Injury and Illness Incidence in a Sergeants Major Academy Class

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ABSTRACT Purpose: This study examined the incidence and risk factors for training injuries and illnesses for 149 male and 6 female U.S. Army Sergeants Major Academy students. Methods: This was a retrospective report based on injuries and illnesses that occurred during 9.5 months of physical fitness training including running, marching, and calisthenics. During this time, 49.7% (74/149) students were injured at least once. The crude incidence rate was 5.2 injuries (68.9%), and accounted for 1749 limited duty days (LDD). The most common overuse injuries were pain, muscle strain, and tendinitis/bursitis involving primarily the lower extremities and lower back. For illnesses, 63.1% (94/149) of the students had one or more illness visits to a medical facility. The crude incidence rate was 6.6 illnesses per 100 soldiers per month. Infectious illnesses were the most frequent illness reported (48.3%), and 94 students had a total of 311 days of illness-associated LDD. Conclusions: Medical record reviews revealed that musculoskeletal injuries were the major cause of LDD during physical fitness training. Overuse lower extremity and lower back injuries were the most commonly reported injuries. Respiratory bacterial and viral infectious illnesses were the most commonly reported illnesses. Alcohol consumption was a risk factor for developing infectious illnesses. Cigarette smoking was associated with slower 2-mile run times when compared with history of nonsmoking.

INTRODUCTION

The Sergeants Major Academy (SGMA) places great emphasis on physical fitness training because it is an important component of combat readiness. Combat readiness drills include ruck sack marching, sand bag circuit training, and guerilla drills. As a result, the training-related incidence of injuries and illnesses can be high because most are not prepared for these forms of training.[1–4] This can be costly in terms of lost training time and also can have an impact on the medical care system in terms of man power usage and medical treatment costs. Collecting medical data from clinic records allows researchers to study the incidence and types of training-related injuries and illnesses that may assist in developing countermeasures to reduce such occurrences.

Several injury risk factors have been identified in recent military studies.[1,5–7] Individuals who smoke cigarettes are more likely to incur an injury during physical training and operational activities.[1,4] Smoking history has been reported as a risk factor for injury in male and female Army basic trainees.[1,4,7] Reynolds et al[4] reported a higher incidence of lower extremity injuries among smokers in an infantry battalion. Jones et al[6] reported that male basic trainees with the highest (19.0 kg/m^2) and the lowest (31.0 kg/m^2) body mass index (BMI) were at a greater risk of injury. Slow run times (over 10 min/mile average) have also been identified as a risk factor for injury in male[5] and female basic trainees[5,6] and male infantry soldiers.[3]

Reynolds et al[4] examined risk factors for illness during training and found that female recruits reporting to basic training with a low iron status (serum ferritin <20 mg/mL) had a higher likelihood of developing an infectious illness than other female recruits. In addition, Blake et al[8] reported an increase in respiratory infections among male and female recruits who were smokers.

Previous reports have primarily examined the incidence of illness and injury among younger soldiers.[9] The primary focus of this study is to examine (1) the incidence of illness and injury among a population of older soldiers (average age is 42) and (2) the risk factors that may contribute to the occurrence of illness and injury among this population that were attending a 9½-month military training course.

METHODS

Description of SGMA Course

The SGMA program is a 9½-month course designed to provide the total Army with competent, confident Sergeants Major and Command Sergeants Major soldiers who are better able to serve in a force protection environment. The SGMA course is a task-based, performance-oriented, scenario-driven course of instruction. The course integrates the learning objectives from the Battle Staff Noncommissioned Officer Course, the Master Fitness Trainer Course, and Facilitator Training. Course emphasis is on skills, knowledge, and attitudes required for Sergeants Major to excel in positions of great responsibility throughout the defense establishment.

