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The Effect of Anterior Cruciate Ligament Reconstruction on the Risk of Knee Reinjury

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Background: Although there is evidence that very active, young patients are better served with anterior cruciate ligament reconstruction, there is a lack of objective data demonstrating that future knee injury is prevented by these procedures.

Hypothesis: Anterior cruciate ligament reconstruction protects against reinjury of the knee that would require reoperation.

Study Design: Retrospective cohort study.

Methods: A cohort of 6576 active-duty army personnel who had been hospitalized for anterior cruciate ligament injury from 1990 to 1996 were identified. Using the Total Army Injury and Health Outcomes Database, the authors followed these individuals for up to 9 years and collected clinical, demographic, and occupational data. These data were evaluated with bivariate and multivariable analyses to determine the effect of anterior cruciate ligament reconstruction on the rate of knee reinjury that required operation.

Results: Of the 6576 study subjects, 3795 subjects (58%) underwent anterior cruciate ligament reconstruction and 2781 (42%) did not. The rate of reoperation was significantly lower among the anterior cruciate ligament reconstruction group (4.90/100 person-years) compared with those treated conservatively (13.86/100 person-years; $P < .0001$). Proportional hazard regression analyses adjusted for age, race, sex, marital status, education, and physical activity level confirmed that anterior cruciate ligament reconstruction was protective against meniscal and cartilage reinjury ($P < .0001$). Secondary medial meniscal injury was more common than secondary lateral meniscal injury ($P < .003$). Younger age was the strongest predictor of failure of conservative management leading to late anterior cruciate ligament reconstruction ($P < .0001$).

Conclusions: Anterior cruciate ligament reconstruction protected against reoperation in this young, active population; younger subjects were more likely to require late anterior cruciate ligament reconstruction.

Clinical Relevance: Strong consideration should be given to anterior cruciate ligament reconstruction after anterior cruciate ligament injury in young, active individuals.

Keywords: adult; anterior cruciate ligament (ACL); injury; reinjury; reoperation; military; outcome study

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Disruption of the ACL is among the most frequent major musculoskeletal injuries affecting physically active men and women. Each year in the United States, more than 100 000 new cases of ACL injury are reported.[56] An estimated 50 000 to 75 000 ACL reconstructions are performed annually to prevent instability episodes and potentially improve the natural history of the injury.[25,30] However, the effect of ACL reconstruction on subsequent knee reinjury is not known. Although many comparative studies have been done regarding different methods of ACL reconstruction,[3,7,9,22,38,39,45,47,48] few studies have compared ACL reconstruction with conservative treatment in adults.[16,18,23,55]

Many small studies have noted an increased risk of secondary meniscal injury[#] and secondary chondral damage[19,29] after conservative treatment of ACL tears. Despite an uncertain natural history, it is believed that increased age, low activity level, and isolated ACL injury are associated with improved outcome for patients who are treated nonoperatively.[**] However, in many cases, it is still unclear when an ACL tear should be treated operatively.[27,31]

There is evidence that very active, young patients are better served with ACL reconstruction.[5] However, there is a lack of objective research demonstrating that future knee injury is prevented by these procedures. To date, most of the studies have been limited by the lack of a control group. This large study of more than 6500 physically active men and women assessed long-term outcome after ACL injury and compared patients undergoing ACL reconstruction with patients treated conservatively.

MATERIALS AND METHODS

The US Army Total Army Injury and Health Outcomes Database (TAIHOD) was used to investigate an active population in which subjects had a wide range of occupational roles and full access to health care. The TAIHOD is a collection of army administrative databases that have been compiled for injury prevention and health services research[2] and has been used in the past for ACL outcomes research.[21] For the current study, the following databases were linked: personnel, hospitalization, and loss from service. Unique identifiers (encrypted social security numbers) were used to link information across databases, which captured the history of a subject's condition from initial ACL-related hospitalization to the outcome event of knee reinjury that required surgery. The unique nature of the TAIHOD allowed a condition-oriented (ACL injury) approach, permitting a comparative study of treatments (ACL reconstruction vs no reconstruction).

