundage, Armed Forces Health Surveillance Center, personal communication, January 10, 2007). The authors believe the drop in the rate of eye injury seen from 2004 to 2005 is most likely attributable to the implementation of new ballistic protective eyewear

programs by both the U.S. Army and the U.S. Marine Corps between 2003 and 2004. These programs use select commercial, off-the-shelf eyewear that has been validated to meet ANSI Z87.1 industrial safety eyewear and military ballistic protection standards. Use of these items has been mandated for deployed personnel and deployment-related training.

Among active duty military personnel, women consistently had higher eye-injury rates than men. The only other studies that present a combined analysis of inpatient and outpatient data are the civilian studies by McGwin et al.[1,2] Both studies found men had a higher rate of eye injury than women. A study of the active duty military population by Andreotti et al.[5] found that women had a slightly higher rate of eye injury than men for ambulatory injuries. Since the majority of encounters in the current study were for outpatient visits, this tends to confirm the current data. Additional exploratory analysis indicated that higher rates were seen among women for injuries typically associated with contact lens wear and dry eye (e.g., corneal disorder due to contact lens, noninfectious conjunctivitis, superficial corneal irritation, and corneal abrasion). Three of four of these diagnoses are found in ICD-9-CM Chapter 6. The use of the additional Chapter 6 (Diseases of the Nervous System and Sense Organs) codes likely explains the higher rates for women seen in this analysis. Other studies cited here had either too small a population[6] or looked specifically at unique populations[3,4] and did not support direct comparison.

Looking at age, one might expect to observe lower eye-injury rates among older personnel due to greater work experience and more time spent on lower-risk, managerial activities. However, this study found that Service members aged $<$20 years had the lowest rate of eye injuries and those aged $\geq$40 years tended to have the highest rates. As noted previously, the only other studies that present a combined analysis of inpatient and outpatient data are the civilian studies by McGwin et al.[1,2] Both studies found that those aged 20–39 years consistently had the highest rate of eye injury. The study by Andreotti et al.[5] noted that those aged 17–24 years had the highest eye-injury rate in 1998 and is in agreement with the data presented in this study for the same year. A potential factor influencing the rates presented in this study may be the increased number of older active duty military personnel engaging in training and operational activities in support of the war. In addition, changes in recruitment policies have expanded age limitations, allowing in new recruits at an older age. As with gender, the use of the additional codes to identify eye injuries may affect this finding, and it provides an avenue for further analysis.

In looking at the diagnoses of eye injuries that resulted in a hospitalization or an outpatient visit, corneal abrasions were, by far, the most common diagnoses. Three previously cited studies[1,2,5] present data on the type of injury and, as noted in the introduction, all three rank superficial injury (abrasion) to the eye as the most common injury, followed by foreign bodies of the external eye and contusions. These studies present their outcomes by code group rather than specific codes and as mentioned previously do not include the additional 300 series codes that make up the second, third, and fourth most common injury codes found in this study.

In this analysis, for 2005, guns and explosives (related to use in training and handling) were found to be the leading cause of inpatient eye injuries for military personnel, followed by war-related enemy actions, followed by fighting or horseplay. In the study by Andreotti et al.,[5] motor vehicle (land transport) crashes and fights were the top causes of eye injuries, followed by machinery and tools, athletics, and falls; these results are consistent with the non–combat-related causes found in this analysis. Both of these studies used the STANAG injury cause categories to define causes of inpatient eye injuries. The relative proportions of guns and explosives and war-related injuries are likely attributable to the influence of wartime activities in Iraq and Afghanistan and training for these activities. Reported causes represent the causes of only the most severe (hospitalized) eye injuries, however. Given that the majority of eye-injury visits (approximately 95%–99%) are treated on an outpatient basis, cause coding of outpatient data is needed to gain a better understanding of causes of all eye injuries.

The strengths of this analysis were the following: (1) the data collected were on all inpatient and outpatient encounters of active duty military personnel, including optometry visits (not reported in the civilian studies cited);[1,2] (2) all medical encounters were subject to standardized and routine recordkeeping; (3) the data collected came from a large patient population (approximately 1.3 million active duty personnel who have access to military health system care); and (4) the data captured care received both within the military health system and outside the military health system.