Physical fitness training is an important component of the SGMA Class course. Organized fitness training during the course was conducted 2 to 3 days per week for 16 consecutive weeks; this begins during week 3 of the course. Physical fitness training consisted of aerobic exercise and muscular strength and endurance activities. Aerobic exercise included organized runs from 3 to 6.2 miles in length for an average total distance per week of 6 to 10 miles, and a 5-mile rucksack march. Muscular strength, endurance, and power training

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included push-ups and sit-ups, circuit training, rifle physical training, sandbag circuit training, and guerilla drills.

Throughout the 9½-month course, individual or small group physical training was encouraged, and fitness facilities were available for use by the students throughout their course.

Subjects and Study Design

Subjects were 149 (143 males, 6 females) Master Sergeants (E8) from different military units and geographic regions enrolled in a SGMA Class from August 14, 1995 to May 31, 1996. Injury and illness data were obtained by retrospective review of all available medical records for 149 of the 200 enrolled students (74.0%). Physical fitness data were based on the initial Army Physical Fitness Test (APFT) administered in the second week of the course.

Demographic Data

Demographic data (race, gender, height, weight, smoking history, and alcohol use) were obtained from a Health Risk Appraisal questionnaire administered during the first week of the course. BMI was calculated (weight/height^2) for each student using the height and weight data collected from the Health Risk Appraisal. Students were asked if they had smoked cigarettes and, if so, the number of cigarettes per day and the length of time they have been smoking. For alcohol history, they were asked the number of drinks consumed per week and the number of years of alcohol usage.

Physical Fitness Data

Baseline physical fitness was assessed from the soldier's initial APFT. The APFT consists of a 2-mile run for time; the maximum number of push-ups completed in 2 minutes; and the maximum number of sit-ups completed in 2 minutes. Each fitness testing component has a maximum point score of 100, which is adjusted by age and gender.

Injury and Illness Data

Of the 200 students enrolled in the SGMA Class, 149 (74.0%) had records available for review in the medical clinic. These records were examined in the last month of the course by a physician and a physical therapist. Only data from injuries and illnesses documented in the record as occurring during the SGMA Class physical fitness training were included in the present study. Information extracted from medical records included the date of the clinic visit, the verbatim diagnosis, body system involved, anatomic location of each injury, and the disposition and days of limited duty resulting from the injury or illness.

For classification purposes, injury cases were defined as any medical complaint documented in the medical record during course attendance that occurred during physical fitness training and resulting in at least one clinic visit. Overuse injuries were defined as injuries caused by repetitive microtrauma (e.g., strains, tendinitis, and stress fractures) associated with such activities as running and marching. Traumatic injuries were defined as injuries associated with a specific single event (e.g., twisting an ankle or falling while running). Illness cases were defined as any medical complaint documented in the medical record during course attendance that resulted in at least one clinic visit. Injuries and illnesses that were not clearly defined in the medical record were categorized as "not otherwise specified" (NOS). A limited duty time injury or illness was defined as a complaint that resulted in at least 24 hours of medically restricted activity prescribed by medical personnel.

Statistical Analyses

Descriptive analyses were performed on 143 male soldiers and 6 female soldiers. All injury and illness data were double-entered and cross-checked for error control and then uploaded for analysis. The total number of initial visits, follow-up visits, and limited duty time were compiled for injuries and illnesses. The cumulative incidence (percentage) of individuals experiencing injuries or illnesses was calculated by dividing the number of soldiers with one or more injuries or illnesses by the total number of soldiers with available medical records.

Statistical Package for the Social Sciences (SPSS; Version 18, Chicago, IL) was used for the statistical analyses. An α of 0.05 was used as the level of significance for all hypothesis testing. Categorical variables were described by frequency, percentage, and 95% confidence interval (CI) through the use of Epi Info Version 6.04 (Centers for Disease Control and Prevention, Atlanta, Georgia).

Univariate testing was performed using χ^2, and the one-way ANOVA test was perfomed to evaluate potential univariate associations of the outcome variables with the various independent variables. Estimates of both incidence and relative risk (RR) were calculated.