Our initial cohort comprised all active-duty US Army personnel with an ACL-related hospitalization between 1990 and 1996. The total follow-up period extended to 1998 (9 years). To be included in the original sample, subjects met the following requirements: (1) active duty at the time of ACL-related surgery and (2) diagnosis of ACL injury confirmed at surgery during the period 1990 to 1996. Patients who had a knee-related hospitalization before 1990 or had a disability rating preceding the initial ACL-related hospitalization were excluded from the cohort. A total of 6918 hospital admissions for inpatient or outpatient surgery with a diagnostic code indicating ACL injury were identified.

The *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) diagnostic codes[46] were used to identify potential subjects with ACL injury in the principal diagnostic field. The inclusion and exclusion criteria based on ICD-9-CM diagnostic and procedure codes listed in the appendix were applied to this group of 6918 ACL injuries to limit the index cases to subjects with a single ligament injury confirmed by arthroscopy. To this end, cases were excluded based on ICD-9-CM procedure codes identified in the sample indicating nonarthroscopic procedures (eg, arthrotomy) and multiple ligament procedures. The ICD-9-CM code 81.45, "other repair of cruciate ligament," was used to designate ACL reconstruction because Current Procedural Terminology codes were not yet used by the army. An individual with an ICD-9-CM code of 81.45 within 6 weeks of his or her index hospitalization (that included a knee arthroscopy) was considered reconstructed at index, whereas subjects with this code later than 6 weeks from index hospitalization were considered late ACL reconstructions. The study cohort consisted of 6576 individuals who met the above criteria.

The outcome of interest was knee reoperation after index ACL-related hospitalization for at least a knee arthroscopy with or without ACL reconstruction. To capture all such events, 2 databases, inpatient and outpatient, were linked using unique patient identifiers. Before 1996, all surgical cases were captured in the inpatient database. After 1996, same-day surgery records were captured by the outpatient database. Hence, the inpatient database captured all reinjury events up to 1996; however, for the 3 years of follow-up time after 1996, both databases were used to capture reinjury events. If a reoperation occurred less than 6 weeks after the index case, it was not considered a reinjury because that time frame is coincident with the postoperative rehabilitation. Repeat surgery during this time is more likely to be a transfer or complication than a reinjury.

Reoperation was defined as any knee-related meniscal or cartilage injury based on follow-up diagnostic codes, as well as late ACL reconstruction. These secondary diagnoses were grouped into 4 clinically relevant categories: medial meniscal injury, lateral meniscal injury, any meniscal injury, and cartilage injury. If subjects had 1 or more of these diagnoses and a confirmatory surgical code (see the appendix), then this was considered an outcome event.

Descriptive and inferential statistics were calculated using these data. Descriptive statistics included means, medians, and SDs for continuous variables and frequencies and percentages for discrete variables. Inferential statistics were used to calculate *P* values to determine the association between the outcome (knee reinjury) and the exposure (ACL reconstruction) using bivariate analysis techniques (χ^2 and Kaplan-Meier survival curves). Cox regression analysis was also conducted to control for potential covariates of interest such as age and physical activity.

Survival analysis techniques were used to measure the time until knee reoperation between the 2 study groups. The starting point for analysis was the date of the initial ACL-related hospitalization, and the outcome of interest was knee reoperation. Subjects who had no knee reoperation because of either discharge from the army or end of the follow-up period (December 31, 1998) were censored. For example, if a subject was hospitalized in January 1990 and remained in the army during the 9-year study period without becoming reinjured, that subject contributed 9 years of follow-up time. If that same subject were to experience a knee reinjury requiring surgery 2 years after

[#]References 10, 13, 19, 24, 29, 35, 37, 40, 41, 44, 53.

