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Incidence of Acute Traumatic Patellar Dislocation Among Active-Duty United States Military Service Members

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Background: Although some studies have reported an increased incidence of patellar dislocations within active populations, few studies have reported incidence rates and examined risk factors for this injury.

Purpose: To examine the incidence of patellar dislocation injuries and the influence of demographic and occupational risk factors associated with injury among active-duty United States (US) service members between 1998 and 2007.

Study Design: Cohort study; Level of evidence, 3.

Methods: Using the Defense Medical Surveillance System, a search was performed for International Classification of Disease, 9th Revision (ICD-9) code 836.3 among all US service members on active duty during the study period. Multivariable Poisson regression analysis was used to estimate the rate of patellar dislocation per 1000 person-years at risk to injury. Incidence rates (IRs) and incidence rate ratios (IRRs) for patellar dislocation along with 95% confidence intervals (CIs) were estimated by gender, age, race, branch of military service, and rank while controlling for the other variables in the model.

Results: There were a total of 9299 individuals with documented patellar dislocation injuries among a population at risk of 13 443 448 person-years. The IR was 0.69 per 1000 person-years at risk. Women were 61% more likely (IRR, 1.61; 95% CI, 1.53-1.69) to sustain a patellar dislocation injury than men. Rates were highest in the youngest age group and decreased with increasing age. Service members aged <20 years were 84% more likely (IRR, 1.84; 95% CI, 1.61-2.10) to sustain a patellar dislocation injury as service members aged ≥40 years. Differences were also noted by race, service, and rank.

Conclusion: The incidence of patellar dislocation injuries among US service members was an order of magnitude greater than that previously reported in civilian population studies. Gender, age, race, rank, and branch of military service are important risk factors related to the incidence of patellar dislocation injuries in this population.

Keywords: patella; dislocation; epidemiology; risk factors

Acute traumatic patellar dislocation accounts for approximately 3% of all knee injuries.[1,32] The natural history of acute patellar dislocation has been described in the literature.[4,10,13,29] Most patellar dislocations are associated with participation in sports and physical activity.[4,10,29] Knee flexion and valgus have been noted as the leading mechanism of injury associated with patellar dislocation, accounting for as many as 93% of all cases.[29] Sillanpaa et al[29] reported that hemarthrosis, medial patellofemoral ligament injury, and medial retinacular disruption were present in nearly all patients with acute traumatic primary patellar dislocation. Osteochondral fractures have been noted in nearly 25% of acute patellar dislocations.[32]

The long-term sequelae after patellar dislocation have also been described.[6,10,13,19,21,22] Many functional limitations have been reported during the 6 months after acute patellar dislocation. Atkin et al[4] noted that more than half of the patients in their study reported pain, difficulty kneeling, squatting, jumping, and cutting at 24 weeks after

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injury. They also reported that patients demonstrated a significant decline in overall sports activity during the first 6 months after injury.[4] Similarly, Sillanpaa et al[29] reported that 21% of the patients in their cohort experienced functional limitations that prevented them from returning to active-duty military service. Recurrent instability and dislocations after initial injury have also been reported in as many as 50% of patients managed nonoperatively,[6,21] and patients with 2 or more dislocations are more than 6.5 times as likely to experience subsequent instability.[10] Posttraumatic osteoarthritis is also common after acute patellar dislocation, regardless of whether recurrent instability events occur.[22] Treatment for acute patellar dislocation remains controversial due to a lack of quality epidemiological and comparative effectiveness studies.[2,10,29]

Despite the long-term effect and relatively poor outcomes associated with acute patellar dislocation injuries, few studies have examined the incidence and risk factors associated with acute patellar dislocation within a young and physically active population. Thus, the purpose of this study was to describe the incidence rate and risk factors associated with primary patellar dislocation injuries in a military population. Our hypothesis was that there would be a higher incidence of patellar dislocation injuries in this young and physically active population compared with previous reports from the general population. A secondary objective was to assess the relationship between demographic and occupational risk factors and the incidence of patellar dislocation.