To control for confounding, statistical modeling was accomplished through the use of multiple logistic regression. Unadjusted odds ratios were estimated through univariate methods and then adjusted by logistic regression. Model reduction was accomplished primarily through selection of biologically important variables. Decisions regarding inclusion or exclusion of variables in the statistical model were based on the difference in the −2 log likelihood score from models with and without a particular variable included in the statistical model. In addition, if the entry of a variable into the model changed the odds ratio by more than 20% and was biologically important, this variable was considered to be a confounder and kept in the model. Model fit was assessed using the Hosmer–Lemeshow Statistic.

RESULTS

Descriptive Data

Tables I and II present descriptive and APFT data for the SGMA students. Mean cholesterol ± S.D for male

TABLE I. Age, Physical Characteristics, and Fitness of Male Students in SGMA Class at the Beginning of Training

Characteristic	*N*	Mean	SD	Minimum	Maximum
Age	132	41.9	4.1	30.0	51.0
Height (cm)	141	177.2	7.0	160.0	198.1
Weight (kg)	141	81.1	8.8	59.1	100.5
BMI (kg/m^2)	141	25.8	2.1	19.4	33.7
Push-ups (no.)	102	45.2	13.7	18.0	85.0
Sit-ups (no.)	103	54.7	13.8	32.0	106.0
Two-mile Run (min)	102	15.5	1.5	12.1	21.1
Total APFT Score	97	238.4	49.3	168.0	300.0
Age	132	41.9	4.1	30.0	51.0

TABLE II. Age, Physical Characteristics, and Fitness of Female Students in SGMA Class at the Beginning of Training

Characteristic	*N*	Mean	SD	Minimum	Maximum
Age	5	49.2	4.8	44.0	53.0
Height (cm)	6	165.5	6.3	157.5	175.3
Weight (kg)	6	67.1	6.5	57.3	74.5
BMI (kg/m^2)	6	24.5	2.8	21.0	28.2
Push-ups (no.)	2	18.5	9.2	12.0	25.0
Sit-ups(no.)	2	52.0	12.7	43.0	61.0
Two-mile Run	1	19.4	—	19.5	19.5
Total APFT Score	1	229.0	—	229.0	229.0

SGMA students (n = 141) was 187.6 ± 29.3 mg/dl. Mean cholesterol ± S.D for female students was 195.8 ± 25.1 mg/dl. Among 129 male soldiers, 34 males (26.4%) reported smoking within the last year. Smoking data were collected for 5 female SGMA students. Only one female reported smoking within the last year (20.0%). Sixty-eight out of this 128 SGMA Class (53.1%) reported consuming alcoholic beverages (65 males and 3 females).

Injury and Illness Data

Incidence and Distribution of Injury

During the 9½-month course, 49.7% (74/149) of the soldiers incurred one or more injuries. Seventy-two of the 143 male students (50.3%) and 2 of the 6 female (33.3%) students were injured at least once during the course. Table III presents the frequency and distribution of injuries, clinic visits, and associated limited duty days (LDD). Injuries were divided into the following 4 general categories: overuse injury, traumatic injury, wound injury, and NOS injury. Injuries were further broken down into subcategories that are outlined in Table IV. The average number of LDD per injured student was 32 days. The crude incidence rate (initial injuries) was 5.2 injuries per 100 students per month. The anatomical sites of injuries and LDD are presented in Table IV. The site of injury was categorized in one of the five following regions: lower extremities, back, upper extremities, head, and trunk, or NOS. The site of injury was further subcategorized by specific location, and these sites are outlined in Table IV.