[**]References 5, 11, 12, 19, 24, 26, 28, 29, 32, 34, 36, 42, 43, 49, 52, 54.

ACL-related hospitalization, 2 years of follow-up time were contributed. For a subject who entered the study in the third year with only 2 months remaining of his or her commitment and then left the army 2 months later for reasons unrelated to knee reinjury, 2 months of follow-up were contributed before this subject was censored. These standard techniques of survival analysis accommodate variable lengths of follow-up by censoring subjects who either experience the outcome (reoperation) or reach an end point (eg, army discharge or end of study period) before experiencing the outcome of interest.[33,51]

Product-limit (Kaplan-Meier) estimates of survival time were used to assess the risk of knee reoperation and the effect of ACL reconstruction. Log-rank tests for equality were used to determine whether differences in time to reoperation for meniscal or cartilage abnormalities between groups were significant (defined as $P \leq .05$). Cox proportional hazards regression models were used to assess the independent (adjusted) influence of ACL reconstruction on survival. The adjustment controls were for other factors thought to be important in the determination of ACL reconstruction or knee reinjury. This analysis produced a relative hazard, which is a measure of the influence a covariate (eg, age, sex) has on the outcome while controlling for the other covariates in the model.

Variables considered for modeling were nominal (sex, race, marital status), ordinal (education, physical activity, rank), or continuous (age). Occupational physical demands, which are determined by maximum upper body strength requirements as defined by the army,[20] were used as a surrogate for physical activity. Occupational physical demands were categorized as very light, light, moderate, moderately heavy, heavy, and very heavy. This rating scale was not applicable to officers; hence, it was only applied to enlisted personnel (5563 of 6576 subjects). For purposes of analysis, officers of all occupational areas were given a physical activity of "officer," thereby permitting comparisons between the rank of officer and those of enlisted personnel. All other variables apply to all subjects in the study. Missing values were uncommon. One variable (marital status) was missing 1.5% of values, and 3 other variables (age, race, and sex) were missing less than 0.5% of values. These missing values were imputed using PROC MI in SAS (SAS Institute, Cary, NC).

Proportional hazard models were fitted to study variables using a forced entry method using all factors of interest. No model reduction was necessary because of the robust sample size and relatively small number of covariates. The proportional hazard regression model assumes that the effects of the covariates are constant over time and that censoring occurs independent of outcome. Statistical analyses were performed using SAS for Windows 8.1 (SAS Institute) and SPSS for Windows, release 11.0 (SPSS Inc, Chicago, Ill).

RESULTS

The cohort was generally young (mean age, 30 years; range, 19-59 years), male (91%, 6010 of 6576 subjects), white (65%, 4302 subjects), and educated (75%, 4896 subjects were high school graduates). Table 1 summarizes these demographic variables by ACL reconstruction status. The mean follow-up time was 36.0 ± 25.2 months (range, 0.20-107.4 months). The median follow-up time was 29.5 months. A total of 236 464.8 months of person-time were accrued. Less than 3% of subjects changed jobs during the follow-up period.

Of the 6576 study subjects, 3795 subjects (58%) underwent ACL reconstruction, and 2781 (42%) did not. Overall, 906 (32.6%) of the 2781 subjects treated conservatively sustained a reoperation versus 483 (12.7%) of the 3795 who underwent index ACL reconstruction ($P < .001$). Of the 2781 subjects treated conservatively, 740 (27%) underwent late ACL reconstruction. As shown in Figure 1, during the 7-year index hospitalization period from 1990 to 1996, the proportion of ACL injuries resulting in reconstruction increased over time ($P < .001$).

Of the 658 total meniscal reoperations, the rate of medial meniscal reinjury (2.32/100 person-years) was higher than the rate of lateral meniscal reinjury (1.31/100 person-years). Isolated medial meniscal reinjuries were significantly more common ($P = .003$) than isolated lateral meniscal reinjuries. The rate of cartilage reinjury requiring reoperation was 2.04 per 100 person-years. The numbers and rates of these reinjuries stratified by ACL reconstruction status are listed in Table 2.

