DEVELOPMENT AND INITIAL RESULTS FROM AN INJURY SURVEILLANCE SYSTEM FOR U.S. ARMY RECRUITS DURING BASIC TRAINING

ANDREA HARRIS, KEITH G. HAURET, ELIZABETH CLEARFIELD, BRUCE H. JONES, FACSM: ARMY INSTITUTE OF PUBLIC HEALTH, ABERDEEN PROVING GROUND, MD

ABSTRACT

BACKGROUND: Injury rates for new recruits in Army Basic Combat Training (BCT) are among the highest rates in the Army. A recent initiative to reduce injuries in BCT (10 weeks) included development and implementation of a first-ever surveillance system to track and report injury rates for individual BCT classes and training companies, rather than for the training center as a whole.

STATEMENT OF PURPOSE: To describe the development of and results from a class and unit-level injury surveillance system at the Army's largest BCT center.

METHODS/APPROACH: Rosters data for classes that began BT from October 2010 to September 2011 were linked to outpatient injury encounter data. Recruits with one or more injuries were identified using two injury indices: the Any Injury Index (AII) and the Lower Extremity Overuse Injury Index (LEOUII). Descriptive statistics included injury incidence (percent of recruits with an injury) for each class, and the incidence for all classes with the range (R).

RESULTS: There were 197 BCT classes during this 12-month period. Recruits entering BCT consisted of 27,704 men and 10,487 women. For BCT classes, the overall AII incidence for men was 37.6% (class range: 10.0%– 64.5%) and for women was 65.9% (range: 38.8% – 92.8%). The LEOUII incidence for men was 19.3% (range: 6.0% –34.2%) and for women was 45.8% (range: 17.4% – 77.4%).

CONCLUSIONS: This class-level injury surveillance provided the first opportunity to monitor injuries in individual training classes and units during Army BCT. The injury surveillance system showed that women in BCT consistently experience higher incidence of injury than men. The data also showed that the greatest amount of variation in injury incidence occurred at the class level. This information could be of value in targeting prevention strategies.

SIGNIFICANCE/ CONTRIBUTION TO THE FIELD: This analysis shows the kind of surveillance that is possible when complete medical records (numerator) and population (denominator) data are available.

BACKGROUND

Injury rates for new recruits in Army Basic Combat Training (BCT) are among the highest rates in the Army. Prior research has shown a cumulative incidence of injuries of 37% for men and 63% for women (Knapik, 1998).

The 10-week BCT course is the first training provided to new recruits. Class size during BCT averages 193 recruits, of which 28% are women. Men and women train side-by-side during all training events.

A recent initiative to reduce injuries during the BCT course included the development and implementation of a first-ever surveillance system to track and report injury rates for individual BCT classes and the Army units that conduct training (training companies and battalions), rather than for the training center as a whole as in the past. Two injury indices were developed for this surveillance. These are the "Any Injury Index" (AII) and "Lower Extremity Overuse Injury Index" (LEOUII).

The purpose of this study was to describe the development of and results from a class and unit-level injury surveillance system at the Army's largest BCT center and to examine injury trends to identify class and unit-level factors that affect injury risk during BCT.

METHODS/APPROACH

Study sample

Class rosters for all BCT classes (n=197 classes) conducted at the Army's largest BCT installation between 1 October 2010 and September 2011 were obtained from the Army Training and Doctrine Command. Class roasters provided demographics for men and women recruits in classes, identified the training unit, and provided the start and ends dates for classes. Injury encounter data with standardized diagnosis codes were obtained from the Defense Medical Surveillance System and were linked to the roster data. Recruits with one or more injuries were identified using two injury indices: Any Injury Index (AII) and the Lower Extremity Overuse Injury Index (LEOUII). This second index was developed because previous studies have shown that 83% to 87% of BCT injuries are overuse injuries of the lower extremities (Knapik, 1998).

Data collection

IBM Statistical Package for Social Sciences (SPSS) version 19.0 was used to analyze the data. Descriptive statistics included injury incidence (percent of recruits with an injury) for men and women in each class, and the overall incidence and incidence range (R) for all classes conducted by each training unit (battalion). The overall risk ratio and 95% confidence intervals (95% CI) were calculated for each battalion to compare injury incidence among women to the incidence for men.

RESULTS

There were 197 BCT classes during this 12-month period that trained 27,703 men and 10,485 women. Figure 1 shows the injury incidence for the two injury indices for men and women during the 12-month period. For Basic Combat Training classes, women had a higher incidence of Any Injury Index (AII), 65.3% (range: 38.8% – 92.8%) compared to men 37.6% (range: 10.0% – 64.5%). The injury incidence from the Lower Extremity Overuse Injury Index (LEOUII) for women was also greater (45.4% [range: 17.4% – 77.4%]) compared to men (19.1% [range: 6.0% – 45.4%]).