Incidence and Distribution of Illness

The cumulative incidence of soldiers with one or more illnesses during the 9½-month course was 63.1% (94/149). The frequency and distribution of different types of illnesses and associated loss of duty time are shown in Table V. A total of 178 illnesses were documented in the 94 soldiers that suffered at least one illness while attending SGMA training. A total number of 435 clinic visits were reported, and these illnesses resulted in 311 LDD. The crude incidence rate (initial illnesses) was 6.6 illnesses per 100 soldiers per month. Infectious illnesses were the most frequent illness category reported and accounted for 178 LDD. Bacterial and viral

TABLE III. Frequency and Distribution of Injuries and Associated LDD by Type in SGMA Class Student

	Injury[a]		Total Clinic Visits[b]			Total LDD		
Type of Injury	*N*	%	*N*	%	Mean[c]	*N*	%	Mean[d]
Overuse	89	69.0	194	61.4	2.2	1749	73.5	19.7
Pain	38	29.5	95	30.1	2.5	863	36.3	22.7
Muscle Strain	36	27.9	65	20.6	1.8	660	27.7	18.3
Tendinitis and Bursitis	9	7.0	17	5.4	1.9	170	7.2	18.9
Stress Reaction	3	2.3	8	2.5	2.7	42	1.8	14.0
Calcaneal Bone Spur	3	2.3	9	2.9	3.0	14	0.6	4.7
Traumatic	23	17.8	81	25.6	3.5	580	24.4	25.2
Ligament Sprain	11	8.5	28	8.9	2.6	317	13.3	28.8
Tear	4	3.1	38	12.0	9.5	140	5.9	35.0
Fracture	4	3.1	11	3.5	2.8	95	4.0	23.8
NOS Trauma	4	3.1	4	1.3	1.0	28	1.2	7.0
Wound	8	6.2	13	4.1	1.6	14	0.6	3.5
Blister	4	3.1	5	1.6	1.3	14	0.6	3.5
Abrasion/Laceration	3	2.3	6	1.9	2.0	0	0.0	0.0
Contusion	1	0.8	2	0.6	2.0	0	0.0	0.0
NOS	9	7.0	28	8.9	3.1	36	1.5	4.0

[a]Students may have more than one injury. [b]Total Clinic Visits = Initial and follow-up visits. [c]Mean = Mean number of clinic visits per injury. [d]Mean = Mean number of LDD per injury.

TABLE IV. Frequency and Distribution of Injuries and Associated LDD by the Site of Injury in SGMA Class

	Injury[a]		Total Clinic Visits[b]			Total LDD		
Site of Injury	*N*	%	*N*	%	Mean[c]	*N*	%	Mean[d]
Lower Extremeties	71	55.0	153	48.4	2.2	1185	49.8	16.7
Knee	26	20.2	75	23.7	2.9	603	25.4	23.2
Foot	19	14.7	30	9.5	1.6	217	9.1	11.4
Ankle	10	7.8	23	7.3	2.3	222	9.3	22.2
Thigh	6	4.7	11	3.5	1.8	35	1.5	5.8
Shin	3	2.3	7	2.2	2.3	42	1.8	14.0
Hip	3	2.3	3	1.0	1.0	37	1.6	12.3
Calf	2	1.6	2	0.6	1.0	29	1.2	14.5
Groin	2	1.6	2	0.6	1.0	0	0.0	0.0
Back	20	15.5	63	19.9	3.2	686	28.8	34.3
Lower Back	19	14.7	61	19.3	3.2	686	28.8	36.1
Upper Back	1	0.8	2	0.6	2.0	0	0.0	0.0
Upper Extremeties	19	14.7	51	16.1	2.7	364	15.3	19.2
Shoulder	12	9.3	37	11.7	3.1	336	14.1	28.0
Hand/Finger	4	3.1	10	3.2	2.5	14	0.6	3.5
Wrist	2	1.6	2	0.6	1.0	0	0.0	0.0
Elbow	1	0.8	2	0.6	2.0	14	0.6	14.0
Head and Trunk	16	12.4	44	13.9	2.8	136	5.7	8.5
Neck	8	6.2	20	6.3	2.5	53	2.2	6.6
Chest	5	3.9	10	3.2	2.0	83	3.5	16.6
Head	2	1.6	13	4.1	6.5	0	0.0	0.0
Face	1	0.8	1	0.3	1.0	0	0.0	0.0
NOS	3	2.3	5	1.6	1.7	8	0.3	2.7
Total	129	100.0	316	100.0	2.5	2379	100.0	18.4

[a]Students may have more than on injury. [b]Total Clinic Visits = Initial and follow-up visits. [c]Mean = Mean number of clinic visits per injury. [d]Mean = Mean number of LDD per injury.