There was a statistically significant ($P < .0001$) decrease in the number of meniscal and cartilage injuries requiring reoperation in the ACL-reconstructed group as compared with the conservatively treated group. These differences are illustrated in the survival curves adjusted for age, race, sex, marital status, education, physical activity, and ACL reconstruction status as shown in Figures 2, 3, and 4 for overall reoperation, meniscal reoperation, and cartilage reoperation, respectively. The relative hazard ratios listed in Table 2 indicate that ACL reconstruction is protective against subsequent lateral meniscal injury requiring surgery (56% reduction), medial meniscal reoperation (42%), and cartilage injury requiring surgery (35% reduction). When subsequent ACL reconstruction is included as a reoperation outcome event in addition to meniscal and cartilage reoperations as an overall reoperation measure, index ACL reconstruction reduces the risk of subsequent reoperation by 66%. All of these reductions in risk were statistically significant ($P < .0001$).

Of the 2781 subjects in the group with no reconstruction, 740 (26.6%) underwent later ACL reconstruction, whereas 236 (6.2%) of the 3795 in the ACL-reconstructed group underwent later ACL reconstruction. In subanalyses of the group with no index ACL reconstruction, age, race, marital status, and an isolated cartilage or meniscal reoperation (not performed in conjunction with later ACL reconstruction) were significantly associated with a later ACL reconstruction. Specifically, married subjects were more likely to require a later ACL reconstruction compared with single subjects (hazard ratio, 1.23; 95% confidence interval [CI], 1.02-1.45; $P = .028$), blacks were less likely to undergo later ACL reconstruction (hazard ratio, 0.82; 95% CI, 0.69-0.97; $P = .021$), older subjects were less

TABLE 1
Demographic Variables by ACL Reconstruction Status

Variable	No ACL Reconstruction No.	%	ACL Reconstruction No.	%	Total	χ^2 Test, P
Sex						
Men	2531	91.0	3479	91.7	6010	.344
Women	250	9.0	316	8.3	566	
Age group, y						
19-24	583	21.0	761	20.1	1344	<.001[a]
25-29	812	29.2	1253	33.0	2065	
30-34	556	20.0	844	22.2	1400	
35-39	482	17.3	597	15.7	1079	
40-44	261	9.4	281	7.4	542	
45-49	67	2.4	49	1.3	116	
50+	20	0.7	10	0.3	30	
Race						
White	1769	63.6	2533	66.7	4302	Reference group
Black	770	27.7	883	23.3	1653	<.01
Other	242	8.7	379	10.0	621	.308
Marital status						
Married	1647	59.2	2271	59.8	3918	Reference group
Single	985	35.4	1370	36.1	2355	.87
No longer married	149	5.4	154	4.1	303	.015
Education						
General equivalency diploma	149	5.4	202	5.3	351	.883[a]
High school	2076	74.6	2820	74.3	4896	
Some college	145	5.2	183	4.8	328	
College graduate	298	10.7	425	11.2	723	
Graduate school	113	4.1	165	4.3	278	
Physical activity						
Officer	411	14.8	602	15.9	1013	
Light	42	1.5	54	1.4	96	.471[b]
Moderate	144	5.2	213	5.6	357	
Moderately heavy	369	13.3	550	14.5	919	
Heavy	59	2.1	88	2.3	147	
Very heavy	1394	50.1	1839	48.5	3233	

[a] χ^2 test for trend.
[b] χ^2 test for trend (light to very heavy).