Figure 1 Overall Injury Incidence from the Any Injury Index (AII) and Lower Extremity Overuse Injury Index (LEOUII) for All Soldiers in Basic Combat Training by Gender.

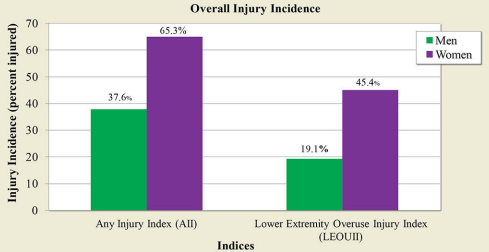


Table 1 shows the injury incidence and risk ratio (men and women) using the Any Injury Index (AII) (LEOUII) for each battalion and the incidence range for all classes trained by the battalion. Women had a statistically significant higher injury risk for the AII (RR=1.7; 95% CI=1.67, 1.76) compared to men.

Table 1 Injury Incidence range and Risk Ratio of Any Injury Index (AII) for Men and Women by Battalion and Class

Any Injury Index (AII)		Men			Women			Risk Ratio (Women:Men)	
Battalion	Number of Classes Trained	Soldiers Trained (N)	Percent Injured[1] (%)	Range for Percent Injured for Classes (min-max)	Soldiers Trained (N)	Percent Injured (%)	Range of Percent Injured for Classes (min-max)	Risk Ratio (RR)	95% Confidence Interval (CI)
1	24	3494	33.6	10.0 - 58.0	1266	60.6	38.8 - 85.0	1.8	(1.69, 1.92)
2	19	2694	39.8	26.9 - 60.2	997	70.9	58.5 - 83.3	1.8	(1.66, 1.88)
3	15	2177	38.9	22.6 - 53.7	910	72.1	57.3 - 86.7	1.9	(1.74, 1.98)
4	24	3756	34.2	20.6 - 53.6	1337	62.2	52.5 - 82.9	1.8	(1.71, 1.93)
5	29	3290	41.9	18.8 - 64.5	1617	66.2	45.3 - 89.4	1.6	(1.49, 1.67)
6	21	3279	38.9	26.9 - 56.5	1307	65.1	54.2 - 80.0	1.7	(1.58, 1.78)
7	24	3449	34.9	22.2 - 57.5	1211	59	44.1 - 74.4	1.7	(1.58, 1.81)
8	18	2290	37.2	23.9 - 53.0	778	68.5	48.1 - 92.9	1.8	(1.11, 1.25)
9	23	3275	40.6	27.8 - 56.8	1064	68.2	41.3 - 90.0	1.7	(1.59, 1.78)
Total	**197**	**27704**	**37.6**	**10.0 - 64.5**	**10487**	**65.3**	**38.8 - 92.9**	**1.7**	**(1.67, 1.76)**

[1]Percent Injured = (number injured/number trained x 100)
[2]Risk Ratio = (percentage of women injured/percentage of men injured)

Similarly, **Table 2** shows the injury incidence and risk ratio using the Lower Extremity Overuse Injury Index for each battalion and the classes trained by the battalion. Women also had a statistically significant higher injury risk for LEOUII (RR=2.4; 95% CI=2.32, 2.50) compared to men.

Table 2 Injury Incidence range and Risk Ratio of Lower Extremity Overuse Injury Index (LEOII) for men and women by battalion and class

Lower Extremity Overuse Injury Index (LEOII)		Men			Women			Risk Ratio (Women:Men)	
Battalion	Number of classes	Soldiers Trained (N)	Percent Injured[1] (%)	Range of Percent Injured for Classes (min-max)	Soldiers Trained (N)	Percent Injured (%)	Range of Percent Injured for Classes (min-max)	Risk Ratio (RR)	95% Confidence Interval (CI)
1	24	3494	17.5	6.7 - 33.0	1266	44.5	21.7 - 71.8	2.5	(2.31, 2.79)
2	19	2694	22.5	12.4 - 42.4	997	49.6	29.2 - 69.2	2.2	(2.01, 2.42)
3	15	2177	19.5	11.7 -30.3	910	53.8	37.6 - 70.0	2.8	(2.48, 3.06)
4	24	3756	18.1	8.5 - 32.1	1337	42.3	18.5 - 58.5	2.3	(2.13, 2.56)
5	29	3290	20.2	10.9 - 33.6	1617	44.9	26.0 - 71.4	2.2	(2.03, 2.42)
6	21	3279	20.2	7.9 - 29.2	1307	46.8	29.3 - 64.0	2.3	(2.12, 2.53)
7	24	3449	15.1	6.0 - 21.8	1211	37.1	19.6 - 60.5	2.5	(2.19, 2.73)
8	18	2290	20.7	9.4 - 31.3	778	49.1	28.2 - 60.7	2.4	(2.13, 2.64)
9	23	3275	19.5	7.2 - 34.2	1064	45.2	17.4 -77.4	2.3	(2.11, 2.55)
Total	**197**	**27704**	**19.1**	**6.0 - 42.4**	**10487**	**45.4**	**17.4 - 77.4**	**2.4**	**(2.32, 2.50)**