TABLE V. Frequency and Distribution of Illness and Associated LDD by Type of Illness in a SGMA Class

	Illness[a]		Total Clinic Visits[b]			Total LDD		
Illness	*N*	%	*N*	%	Mean[c]	*N*	%	Mean[d]
Infectious Illness	86	48.3	118	27.1	1.4	178	57.2	2.1
Bacterial	51	28.7	77	17.7	1.5	131	42.1	2.6
Viral	30	16.9	35	8.1	1.2	47	15.1	1.6
Fungal	3	1.7	3	0.7	1.0	0	0.0	0.0
Chlamydia	1	0.6	2	0.5	2.0	0	0.0	0.0
NOS	1	0.6	1	0.2	1.0	0	0.0	0.0
Dermal	12	6.7	16	3.7	1.3	46	14.8	3.8
Edema	4	2.3	7	1.6	1.8	46	14.8	11.5
Dermatitis	4	2.3	4	0.9	1.0	0	0.0	0.0
Bite	2	1.1	2	0.5	1.0	0	0.0	0.0
Rash	2	1.1	3	0.7	1.5	0	0.0	0.0
Gastrointestinal	4	2.3	6	1.4	1.5	0	0.0	0.0
Ulcer	3	1.7	5	1.2	1.7	0	0.0	0.0
Hemorrhoid	1	0.6	1	0.2	1.0	0	0.0	0.0
Cardiovascular	40	22.5	214	49.2	5.4	16	5.1	0.4
Hypertension	35	19.7	208	47.8	5.9	15	4.8	0.4
Chest Pain	5	2.8	6	1.4	1.2	1	0.3	0.2
Other Illnesses	36	20.2	81	18.6	2.3	71	22.8	2.0
NOS	19	10.7	46	10.6	2.4	1	0.3	0.1
Allergy	14	7.9	30	6.9	2.1	70	22.5	5.0
Reproductive	2	1.1	4	0.9	2.0	0	0.0	0.0
Numbness	1	0.6	1	0.2	1.0	0	0.0	0.0
Total	178	100.0	435	100.0	2.4	311	100.0	1.8
Infectious Illness	86	48.3	118	27.1	1.4	178	57.2	2.1

[a]Students may have more than on illness. [b]Total Clinic Visits = Initial and follow-up visits [c]Mean = Mean number of clinic visits per illness [d]Mean = Mean number of LDD per illness

TABLE VI. Association Between Self-reported Smoking History and 2-mile Run Times

Smoking	*N*	Mean Run Time (min)	SD	Range (min)
Yes	22	16.5*	1.7	13.3–20.8
No	73	15.5	1.4	12.1–21.1

*$p = 0.01$.

infections were reported most frequently and accounted for 57.2% of the total LDD. These infections primarily affected the respiratory system. Hypertension accounted for the greatest number of total clinic visits (208 initial and follow-up visits).

Association Between Smoking, Alcohol Use and APFT Scores

Smoking, push-up, sit-up, and run-time data were available for 95 students. These data were analyzed using a one-way ANOVA test which indicated that smokers had significantly slower run times than nonsmokers ($p = 0.01$, Table VI). However, no significant associations were found between push-up and sit-up test scores and smoking.

A logistic regression model was conducted on smoking, run time, and age. The model was based on 93 students with complete data on these three variables. According to the model, as run times increased by 1 minute, the odds of being a smoker increased by 54.0% or 1.54 times. The age range was small and not found to be statistically significant in the model.

Self-reported alcohol use and push-up, sit-up, and 2-mile run test scores were evaluated using ANOVA analyses. No significant relationships were found between alcohol use and these variables.