MATERIALS AND METHODS

A retrospective cohort study was conducted to examine injury data extracted from the Defense Medical Surveillance System (DMSS) related to the primary occurrence of patellar dislocation injuries among United States (US) service members on active duty between 1998 and 2007 inclusive. The DMSS has been the central repository for data related to all health care encounters between providers and beneficiaries in all 4 branches of US military service since 1997.[3,26] The capabilities, structure, and utility of the DMSS for public health surveillance and epidemiological research have been described in the literature,[3,5,26] and data from the DMSS have been used to examine the incidence and risk factors for a number of musculoskeletal injuries and conditions.[5,23-25,27,36,37] All data in the DMSS are coded according to the International Classification of Disease, 9th Revision (ICD-9) coding definitions. Study exemption for this investigation under the provision for the "Secondary Use of Existing Data for Epidemiological Research" was granted by the Institutional Review Board at Keller Army Hospital (West Point, New York) with secondary review by the US Army Clinical Investigation Regulatory Office (Ft Sam Houston, Texas).

To identify all incident cases of patellar dislocation during the study period, we queried the DMSS database by gender, age, race, service, and rank using ICD-9 code 836.3. The age categories were <20, 20 to 24, 25 to 29, 30 to 34, 35 to 39, and ≥40 years. The race categories were white, black, and "other." The "other" category was used for all individuals of race other than white or black and included Latinos, Asians, Native Americans, and numerous other racial groups. The service categories were US Army, US Marine Corps, US Navy, and US Air Force. The rank categories included junior enlisted (E1-E4), senior enlisted (E5-E9), junior officer (O1-O4), and senior officer (O5-O9). Inpatient data were excluded to capture only ambulatory encounters with a primary diagnosis of patellar dislocation. In addition to primary diagnosis, incident events were limited to a "first occurrence" to exclude repeat coding of the same initial injury for all service members during the study period.[3] In the present study, a "first occurrence" was operationalized so that all incident injuries during the study period represented the first patellar dislocation injury (represented by ICD-9 code 836.3) for each individual from the time he or she entered military service and excluded all subsequent health care visits (with an ICD-9 code of 836.3) for the same individual.

The primary outcome of interest was the incidence rate of patellar dislocation injuries per 1000 person-years at risk of injury during the study period. The incidence rate for an injury or illness is defined as the number of new cases occurring during a specific period of time in a population at risk for experiencing the injury.[18] Incidence rates are calculated by dividing the total number of injuries observed in a population by a measure of exposure or person-time at risk to injury.[18] Accurate population denominator data (person-time) for incidence rate calculations are available through the DMSS and are validated against Department of Defense personnel data obtained from the Defense Manpower Data Center.[3] Exposure time during the current study period was calculated from the day each individual entered military service until he or she either sustained an incident patellar dislocation injury or left military service. As a result, patients sustaining an incident patellar dislocation injury were censored at the time of injury and contributed no further exposure time during the study period. All incidence rates are reported per 1000 person-years at risk to injury in the present study.

The overall incidence of patellar dislocation in the study population, along with the 95% confidence interval, was calculated by dividing the total number of injuries by the total person-years at risk and multiplying by 1000. Using the injury and personnel data extracted from the DMSS, we used a multivariable Poisson regression model to estimate the adjusted incidence rate of patellar dislocation injuries per 1000 person-years by strata (eg, gender) while controlling for the influence of the other variables in the model (age, race, service, and rank). In other words, the statistical model made it possible to assess each parameter independently, permitting estimation of the unique effects of a particular variable on the incidence of patellar dislocation injury while holding all other variables constant. Significant main effects were noted for all 5 variables ($P < .001$), indicating that gender, age, race, service, and rank are independent risk factors for patellar dislocation. Despite a correlation between some demographic

TABLE 1
Unadjusted and Adjusted Rates and Rate Ratios by Gender Among United States Service Members Between 1998 and 2007[a]

	Observed		Unadjusted		Adjusted	
Demographic	Injuries	Person-Years	Rate	Rate Ratio (95% Confidence Interval)	Rate	Rate Ratio (95% Confidence Interval)
Female	2014	1 959 524	1.03	1.62 (1.54-1.70)	0.63	1.61 (1.53-1.69)
Male	7285	11 483 924	0.63		0.39	

[a]Rate per 1000 person-years; male referent category; adjusted for race, age, service, and rank.

