# The Value of Surveys to Identify Modifiable Causes and Risk Factors for Injuries in Hard to Follow Populations: Example from Deployed Male U.S. Army Soldiers

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**Abstract:** Injuries are a leading health problem for the US Army, but knowledge concerning deployment-related injuries is limited.

**Purpose:** Identify modifiable injury risk factors for male U.S. Army Soldiers during deployment.

**Methods:** Participants were 1,960 males from a light infantry brigade who recently returned from deployment. Personal characteristics, physical activity, health risk behaviors and injury during deployment were collected by questionnaire. Multivariate logistic regression was used to calculate odds ratios (OR) and 95% confidence intervals (95% CI).

**Results:** Participants were 27.5±5.8 years of age. Injury incidence during deployment was 30.4% with 74.2% of injuries being new injuries. Activities in which an injury occurred included: Lifting or moving heavy objects (19.9%), walking, hiking, or marching (19.7%), Unit physical training (15.7%), stepping or climbing (10.6%) and sports/recreation (4.1%). Older, heavier males had a higher risk of injury compared to younger Soldiers and Soldiers within normal weight limits (OR(31 years or older/younger than 22 years)= 1.80, 95%CI 1.20-2.69) and (OR(Obese/Normal)= 2.17, 95%CI 1.40-3.36), respectively. Deployed males averaging 7 or more miles per day foot patrolling had a higher injury risk than those averaging 2 or less miles per day (OR(7or more/2 or less)= 2.23, 95%CI 1.40-3.56). In addition, results suggested that those participating in sports 3 or more times per week were less likely to be injured than those participating less than 3 times per week (OR(3 or more/less than3)= 0.65, 95%CI 0.41-1.05).

**Conclusions:** BMI, foot patrol distance, and sports participation are modifiable injury risk factors among deployed male Army Soldiers.

## Background

One of the biggest health concerns facing the U.S. military is injuries [1]. Medical records have shown over 1.8 million encounters affecting more than 800,000 military service men and women occur each year [2]. Although injuries in U.S. Army recruits have been well studied [3-6], few investigations have examined injuries among deployed Army soldiers are limited [7]. The purpose of this investigation is to identify modifiable risk factors for injuries among deployed soldiers.

## Methods

During the months of June and July in 2012, a light U.S. Army infantry brigade completed a questionnaire following their deployment to Afghanistan in support of Operation Enduring Freedom. There were 1,960 male and 133 female Soldiers who completed the survey. The survey included descriptive measures, such as age, height, weight, and rank, as well as physical activities, health risk behaviors, and injuries during deployment. Because of the limited female data, only male soldiers were included in this analysis.

BMI was calculated from self-reported height (m) and weight (kg) as kg/m$^2$. The Centers for Disease Control and Prevention guidelines for BMI classification were used [(Underweight=<18.5) (Normal=18.5-24.9) (Overweight=25.0-29.9) (Obese=≥30.0)] [8]. An individual smoking more than 100 cigarettes in their lifetime and at least one cigarette in the last 30 days was considered a smoker.

Data analysis was conducted using PASW (IBM SPSS) version 19. Univariate logistic regression was used to determine variables to enter into the multivariate logistic regression model; variables with a p-value less than 0.05 were entered into the model. Odds ratios (OR) and 95% confidence intervals (95% CI) were calculated.

## Results

Of the 1,960 participants, 30.4% reported an injury while deployed with 74.2% of those injuries listed as 'new injuries'. Participants were 27.5±5.8 years of age. The average BMI was 26.1±3.2 kg/m$^2$. Percentages for Underweight, Normal, Overweight, and Obese Soldiers were 0.4%, 35.4%, 52.9% and 11.3% respectively. Among the Soldiers, 42.7% were classified as smokers.

Variables considered for the multivariate logistic regression model included age, BMI, smoking status, rank, APFT scores (push-ups, sit-ups, 2-mile run time), total distance run per week, foot patrolling, and sports participation. Table 1 shows the results of the univariate analysis.