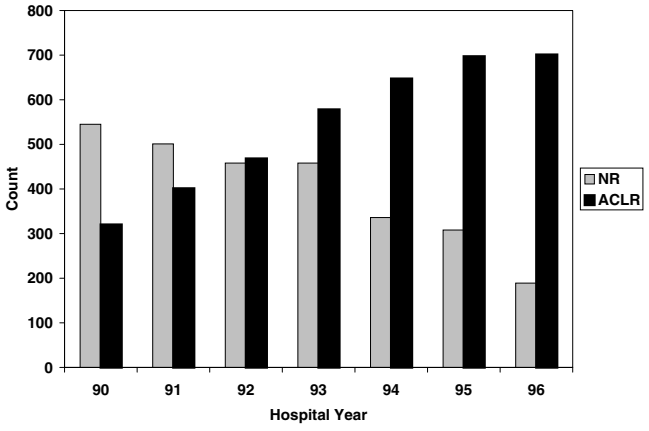

Figure 1. Anterior cruciate ligament reconstruction procedures for US Army, 1990 to 1996. NR, no reconstruction; ACLR, ACL reconstruction.

likely to have a later reconstruction (hazard ratio, 0.95; 95% CI, 0.94-0.97; $P < .001$), and those that had isolated cartilage or meniscal reoperations not performed in conjunction with a later ACL reconstruction (ie, subjects who remain ACL deficient) were more likely to ultimately require a later reconstruction (hazard ratio, 1.28; 95% CI, 1.03-1.60; $P = .027$). These findings, although statistically significant, are likely not clinically significant. The strongest predictor of requiring a later ACL reconstruction in this model was younger age; the hazard ratio was 0.95 (95% CI, 0.94-0.97), which can be interpreted as a 5% reduction in risk for each year of life. If age is treated as a categorical variable, a graded response can be seen in Table 3, which demonstrates that the older the patient at the time of ACL injury, the lower the risk of requiring a subsequent ACL reconstruction.

The number of ACL reconstructions needed to prevent one knee reoperation (number needed to treat) is 4.29

TABLE 2
Reinjury Frequencies and Rates by ACL Reconstruction Status, 1990-1998

	No ACL Reconstruction	ACL Reconstruction	Total	Adjusted Relative Hazard Ratio (95% Confidence Interval)[a]
Lateral meniscal injury				
Frequency	162	89	251	
Reinjury rate per 100 person-years	1.90	0.84	1.31	0.44 (0.34-0.57)
Medial meniscal injury				
Frequency	251	185	436	
Reinjury rate per 100 person-years	3.01	1.77	2.32	0.58 (0.47-0.69)
Cartilage injury				
Frequency	213	172	385	
Reinjury rate per 100 person-years	2.53	1.64	2.04	0.65 (0.53-0.80)
Any reoperation (including subsequent ACL reconstruction)				
Frequency	906	483	1389	
Reinjury rate per 100 person-years	13.86	4.90	8.47	0.34 (0.30-0.38)
No reinjury	2293	3432	5725	

[a]Adjusted for sex, age, race, marital status, education, and physical activity (all hazard ratios significant at $P < .0001$).

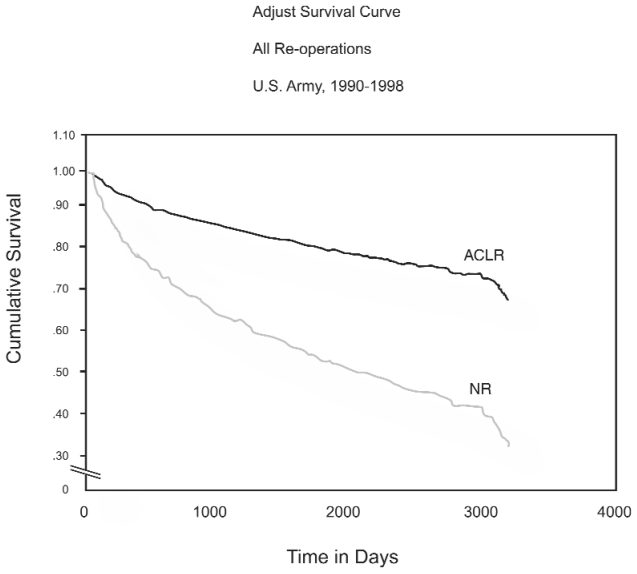

Figure 2. Influences of index ACL reconstruction on time to reoperation adjusted for age, race, sex, marital status, education, and physical activity. ACLR, ACL reconstruction; NR, no reconstruction.