TABLE 2
Unadjusted and Adjusted Rates and Rate Ratios by Age Among United States Service Members Between 1998 and 2007[a]

	Observed		Unadjusted		Adjusted	
Demographic	Injuries	Person-Years	Rate	Rate Ratio (95% Confidence Interval)	Rate	Rate Ratio (95% Confidence Interval)
<20	1228	1 096 477	1.12	3.65 (3.27-4.08)	0.64	1.84 (1.61-2.10)
20-24	3855	4 414 406	0.87	2.85 (2.57-3.15)	0.54	1.56 (1.39-1.77)
25-29	1937	2 770 396	0.7	2.28 (2.05-2.53)	0.55	1.60 (1.42-1.79)
30-34	1028	1 990 365	0.52	1.68 (1.50-1.89)	0.48	1.38 (1.22-1.55)
35-39	832	1 805 512	0.46	1.50 (1.34-1.69)	0.45	1.31 (1.16-1.48)
≥40	419	1 366 292	0.31		0.35	

[a]Rate per 1000 person-years; >40 referent category; adjusted for gender, race, service, and rank.

variables, specifically age and rank, both variables maintained their independent predictive value and were therefore included in the model as independent parameters. An analysis of the model's parameters provides no indication of numerical issues or degradation of fit with the model. This suggests that each demographic variable provides some additional information for the incidence of patellar dislocation. We calculated incidence rates (IRs), incidence rate ratios (IRRs), and 95% confidence intervals (CIs) for each demographic category using the subset with the lowest incidence rate as the referent category.

RESULTS

There were a total of 9299 individuals with documented patellar dislocations in the DMSS during the 10-year study period among a population at risk of 13 443 448 person-years. There was an average of 930 patellar dislocations diagnosed per year during the study period. The overall IR for patellar dislocation injuries during the study period was 0.69 (95% CI, 0.68-0.71) per 1000 person-years. The IR for injury varied significantly by gender, age, race, military service, and rank. All 5 demographic variables were associated with the incidence of patellar dislocation, indicating that gender, age, race, service, and rank are important risk factors related to patellar dislocation injuries.

Women experienced patellar dislocation injuries at a significantly higher rate than men, when controlling for the influence of the other risk factors in the model. Among all service members, women were 61% more likely (IRR, 1.61; 95% CI, 1.53-1.69) to sustain a patellar dislocation injury when compared with men. The adjusted IR for women was 0.63 per 1000 person-years at risk to injury compared with 0.39 for men. Incidence rates, IRRs, and 95% CIs by gender are presented in Table 1.

The IR for patellar dislocation injuries was highest in the <20 years age group, and rates generally declined with increasing age. When compared with the ≥40 years age group, all other age groups experienced significantly higher rates for patellar dislocation (Table 2). Service members <20 years of age were 84% more likely to sustain a patellar dislocation injury compared with those ≥40 years of age (IRR, 1.84; 95% CI, 1.61-2.10). Incidence rates, IRRs, and 95% CIs by age group are presented in Table 2.

The IR of patellar dislocation injuries was significantly higher for black and white service members than for those in the "other" category for race. No difference was noted in the rates of patellar dislocation between black and white service members. The adjusted IR observed for white service members was 0.59 per 1000 person-years at risk to injury and 0.57 for black service members, compared with 0.36 for service members in the "other" category for race. White and black service members were 65% (IRR, 1.65; 95% CI, 1.52-1.80) and 59% (IRR, 1.59; 95% CI, 1.46-1.75) more likely to sustain a patellar dislocation injury compared with service members in the "other" category for race, respectively. Incidence rates, IRRs, and 95% CIs for each racial group are presented in Table 3.