Association Between Smoking and Baseline Cholesterol Levels

Table VII outlines the association between smoking and baseline cholesterol level. Baseline cholesterol levels were defined as values obtained during the first week of the course. Smoking and cholesterol data were available for 134 SGMA students. The group mean baseline cholesterol level was significantly higher ($p = 0.04$) for smokers than nonsmokers. The difference between the mean cholesterol levels of the two groups was 7.0 mg/dl.

Risk Factors for Injury and Illness

No significant associations were found between musculoskeletal injuries and age, height, weight, BMI, physical fitness, cholesterol, smoking, and alcohol use.

TABLE VII. Association Between Smoking and Baseline Cholesterol Levels

Smoking	*N*	Mean Cholesterol (mg/dl)	SD	Range (mg/dl)
Yes	35	196.8*	29.9	125.0–263.0
No	99	189.8	28.8	133.0–268.0

*$p = 0.04$.

TABLE VIII. Incidence of Infectious Illness, RR, and 95% CI for Alcohol Consumption

Alcohol Use	*N*	Illness Incidence (%)	RR	95% CI
Yes	68	51.5	2.1	1.3–3.4
No	60	25	Referent	N/A

Alcohol and illness data were available for 128 students. Individuals that self-reported alcohol use were two times as likely to have an infectious illness as nonusers. These data are outlined in Table VIII. No significant association was found between smoking and illness.

DISCUSSION

The present study examined the incidence of injury and illness among students enrolled in an SGMA Class. While attending the 9½-month course, students were much more likely to develop an illness than incur an injury (63.1% vs. 49.7%). However, the total number of LDD was 7.6 times greater for injuries than illnesses. These findings are supported by Billings.[10]

Most of the injuries involved either lower extremities or the lower back. These findings are again consistent with other published reports.[10,11] These results are not surprising, since physical training involves running and marching, which are weight-bearing activities that stress the lower body.

Infectious illnesses were the most common illnesses reported among the SGMA students and accounted for the greatest number of LDD. The majority of clinic visits for infectious illnesses involved the respiratory system (57.0%). Several studies reported that the majority of clinic visits for all illnesses during basic cadet training were attributed to upper respiratory infections.[10,11] Respiratory-transmitted infections have been reported at Army training centers where soldiers are in close quarters, training together, and immunologically susceptible to infection.[12] The majority of the SGMA students were in separate housing, but they trained together and participated in indoor classroom activities that would increase the risk for transmission of airborne infectious agents. Factors that may have attributed to increased susceptibility to airborne agents in this older student population include underlying chronic illnesses, vigorous physical training,[13] and psychological stressors[14,15] that attribute to course demands and requirements.

Direct comparisons of injury and illness incidence are difficult to make between this cohort group of SGMA students and previous SGMA classes because of a lack of published data. However, comparisons to other published Army studies are of interest. Bijur et al[16] reported an injury incidence for male Army recruits, which was lower than that found in males in the present study (28% vs. 50.3%). However, soldiers in this study were younger than the study participants (mean age 20.2 vs. 41.9). It is possible that this age differential accounts for the increased number of injuries found in this study. This is supported by the findings

of Jones et al,[6] where the RR of lower extremity injury was greater with increasing age among male Army recruits during basic training. The effects of age on risk injury vary according to the population being studied.[17] If soldiers train at similar intensity levels, the risk of injury is greater for older soldiers.[6]

History of alcohol use before SGMA training was a significant risk factor for infectious illnesses. Engs et al[18] reported that among 1,100 undergraduate students, the incidence of upper respiratory infection was higher for students who consumed 22 or more alcoholic drinks per week when compared to nondrinkers. In this study, the quantity of alcohol was not documented, but a strong relationship was observed between alcohol consumption and infectious illnesses. Laboratory studies[19] on spleens of mice have suggested that chronic alcohol consumption impairs lymphocytic recruitment, therefore increasing susceptibility to infection.