[1]Percent Injured = (number injured/number trained x 100)
[2]Risk Ratio = (percentage of women injured/percentage of men injured)

Figures 2 and 3, display the variability of injury incidence for men and women, respectively, within 2 battalions, comprised of 11 training companies, and 43 classes. Injury incidence is displayed for the Any Injury Index (AII). The AII was chosen to demonstrate the variability of incidence at the class-level because it accounted for all injuries and had a greater variation. Battalions 1 and 2 were chosen to show the differences within classes because they had the lowest (Battalion 1) and highest (Battalion 2) incidence in relation to other battalions.

In **Figure 2,** the greatest variability in the class-level injury incidence for the AII among men was illustrated by units D-1 and G-2 and the overall incidence was lower in Battalion 1 (33.6%) compared to Battalion (2) 39.8%. In **Figure 3**, the greatest variability was noted in units B-1 and G-2, and the overall incidence was lower in Battalion1 (60.6%) compared to Battalion 2 (70.5%).

Figure 2 Variability of Injury Incidence of Any Injury Index (AII) for Men in 43 Classes (11 Companies) in Two Battalions for Basic Combat Training

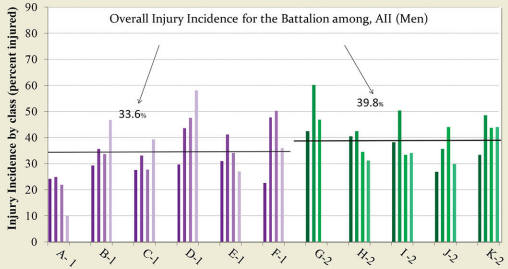
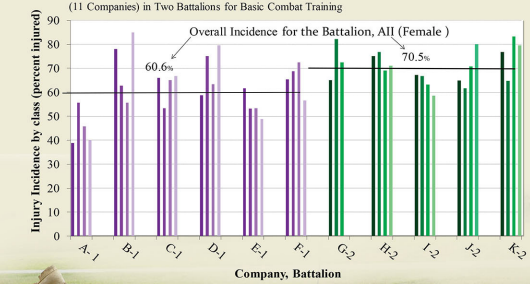


Figure 3 Variability of Injury Incidence of Any Injury Index (AII) for Women in 43 Classes (11 Companies) in Two Battalions for Basic Combat Training



CONCLUSIONS

Men and women trained side-by-side in this controlled environment. But women had an overall higher incidence of injury by both injury indices, and consistently experienced a higher relative risk of injury than men within battalions and classes. This finding is consistent with previous studies of Army BCT (Jones BH et al. Am J Sports Medicine, 1993, Knapik JJ et al. MSSE 2001).

This class-level injury surveillance system demonstrated the feasibility of monitoring trends in injuries at the level of individual training classes and units during Army Basic Combat Training. It also showed that there is substantial variation in the incidence of injuries between classes suggesting that the class or unit is the place to prevent injuries. Classes with high injury incidences, especially those with consistently high injury incidences, present clear targets for injury prevention.

SIGNIFICANCE/ CONTRIBUTION TO THE FIELD

The results from this surveillance system illustrate that the first step in the public health process to identify and monitor injuries is feasible in Army BCT. The data show what is possible with complete medical records (numerator) and population (denominator) data, such as the Army possesses. The preliminary findings from the surveillance system indicate that sub-populations at higher risk, such as women, can be identified and potentially targeted for tailored interventions. Also, the findings of this surveillance system show that the greatest amount of variation in injury incidence occurs at the class or unit level, which is the level at which physical training programs are conducted. This suggests that the class, the lowest level at which the training that produces injuries occurs, may be the level at which to target training-related injury prevention strategies. The future success of focused prevention efforts in Army BCT populations may establish a model for injury prevention in other populations.

REFERENCES

Knapik JJ, Hauret K, Canham-Chervak M, Arnold S, Barker T. Multivariate analysis of intrinsic injury risk factors in a cohort of US Army basic trainees. Medicine and Science in Sports and Exercise 33:S6, 2001.

Knapik JJ, Cuthie J, Canham M, Hewitson W, Laurin MJ, Nee MA, Hoedebecke E, Hauret K, Carroll D, Jones BH. Injury Incidence, Injury Risk Factors, and Physical Fitness of U.S. Army Basic Trainees at Ft Jackson, SC, 1997. Epidemiological Consultation Report No 29-HE-7513-98, Army Center for Health Promotion and Preventive Medicine, Aberdeen Proving Ground, MD, 1998.