Branch of military service was an important occupational risk factor for patellar dislocation. Examining the IRs by service suggests that those serving in the Marine Corps, Army, and Air Force experienced higher rates of patellar dislocation compared with those serving in the Navy (Table 4). The highest rate of injury was experienced by those serving in the Marine Corps, followed by those in

TABLE 3
Unadjusted and Adjusted Rates and Rate Ratios by Race Among United States Service Members Between 1998 and 2007[a]

	Observed		Unadjusted		Adjusted	
Demographic	Injuries	Person-Years	Rate	Rate Ratio (95% Confidence Interval)	Rate	Rate Ratio (95% Confidence Interval)
White	6715	9 463 137	0.71	1.54 (1.42-1.67)	0.59	1.65 (1.52-1.80)
Black	1971	2 650 131	0.74	1.61 (1.47-1.77)	0.57	1.59 (1.46-1.75)
Other	613	1 330 180	0.46		0.36	

[a]Rate per 1000 person-years; other referent category; adjusted for gender, age, service, and rank.

TABLE 4
Unadjusted and Adjusted Rates and Rate Ratios by Branch of Military Service Among United States Service Members Between 1998 and 2007[a]

	Observed		Unadjusted		Adjusted	
Demographic	Injuries	Person-Years	Rate	Rate Ratio (95% Confidence Interval)	Rate	Rate Ratio (95% Confidence Interval)
Marine Corps	1548	1 681 749	0.92	1.63 (1.52-1.74)	0.60	1.48 (1.39-1.59)
Army	3499	4 719 117	0.74	1.31 (1.24-1.39)	0.52	1.27 (1.20-1.34)
Air Force	2227	3 459 245	0.64	1.14 (1.07-1.21)	0.47	1.15 (1.08-1.22)
Navy	2025	3 583 337	0.57		0.41	

[a]Rate per 1000 person-years; Navy referent category; adjusted for gender, race, age, and rank.

TABLE 5
Unadjusted and Adjusted Rates and Rate Ratios by Military Rank Among United States Service Members Between 1998 and 2007[a]

	Observed		Unadjusted		Adjusted	
Demographic	Injuries	Person-Years	Rate	Rate Ratio (95% Confidence Interval)	Rate	Rate Ratio (95% Confidence Interval)
E1-E4	5723	5 950 222	0.96	4.30 (3.72-4.96)	0.86	2.95 (2.50-3.48)
E5-E9	2875	5 340 451	0.54	2.40 (2.08-2.78)	0.59	2.02 (1.73-2.36)
O1-O4	510	1 299 645	0.39	1.75 (1.48-2.07)	0.39	1.34 (1.12-1.60)
O5-O9	191	853 130	0.22		0.29	

[a]Rate per 1000 person-years; O5-O9 referent category; adjusted for gender, race, age, and service.

the Army, Air Force, and Navy. Service members in the Marine Corps were nearly 50% more likely to experience a patellar dislocation injury compared with those serving in the Navy. A complete listing of the IRs, IRRs, and 95% CIs by branch of military service is presented in Table 4.

Military rank was also associated with the incidence of patellar dislocation after controlling for the influence of age and the other variables in the statistical model. The highest adjusted IR for patellar dislocation injuries was observed in junior enlisted service members, followed by senior enlisted service members, junior officers, and senior officers. All groups experienced significantly higher rates of injury compared with senior officers. The rate of patellar dislocations was nearly 3 times higher (IRR, 2.95; 95% CI, 2.50-3.48) among junior enlisted service members, just over 2 times higher (IRR, 2.02; 95% CI, 1.73-2.36) among senior enlisted service members, and 34% higher (IRR, 1.34; 95% CI, 1.12-1.60) among junior officers. Incidence rates, IRRs, and 95% CIs by military rank are presented in Table 5.