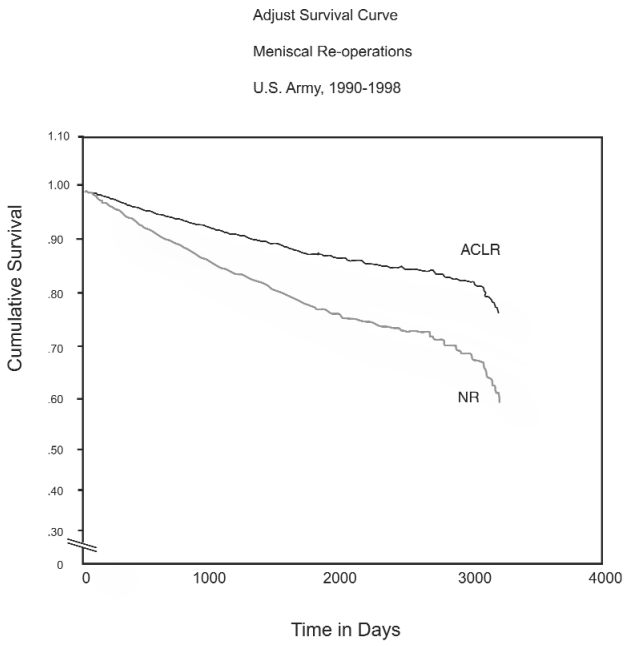

Figure 3. Influences of index ACL reconstruction on time to meniscal reoperation adjusted for age, race, sex, marital status, education, and physical activity. ACLR, ACL reconstruction; NR, no reconstruction.

(95% CI, 4.27-4.32), 5.01 (95% CI, 4.96-5.06), and 4.71 (95% CI, 4.58-4.85) at 2, 5, and 8 years after the initial hospitalization/arthroscopy, respectively.

Clinical data were obtained from ICD-9-CM coding, which does not include a laterality indicator. Hence, the proportion of reoperations that occurred on the same side is unknown. This could introduce bias into the study if contralateral reinjuries were not equally distributed between the 2 groups. If more contralateral reinjuries occurred in the conservatively treated group, falsely elevating the number of reinjuries to the index knee, the results could be biased in favor of ACL reconstruction. A sensitivity analysis was performed to determine the percentage of contralateral reinjuries that would need to be present in the conservative group to change the results. If up to 40% of lateral meniscal injuries, 30% of medial meniscal injuries, and 25% of cartilage injuries were on the contralateral side in the conservatively treated group, without any misclassification relating to contralateral surgery in the ACL-