In this study, 26.1% of SGMA students self-identified themselves as cigarette smokers. Subjects who self-reported a history of smoking before SGMA training had significantly lower cardiorespiratory endurance (i.e., 2-mile run time) compared with nonsmokers. However, the authors speculated that a positive association may have been found if the population was older and had a longer smoking history. Such speculation is supported by Daniels et al[20] who showed the maximal oxygen consumption (VO_2 max) between smokers and nonsmokers was not different for a younger population (mean age 22.0), but did differ significantly for soldiers 15 to 20 years older. The present data support the findings of Daniels et al[20] in that smoking among other subjects was correlated with slower run times.

In this study, smoking history was associated with higher total cholesterol levels. Hughes et al[21] reported higher mean triglyceride levels and lower mean serum high density lipoprotein cholesterol levels in male smokers of ages 30 to 69 when compared to nonsmokers. In addition, Dullart et al[22] found lower high density lipoprotein cholesterol levels in nondiabetic smokers. It is well known that smokers have impaired cholesterol transport mechanisms, which may explain the association between smoking history and increased total cholesterol levels.[23]

CONCLUSIONS

The data presented in this study indicates that although injuries were associated with a greater number of lost training days than illnesses future SGMA medical surveillance should focus on strategies to reduce both injuries and illnesses in SGMA training. Past investigations show associations between injury, age, gender, prior history of smoking, percent body fat, low aerobic capacity, and reduced muscular strength.[4,5] No independent risk factors for injuries were found in this study. However, the study found that trainees with a prior smoking history had slower run times. Past military research[5] has reported an association of injuries with lower aerobic capacity before military training programs. More research is required with larger sample sizes of male and female SGMA students to determine the effects of improving aerobic capacity before SGMA training with appropriate interventions (e.g., smoking cessation programs, progressive running with interval training).

Respiratory bacterial and viral infections were the most commonly reported illnesses. Alcohol consumption was a risk factor in the development of infectious illnesses.[24]

Future research should focus on methods to reduce the respiratory illnesses in the SGMA population including reducing alcohol consumption, frequent hand washing, intranasal saline lavages, and investigation of other modalities to reduce infectious illnesses in field environments.

Study Limitations

This study had several limitations. For example, the electronic medical records database had not been established at the time of the study. Therefore, data were collected and analyzed from hand-carried medical records. Missing data limited the analysis of injuries and associated limited duty time. These data were essential to assessing the degree of severity of injuries and potential cost due to lost training time from physical training at the SGMA.

Injury and illness data were collected from troop medical records. Study staff researchers attempted to determine a specific injury/illness diagnosis for each visit. Some of the medical data in the clinical records did not list an anatomical location.

Future researchers should determine the types of physical training activities associated with injuries to define countermeasures for reducing injury incidence. Missing information on how and where the injuries occurred limits the ability to target interventions that may reduce injury incidence.

Gender differences in injury and illness incidence has been reported in military studies. Because of the small sample size of females in our study, we were unable to detect whether or not gender differences existed in the variables (smoking, run times, alcohol and APFT Scores) and injury and illness incidence.[2,10]

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REFERENCES

1. Knapik JJ, Jones SB, Darakjy S, et al: Injuries and injury risk factors among members of the United States Army Band. Am J Ind Med 2007; 50(12): 951–61.
2. Knapik JJ, Sharp MA, Canham-Chervak M, Hauret K, Patton JF, Jones BH: Risk factors for training-related injuries among men and women in basic combat training. Med Sci Sports Exerc 2001; 33(6): 946–54.
3. Knapik JJ, Hauret KG, Canada S, Marin R, Jones B: Association between ambulatory physical activity and injuries during United States Army Basic Combat Training. Phys Act Health 2011; 8(4): 496–502.