DISCUSSION

Despite the significant morbidity and long-term sequelae after patellar dislocation, there is limited information about the epidemiology of patellar dislocation injuries, and few population-based studies have examined the incidence and risk factors associated with patellar dislocation.[2,4,10,29] Atkin et al[4] and Fithian et al[10] reported on the short- and long-term outcomes in a cohort of patients experiencing patellar dislocation injuries in the Kaiser Permanente health care system in the greater San Diego area. They reported overall unadjusted rates for patellar

TABLE 6
Comparison of Previous Population-Based Studies Calculating Incidence Rates for Patellar Dislocation Injuries

Study (Duration)	Population	Injuries	Population (Person-Years)	Age (Years)	Incidence Rate (per 1000 Person-Years)
Atkin et al[4] (3 y)[a]	Civilian, urban	74	1 102 005	11-56	0.067
Fithian et al[10] (2-5 y)[a]	Civilian, urban	125	1 944 000	10-30+	0.058
Sillanpaa et al[29] (5 y)	Military, Finnish	73	96 200	17-30	0.774
Current (10 y)	Military, United States	9299	13 443 448	17-40+	0.692

[a]Results for short- and long-term follow-up within the same cohort.

dislocation injuries that ranged between 0.058 and 0.070 per 1000 person-years in this civilian population. The overall unadjusted IR for patellar dislocation observed in the present study was 0.69 per 1000 person-years, which is an order of magnitude higher than the rates reported previously within a civilian population.[4,10] A recently published study examining the incidence and risk factors of acute traumatic patellar dislocation over a 5-year period in the Finnish military provides a more comparable IR of 0.77 per 1000 person-years; however, women were excluded from this study due to a limited number (n = 2) of documented injuries.[29] In contrast, there were over 2000 incident patellar dislocation injuries among women in the present study who contributed nearly 2 million person-years of observation. A review of prior population-based studies that have reported IRs for patellar dislocation injuries is presented in Table 6.

It is not surprising that the rates for patellar dislocation observed in the present study and previously published studies utilizing similar military populations are significantly higher than rates reported in civilian populations. The cohort studied represents a young and physically active population that has been shown to experience a number of soft tissue and athletic injuries.[20] The physical fitness and training requirements of military service increase soldiers' risk for musculoskeletal injuries in general and injury to the lower extremity[5,7,17,20] and knee specifically.[20,24] Sillanpaa et al[29] reported that 63% of the patellar dislocation injuries observed in their study of Finnish military personnel resulted from participating in sports activities with the remaining 37% resulting from military and physical training. Similarly, Fithian et al[10] reported that 61% of acute patellar dislocations in their study were the results of athletic participation. Disability and discharge due to traumatic knee injury are also common among military service members.[8,33,34] Sillanpaa et al[29] reported that 21% of service members experiencing an acute traumatic patellar dislocation never returned to active duty, and the median time loss due to injury was 51 days (range, 15-120). Extrapolating these data to the present study, patellar dislocation injuries would account for 47 430 days lost to training and 195 separations from military service due to disability annually.

According to Arendt et al,[2] patellar dislocations and subluxations have traditionally been considered a disorder affecting women. Although few population-based studies have examined the association between gender and the risk for patellar dislocation injuries, some studies suggest a male preponderance.[2,12-15] Early results reported by Atkin et al[4] lacked adequate statistical power to make meaningful comparisons between men and women. Subsequent results suggested that women experienced higher rates of primary and recurrent patellar dislocation, although once again, inadequate statistical power precluded meaningful gender comparisons.[10] Similarly, Sillanpaa et al[29] excluded injuries sustained by female service members from their analysis because only 2 patellar dislocations were experienced by female service members during the 5-year study. In the present study, female service members experienced patellar dislocation injuries at a significantly higher rate than their male counterparts. Women were 61% more likely to experience a patellar dislocation when the influences of age, race, branch of service, and rank were controlled statistically.