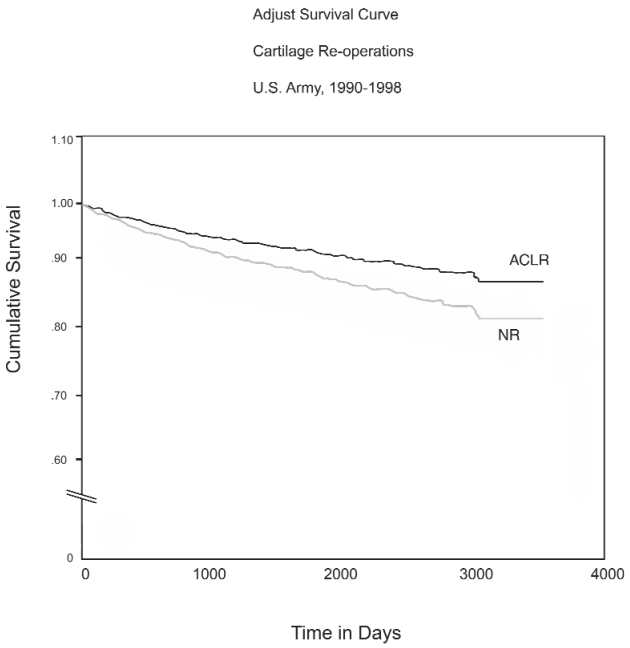

Figure 4. Influences of index ACL reconstruction on time to cartilage reoperation adjusted for age, race, sex, marital status, education, and physical activity. ACLR, ACL reconstruction; NR, no reconstruction.

TABLE 3
Risk of Subsequent ACL Reconstruction in the No Reconstruction Group Stratified by Age Category

Covariate	Adjusted Hazard Ratio (95% Confidence Interval)	*P*
Age category, y		
< 29	10.02 (3.68-27.28)	<.001
30-34	8.54 (3.15-23.15)	<.001
35-39	6.99 (2.57-18.98)	<.001
40-44	4.60 (1.67-12.89)	.003
45+	Reference group	

reconstructed group, there would still be a statistically significant difference ($P < .05$) in reoperation rate.

DISCUSSION

To our knowledge, this is the largest epidemiologic study comparing rates of reoperation in patients who have had ACL reconstruction to the rates of reoperation in patients treated conservatively. These results suggest that ACL reconstruction is protective against subsequent knee reinjury requiring surgery. Multivariable analyses confirmed this finding, and after adjusting for many covariates including physical activity, ACL reconstruction reduced the risk of subsequent meniscal surgery by about half and cartilage surgery by a third.

Subsequent ACL reconstruction after initial conservative treatment occurred in 26% of the controls. Other investigators have found similar later reconstruction frequencies. Barrack et al[5] reported 35% late reconstructions in a military population initially treated conservatively, and Daniel et al[18] reported a 16% frequency of late reconstruction.

Figure 1 shows that conservative management was more common than ACL reconstruction during the first 2 years of the study and that ACL reconstruction became increasingly common during the study period ($P < .001$). This trend may reflect the belief that ACL reconstruction is beneficial in high-demand individuals, based on improved surgical technique that evolved in the late 1980s and early 1990s. This study was limited to the 1990s to reflect modern ACL reconstruction techniques; however, surgical ability, indications for surgery, and technique may have varied throughout the study. The fact that there was relatively more person-time contributed from ACL reconstruction cases later in the study period was accounted for by survival analysis methodology and, therefore, did not influence the results because adequate follow-up time was available for early ACL reconstructions. Furthermore, the follow-up period continued for 2 years after the cohort entry period ended. The increase in the percentage of cases treated with reconstruction over the course of the study may be because of the awareness that early ACL reconstruction for young patients allows full return to activities.

Although it is known that women are at increased risk for ACL injury,[17,56] the current study did not find women to be at increased risk of knee reinjury. Although our population was largely male, we did not find gender to be a significant factor, which is consistent with the results of Barber-Westin et al.[4] Nor was there a statistically significant difference in the rate of ACL reconstruction between sexes ($P = .443$).

Barrack et al reported on 107 patients in the military who were treated nonoperatively, and they found that complete ACL disruption was associated with a high incidence of meniscal tears.[6] Smith et al showed in a dog model that the medial meniscus was prone to injury over time after ACL disruption,[50] and several authors have noted that medial meniscal tears are more common with chronic ACL deficiency compared with lateral meniscal tears, which are more common after acute ACL disruption.[1,8,15] Our data support these findings. The rate of medial meniscal reinjury was higher than the rate of lateral meniscal reinjury (Table 2).

This study was not able to capture those subjects who had ACL injury but were not hospitalized for initial surgery. The administrative database used in this study did not include data on injury severity. Some investigators have considered hospitalization an indicator of severity,[14] but this assumption is not valid for the current study population because hospitalization was the standard of care for part of the study period. Also, knee function, symptoms, and quality of life could not be assessed using the available data.