**Table 1.** Univariate associations between questionnaire variables and injury risk among deployed males

| Variable | Strata | N | Odds ratio (95% CI) | p-value |
|---|---|---|---|---|
| Age | ≤22.9 years | 377 | 1.00 | Referent |
| | 23.0-25.9 years | 485 | 1.05 (0.69-1.60) | 0.83 |
| | 26.0-30.9 years | 558 | 1.21 (0.80-1.84) | 0.37 |
| | ≥31.0 years | 481 | 1.85 (1.17-2.91) | <0.01 |
| | | | | |
| BMI | <18.5 kg/m$^2$ | 6 | 1.57 (0.28-8.64) | 0.61 |
| | 18.5-24.9 kg/m$^2$ | 674 | 1.00 | Referent |
| | 25.0-29.9 kg/m$^2$ | 1005 | 1.51 (1.21-1.88) | <0.01 |
| | ≥30 kg/m$^2$ | 211 | 2.12 (1.53-2.93) | <0.01 |
| | | | | |
| Smoking Status | Smoker | 811 | 1.11 (0.91-1.36) | 0.57 |
| | Non-smoker | 1085 | 1.00 | Referent |
| | | | | |
| Rank | Enlisted (E1-E9) | 1793 | 1.00 | Referent |
| | Officer (O1-O10) | 106 | 0.70 (0.44-1.10) | 0.12 |
| | Warrant Officer (W1-W5) | 9 | 2.83 (0.76-10.56) | 0.12 |
| | | | | |
| Push-ups | ≤ 55 | 407 | 1.00 | Referent |
| | 56-66 | 401 | 0.99 (0.73-1.33) | 0.93 |
| | 67-76 | 449 | 0.97 (0.73-1.30) | 0.84 |
| | 77 or more | 414 | 0.93 (0.69-1.26) | 0.64 |
| | | | | |
| Sit-ups | ≤ 60 | 548 | 1.00 | Referent |
| | 61-67 | 301 | 0.94 (0.69-1.27) | 0.69 |
| | 68-76 | 422 | 1.02 (0.78-1.34) | 0.89 |
| | 77 or more | 398 | 0.72 (0.54-0.96) | 0.03 |
| | | | | |
| 2-mile Run Time | ≤ 14.03 minutes | 359 | 1.00 | Referent |
| | 14.04-14.93 minutes | 369 | 0.84 (0.60-1.16) | 0.29 |
| | 14.94-15.83 minutes | 352 | 1.15 (0.83-1.58) | 0.41 |
| | 15.84 minutes or more | 316 | 1.35 (0.97-1.87) | 0.08 |
| | | | | |
| Total Distance Run | Did Not Run | 313 | 1.00 | Referent |
| | 1 to 5 miles | 1233 | 0.76 (0.58-0.99) | 0.04 |
| | 6 to 10 miles | 297 | 1.04 (0.74-1.45) | 0.83 |
| | More than 10 miles | 26 | 0.45 (0.17-1.23) | 0.12 |
| | | | | |
| Sports Activity | <3 days/week | 999 | 1.00 | Referent |
| | 3 or more days/week | 109 | 0.65 (0.41-1.05) | 0.05 |
| | | | | |
| Foot Patrol | ≤2 miles/day | 326 | 1.00 | Referent |
| | 3-6 miles/day | 677 | 1.31 (0.98-1.77) | 0.07 |
| | 7 or more miles/day | 105 | 2.23 (1.40-3.56) | <0.01 |

Interestingly, smoking was not found to be an injury risk factor as previously reported. [9-10] Rank, APFT scores, smoker/non-smoker and total distance run per week were dropped from the model during analysis. Table 1 shows the results of the multivariate logistic regression model.

**Table 2.** Multivariate associations between questionnaire variables and injury risk among deployed males

| Variable | Strata | N | Odds ratio (95% CI) | p-value |
|---|---|---|---|---|
| Age | ≤22.9 years | 247 | 1.00 | Referent |
| | 23.0-25.9 years | 314 | 1.10 (0.75-1.60) | 0.63 |
| | 26.0-30.9 years | 320 | 1.15 (0.79-1.67) | 0.48 |
| | ≥31.0 years | 227 | 1.80 (1.20-2.69) | <0.01 |
| | | | | |
| BMI | <18.5 kg/m$^2$ | 4 | 2.91 (0.40-21.0) | 0.29 |
| | 18.5-24.9 kg/m$^2$ | 394 | 1.00 | Referent |
| | 25.0-29.9 kg/m$^2$ | 587 | 1.54 (1.14-2.07) | <0.01 |
| | ≥30 kg/m$^2$ | 123 | 2.17 (1.40-3.36) | <0.01 |
| | | | | |
| Sports Activity | <3 days/week | 999 | 1.00 | Referent |
| | 3 or more days/week | 109 | 0.65 (0.41-1.05) | 0.05 |
| | | | | |
| Foot Patrol | ≤2 miles/day | 326 | 1.00 | Referent |
| | 3-6 miles/day | 677 | 1.31 (0.98-1.77) | 0.07 |
| | 7 or more miles/day | 105 | 2.23 (1.40-3.56) | <0.01 |

## Implications

Because of the large burden injuries have on the U.S. Armed Forces [1], it is important to identify potentially modifiable injury causes and risk factors. Not only is an injury detrimental to the individual Soldier, but also to the military unit's ability to be combat-ready. In consonance with a previous study [11], older males engaged in longer foot patrols have a higher risk of injury during deployment. However, unlike the study conducted by Hauret et al. [7], more frequent sports activities did not increase injury risk among the Soldiers surveyed.

The findings of this survey illustrate the value of self-reported data in identifying modifiable health hazards. According to this analysis, special attention should be placed on BMI, leisure-time sports activity and physical demands of operational activities, such as patrolling, among deployed troops. These findings are consistent with previous prospective Army cohort studies. [12-13, Knapik et al. U.S. Army Institute of Public Health, unpublished data,2007]

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