We observed the highest rates for patellar dislocation injuries in the youngest age group, and rates declined with increasing age. This trend was also observed in previous population-based studies,[4,10] although only crude rates were reported for a limited number of observations, especially in the older age groups.[4,10,29] This relationship between age and the incidence of injury has also been observed for shoulder dislocation and ankle sprain injuries among active-duty US service members.[5,23] This finding may be associated with increased activity levels in younger individuals and higher rates of participation in organized and recreational sporting activities. Another potential explanation for the observed relationship in the present study is that the youngest age groups typically include service members who are going through Basic Combat Training. Studies have reported high rates of acute and traumatic musculoskeletal injuries within Basic Combat Training populations.[17] Previous studies within military populations have also reported that age is associated with occupational disability after treatment for anterior cruciate ligament (ACL) injuries[8] and the failure of nonoperative management after ACL rupture.[9] More precise athletic and occupational exposure data might be useful in analyzing the role of increased activity in this observed relationship between age and the risk for patellar dislocation injuries.[18,23]

To our knowledge, the association between race and the risk for patellar dislocation has not been examined previously. We observed no difference between white and black service members; however, both of these racial groups experienced significantly higher rates for patellar dislocation compared with those in the "other" racial category.

Unfortunately, the complex heterogeneity within the "other" racial category limits our ability to make meaningful interpretations relative to this finding. These categories for race are the standard categories used within the DMSS, and our analysis and interpretation of these results are limited by the inherent characteristics associated with these data. Despite the limitations noted above, the prospect that race may be associated with patellar dislocation injuries suggests the possibility of a genetic predisposition for injury and suggests the need for further investigation in this area.

Service in the Marine Corps and Army, as well as being in the enlisted ranks, were associated with increased rates for patellar dislocation injuries. Previous studies within this population have reported similar results for shoulder dislocation[23] and ankle sprain injuries.[5] The effect of rank may reflect differences in activity levels and job responsibilities between these groups. For example, as service members achieve higher military rank, they generally take on more administrative duties, which may reduce their risk for patellar dislocation injury. Differences between branches of military service may be attributable to the unique operational mission each branch fulfills. Service members in the Marine Corps and Army must meet more rigorous physical fitness standards. Similarly, because the primary mission of the Marine Corps and Army is ground warfare, military training in these branches often requires marching for long distances over uneven terrain, negotiating obstacles, and jumping out of vehicles. All of these fitness and military training activities may place those serving in the Marine Corps and Army at increased risk for patellar dislocation injuries and other musculoskeletal injuries when compared with those serving in the Navy and Air Force. Different cultural values related to physical activity and participation in competitive sporting activities among the 4 branches of military service may also help explain the differences in the incidence of musculoskeletal injuries such as patellar dislocation. Behavioral factors such as risk propensity have been noted to play a role in increased injury risk and risk-taking behavior among younger service members and those serving in direct combat and close-support occupational groups common to the Marine Corps and Army.[16,28,31,35] The association between behavioral risk factors, risk-taking behavior, and increased rates of musculoskeletal injury among US service members warrants further investigation.