The sensitivity analysis suggested that the findings of this study are robust despite the lack of information on lat-

erality. In one of the few epidemiologic studies investigating outcomes of operative versus nonoperative treatment for ACL injury, Daniel et al studied a group of 292 patients at the Kaiser Medical Center and found that 30% had reoperation on the index knee whereas only 3% had reoperation on the nonindex knee.[18]

The current study involved the index hospitalization, which does not necessarily indicate the initial time of the injury or event. Following subjects from index hospitalization allows only a partial view of the natural history. Another limitation of this study was selection bias. The administrative database did not include clinical detail, such as what criteria were used to determine whether operative or nonoperative treatment was provided to a given patient. However, if selection bias was related to injury severity and higher activity level in which only the most severe and very active cases were reconstructed, this would bias the results toward the null. Also, this population was studied under the assumption that it is a representative sample of an active adult population. Although the army is one of the largest employers in the United States and offers a wide variety of occupations, many of which are directly comparable with civilian occupations, generalizing these findings to civilians requires caution.

Although retrospective follow-up studies using administrative databases have limitations, it is not feasible to conduct a randomized clinical trial for the preventive benefit of ACL reconstruction for secondary meniscal and cartilage injury because of a lack of equipoise. In other words, most orthopaedic surgeons are convinced that ACL reconstruction is beneficial for very active patients, so they would likely be unwilling to randomize their patients to ACL reconstruction versus no ACL reconstruction.

In conclusion, ACL reconstruction was protective against subsequent meniscal and cartilage injury requiring surgery. As compared with those not reconstructed, ACL reconstruction decreased the risk of a subsequent meniscal reoperation by half and subsequent cartilage reoperation by a third. These data suggest that the rate of reoperation after ACL injury may be decreased with ACL reconstruction, particularly in younger persons. Results demonstrate that medial meniscal injury is more common than lateral meniscal injury after ACL disruption, and both are more common in those who do not undergo ACL reconstruction. These results have important implications for the treatment of ACL deficiency in relatively young, active individuals.

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APPENDIX
Inclusion and Exclusion Criteria[a]

	ICD-9-CM Procedure Code	Description	ICD-9-CM Diagnostic Code	Description
Exclusion	81.22	Knee fusion	844.0	Lateral collateral ligament sprain
	81.46	Other repair of collateral ligaments	844.1	Medial collateral ligament sprain
	81.54	Total knee replacement	717.84	Posterior cruciate ligament sprain
	81.55	Revision total knee		
	81.43	Triad knee repair		
	81.42	Five-in-one repair of knee		
	84.3	Revision of stump		
	77.06	Sequestrectomy, patella		
	77.09	Sequestrectomy, other		
	79.76	Closed reduction of knee dislocation		
	80.16	Arthrotomy of knee		
	80.06	Arthrotomy for removal of prosthesis		
Inclusion	77.66	Local excision of lesion or tissue of bone, patella		
	77.76	Excision for bone graft, patella[b]		
	77.77	Excision for bone graft, tibia[b]		
	78.06	Bone graft, patella[b]		
	83.41	Excision of tendon for graft[b]		
	83.81	Tendon graft[b]		
	81.45	Other repair of cruciate ligament		
	80.6	Excision of semilunar cartilage of knee		
	80.26	Knee arthroscopy		
	80.46	Division of joint capsule, ligament, or cartilage of knee		
	80.76	Synovectomy of knee		
	80.86	Other local excision or destruction of lesion of joint of knee		
	80.96	Other excision of joint of knee		
	81.47	Other repair of knee		

[a]ICD-9-CM, *International Classification of Diseases, 9th Revision, Clinical Modification.*
[b]Possibly related to bone-tendon-bone graft harvest.