Weaknesses and limitations to this analysis included that the DMSS does not capture treatment for minor injuries seen only at battalion aid stations, or medical care received in theaters of operation such as Iraq and Afghanistan that was not evacuated out of country. The lack of these data may lead to an underestimation of rates. In addition, as mentioned previously, DMSS does not capture causes of eye injuries treated in outpatient settings, where an estimated 95%–99% of all eye injuries are treated. Such cause information is essential for prevention of the vast majority of eye injuries and to properly discern a work-related injury from an off-duty injury

when planning interventions. The DMSS also does not capture the presence or absence of eye protection at the time of injury for either inpatient or outpatient care. Lack of these data limits the ability to determine the impact of preventive strategies involving the use of safety eyewear.

Finally, the list of ICD-9-CM diagnosis codes selected to identify eye injuries in this study differs from some previous work,[1,2,4,5] in that it includes forty-five 360–379 series ICD-9-CM codes in addition to forty-eight 800–999 series ICD-9-CM codes. A number of prior studies used a code set that included only 800–999 series injury codes that applied to the eye. Andreotti et al.[5] acknowledged in their commentary that "... diagnoses associated with, but not specific for, eye injuries were not included (e.g., hyphema, iritis, retinal detachement, photokeratitis, and corneal edema)" and noted that this (in addition to other factors) lead to an underestimation of eye-injury rates in their study.

While the inclusion of these additional codes may result in a high-end estimation of rates, as some are associated with eye disease or degenerative conditions in addition to injury, it was felt to be necessary and appropriate to include these codes in order to ensure comprehensive eye-injury surveillance. A 2008 study of eye injuries among U.S. military personnel included a smaller subset of the ICD-9-CM 300 series codes.[10] Validating and refining this expanded code list, as well as developing means to identify injuries coded solely with non-injury diagnosis codes, is another avenue for further study.

Conclusion and Recommendations

This analysis represents the first step in the public health process[11,12]: describing the problem. Key findings were as follows: (1) DoD active duty women had a higher eye-injury rate than men; (2) differences in rates of eye injuries among age groups were small overall, with active duty personnel aged <20 years having the lowest rates of eye injuries, while active duty personnel aged >40 years had the highest rates of eye injuries; (3) corneal abrasions were the most common diagnoses of eye-injury outpatient visits and hospitalizations in 2005; and (4) guns/explosives handling and enemy action were the leading causes of eye-injury hospitalizations in 2005, followed by fighting, land transport (motor vehicle), and sports.

As stated earlier, surveillance systems used by DoD for tracking eye injuries, such as DMSS, lack the ability to discern cause of injury for eye injuries treated in outpatient settings. As outpatient eye injuries represent 95%–99% of total eye injuries, it is especially important to identify the underlying cause and how it is related to duty and recreation. These systems also do not discern whether or not eye protection was used at the time of injury. As use of protective eyewear increases under the new military programs, these data become critical in determining their impact on eye injury–rate reductions.

Conducting injury surveillance using systems like the DMSS is dependent on the codes used to identify the injuries. Previous studies have limited their codes to the discrete 800–999 eye-injury codes, which may underestimate incidence. This analysis attempted to remedy this problem by using an expanded code set aimed at capturing additional eye injuries not usually captured by the 800–999 code series. An important benefit of consistent cause coding for outpatient injury visits would be the ability to more accurately identify an injury coded with a non-injury code, based on the presence of a cause code. Policies and enhancements to the current medical data collection systems are needed to ensure capture of these cause codes for all conditions occurring due to injury, including those that fall outside of the acute-injury code group (ICD-9-CM 800–999). Military systems do not need to rely on STANAG coding to do this; recent additions (1 October 2008 and 1 October 2009) to ICD-9-CM and ICD-10-CM external cause of injury codes should allow for improved capture of military-relevant causes of injury, both now and in the future.

In addition, more detailed analyses of DMSS data, looking at component, military service branch, and occupational specialty, are warranted. Further exploration of the cause-coded hospitalization data, looking at causes in more detail and over multiple years, is also needed. Multivariate analyses using available surveillance data would enable further understanding of the most important predictors of eye injury among military personnel. Despite the need to know more, the leading causes and diagnoses identified in this analysis suggest that continued use of protective eyewear use during ordnance handling, combat, land transport (motor vehicle), and sports activities would greatly assist with prevention of eye injuries among military Service members.

No financial disclosures were reported by the authors of this paper.

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