Some limitations associated with utilizing large-scale administrative databases to conduct epidemiological research should be noted with the current study and have been described previously.[5,23] The overall quality of medical surveillance data depends on the completeness, validity, consistency, timeliness, and accuracy of the data overall.[3] Despite the comprehensive nature of the injury data collected and stored in the DMSS, common data quality concerns associated with administrative health care databases cannot be overlooked.[5,23] Miscoding data at the health care provider or coding department level, as well as failure to accurately complete data records, may affect the overall quality of data contained within the DMSS. This issue is not uncommon when conducting epidemiological research using administrative databases. This may introduce some informational bias due to misclassification of the outcome of interest. Such misclassification can lead to either overestimation or underestimation of the true incidence of patellar dislocation; however, we expect that the likelihood of differential misclassification in the current study is low because patellar dislocation is a specific diagnosis, the injury data in the current study are representative of multiple providers throughout the entire military medical system, and none of the providers assessing the outcome of interest was privy to whether cases were exposed to the risk factors of interest. As a result, we expect any misclassification in the current study to be nondifferential and random in nature. The usual effect of nondifferential misclassification is that the rate ratio would be diluted and shifted toward the null.[11] Therefore, we expect that any misclassification in the current study would result in underestimating the true incidence of patellar dislocation in the study population. Furthermore, because the rates observed in the current study were very similar to rates reported recently in a similar population,[29] the effect of misclassification appears to be minimal. Another limitation is that recurrent patellar dislocation injuries were likely missed because we chose to include only the first occurrence for incident injuries per service member to document first-time dislocation events in our population. Due to the large number of injuries documented within the population at risk during the study period, it was not possible for us to confirm all cases through a review of each patient's medical records. Unfortunately, the severity of injury and associated diagnoses (eg, osteochondral fracture, hemarthrosis, medial patellofemoral ligament injury, or medial retinacular disruption) was not available for our analyses, as this would have strengthened the findings of this study. A final limitation of the injury data contained within the DMSS is that they are not linked to data that could be used to assess the effect of injuries in the present study. No data for time loss from injury, rehabilitation workload, or injury-related disability and subsequent discharge due to injury are available in the DMSS. The Department of Defense should make it a priority to coordinate medical profile and disability information into subsequent versions of the Armed Forces Health Longitudinal Technology Application (AHLTA), which is the electronic medical record for the Military Healthcare System and subsequently the Standard Ambulatory Data Record for documenting all ambulatory visits in the DMSS. Integrating standardized medical and patient outcomes generalizable to the civilian population would also greatly enhance the clinical relevance of the injury data contained within the DMSS in future studies.

Despite the limitations noted above, this study provides several strengths over previous population-based studies that have examined the incidence and risk factors for patellar dislocation injuries. Patellar dislocation injuries are relatively rare compared with other joint dislocations; for example, when comparing the results of the current investigation with prior results for glenohumeral joint dislocation in the same population, shoulder dislocations occur nearly 2.5 times more frequently.[23] Because patellar dislocation is a rare event, previous population-based

studies have identified relatively few incident injuries.[4,10,29] This has limited their ability to evaluate the role of demographic risk factors for injury and to make meaningful comparisons between groups. This study was conducted within a large and physically active population at high risk for patellar dislocation injuries. The current study used a large administrative database to examine the incidence and demographic risk factors associated with patellar dislocation, a condition that has been associated with significant long-term morbidity, and over 9000 injuries were documented during the study period. The Armed Forces Health Surveillance Center makes a concerted effort to validate the records contained within the DMSS, and all records are processed using standardized procedures.[3] The DMSS also contains accurate demographic data, and documenting person-time at risk for injury for the entire population at risk during this investigation was possible. These data are validated against data in the Defense Manpower Data Center database and document exposure from the time each patient enters military service until either he or she experiences the outcome of interest or they leave military service.[3] The data on person-time at risk within the DMSS provide excellent denominator data for calculating IRs for the entire active-duty military population and within each stratified data field.[3,30] Finally, this study evaluated the incidence and risk factors for patellar dislocation within a closed health care system in which all service members have open access to medical care. As a result, it is likely that nearly all incident injuries were documented within the DMSS during the study period.[5,23]

This study is the largest known population-based study to examine the incidence of patellar dislocation injuries. The overall IR for patellar dislocation injuries observed in the present study was similar to a recent population-based study conducted within a military population in Finland but was an order of magnitude higher compared with studies previously conducted in civilian populations. Gender, age, race, rank, and branch of military service were all important risk factors associated with patellar dislocation injuries in the current study. Notably, women experienced patellar dislocation injuries 61% more frequently compared with men. Future research should focus on further identifying modifiable risk factors for patellar dislocation injuries in high-risk populations. These factors may include behavioral factors, strength, neuromuscular control, and postural stability. This information will aid in developing injury prevention initiatives to reduce the risk of patellar dislocation injuries in high-risk populations.

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