4. Reynolds KL, Heckel HA, Witt CE, et al: Cigarette smoking, physical fitness and injuries in infantry soldiers. Am J Prev Med 1994; 10: 145–50.
5. Knapik J, Montain SJ, McGraw S, Grier T, Ely M, Jones BH: Stress fracture risk factors in basic combat training. Int J Sports Med 2012; 33(11): 940–6.
6. Jones BH, Bovee MW, Knapik JJ: Associations among body composition, physical fitness, and injury in men and women Army trainees. In: Body Composition and Physical Performance, pp. 141–72. Edited by B.M. Marriot and J. Gumstrup-Scott. Washington, DC, National Academy Press, 1992.
7. Jones BH, Knapik JJ: Physical training and exercise-related injuries. Surveillance, research and injury prevention in military populations. Sports Med 1999; 27(2): 111–25.
8. Blake GH, Abell TD, Stanley WG: Cigarette smoking and upper respiratory infection among recruits in basic combat training. Ann Intern Med 1988; 109(3): 198–202.
9. Knapik J, Ang P, Reynolds K, Jones B.J: Physical fitness, age, and injury incidence in infantry soldiers. Occup Med 1993; 35(6): 598–603.
10. Billings CE: Epidemiology of injuries and illnesses during the United States Air Force Academy 2002 Basic Cadet Training Program: documenting the need for prevention. Mil. Med 2004; 169(8): 664–70.
11. Piantanida NA, Knapik JJ, Brannen S, O'Connor F: injuries during Marine Corps officer basic training. Mil Med 2000; 165(7): 515–20.
12. Brundage JF, Scott RM, Lednar WM, Smith DW, Miller RN: Building-associated risk of febrile acute respiratory diseases in Army trainees. JAMA 1988; 259: 2108–12.
13. Keast D, Cameron K, Morton AR: Exercise and the immune response. Sports Med 1988; 5: 248–67.
14. Cohen SE, Doyle WJ, Skoner DP, Rabin BS, Gwaltney JM: Types of stressors that increase the susceptibility to the common cold in healthy adults. Health Psychol 1998; 17(3): 214–23.
15. Graham NMH, Douglas RM, Ryan P: Stress and acute respiratory infection. Am J Epidemiol 1986; 124: 389–401.
16. Bijur PE, Horodyski M, Egerton W, Kurzon M, Lifrak S, Friedman S: Comparison of injury during cadet basic training by gender. Arch Pediatr Adolesc Med 1997; 151(5): 456–61.
17. Knapik JJ, Grier T, Spiess A, et al: Injury rates and injury risk factors among Federal Bureau of Investigation new agent trainees. BMH Public Health 2011; 11: 920.
18. Engs RC, Aldo-Benson M: The association of alcohol consumption with self-reported illness in university students. Psychol Rep 1995; 76 (3 pt 1): 727–36.
19. Shellito JE, Olariu R: Alcohol decreases T-lymphocyte migration into lung tissue in response to Pneumocystis carinii and depletes t-lymphocyte numbers in the spleens of mice. Alcohol Clin Exp Res 1998; 22(3): 658–63.
20. Daniels WL, Patton JF, Vogel J, Jones BH, Zoltick JM, Yaney SF: Aerobic fitness and smoking. Med Sci Sports Exerc 1984; 16: 195–6.
21. Hughes K, Choo M, Kuperan P, Ong CN, Aw TC: Cardiovascular risk factors in relation to cigarette smoking: a population-based survey among Asians in Singapore. Atherosclerosis 1998; 137(2): 253–8.
22. Dullart RP, Beusekamp BJ, Riemens SC, et al: High-density lipoprotein cholesterol is related to the TaqIB cholesteryl ester transfer protein gene polymorphism and smoking, but not to moderate alcohol consumption in insulin-dependent diabetic men. Scan J Clin Invest 1998; 58(3): 251–8.
23. Mero N, van Tol A, Scheek LM, et al: Decreased postprandial high density lipoprotein cholesterol and apolipoproteins A-I and E in normolipidemic smoking men: relations with lipid transfer proteins and LCAT activities. J Lipid Res 1998; 39(7): 1493–502.
24. Sabetta JR, DePetrillo P, Cipriani RJ, Smardin J, Burns LA, Landry ML: Serum 25-hydroxyvitamin d and the incidence of acute viral respiratory tract infections in healthy adults. PLoS One 2010; 14:5(6): e11088.